UNIVERSITY OF COPENHAGEN
FACULTY OF LAW

PhD Dissertation

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Life Insurance and Shadow Banking - a Comparison of Solvency II and the Finalised Basel III

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Submitted on: 31 August, 2019

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31st August 2019

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Summary

The Financial Stability Board broadly defines “shadow banking” as the system of credit intermediation that involves entities and activities outside the regular banking system. Due to indications of shadow banking, in the form of Danish life insurance undertakings’ alternative credit investments and repos, this dissertation conducts a comparison of (i) the EU’s regulation of life insurance in Solvency II and (ii) the global banking standards in the recently finalised Basel III. Based on a scenario derived from academic literature, the comparison applies a risk-based approach in order to assess if - and how - Solvency II and the finalised Basel III address specific risk types via quantitative pillar 1 requirements. The comparison concludes that Solvency II does not subject bank-like liquidity risk, leverage or systemic risk to quantitative requirements while these risks and leverage are addressed via quantitative requirements in the finalised Basel III.

In the finalised Basel III, the financial crisis led to risk-based capital requirements being supplemented with quantitative requirements regarding liquidity risk, leverage and systemic risk. Solvency II includes risk-based solvency requirements and the total balance sheet approach but Solvency II does not address shadow banking-based liquidity risk, leverage or systemic risk via quantitative requirements. These differences in the regulation of liquidity risk, leverage and systemic risk presumably entail regulatory arbitrage possibilities - and the possibility of systemic risk - as life insurance undertakings can obtain leverage, via repos and other securities financing transactions, without being subject to quantitative requirements for such non-insurance liabilities.

Resumé

Financial Stability Board definerer “shadow banking” bredt som kreditformidlingssystemet der involverer enheder og aktiviteter uden for det traditionelle banksystem. På baggrund af indikationer vedrørende shadow banking, i form af danske livsforsikringsselskabers alternative kreditinvesteringer og repoer, foretager denne afhandling en sammenligning af (i) EUs regulering af livsforsikring i Solvens II og (ii) de globale standarder for bankvirksomhed i det for nylig vedtagne Basel III. Baseret på et scenarie, der er udledt af akademisk litteratur, anvender sammenligningen en risikobaseret tilgang, med henblik på at vurdere om - og hvordan - Solvens II og det endelige Basel III adresserer specifikke risikotyper via kvantitative søjle 1-krav. Sammenligningen konkluderer at Solvens II ikke pålægger bank-lignende likviditetsrisiko, gearing eller systemisk risiko kvantitative krav, imens disse risikotyper og gearing bliver adresseret via kvantitative krav i det endelige Basel III.

I det endelige Basel III medførte finanskrisen, at risikobaserede kapitalkrav blev suppleret med kvantitative krav vedrørende likviditetsrisiko, gearing og systemisk risiko. Solvens II indeholder risikobaserede kapitalkrav og “the total balance sheet approach”, men Solvens II adresserer ikke “shadow banking-baseret” likviditetsrisiko, gearing eller systemisk risiko via kvantitative krav. Disse forskelle i reguleringen af likviditetsrisiko, gearing og systemisk risiko indebærer antageligt muligheder for regulatorisk arbitrage - og muligheden for systemisk risiko - da livsforsikringsselskaber kan få adgang til gearing, via repoer og andre værdipapirfinansieringstransaktioner, uden at være underlagt kvantitative krav vedrørende sådanne ikke-forsikringsmæssige passiver.

Nomenclature

AIFM Directive	Directive 2011/61/EU
Basel I	Basel Committee on Banking Supervision, International Convergence of Capital Measurement and Capital Standards, July 1998
Basel II	Basel Committee on Banking Supervision, International Convergence of Capital Measurement and Capital Standards. A Revised Framework, Comprehensive Version, June 2006
Basel III	Basel Committee on Banking Supervision, Basel III: A global regulatory framework for more resilient banks and banking systems, December 2010 (rev June 2011)
BCBS	Basel Committee on Banking Supervision
Capital Markets Union Action Plan	COM(2015) 468 final
CCP	Central counterparty
CEIOPS	Committee of European Insurance and Occupational Pensions Supervisors
CET1	Common equity tier 1
CRD	Directive 2006/48/EC
CRD IV	Directive 2013/36/EU
CRD V	Directive (EU) 2019/878
CRR	Regulation (EU) 575/2013

CRR II	Regulation (EU) 2019/876
CVA	Credit valuation adjustment
DLT market	Deep, liquid and transparent market
EAD	Exposure at default
EBA	European Banking Authority
EBA Regulation	Regulation (EU) No 1093/2010
ECAI	External credit assessment institution
ECAI Regulation	Regulation (EC) 1060/2009
EIOPA	European Insurance and Occupational Pensions Authority
EIOPA Regulation	Regulation (EU) No 1094/2010
EMIR	Regulation (EU) 648/2012
EMIR Delegated Regulation	Delegated Regulation (EU) 153/2013
ESA Regulations	Regulation (EU) No 1093/2010, Regulation (EU) No 1094/2010 and Regulation (EU) No 1095/2010
ESAs	EBA, EIOPA and ESMA
ESMA	European Securities and Markets Authority
ESMA Regulation	Regulation (EU) No 1095/2010
ESRB	European Systemic Risk Board
ESRB Regulation	Regulation (EU) No 1092/2010
finalised Basel III	See chapter 2.1.2 of this dissertation and the draft 2022 consolidated Basel Framework at www.bis.org
Financial Collateral Directive	Directive 2002/47/EC
Financial Collateral Directive Proposal	COM/2001/0168 final
FSB	Financial Stability Board
G-SIB	Global systemically important bank
G-SII	Global systemically important insurer

GMRA	Global Master Repurchase Agreement, 2011 version, International Capital Market Association
HQLA	High-quality liquid assets
IAA	International Actuarial Association
IAIS	International Association of Insurance Supervisors
IRB	Internal ratings-based
LCMPF	Life insurance companies and multi-employer occupational pension funds
LCR	Liquidity coverage ratio
LGD	Loss given default
M	Effective maturity
MCR	Minimum capital requirement
MMF Regulation	Regulation (EU) 2017/1131
MUNFI	Monitoring universe of non-bank financial intermediation
NSFR	Net stable funding ratio
NTNI	Non-traditional and non-insurance activities
Omnibus II	Directive 2014/51/EU
ORSA	Own risk and solvency assessment
OTC	Over-the-counter
PD	Probability of default
QIS	Quantitative impact study
Quick Fix 2 Proposal	COM/2013/0680 final
SCR	Solvency capital requirement
SFT	Securities financing transaction
SFT Regulation	Regulation (EU) 2015/2365

SIFI	Systemically important financial institution
Solvency II	Directive 2009/138/EC
Solvency II Delegated Regulation	Delegated Regulation (EU) 2015/35
Solvency II ECA Mapping Regulation	Implementing Regulation (EU) 2016/1800
Solvency II Proposal	COM/2007/361 final
TFEU	Treaty on the Functioning of the European Union
UCITS	Undertakings for collective investment in transferable securities
UCITS Directive	Directive 2009/65/EC
VaR	Value-at-Risk

Contents

Part I

Introduction

Chapter 1

Life Insurance and Shadow Banking?

The Financial Stability Board ("FSB") broadly defines "shadow banking" as "the system of credit intermediation that involves entities and activities outside the regular banking system".[1] As described in chapters 5 and 6, credit intermediation may entail systemic risk developments due to three essential characteristics in shadow banking as well as regular banking:

- maturity transformation - the issuing of short-term liabilities to fund long-term assets such as loans.[2]
- liquidity transformation - the issuing of liquid liabilities to finance illiquid assets that cannot easily be converted into cash without a loss.[3]
- leverage - the ratio between a capital measure and an exposure measure that reflects the financing of assets and exposures via, inter alia, liabilities.[4]

In EU law, a "regular" bank - a credit institution - is defined as an undertaking the business of which is to take deposits or other repayable funds from the public

[1] FSB (2011c), p. 3. See also European Commission (2013b), p. 3.

[2] FSB (2011c), section 2.4.1, FSB (2011b), footnote 5, EBA (2014a), footnote 1, and ESRB (2017b), p. 6.

[3] Diamond and Dybvig (1983), p. 402-405, FSB (2011b), footnote 5, EBA (2014a), footnote 1, and ESRB (2017b), p. 6.

[4] FSB (2013d), annex 1, economic function # 2, EBA (2014a), footnote 1, BCBS Consol. Basel III (2019), LEV20.3 and BCBS Basel III (2014a), para. 6. In relation to derivatives, leverage can viewed in terms of "economic leverage" that reflects a heightened price sensitivity to market fluctuations, cf. President's Working Group (1999), appendix A-2. See also EU case law in T-768/16 (2018) (BNP Paribas v. European Central Bank), para. 41, T-758/16 (2018) (Crédit Agricole SA v. European Central Bank), para. 41, T-757/16 (2018) (Société Générale v. European Central Bank), para. 45, and T-751/16 (2018) (Confédération Nationale du Crédit Mutuel v. European Central Bank), para. 46, T-745/16 (2018) (BPCE v. European Central Bank), para. 45, and T-733/16 (2018) (La Banque Postale v. European Central Bank), para. 46.

and to grant credits for its own account.[5] As a part of this credit intermediation, banks perform the fundamental function of transforming illiquid assets into liquid liabilities as they issue short-term liquid liabilities, in the form of e.g. deposits, and grant illiquid and/or long-term credits for their own account.[6] Credit intermediation may accordingly entail maturity transformation and/or liquidity transformation as assets are not matched with liabilities in terms of duration and liquidity.[7] In addition, the value of banks' issued liabilities are generally their face value while a predominant share of their assets are not traded in markets that provide current market prices.[8] This form of "traditional" banking is illustrated in blue in figure 1.1.

In a "run" on banks, depositors rush to withdraw deposits due to fears of bank failures which forces the banks to liquidate many assets at a loss via "fire sales" and to fail.[9] In general, the need to obtain liquidity via fire sales of assets may entail systemic risk as fire sales may lead to price falls and create mark-to-market losses and funding problems for all undertakings exposed to the assets.[10] In the EU, only banks are allowed to carry out the business of taking deposits or other repayable funds from the public.[11] This requirement should generally entail that only banks are susceptible to runs that lead to fire sales of assets and systemic risk.

However, the financial crisis showed that shadow banks' credit intermediation may also be susceptible to runs. As described in detail in chapter 6, the FSB's global identification of shadow banking entails a two-step approach:

- step 1, where a wide net looks at all *non-bank* credit intermediation, and
- step 2, where the focus is narrowed to the subset of non-bank credit intermediation where there are (i) developments that increase *systemic risk* and/or (ii) indications of *regulatory arbitrage* that is undermining the benefits of financial regulation.[12] Similar to banking and the risk of runs, "developments that increase systemic risk" include - in particular - maturity transformation, liquidity transformation and/or leverage.[13]

Contrary to banking, "traditional" insurance is not associated with banking-like credit intermediation, the use of short-term funding, maturity transformation,

[5] CRR, art. 4(1)(1).
[6] See e.g. Diamond and Dybvig (1983) and ESRB (2017b), p. 6.
[7] EBA (2014a), footnote 1. See also EIOPA (2018e), p. 21 (box 3).
[8] ESRB (2017b), p. 6.
[9] Diamond and Dybvig (1983), p. 401. In relation to the EU deposit guarantee scheme, COM(2010) 368 final, section 1, stated that *"No bank, whether sound or ailing, holds enough liquid funds to redeem all or a significant share of its deposits on the spot. This is why banks are susceptible to the risk of bank runs if depositors believe that their deposits are not safe and try to withdraw them all at the same time."*
[10] FSB (2013c), section 1.2, IAIS (2018a), including para. 33-34, 37, 50-52 and 58, and EIOPA (2017c), p. 41.
[11] CRD IV, art. 9(1).
[12] FSB (2011c), section 1.
[13] FSB (2011c), section 1.

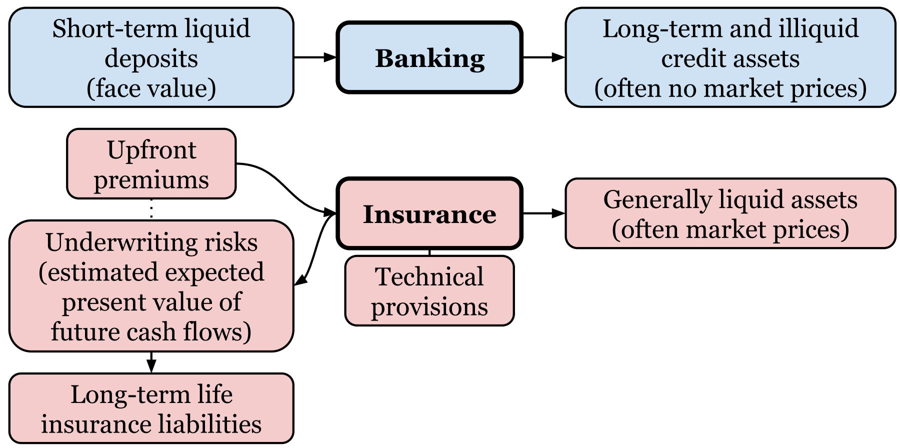

Figure 1.1: Illustration of differences in "traditional" business models. In this dissertation, banking-related figures will generally be in blue while insurance-related figures will generally be in red.

liquidity transformation, exposures to liquidity risk and runs, excessive leverage, or systemic risk.[14]

In traditional life insurance, policyholders pay premiums upfront and life insurance undertakings make payments to policyholders and beneficiaries when an insured event has occurred.[15] "Insurability" generally entails that losses must be well-defined, accidental (i.e. not controlled by the insured), occur randomly and be subject to the "law of large numbers".[16] Based on the law of large numbers, the traditional insurance business model builds on the underwriting of large diversified pools of generally idiosyncratic and uncorrelated risks.[17] The law of large numbers entails that cash flows are considered reasonably predictable for such a large portfolio of life insurance business.[18] In addition, insurance cash outflows are tied to the occurrence of the insured event and the characteristics of the insurance product (which may vary significantly) will accordingly determine the liquidity of a life insurance undertaking's liabilities.[19] While lapses and mass surrenders as well as catastrophic events may entail

[14] IAIS (2010), para. 6 and 7, IAIS (2011), para. 9, 13, 15, 18 and 68, IAIS (2013a), para. 11, IAIS (2017), para. 41 and 50, FSB (2011b), footnote 4, FSB (2013d), p. 3, FSB (2013a), annex 3 (p. 44), FSB (2017b), p. 15, European Commission (2001), para. 27, EIOPA (2012), p. 1, EIOPA (2016), para. 19-20 and 22-23, EIOPA (2017c), pp. 3, 11-12 and 23-24, EIOPA (2018e), pp. 21 (box 3), 27, 33 and 65, and ESRB (2017b), p. 6.

[15] IAIS (2010), para. 3, IAIS (2011), para. 14 and 18, and EIOPA (2016), para. 19, EIOPA (2018e), p. 21 (box 3), and ESRB (2017b), p. 6.

[16] IAIS (2011), para. 24. In simple terms, the law of large numbers states that the aggregation of a large number of idiosyncratic risks ultimately results in a normal curve of distribution, cf. IAIS (2013a), para. 8. See chapter 9.3 regarding the normal distribution.

[17] IAIS (2011), para. 13 and 24, and IAIS (2013a), para. 8, IAIS (2013b), para 13.

[18] CEIOPS (2005b), para. 10.33, IAIS (2010), para. 9, and IAIS (2013a), para. 8.

[19] IAIS (2011), para. 3 and 18, IAIS (2013b), para. 11-13, and EIOPA (2018e), p. 27.

liquidity risk, the financial distress of a life insurance undertaking will generally play out over a long time horizon as assets will not need to be liquidated until payments have to be made in accordance with insurance policies.[20] Mass runs on a life insurance undertaking via surrenders may also be limited as life insurance products may be idiosyncratic, conditional upon employment and connected to other insurance products offered by the life insurance undertaking. Surrenders of life insurance products may also be subject to fiscal penalties, lapse fees or market value adjustments.[21] Lastly, underwriting risks are generally not correlated with the economic business cycle or financial market risks.[22]

Contrary to banking, traditional life insurance is associated with the transformation of long-term and less liquid liabilities into shorter term and more liquid assets as well as a *liability-driven* investment approach, which closely matches assets with liabilities.[23] The long-term nature of life insurance liabilities is considered able to provide important long-term investments, and long-term investment horizons are expected to make a positive contribution to financial stability.[24] Premiums are generally invested on capital markets, including diversified marketable financial instruments such as bonds and equities, in order to generate returns to fulfil life insurance obligations to policyholders and beneficiaries.[25] The value of life insurance undertakings' assets is therefore generally obtainable via market prices.[26]

The differences between traditional banking and life insurance are reflected in EU law, where banking and life insurance are subject to their respective regulatory regimes. Solvency II governs the taking-up and pursuit of direct insurance.[27] As described in chapter 6.3.1.1, insurance liabilities are estimated via the expected present value of future cash flows and life insurance undertakings must establish technical provisions, with respect to all of their insurance obligations towards policyholders and beneficiaries, and cover these technical provisions with registered assets.[28] Life insurance undertakings are accordingly viewed as having a large amount of assets on hand - relative to liabilities - in

[20] IAIS (2010), para. 5 and 11, and EIOPA (2016), para. 19-20, EIOPA (2018e), pp. 27 and 37.

[21] EIOPA (2018e), p. 27.

[22] IAIS (2013a), para. 11, and EIOPA (2016), para. 19.

[23] IAIS (2011), para. 3, 8 and 25, IAIS (2013a), para. 10, IAIS (2013b), para. 13, IAIS (2017), para. 41 and 50, FSB (2013a), annex 3 (p. 44), CEIOPS (2005b), para. 10.31, and EIOPA (2018e), p. 27, EIOPA (2018c), pp. 14, 57 and 67, EIOPA (2018e), pp. 21 (box 3), 27, 33, 65)

[24] FSB (2017b), p. 15, and EIOPA (2017c), p. 51.

[25] European Commission (2001), para. 27, CEIOPS (2007b), para. 2.6, and ESRB (2017b), p. 6.

[26] ESRB (2017b), p. 6.

[27] Solvency II, art. 1. Solvency II simply defines insurance undertakings as direct life (or non-life) insurance undertakings that have received authorisation under Solvency II, cf. Solvency II, art. 13(1). Pursuant to Solvency II, art. 14 and 15, the business of direct insurance is subject to a prior authorisation that is given for a particular class of direct insurance, including life insurance.

[28] Solvency II, recitals 53 and 58 and art. 76(1), 77(2), 275(3) and 276, and Solvency II Delegated Regulation, title I, chapter III. See also IAIS (2011), para. 25, and ESRB (2017b), p. 6.

comparison to banks.[29] As illustrated in red in figure 1.1 above, traditional life insurance accordingly entails that generally long-term and less liquid liabilities are used to finance shorter term and more liquid assets. In addition, technical provisions must be established in order to ensure that life insurance undertakings can meet their commitments towards policyholders and beneficiaries.[30]

As reflected above, traditional life insurance is not associated with bank-like credit intermediation. However, in line with step 1 of the FSB's approach for identifying shadow banking, chapter 6.2 presents data regarding increases in Danish life insurance undertakings' *alternative credit investments*. Pursuant to the Danish Financial Supervisory Authority ("Danish FSA"), alternative investments are - in comparison to traditional investments - characterised by being traded on a shallow, illiquid and non-transparent market as well as being long-term and associated with different risks.[31] These characteristics and the lack of observable market prices make it challenging to value such alternative investments.[32] As illustrated in green (and to the right) in figure 1.2 above, these alternative credit investments may be similar to the illiquid and/or long-term credits that banks grant as a part of their credit intermediation.

Danish life insurance undertakings' alternative credit investments have to be viewed in the light of current economic conditions. In relation to a reduction in the interest rate of the ECB, Denmark entered into a negative interest rate environment in 2012 with, inter alia, a negative certificates of deposit rate for the first time in 200 years.[33] Danish FSA (2014b) stated that the low interest rate level in Denmark and the euro area posed a challenge to Danish life insurance undertakings' ability to generate returns to policyholders.[34] Subsequently, Danish FSA (2016) similarly stated that a decrease in the returns generated by Danish life insurance undertakings was primarily ascribed to returns on investments, including a large decrease in returns on bonds and financial instruments, and that the investment return reflected continuous low interest rates and low returns on global financial markets.[35] At the EU level, the European Insurance and Occupational Pensions Authority ("EIOPA") labels the low interest rate environment as the "most widely acknowledged issue of concern for the insurance sector" and the main risk for both the insurance and pension sector.[36]

The conditions on the financial markets may induce life insurance undertakings to "search for yield" which may entail that they "migrate" into banking and more risky asset classes, including lower rated or high-yield bonds and

[29] IAIS (2010), para. 9, and EIOPA (2016), para. 21.

[30] Solvency II, recital 53.

[31] Danish FSA (2014b), p. 1, Danish FSA (2016), pp. 1 and 13-14, Danish FSA (2017a), pp. 1 and 9, and Danish FSA (2018b), p. 11.

[32] Danish FSA (2016), p. 13, Danish FSA (2017a), p. 9, and Danish FSA (2018b), p. 11.

[33] See e.g. Danmarks Nationalbank (2012), pp. 57 and 59-60, which also notes that negative market interest rates were observed as early as 2011.

[34] P. 1.

[35] P. 1.

[36] EIOPA (2017c), p. 34, and EIOPA (2018c), pp. 5 and 50. See also EIOPA (2018a), para. 25.

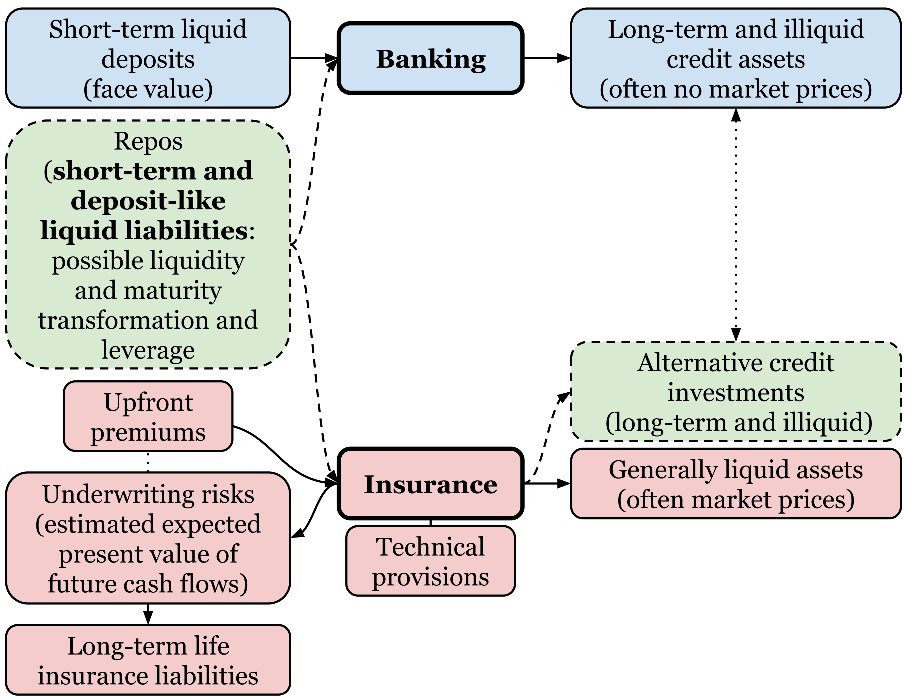

Figure 1.2: Illustration of the "traditional" business models and the similarities between banking and life insurance undertakings' repos and alternative credit investments.

alternative asset classes.[37] Chapter 6 of this dissertation describes how the migration into non-traditional assets has been given significant attention at both the Danish and EU level. In addition, chapter 10 will show how the EU actually supports life insurance undertakings' investments in unrated bonds and loans via a specialised treatment.

The migration into bank-like credit assets by life insurance undertakings does presumably not in itself constitute shadow banking. As described above, step 2 of the FSB's approach for identifying shadow banking entails the identification of developments that increase systemic risk, and these systemic risk developments include maturity transformation, liquidity transformation and/or leverage.[38] Shadow banking should accordingly be discussed and determined from a perspective that captures *both* assets and liabilities.

Life insurance undertakings can conduct credit intermediation without significant maturity or liquidity transformation as long-term and less liquid life insurance liabilities can be used to finance long-term and illiquid credit assets. This type of credit intermediation could even be a more stable source of funding than bank-based funding. However, if long-term and illiquid credit assets are financed by short-term and/or liquid liabilities, then maturity transformation and liquidity transformation may be taking place.

As reflected above, traditional life insurance is generally not associated with liquidity risk except for insurance-based lapse risk and mass surrenders.[39] In the EU, EIOPA's insurance stress test framework accordingly targets market risks and insurance-specific risk, including (i) an upward shift in the yield curve combined with increases in lapses, (ii) a downward shift in the yield curve combined with a longevity (i.e. life expectancy) stress, and (iii) a natural catastrophe scenario.[40]

However, as described in chapters 5 and 12, the financial crisis showed that the issuing of money-like, short-term and liquid liabilities, via repurchase agreements ("repos"), securities lending and other securities financing transactions ("SFTs"), may expose both banks and non-banks to liquidity risk and runs.[41] Repos, financial collateral arrangements and the associated liquidity risk and leverage are presented in chapter 5, which describes how a run on repos and other SFTs may manifest itself via no refinancing upon maturity and/or an increase in margin requirements and haircuts on financial collateral.[42] In life insurance, the primary example of SFT-based liquidity risk is presumably American International Group ("AIG").[43] In this case, an AIG non-insurance subsidiary lent out

[37] EIOPA (2017c), pp. 34-35, 49 , 50 and 55-56, and EIOPA (2018c), pp. 4, 52 and 56.

[38] FSB (2011c), section 1.

[39] EIOPA (2018e), pp. 27 and 33.

[40] EIOPA (2018a), para. 17-18 and 24-32.

[41] FSB (2013c), sections 1 and 2 and pp. 6-7, FSB (2013d), p. ii and e.g. section 2.2, BCBS (2008a), pp. 2-3 and 4, IAIS (2011), para 18 and appendix A7, IAIS (2017), p. 14, and EIOPA (2017c), p. 46.

[42] Gorton and Metrick (2012), Copeland et al. (2014), FSB (2012c), section 5.6, FSB (2013c), sections 1.1 and 1.2 and pp. 6-7, IAIS (2017), para. 42-44, IAIS (2018a), para. 33-34, 37 and 50-51 and p. 21.

[43] IAIS (2011), para 18 and appendix A7, FSB (2012c), section 5.6, IAIS (2017), p. 14,

securities (provided by AIG life insurance subsidiaries) in return for cash financial collateral which it reinvested in long-term and illiquid assets.[44] This activity made AIG subject to runs by securities borrowers (i.e. the cash lenders) as they could demand their cash financial collateral returned on short notice when they became aware of AIG being subject to, inter alia, margin calls under credit default swaps.[45] In general (and as described below and in chapters 6.1.1 and 14), life insurance undertakings' repos and securities lending are categorised as possible systemic non-insurance or shadow banking activities.[46]

In order to also capture life insurance undertakings' possible maturity and liquidity transformation as well as leverage, chapter 6.3 documents significant increases in the repo activities of the "top 5" Danish life insurance undertakings. These repo activities may *indicate* a possible systemic risk development in accordance with step 2 of the FSB's approach for identifying shadow banking.

As shown in green (to the left) in figure 1.2 above, both banks and life insurance undertakings can obtain short-term funding via repos and accordingly expose themselves to deposit-like liquidity risk and runs. When using repos as an indication of shadow banking, it must be remembered that maturity and/or liquidity transformation must also be present in relation to those repos as the reinvestment of cash financial collateral into liquid and high credit quality assets is assumed to form a part of traditional insurance and generally *not* amount to shadow banking.[47] However, except for financial collateral in the form of bonds, the balance sheets of the "top 5" Danish life insurance undertakings do not allow the tracking of reinvestment of cash financial collateral. In addition, chapter 6.3 will document non-compliance with the collateral reporting obligation which entails a lack of transparency regarding possible shadow banking and uncertainty regarding which assets constitute financial collateral in repos or "available" unencumbered assets.

Despite this lack of transparency, an increase in short-term and liquid liabilities (via repos) combined with a simultaneous increase in long-term and illiquid alternative credit investments may - from an overall perspective - entail changes in the risk profiles of Danish life insurance undertakings as well as necessitate revisions of assumptions regarding life insurance and systemic risk, including liquidity risk, leverage and fire sales.[48] In addition, and as described in chapter 6.3, registered assets may only be used for the satisfaction of policyholders and beneficiaries.[49] This necessitates a modification to the general

EIOPA (2017c), p. 46, and EIOPA (2018f), p. 44.

[44] IAIS (2011), para 18 and appendix A7, IAIS (2017), p. 14, FSB (2012c), section 5.6, EIOPA (2017c), p. 46, EIOPA (2018f), p. 44, and McDonald and Paulson (2015), p. 85.

[45] IAIS (2011), para 18 and appendix A7, IAIS (2017), p. 14, FSB (2012c), section 5.6, EIOPA (2017c), p. 46, EIOPA (2018f), p. 44, and McDonald and Paulson (2015), pp. 86-87 and 102.

[46] See e.g. IAIS (2011), para. 24, 27-29 and 31-32, IAIS (2013b), para. 14 and 18, IAIS (2013a), para. 13 and 29, IAIS (2016b), para. 2.3-2.5, and IAIS (2016a), para. 25 and p. 14 (table 2).

[47] IAIS (2013b), para. 18, example a. See also FSB (2015c), p. 8.

[48] See e.g. FSB (2013a), annex 3 (p. 44), IAIS (2017), para. 41-44, IAIS (2018a), para. 33-34, 37 and 50-52 and p. 21, EIOPA (2017c), pp. 46 and 49-50, and EIOPA (2018c), p. 52.

[49] Danish Financial Business Act, sec. 167(4).

assumptions regarding life insurance undertakings' large amounts of assets - relative to liabilities - as life insurance undertakings cannot simultaneously use registered assets as financial collateral in repos and therefore not use registered assets to meet non-insurance liquidity outflows.

The documented repo activities of one of the Danish life insurance undertakings may possibly not constitute a systemic risk development. However, the International Association of Insurance Supervisors' ("IAIS") proposed holistic framework for systemic risk assumes that systemic risk may arise from both entity-based sources as well as collective activities and exposures.[50] The holistic framework identifies liquidity risk (including SFTs and liquidity transformation) as a microprudential concern that may become a macroprudential concern due to fire sales that trigger a decrease in asset prices and significantly disrupt trading or funding in key financial markets or cause significant losses or funding problems for other undertakings with similar exposures.[51] In the EU, EIOPA (2018e) distinguishes between "traditional insurance" and banking-like activities and EIOPA (2017c) focuses on how e.g. bank-like activities may propagate or amplify shocks to the rest of the financial system and the real economy, independent of the failure of a single institution, and EIOPA identifies, inter alia, SFTs and direct lending as activities-based systemic risk drivers.[52] In addition, EIOPA discusses how behaviour-based sources of systemic risk include (i) excessive risk-taking and the "search for yield", (ii) excessive concentrations and (iii) collective behaviour that may exacerbate market price movements, including fire sales and herding.[53] From both a global and EU perspective, life insurance undertakings' collective use of repos and other SFTs may accordingly entail

- liquidity risk that may be propagated via an "asset liquidation channel" or "bank-like activities channel", including fire sales that could trigger a decrease in asset prices and significantly disrupt trading or funding in markets or cause significant losses or funding problems for other undertakings with similar exposures.[54]

- interconnectedness via direct counterparty exposures (to e.g. banks due to repos with banks and the holding of bank bonds and mortgage credit bonds) that may be propagated via an "exposure channel".[55]

- interconnectedness via herding behaviour, correlated exposures and common exposures to macroeconomic risk factors: if life insurance undertakings and other financial entities are generally exposed to a specific asset

[50] IAIS (2018a), para. 1 and 23-24.

[51] IAIS (2018a), para. 33-37, 49-52 and 58 and p. 21 (figure 1). See also IAIS (2017), para. 33-34, 41-44, and p. 14 (regarding AIG).

[52] EIOPA (2018e), p. 21, and EIOPA (2017c), pp. 5, 27-28, 30, 43-44, 46 and 49.

[53] EIOPA (2017c), pp. 5, 27, 30 and 50-52.

[54] IAIS (2018a), para. 29, 33-34, 49-51 and 56 and p. 21 (figure 1), and EIOPA (2017c), p. 5, 28-30, 43-44, 46 and 49-50.

[55] IAIS (2018a), para. 29, 38-41, 53 and 55 and p. 21 (figure 1), and EIOPA (2017c), p. 29, 43-44, 49, 53 and 58.

class (e.g. mortgage credit bonds), it may lead to correlated or collective behaviour that may be propagated via the "asset liquidation channel" and "exposure channel", including fire sales, deleveraging and reductions in available funding.[56]

As done in the last two points above, the role of liquidity risk and interconnectedness in systemic risk can be exemplified via repo-based exposures to Danish mortgage credit bonds.

In 2018, Danish life insurance undertakings' government bonds and mortgage credit bonds amounted to DKK 343.185 bill. for "average rate products" while they amounted to DKK 199.782 bill. for "market rate products".[57] A Danish mortgage credit bond is a considered very liquid and a reasonable match for life insurance liabilities.[58] Life insurance undertakings may also have large holdings of, inter alia, Danish mortgage credit bonds that function as a liquidity buffer and are to be sold or used as collateral in a stress scenario.[59] As described above, in traditional life insurance, a majority of life insurance undertakings' assets are supported by long-term and less liquid insurance liabilities. Life insurance undertakings can accordingly limit exposures to market risk if they can hold such mortgage credit bonds (or other assets with similar cash flow characteristics) to maturity and match the cash flows of those assets with their life insurance liabilities.[60]

However, as described in chapter 5.1.1.2, contrary to the traditional funding of life insurance undertakings' mortgage credit bonds or other assets, repo-based funding of assets entails that those assets may be funded by procyclical leverage which exposes the life insurance undertakings to liquidity risk that may lead to fire sales and exposures to market risk. If several Danish life insurance undertakings use repo-based leverage to fund the same strategy or asset (e.g. Danish mortgage credit bonds), then funding problems may lead to deleveraging and fire sales of that type of asset and trigger the liquidity and loss spirals of Brunnermeier and Pedersen (2009). These spirals may move asset prices away from fundamentals and spread to the balance sheets of other financial entities as well as their secured funding, if they use the assets as financial collateral.

In order to capture such possible entity-/activities-/behaviour-based sources of systemic risk developments, Danish life insurance undertakings' repo activities should be viewed from an aggregated perspective. This perspective is provided in chapter 6.3.1.2. The data show how the "top five" Danish life insurance undertakings' aggregated debt to credit institutions and repo collateral both increased more than DKK 100 bill. (approx. EUR 13.4 bill.) in the period of 2012-2016, whereafter a significant decline occurred.

[56]IAIS (2018a), para. 29, 35-37 and 52-54 and p. 21 (figure 1), and EIOPA (2017c), p. 5, 29-30, 43 and 50-51, 58.

[57]Danish FSA (2019b), table 1.5 (both figures have been rounded). See chapter 6.2 in relation to average rate products and market rate products.

[58]European Commission QIS4 (2008), TS.XVII.F.1-2.

[59]See e.g. Danica (2018), C.4.

[60]See also Omnibus II, recital 31.

In line with the FSB's two steps for identifying shadow banking, the documented alternative credit investments of Danish life insurance undertakings in chapter 6.2 (i.e. non-bank credit intermediation in step 1), as well as the documented individual and aggregated repo activities of the "top five" Danish life insurance undertakings in chapter 6.3 (i.e. step 2), may amount to *possible* systemic risk developments and *indications* of shadow banking in Danish life insurance. However, the FSB states that the shadow banking definition's criterion regarding "entities and activities outside the regular banking system" implies focusing on

> *"...credit intermediation that takes place in an environment where prudential regulatory standards and supervisory oversight are either not applied or are applied to a materially lesser or different degree than is the case for regular banks engaged in similar activities."*[61]

The possible systemic risk developments and indications of shadow banking in Danish life insurance do accordingly not amount to shadow banking if the life insurance undertakings' bank-like activities are subject to prudential regulatory standards that are similar to the prudential regulatory standards that apply upon banks that conduct similar activities. However, if this is not the case, then life insurance undertakings may not be forced to internalise the cost of the risks associated with the bank-like activities. Based on this regulatory criterion, the following chapter will define regulatory arbitrage and present the overall research question as well as the structure of this dissertation.

1.1 Regulatory Arbitrage and Research Question

As described above, step 2 of the FSB's identification of shadow banking includes (i) developments that increase systemic risk and/or (ii) indications of regulatory arbitrage that is undermining the benefits of financial regulation.[62] In relation to shadow banking, regulatory arbitrage can be defined as differences in regulation that allow non-banks to conduct bank-like activities, without internalising the cost of the associated risks, and thereby gain a competitive advantage relative to banks that are subject to regulation that aims to achieve such an internalisation.[63] Regulatory arbitrage may therefore undermine banking regulation, including the financial crisis-based reforms, and entail an increase of bank-like risks and leverage in the financial system.[64]

In the EU, lawmakers are accordingly faced with a challenge as the regulation of banks may entail that bank-like activities migrate from regulated banks to

[61] FSB (2011c), p. 3.
[62] FSB (2011c), section 1.
[63] FSB (2011b), section 1.2.2, and FSB (2011c), section 2.4.2. See also European Commission (2005), para. 10, and European Commission (2013b), p. 4.
[64] FSB (2011b), section 1.2.2, and FSB (2011c), section 2.4.2, European Commission (2013b), p. 2, and ESRB (2016b), para. 6-7.

non-banks due to possibilities of regulatory arbitrage.[65] In addition, banks may themselves use shadow banks to circumvent capital or liquidity requirements and increase leverage.[66] As an example, a financial conglomerate, which includes e.g. a bank and a life insurance undertaking, could compare differences in the applicable regulation of credit risk, liquidity risk and leverage.[67] Based on the comparison, the financial conglomerate could obtain funding via the entity that is subject to the least restrictive requirements regarding liquidity risk and leverage. At the same time, it could grant credits via the entity that is subject to the lowest capital requirements for credit risk.

In relation to life insurance, regulatory arbitrage was given attention during the Solvency II project that was initiated in 1999.[68] In order to ensure consistency across financial sectors, the Solvency II project initially stated that the general layout of Solvency II was to - the extent necessary and possible - be compatible with the approach and rules used in the banking field.[69] Products containing similar risks were to - in principle - be supervised in the same way and be subject to the same capital adequacy or solvency requirements.[70] Assessments of the relevance of banking regulation began as early as 2001 and the Solvency II project generally referred to the global banking standards in the former Basel II as well as CRD (that implemented Basel II into EU law), which could be used as a "starting point" and be adapted to the needs of insurance.[71]

In 2009, Solvency II was adopted at level 1. Subsequently, it was amended by, inter alia, Omnibus II that was adopted in 2014 and introduced the long-term guarantee measures to address the low interest rate environment.[72] As reflected in red in figure 1.3 below, Solvency II's initial level 1 regulation, which governs the adoption of regulation at level 2, may therefore have been developed before (and during) the financial crisis and therefore not include the purpose of capturing the shadow banking and systemic risk that emerged during the financial crisis.[73] In line with this "pre-financial crisis perspective", chapter 14 describes

[65] SFT Regulation, recitals 1 and 6, European Commission (2012), p. 2, European Commission (2013b), pp. 2 and 4, EIOPA (2012), p. 3, EIOPA (2018e), p. 22, and ESRB (2016b), para. 6-7.

[66] FSB (2011b), section 1.2.2, and FSB (2011c), section 2.4.2. See also European Commission (2012), p. 5.

[67] This approach could of course be affected by consolidation which is outside the scope of this dissertation.

[68] European Commission Action Plan (1999), strategic objective 3, p. 26, and European Commission (1999), section 1.1,

[69] European Commission (2003), para. 10, European Commission (2004c), p. 3, European Commission (2004a), p. 3, European Commission (2004b), p. 3, European Commission (2005), para. 10, and European Commission (2006), para. 10.

[70] European Commission (2003), para. 10, European Commission (2004a), p. 3, European Commission (2004b), p. 3, European Commission (2005), para. 10, and European Commission (2006), para. 10.

[71] BCBS (2006), CRD, recital 37, and e.g. European Commission (2001), European Commission (2003), para. 7, European Commission (2004c), p. 3, European Commission (2005), para. 2, and European Commission (2006), para. 2.

[72] Omnibus II, art. 2(23) and (36), and Solvency II, art. 77a-f and 138(4). See chapter 13.1 regarding the long-term guarantee measures.

[73] See chapter 2.2 regarding level 1 and 2 regulation.

how Solvency II is generally not considered a macroprudential framework that is calibrated to address system-wide risks, designed to limit non-insurance activities, or structured to impose additional capital requirements for macroprudential purposes.[74]

In 2014, the European Commission adopted the level 2 Solvency II Delegated Regulation that includes detailed pillar 1 requirements, including the SCR standard formula's risk-based capital requirements.[75] As also reflected in figure 1.3, the Solvency II Delegated Regulation was initially based upon level 2 advice, which was provided by the former CEIOPS until 2010, as well as other advice from CEIOPS and input from five quantitative impact studies during 2005-2011.[76] While the Solvency II Delegated Regulation underwent a review during 2016-2019, it continues to be governed by the framework principles at level 1 in Solvency II, which may reflect the pre-financial crisis perspective of systemic risk.[77]

As reflected above, Solvency II's level 1 framework principles and regulatory arbitrage may have been developed and assessed in the light of Basel II. However, the finalised Basel III is replacing Basel II, and Solvency II's level 1 and *initial* level 2 regulation was finalised before the adoption of all of the finalised Basel III's individual standards. This is illustrated in blue in figure 1.3.

Due to the financial crisis, the global Basel Committee on Banking Supervision ("BCBS") initially structured the Basel III framework in 2010.[78] However, Basel III was not finalised until the adoption of BCBS Basel III (2017), which includes, inter alia, the finalised leverage ratio and the capital requirements for credit risk, and BCBS Basel III (2019), which includes the minimum capital requirements for market risk. Depending on the implementation of the finalised Basel III into EU law, Solvency II may not address (future) regulatory arbitrage possibilities in relation to bank-like risks and activities that the finalised Basel III addresses due to the financial crisis, including the components of credit risk as well as liquidity risk, leverage and systemic risk.[79]

The global transposition dates for significant parts of the finalised Basel III have been placed in the year 2022.[80] The EU's implementation of the finalised Basel III is not being done via a single amendment to the CRR, which includes the EU's prudential requirements for credit institutions. Instead, one amendment, which was initially proposed in 2016 as a part of the "Banking Package", was adopted in 2019 as CRR II alongside CRD V.[81] The Banking Package and

[74] ESRB (2015), section 6, ESRB (2016a), p. 13, EIOPA (2016), para. 34, 53, 56 and 67, EIOPA (2017c), pp. 14 and 66, EIOPA (2018f), p. 3.

[75] Solvency II Delegated Regulation, title I, chapter V.

[76] See, inter alia, eiopa.europa.eu/publications/solvency-ii-final-l2-advice and eiopa.europa.eu/Pages/QIS/Quantitative-Impact-Studies.aspx

[77] In relation to the review, see Commission Delegated Regulation (EU) 2019/981, European Commission (2016) and European Commission (2017c).

[78] See Basel III in BCBS (2011).

[79] See chapter 4 regarding the components of credit risk.

[80] BCBS Basel III (2017), Introduction, para. 9, and BCBS Basel III (2019), Introduction.

[81] COM/2016/850 final and CRR II, which includes, inter alia, (i) the standardised approach for measuring counterparty credit risk exposures in relation to derivatives, (ii) exposures to CCPs, (iii) the binding leverage ratio of 3%, (iv) the binding NSFR and (v) the FSB's total

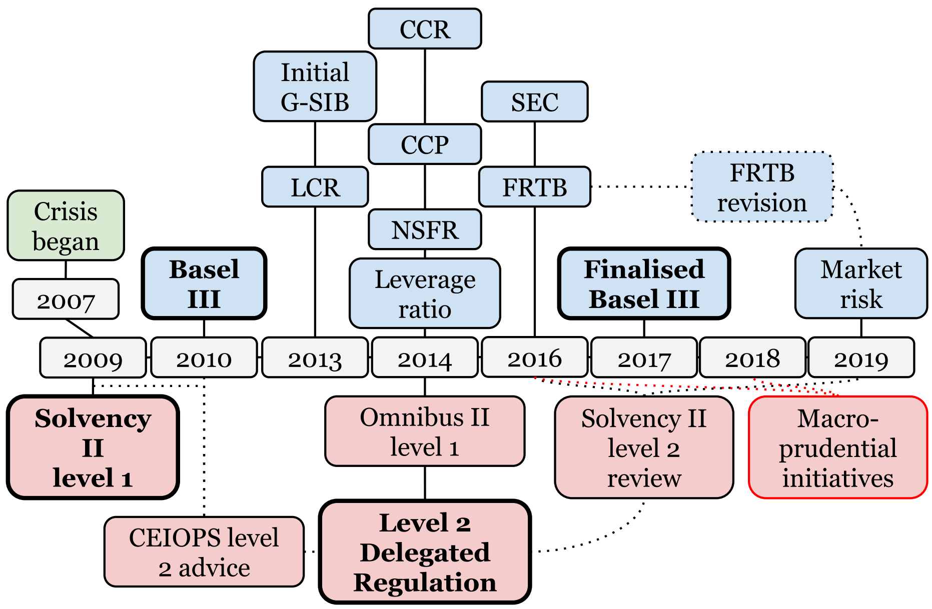

Figure 1.3: Timeline that reflects how the level 1 framework principles in Solvency II were adopted before the initial Basel III and finalised Basel III, including the (i) liquidity coverage ratio in BCBS Basel III (2013) ("LCR"), (ii) the initial G-SIB methodology and higher loss absorbency requirement in BCBS (2013b) ("G-SIB"), (iii) leverage ratio in BCBS Basel III (2014a), (iv) net stable funding ratio in BCBS Basel III (2014b) ("NSFR"), (v) capital requirements for CCP exposures in BCBS Basel III (2014c) ("CCP"), (vi) counterparty credit risk standards in BCBS Basel III (2014d) ("CCR"), (vii) the fundamental review of the trading book in BCBS Basel III (2016b) ("FRTB"), (viii) the securitisation framework in BCBS Basel III (2016a) ("SEC") and BCBS Basel III (2018), (ix) the finalised Basel III in BCBS Basel III (2017), and (x) the finalised minimum capital requirements for market risk in BCBS Basel III (2019). The macro-prudential initiatives in relation to Solvency II include EIOPA (2016), EIOPA (2017c), EIOPA (2018e), and EIOPA (2018f).

CRR II was not to include, inter alia, the finalised Basel III's capital requirements for credit risk or minimum capital requirements for market risk.[82] In EBA (2019a), the European Banking Authority ("EBA") is of the view that the overall revisions in BCBS Basel III (2017) should be implemented into EU law in accordance with the proposed transposition dates, including the capital requirements for credit risk with minor exceptions.[83] The European Commission has also called on the EBA to provide advice on the finalised Basel III's minimum capital requirements for market risk, and the European Commission is to submit a legislative proposal - by June, 2020 - that implements those minimum capital requirements for market risk.[84]

The EU's implementation of the finalised Basel III may accordingly entail adjustments as well as suddenly change tracks and speed due to political negotiations in the EU and/or subsequent amendments by the BCBS.[85] To provide a complete picture of EU banking regulation accordingly resembles the art of aiming for a target that constantly changes size and speed.

Obviously, the default approach for assessing EU life insurance undertakings' possible shadow banking via regulatory arbitrage possibilities would be a comparison of the EU's regulation of banks and life insurance undertakings. However, as reflected above, the EU's implementation of the finalised Basel III entails that the *entire* finalised Basel III will *not* become applicable EU law during the writing of this dissertation. The question is therefore whether to

- focus purely on applicable EU law that reflects parts of the finalised Basel III, or
- compare (i) the EU's regulation of life insurance in Solvency II to (ii) the global banking standards in the entire finalised Basel III.

This dissertation compares Solvency II to the finalised Basel III as essential parts of the FSB's shadow banking initiatives and the BCBS' responses to the financial crisis are placed in the finalised Basel III. This approach will also enable a meaningful comparison that is not inhibited by implementation challenges. The comparison is carried out while being fully aware of the legal fact that the finalised Basel III only amounts to global standards as well as that the BCBS does not possess any formal supranational authority and that its decisions do not have legal force.[86]

In addition to the above, the finalised Basel III's treatment of e.g. SFTs, credit risk and market risk was developed in the light of the financial crisis and may capture risks - and abandon prior risk assumptions - that are relevant

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loss absorbing capacity for G-SIBs, cf. CRR II, inter alia, recitals 8-10, 15-18, 33-35, and 45-55.

[82] European Commission (2019), sections 1 and 3.3. See also BCBS Basel III (2017) and BCBS Basel III (2019).

[83] Pp. 25-26.

[84] European Commission (2018a), section 7, European Commission (2019), section 3.3, and EBA (2019a), para. 331.

[85] See e.g. European Commission (2019), section 3.3.

[86] BCBS Charter (2018), section 3.

in relation to life insurance undertakings' possible shadow banking activities. Although parts of the finalised Basel III may not become EU law, they may still be relevant when assessing Solvency II as they reflect a coordinated effort by the FSB and BCBS to address shadow banking. As described in chapter 13.2, this is especially the case in relation to the FSB's numerical haircut floors framework, which is placed in the finalised Basel III but targets non-banks' access to leverage via certain SFTs.[87]

Despite the above, life insurance may not be associated with shadow banking due to the existence of Solvency II. As described in chapter 6.1.2, the EBA excludes insurance undertakings from its definition of shadow banking entities while stating that they are subject to an "appropriate and sufficiently robust prudential framework".[88] However, whether life insurance can be associated with shadow banking is not simply a question of whether life insurance is subject to prudential requirements in Solvency II as regulatory arbitrage can be conducted in relation to individual risk types that may not be "captured" in an otherwise "robust" framework. As described in chapter 8, this dissertation relies on a scenario that enables a risk-based approach that focuses on the assumed risk exposures regardless of the legal or institutional form of the activities or the entity that may perform those activities.[89] This approach allows an assessment whether individual risk types are subject to quantitative requirements in both Solvency II and the finalised Basel III. Such an approach also seems to be in line with the FSB's definition of shadow banking which implies focusing on credit intermediation that takes place in an environment where prudential regulatory standards and supervisory oversight are either not applied or are applied to a materially lesser or different degree than is the case for regular banks engaged in *similar activities.*[90]

Based on the possible systemic risk developments and indications of shadow banking in chapter 6, and in order to assess the possibilities of regulatory arbitrage, this dissertation's overall research question is as follows:

> *Does Solvency II subject life insurance undertakings' bank-like risk exposures to requirements that are similar to the finalised Basel III's requirements for banks that are exposed to similar risks?*

Based on the scenario in chapter 8, this overall research question will be answered by comparing how Solvency II and the finalised Basel III address the following:

- credit risk (in the form of default risk, credit spread risk and migration risk) and counterparty credit risk (see part VI).

- liquidity risk (see part VII).

[87] FSB (2015c), section 3, BCBS Consol. Basel III (2019), CRE56, and BCBS Basel III (2017), Standardised approach for credit risk, para. 179-188.

[88] EBA Guidelines (2015), section 2.1.2 , para. 7 and 10, and section 3, para. 8 and 11 (definition of "excluded undertakings"). See also EBA (2014a), pp. 1 (footnote 3) and 4, EBA (2014b), para. 4 (footnote 4) and 46-49, and EBA (2015), para. 8 and 9.

[89] IAIS (2018a), para. 23, and IAIS (2017), para. 16 and 34. See also EIOPA (2012), p. 2.

[90] FSB (2011c), p. 3.

- leverage and the associated procyclicality (see part VIII).
- systemic risk (see part IX).

Part V will describe the overall structural differences between pillar 1 requirements in Solvency II and the finalised Basel III. In short, these are:

- overall capital requirements,
- risk measures and calibration, and
- aggregation and diversification effects.

Due to the structural differences, the comparison of Solvency II and the finalised Basel III will not entail an application of quantitative pillar 1 requirements to a defined scenario in order to assess the respective value differences in e.g. the calculated pillar 1 requirements. Instead, the comparison will be limited to assessing whether the risk types and leverage are *subject* to quantitative pillar 1 requirements. If a quantitative pillar 1 requirement exists for the risk type in both Solvency II and the finalised Basel III, then the requirement will be regarded as "similar" and the risk type will not be viewed as being addressed to a materially lesser or different degree.

The term "shadow banking" may be perceived as pejorative.[91] However, the FSB and EU generally recognise that non-bank credit intermediation can have advantages, including that it may constitute an alternative source of funding and liquidity as well as provide efficient credit based on specialised expertise.[92] The purpose of this dissertation is only to assess the possibilities of regulatory arbitrage in Solvency II that may have systemic risk implications. The purpose is not to identify systemically important Danish life insurance undertakings. However, and as discussed above, while the possible SFT-based shadow banking activities of one life insurance undertaking may not be considered able to have systemic risk implications, the collective behaviour of life insurance undertakings may have such systemic risk implications.

[91] FSB (2011c), footnote 3, and European Commission (2013b), section 1.2, and European Commission (2013b), section 1.2.

[92] FSB (2011b), p. 1, FSB (2011c), p. 1 and footnote 3, and FSB (2013d), p. ii, European Commission (2012), section 4, and EBA Guidelines (2015), section 2.1, para. 29.

Part II

Sources and Background

Chapter 2

Sources and Applicability

The G20's responses to financial crisis included, inter alia,

- the strengthening of international banking regulation, including the improvement of both the quantity and quality of bank capital and the discouraging of excessive leverage.[1]
- the establishment of central counterparties ("CCPs"), which are subject to effective regulation and supervision, as well as the clearing and reporting of standardised OTC derivatives.[2]
- that all systemically important financial institutions ("SIFIs"), markets, and instruments (including shadow banks) should be subject to an appropriate degree of regulation and oversight.[3]
- that the FSB should propose measures regarding SIFIs, including intensive supervision and additional capital, liquidity and other prudential requirements.[4]
- that the FSB should work in collaboration with other international standard setting bodies to develop recommendations to strengthen the regulation and oversight of the shadow banking system as regulatory gaps in the shadow banking system could emerge upon the completion of the new banking regulation.[5]

The regulation of banks, shadow banking and systemic risk is accordingly of a global nature and the result of interaction between several global bodies. In chapter 2.1, the FSB, BCBS and IAIS as well as their global standards will be introduced in an overall fashion.

[1] G20 (2009a), p. 2, and G20 (2009b), p. 8, para. 13.
[2] G20 (2009a), p. 3, and G20 (2009b), p. 9, para. 13.
[3] G20 (2009a), p. 3.
[4] G20 (2009b), p. 9, para. 13.
[5] G20 (2010), p. 10, para. 41.

In the EU, life insurance undertakings are governed by Solvency II, including the Solvency II Delegated Regulation at level 2.[6] Solvency II and its three pillars are introduced in an overall fashion in chapter 3. However, chapter 2.2 will describe the use of sources from the European System of Financial Supervision, including EIOPA, EBA, the European Securities and Markets Authority ("ESMA") and the European Systemic Risk Board ("ESRB"). Chapter 2.3 will then describe the limited amount of EU case law while chapter 2.4 will describe the use of financial literature.

2.1 Global Standards

2.1.1 FSB - Systemic Risk and Shadow Banking

The FSB was established at a G20 summit in 2009 in the light of the financial crisis.[7] At the international level, the FSB has the objective of coordinating the work of national financial authorities and international standard setting bodies.[8] The BCBS and IAIS are members of the FSB, and the BCBS' global standards relate to banking and financial stability while the IAIS's global standards relate to insurance and financial stability.[9] Under the purview of the FSB, both the BCBS and IAIS implement the FSB's policy measures for SIFIs as well as implement initiatives regarding shadow banking.[10]

As described in chapter 14, the G20's initiatives in relation to systemic risk resulted in the FSB's recommendations, policy measures and principles for SIFIs, global systemically important banks ("G-SIBs") and global systemically important insurers ("G-SIIs"), including higher loss absorbency requirements.[11] In addition to addressing SIFI-based systemic risk, the FSB has issued recommendations that are to strengthen the oversight and regulation of shadow banking, including repos and securities lending, as well as proposed minimum haircut floors for certain SFTs.[12] When doing so, the FSB has five shadow banking workstreams[13] that focus on:

1. the regulatory reform of money market funds.

[6] Solvency II, art. 2(1).

[7] G20 (2009a).

[8] FSB (2012a), art. 1 and 2(1)(e).

[9] FSB (2012a), annex A(C), BCBS Charter (2018), sections 1, 2(c) and 12, and IAIS By-Laws (2018), art. 2(1) and (2)(a) and (c).

[10] See e.g. BCBS Consol. Basel III (2019), CRE56, and BCBS Basel III (2017), Standardised approach for credit risk, para. 179, BCBS (2018), para. 6 and 7, IAIS (2013b), para. 18, and IAIS (2016a), para. 1.

[11] See, inter alia, FSB (2010b) (recommendations regarding SIFIs, including a (i) loss absorption capacity beyond Basel III and (ii) resolution frameworks), FSB (2011a) (policy measures to address SIFIs, including the additional loss absorption capacity for G-SIBs), FSB (2013b) (policy measures for G-SIIs, including higher loss absorbency requirements for non-traditional and non-insurance activities), and FSB (2015b) (principles on loss-absorbing and recapitalisation capacity of G-SIBs in resolution).

[12] FSB (2011b), FSB (2011c), FSB (2012c), FSB (2013c), FSB (2013d) and FSB (2015c)

[13] FSB (2011c), pp. 4-5.

2. the regulation of "other" shadow banking entities (i.e. other than money market funds).[14]

3. the regulation of securitisation.

4. the regulation of securities lending and repos, including the procyclicality associated with margins and haircuts in SFTs.[15]

5. the regulation of banks' interactions with shadow banking entities.

This dissertation will primarily focus on workstreams 4 and 5, especially as the policy framework[16] for addressing shadow banking risks in securities lending and repos, including the regulatory framework[17] for haircuts on non-centrally cleared SFTs, serves as the FSB's primary framework for shadow banking via securities lending and repos.[18] The "secondary" policy framework for strengthening oversight and regulation of "other" shadow banking entities may supplement the primary framework as it includes an economic functions-based framework that allows authorities to categorise non-bank financial entities by economic functions or activities instead of legal forms or names.[19] The economic functions include loan provision that is dependent on short-term funding, e.g. credit provision with funding heavily dependent on wholesale funding markets (e.g. repos and asset-backed commercial paper) or short-term commitment lines from banks.[20]

2.1.2 BCBS and the Finalised Basel III

The BCBS is the primary global standard setter for the prudential regulation and supervision of banks.[21] It has the mandate to strengthen the regulation, supervision and practices of banks worldwide with the purpose of enhancing financial stability.[22]

The BCBS sets the Basel framework, including the finalised Basel III, which constitutes global standards for internationally active banks.[23] The BCBS initially issued Basel I in 1988 and Basel II in 2004 as well as a comprehensive

[14] See FSB (2013d)

[15] See FSB (2013c) and FSB (2015c).

[16] FSB (2013c).

[17] FSB (2015c).

[18] FSB (2013d), p. 12, footnote 19.

[19] FSB (2013d), p. 6.

[20] FSB (2013d), section 2. The other functions are (i) management of collective investment vehicles with features that make them susceptible to runs, (ii) intermediation of market activities (e.g. broking and prime brokerage to hedge funds) that is dependent on short-term funding or on secured funding of client assets, (iii) facilitation of credit creation (e.g. credit enhancement in the form of guarantees), including credit creation by non-bank financial entities whose funding is heavily dependent on wholesale funding markets (e.g. repos and asset-backed commercial paper) or short-term commitment lines from banks and (iv) securitisation-based credit intermediation and funding of financial entities (e.g. securitisation that is used to fund long-term, illiquid assets by raising shorter-term funds).

[21] BCBS Charter (2018), sections 1 and 12.

[22] BCBS Charter (2018), section 1.

[23] BCBS Charter (2018), section 12, and BCBS Consol. Basel III (2019), SCO.10.1.

version of Basel II in 2006.[24] As a response to the financial crisis, Basel II was amended by "Basel 2.5" in 2009.[25] Subsequently, the G20's initiatives in relation to, inter alia, the improvement of bank capital as well as the introduction of capital buffers, liquidity requirements and a non-risk based measure for leverage resulted in the initial Basel III, which builds on the three pillars of Basel II.[26]

As stated in relation to the overall research question in chapter 1.1, the finalised Basel III only amounts to global standards and the BCBS does not possess any formal supranational authority and that its decisions do not have legal force.[27] The finalised Basel III is made up of a significant number of adopted individual standards that are also referred to as "Basel IV".[28] In order to improve accessibility, the BCBS issued - in April 2019 - the draft consolidated version of the finalised Basel III and comments are to be provided by August 2019.[29] The draft consolidated version includes the finalised Basel III's standards that are applicable as of 2022. This entails that the writing of this dissertation occurred before a final consolidation of the finalised Basel III's individually adopted standards. However, the consolidation does generally not include any intention to introduce new requirements or amend the standards.[30] This dissertation accordingly refers to both the draft consolidated version and the individual standards in the finalised Basel III.

2.1.3 IAIS

The IAIS has the purpose of promoting effective and globally consistent supervision of the insurance industry in order to develop and maintain fair, safe and stable insurance markets for the benefit and protection of policyholders.[31] It also has the purpose of contributing to global financial stability.[32] The IAIS is to develop principles, standards and guidance for the supervision of insurance

[24] BCBS (1988) and BCBS (2006).

[25] BCBS (2009a), BCBS (2009d) and BCBS (2009c).

[26] Basel III, para. 7, G20 (2009a), pp. 2-3, and G20 (2009b), p. 8, para. 13.

[27] BCBS Charter (2018), section 3.

[28] See, inter alia, BCBS Basel III (2013) (liquidity coverage ratio and liquidity risk monitoring tools), BCBS Basel III (2014b) (net stable funding ratio), BCBS Basel III (2014d) (standardised approach for measuring counterparty credit risk exposures), BCBS Basel III (2014c) (capital requirements for bank exposures to central counterparties), BCBS Basel III (2016a) (revisions to the securitisation framework and criteria for simple, transparent and comparable ("STC") securitisations), BCBS Basel III (2018) (capital treatment for short-term STC securitisations), BCBS Basel III (2014e) (supervisory framework for measuring and controlling large exposures), BCBS Basel III (2017) (finalisation of Basel III, including (i) the standardised approach for credit risk, (ii) internal ratings-based ("IRB") approach for credit risk, (iii) minimum requirements for credit valuation adjustment ("CVA") risk, (vi) minimum capital requirements for operational risk, (vii) a finalised leverage ratio, and (viii) a capital floor, based on 72.5% of risk weighted assets, calculated using only standardised approaches) and BCBS Basel III (2019) (finalised minimum capital requirements for market risk).

[29] BCBS (2019a), p. 1. The draft consolidated version is accessible via bis.org/basel_framework/

[30] BCBS (2019a), p. 2.

[31] IAIS By-Laws (2018), art. 2(1)(a).

[32] IAIS By-Laws (2018), art. 2(1)(b).

markets and to develop methodologies for the assessment of the observance of its principles and standards.[33]

As described in chapter 14, the FSB relies on the IAIS' assessment methodologies for designating G-SIIs when imposing the higher loss absorbency requirement upon G-SIIs.[34] These assessment methodologies also relate to shadow banking as they include indicators that capture shadow banking activities, including repos.[35]

The IAIS' global standards can be viewed as parallels to the BCBS' global standards for banks and systemic risk. However, a significant difference between global standards for banks and insurance undertakings is that there is currently no global capital standards for insurance that are applied in a global fashion like the Basel framework for banks.[36] FSB (2013b) initially requested the IAIS to develop the global risk-based insurance capital standard ("ICS") for internationally active insurance groups and G-SIIs in order to support financial stability.[37] The ICS is expected to be completed in late-2019 whereafter monitoring is to begin in 2020 and implementation is to occur in 2024.[38] The IAIS also issues "insurance core principles" which provide a global framework for the supervision of the insurance sector.[39]

In EU law, the role of the IAIS also appears to have been less evident than the role of the BCBS. The Solvency II project was to take account of the parallel work of the IAIS and compliance with international solvency standards.[40] In addition, the European Commission referred CEIOPS to the global framework for insurer solvency assessment in International Actuarial Association (2004), which was prepared in support of the IAIS.[41] Similarly, CEIOPS (2007a) discussed the IAIS' approaches, in relation to valuation and technical provisions, and considered the IAIS' developments to - at a certain extent - be consistent with the European Commission's objectives for technical provisions.[42] In its recitals, Solvency II simply states that an economic risk-based approach was to be adopted in line with the latest developments in risk management in the context of, inter alia, the IAIS and the International Actuarial Association ("IAA").[43]

As this dissertation compares the EU's Solvency II to the finalised Basel III,

[33] IAIS By-Laws (2018), art. 2(2)(a) and (c).

[34] FSB (2011a), para. 12, IAIS (2013b), IAIS (2015), para. 1, and IAIS (2016a). See also e.g. FSB (2017c).

[35] IAIS (2013a), p. 16, IAIS (2013b), para. 18, IAIS (2016a), para. 25 and p. 14, table 2, and IAIS (2016b), para. 1.2 and 2.3-2.5.

[36] IAIS (2015), para. 3, 5, 9 and 10. See also IAIS (2014), para. 2.

[37] FSB (2013b), para. 8, and IAIS (2018c), para. 11 and 13.

[38] IAIS (2018c), para. 1 and 10.

[39] IAIS (2018b).

[40] Solvency II, recital 15, European Commission (1999), section 4.2, European Commission (2002), para 107, and section 2.3.2.2, European Commission (2003), para. 14-15, European Commission (2004c), p. 3 and annex 1, p. 3, European Commission (2004b), p. 3, European Commission (2004d), section 4.2 and 4.4, European Commission (2005), para. 11, European Commission (2006), para. 11 and 16, and European Commission (2007), section 9.

[41] European Commission (2004d), section 5.2.

[42] Para. 2.6-2.11, 2.14, and 2.20.

[43] Solvency II, recital 15.

the IAIS' ICS will generally not be referred to. However, this dissertation relies on the IAIS' standards and publications when describing the global approach for life insurance undertakings and shadow banking, including the higher loss absorbency requirement for G-SIIs[44] and the proposed holistic framework[45] for entity-based and activity-based sources of systemic risk.

2.2 EU Supervisory Authorities

In the light of the financial crisis, de Larosiere Group (2009) found that regulators and supervisors focused on the microprudential supervision of individual financial institutions and not sufficiently on the systemic risks of a contagion of correlated horizontal shocks.[46] The Group believed that effective macroprudential supervision encompassed all sectors of finance, and the wider macroeconomic context, and it recommended a macroprudential supervision of all financial activities.[47] Subsequently, the ESRB Regulation established the ESRB and states that the ESRB should contribute towards implementing the recommendations of, inter alia, the FSB and Bank for International Settlements (where BCBS is a committee).[48] This dissertation accordingly relies on the ESRB's publications as well as the publications of the european supervisory authorities EIOPA, ESMA and EBA (collectively the "ESAs").

As described in chapter 1.1, CEIOPS (which was replaced by EIOPA) was the primary advisor of the European Commission during the Solvency II project.[49] Through its answers to the European Commission's three waves of "calls for advice", quantitative impact studies and level 2 advice, CEIOPS advised the European Commission on Solvency II before its adoption at both level 1 and 2.[50] Accordingly, CEIOPS' level 1 and 2 input will be used to find the reasoning behind the final approaches of Solvency II and the Solvency II Delegated Regulation, including views on consistency with banking regulation.

When laying out the framework for establishing the European System of Financial Supervision, de Larosiere Group (2009) proposed that level 3 should ensure harmonisation by providing the European Commission with proposals for level 1 and 2 regulation.[51] The ESAs were to, inter alia, advise the European Commission on regulatory and other issues, define overall supervisory policies

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[44] IAIS (2015).
[45] IAIS (2018a).
[46] Para. 29, 39 and 153.
[47] de Larosiere Group (2009), para. 153, 173 and 177 and recommendation 16.
[48] ESRB Regulation, recitals 4-8 and art. 1.
[49] See e.g. European Commission (2004c), pp. 4 and 6, and EIOPA Regulation, recital 9 and art. 80.
[50] See e.g. European Commission (2004c), European Commission (2004b), European Commission (2005), European Commission (2006), European Commission (2004d), CEIOPS (2005a), CEIOPS (2005b), CEIOPS (2006a), CEIOPS (2007b), CEIOPS (2007a), CEIOPS (2007d), CEIOPS (2009a), CEIOPS (2009c), CEIOPS (2009d), CEIOPS (2009b), CEIOPS (2010a) and CEIOPS (2010c).
[51] Para. 200 and recommendation 20.

and ensure convergence of supervisory rules and practices.[52] In line with this approach, the ESA Regulations state that the ESAs are to contribute to the establishment of high-quality common regulatory and supervisory standards and practices, in particular by providing opinions to EU institutions and by developing guidelines and recommendations as well as drafting regulatory and implementing technical standards.[53]

Based on the ESAs' highly specialised expertise and a need to introduce an effective instrument to establish harmonised regulatory technical standards, which could ensure a level playing field and adequate protection of depositors, policyholders and investors, the ESAs are entrusted with the elaboration of draft regulatory technical standards which are not to imply strategic decisions or policy choices.[54] At level 2, the draft regulatory technical standards may be adopted by the European Commission by means of delegated acts under TFEU, art. 290.[55] In the process of the European Commission's endorsement and adoption of the ESAs' draft regulatory technical standards, the recitals of the ESA Regulations state that amendments are only to be made in very restricted and extraordinary circumstances as the ESAs are considered to be in close contact with - and knowing best - the daily functioning of financial markets.[56] In addition, any changes to the content of draft regulatory technical standards must be done in coordination with the ESA.[57]

The ESA Regulations also empower the ESAs to draft implementing technical standards to be adopted by the European Commission via implementing acts under TFEU, art. 291.[58] Such implementing technical standards must be technical and may not imply strategic decisions or policy choices.[59] Similar to regulatory technical standards, the European Commission is not to change the content of draft implementing technical standards without prior coordination with the ESA.[60]

In the case C-270/12 (2014), the European Commission stated that TFEU, art. 290, expressly governs the delegation of "quasi-legislative powers".[61] However, European Commission (2018b) stated that the delegation of regulatory powers to an ESA (i.e. ESMA) was not legally possible under the regulatory framework for the ESAs.

Solvency II was amended by Omnibus II to accommodate the development of

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[52] de Larosiere Group (2009), para. 206.

[53] Art. 8(1)(a) of the EBA Regulation, EIOPA Regulation and ESMA Regulation.

[54] EBA Regulation, recital 22 and art. 10(1), EIOPA Regulation, recital 21 and art. 10(1), and ESMA Regulation, recital 22 and art. 10(1).

[55] Art. 10(1) of the EBA Regulation, EIOPA Regulation and ESMA Regulation.

[56] EBA Regulation, recital 23 and art. 10(1), EIOPA Regulation, recital 22 and art. 10(1), and ESMA Regulation, recital 23 and art. 10(1).

[57] EBA Regulation, recital 23 and art. 10(1), subpara. 8, EIOPA Regulation, recital 22 and art. 10(1), subpara. 8, and ESMA Regulation, recital 23 and art. 10(1), subpara. 8.

[58] EBA Regulation, recital 25 and art. 15, EIOPA Regulation, recital 24 and art. 15, and ESMA Regulation, recital 25 and art. 15.

[59] Art. 15(1) of the EBA Regulation, EIOPA Regulation and ESMA Regulation.

[60] Art. 15(1), subpara. 7, of the EBA Regulation, EIOPA Regulation and ESMA Regulation.

[61] Para. 76. The case related to ESMA's conferred powers of intervention under Regulation (EU) No 236/2012 on short selling.

the single rulebook, including the drafting of technical standards by EIOPA and the subsequent adoption of the technical standards by the European Commission in accordance with art. 290 and 291 of the TFEU.[62] The European Commission accordingly exercises its "quasi-legislative powers" via the level 2 adoption of regulatory and implementing technical standards but those powers seem to be subject to a form of "expertise-based power" placed with the ESAs through the drafting of those technical standards, the establishment of a single rulebook and the issuing of guidelines and recommendations.[63]

In relation to level 3, de Larosiere Group (2009) introduced a new task wherein the ESAs were to *"...play a decisive role in the technical level 3 interpretation of level 1 and level 2 measures and in the development of level 3 technical standards."*[64] The Group proposed that *"A legal mechanism should be put in place so as to ensure that, once an Authority has decided on a given interpretation (through guidance, recommendations etc), this interpretation becomes legally valid throughout the EU."*[65] Accordingly, in areas which are not covered by level 2 regulatory or implementing technical standards, the ESAs have been given the power to issue level 3 guidelines and recommendations on the application of EU law.[66]

The ESA Regulations state that ESAs are to issue guidelines and recommendations addressed to competent authorities or financial institutions in order to establish consistent, efficient and effective supervisory practices and to ensure the common, uniform and consistent application of EU law.[67] Competent authorities and financial institutions shall make every effort to comply with the guidelines and recommendations.[68] In addition, *competent authorities* must confirm whether they comply - or intend to comply - with guidelines or recommendations and the ESAs are to be informed of non-compliance, including the reasons why.[69] If required by a guideline or recommendation, *financial institutions* must report, in a clear and detailed way, whether they comply with that guideline or recommendation.[70] In line with the ESA Regulations, European Commission (2017b) stated that *"While the guidelines are not mandatory, competent authorities and financial market participants must make every effort to comply with those guidelines and recommendations or explain why they do not intend to comply with them."*[71] Accordingly, while guidelines are not mandatory, they entail an obligation to "make every effort to comply".

As shown in chapter 11 of this dissertation, EIOPA uses guidelines to set

[62] Omnibus II, recitals 8-12, and art. 2, and EIOPA Regulation, art. 2.

[63] EBA Regulation, recitals 5 and 22 and art. 10-16, EIOPA Regulation, recitals 5 and 21 and art. 10-16, and ESMA Regulation, recitals 5 and 22 and art. 10-16.

[64] Para. 208(iii).

[65] de Larosiere Group (2009), para. 208(iii) and recommendation 22.

[66] EBA Regulation, recital 26 and art. 16, EIOPA Regulation, recital 25 and art. 16, and ESMA Regulation, recital 26 and art. 16.

[67] EBA Regulation, recital 26 and art. 16(1), EIOPA Regulation, recital 25 and art. 16(1) and ESMA Regulation, recital 26 and art. 16(1).

[68] Art. 16(3) of the EBA Regulation, EIOPA Regulation and ESMA Regulation.

[69] Art. 16(3) of the EBA Regulation, EIOPA Regulation and ESMA Regulation.

[70] Art. 16(3) of the EBA Regulation, EIOPA Regulation and ESMA Regulation.

[71] Pp. 7-8.

the treatment of repos and securities lending in the market risk module and counterparty default risk module of Solvency II's SCR standard formula.[72] As this treatment is not explicitly provided in level 1 or 2 regulation, it can of course be discussed whether this level 3 treatment is equivalent to the treatment of comparable risks in the finalised Basel III. Hansen (2011) discussed the status of the former CESR's level 2 advice and level 3 official guidance and stated that it was likely that the Court of Justice would include CESR's level 2 advice in its interpretation of level 2 EU legislation that was made upon receipt of such advice.[73] However, Hansen (2011) found it less likely that the Court of Justice would attach similar importance to CESR's level 3 guidance.[74]

If Solvency II's requirements have been adopted on the basis of draft technical standards or other input from ESAs, it seems plausible that significant weight will given to the ESA's interpretation of any its own level 1 and 2 input that ends up as EU regulation, regardless of whether the interpretation is presented during the legislative process or subsequently via e.g. guidelines. Accordingly, the advice, guidelines, reports and Q&As from especially EIOPA (and formerly CEIOPS) are used as primary sources for the interpretation of Solvency II's level 1 and 2 regulation.

2.3 EU Case Law

The finalised Basel III is a global standard that has to be implemented into EU law before it can be assessed and interpreted by the Court of Justice.[75] As described in chapter 1.1, the Basel III framework was not finalised until 2017 and 2019 and the globally agreed transposition year for key parts of the finalised Basel III is 2022.[76] This recent finalisation and the transposition dates will obviously have an effect on the amount of relevant EU case law.[77]

However, in recent EU case law, regarding exposures to the French public Caisse des Dépôts, the General Court referred to recitals of the CRR - as well as Basel III itself - when assessing the purposes of the Basel III-based leverage ratio.[78] The interpretation of EU banking law is accordingly not limited to EU law itself but may also refer to the global standards on which it is based. The use of global standards as an interpretation tool is described in chapter 7.

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[72] EIOPA Guidelines (2014d), guideline 8.

[73] P. 362.

[74] P. 362.

[75] TFEU, e.g. art. 263 and 267.

[76] See BCBS Basel III (2017) and BCBS Basel III (2019).

[77] Searches for relevant EU case law have been made via CURIA and been based on level 1 regulation, i.e. CRR, CRD IV and Solvency II as well as the repealed CRD and Directive 2006/49/EC. CRR II and CRD V were both adopted in May, 2019.

[78] T-768/16 (2018) (BNP Paribas v. European Central Bank), para. 40-42, T-758/16 (2018) (Crédit Agricole SA v. European Central Bank), para. 40-42, T-757/16 (2018) (Société Générale v. European Central Bank), para. 44-46, T-751/16 (2018) (Confédération Nationale du Crédit Mutuel v. European Central Bank), para. 45-47, T-745/16 (2018) (BPCE v. European Central Bank), para. 44-46, and T-733/16 (2018) (La Banque Postale v. European Central Bank), para. 46-48.

2.4 Literature

In its considerations regarding SFTs and financial stability, the FSB referred to, inter alia, Brunnermeier and Pedersen (2009), Adrian and Shin (2010) Gorton and Metrick (2012) and Copeland et al. (2014).[79] This dissertation's assumptions, regarding the risks associated with repos, margin, haircuts and leverage, are primarily derived from this financial literature.

Based on the literature, chapter 5 presents an overall picture of repos, financial collateral arrangements and the associated risks. The literature will also be used to derive a scenario for the scope of the comparison which is defined in chapter 8. As this dissertation is a legal dissertation, the literature will not be reviewed. However, it will be shown how the academic perceptions of the risks have subsequently been reflected in global policy measures regarding e.g. repos and other SFTs.

[79] FSB (2012c), annex 3.2.

Chapter 3

Solvency II and the Three Pillars

In EU law, Solvency II applies to direct life and non-life insurance undertakings as well as reinsurance undertakings, but it includes, inter alia, size-based exemptions.[1] During the development of Solvency II, it was decided that Solvency II should be based on the three pillars of the former Basel II, which were to be adapted to the needs of insurance.[2] As also described in chapter 9, Solvency II's

- pillar 1 includes the quantitative requirements, including technical provisions, the solvency capital requirement ("SCR") and minimum capital requirement ("MCR"), as well as own funds to cover the SCR and MCR,
- pillar 2 includes qualitative requirements, including the system of governance and risk management, as well as rules on supervision, including the supervisory review, and
- pillar 3 includes supervisory reporting and public disclosure.[3]

As described in chapter 8, this dissertation will be limited to a comparison of quantitative pillar 1 requirements. However, the Solvency II project emphasised that the supervisory review process in pillar 2 was to be "highlighted" and considered essential for the functioning of Solvency II.[4]

[1] Solvency II, recitals 4 and 5, and art. 2(1) and 4.

[2] European Commission (2003), para. 7 and European Commission (2004c), p. 3 European Commission (2004a), p. 2, European Commission (2004b), p. 2-4, European Commission (2005), para. 2, European Commission (2006), para. 2 and Solvency II Proposal, section 5(a), (b) and (d).

[3] Solvency II, including title I, chapters III-VI, Solvency II Proposal, section 5(a), (b) and (d), and European Commission (2015b), section 2.

[4] European Commission (2003), para. 7 and 33, European Commission (2004c), p. 3 and annex 1, p. 2, European Commission (2004b), p. 2-4, European Commission (2005), para. 2, and European Commission (2006), para. 2.

Under Solvency II, financial supervision by supervisory authorities entails verification of, inter alia, a life insurance undertaking's state of solvency, technical provisions, assets and eligible own funds.[5] It also entails the power to take preventive and corrective measures to ensure compliance as well as the right to require all information necessary to conduct supervision.[6]

The supervisory review entails an assessment of compliance with, inter alia, the regulation of technical provisions, capital requirements, investment rules, and the quality and quantity of own funds.[7] As described in chapter 12.3.1, a supervisory review may lead to the imposing of a capital add-on.[8] The supervisory review also includes a review of the qualitative requirements regarding the system of governance, the assessments of current - and possible - risk exposures, and the ability to assess those risks, including the own-risk and solvency assessment ("ORSA").[9]

In order to provide an introduction, the following chapter 3.1 will - in an overall fashion - describe the capital requirements SCR and MCR in pillar 1. The SCR will subsequently be presented in detail during the comparison of quantitative pillar 1 requirements in Solvency II and the finalised Basel III. In chapter 3.2, the pillar 2-based risk management requirements and the ORSA will also be described in an overall fashion in order to provide context and illustrate the nature of pillar 2 requirements in relation to liquidity risk, which must be kept in mind when reading chapter 12.

3.1 SCR and MCR

In line with the latest global developments in risk management of, inter alia, the IAIS and IAA, Solvency II introduced an economic risk-based approach to provide incentives for life insurance undertakings to properly measure and manage their risks.[10] The SCR is a risk-sensitive capital requirement and characterised as the starting point for the adequacy of the quantitative requirements.[11] As described in detail in chapter 9.3, the level 1-based general provisions for the SCR state that the SCR must correspond to the value-at-risk ("VaR") of the basic own funds of a life insurance undertaking subject to a confidence level of 99.5% over a one-year period.[12] It is to be calibrated to ensure that *all quantifiable risk exposures* are taken into account and it must cover existing business and the new business expected to be written over the following 12 months.[13] The SCR can be calculated in accordance with the SCR standard formula or

[5] Solvency II, art. 30(2).
[6] Solvency II, art. 34(1)-(3) and 35.
[7] Solvency II, art. 36(2).
[8] Solvency II, art. 37, and Solvency II Delegated Regulation, title I, chapter X.
[9] Solvency II, art. 36(1) and (2)(a), and Solvency II Delegated Regulation, title 1, chapter IX.
[10] Solvency II, recital 15.
[11] Solvency II, recitals 26 and 60.
[12] Solvency II, art. 101(3).
[13] Solvency II, art. 101(3).

the SCR internal model.[14] At level 2, the Solvency II Delegated Regulation was adopted to provide, inter alia, detailed pillar 1 regulation regarding the SCR standard formula, the SCR internal model, the MCR, and own funds requirements to cover the SCR and MCR.[15]

The MCR is characterised as a minimum level of security below which the amount of financial resources should not fall.[16] Level 1 states that the MCR must correspond to an amount of eligible basic own funds below which policyholders and beneficiaries are exposed to an unacceptable level of risk if the life insurance undertaking were allowed to continue its operations.[17] It must calibrated to the VaR of the basic own funds of the life insurance undertaking subject to a confidence level of 85% over a one-year period.[18] At level 1 and 2, the MCR is subject to absolute floors as well as upper and lower percentage limits in relation to the life insurance undertaking's SCR.[19] In this dissertation, the MCR will not be further dealt with as the SCR is the risk-based capital requirement that may possibly address the risk types that are identified via the scenario in chapter 8.

3.2 Risk Management and ORSA - Liquidity Risk

Solvency II states that some risks may only be properly addressed through governance requirements rather than through the quantitative requirements in the SCR.[20] This aspect is important in relation to chapter 12, as liquidity risk is not considered a major risk in traditional insurance.[21]

In Solvency II's pillar 2, the system of governance includes the (i) risk-management system and function, (ii) compliance function, (iii) internal audit function and (iv) actuarial function.[22] The risk-management system must cover the risks explicitly included in the SCR as well as the risks that are not - or not fully - included in the SCR.[23] The risk management system must include, inter alia, the following areas[24]:

- *asset–liability management*, which must (i) regularly assess, inter alia, sensitivities in relation to the use of long-term guarantee measures[25], including the forced sale of assets, and (ii) include policies regarding (a)

[14]Solvency II, art. 100.
[15]Solvency II Delegated Regulation, title I, chapters IV-VII.
[16]Solvency II, recital 60.
[17]Solvency II, art. 129(1)(b).
[18]Solvency II, art. 129(1)(c) and (2).
[19]Solvency II, art. 129(1)(d) and (3), and Solvency II Delegated Regulation, title I, chapter VII.
[20]Solvency II, recital 29.
[21]See e.g. EIOPA (2018e), p. 33.
[22]Solvency II, title I, chapter VI, section 2, including art. 41, 44-48, and Solvency II Delegated Regulation, title I, chapter IX, including art. 258-261a and 268-272.
[23]Solvency II, art. 44(2).
[24]Solvency II, art. 44(2) and (2a), and Solvency II Delegated Regulation, title I, chapter IX, including art. 259-262 and 268-269.
[25]See chapter 13.1.

the structural mismatch between assets and liabilities, (b) the duration mismatch of those assets and liabilities, (c) any dependency between risks of different asset and liability classes, (d) any off-balance sheet exposures and (e) the effect of risk-mitigating techniques on asset-liability management.[26]

- investment, in particular derivatives and similar commitments. At level 3, EIOPA's guidelines state that investment risk management policies should cover, inter alia, (i) the targeted level of security, quality, *liquidity* and profitability, in relation to the whole portfolio, as well as *quantitative limits* on assets and exposures used to achieve this target and availability, (ii) the targeted level of *availability* of the whole portfolio of assets, and (iii) the conditions under which assets can be pledged or lent.[27] In relation to investment risk, the life insurance undertaking must also demonstrate that it complies with, inter alia, the *prudent person principle* that is described in chapter 12.2.[28]

- *liquidity and concentration risk*. Liquidity risk policies must include (i) actions to address both short-term and long-term liquidity risk, (ii) the appropriateness of the composition of assets in terms of their nature, duration and liquidity in order to meet obligations as they fall due, and (iii) a plan to deal with changes in expected cash inflows and outflows.[29] At level 3, EIOPA's guidelines state that the policies should cover, inter alia, (i) mismatches between the cash inflows and cash outflows as well as total liquidity needs in the short term and medium term, including an appropriate liquidity buffer to guard against a liquidity shortfall, (ii) the level and monitoring of liquid assets, including a quantification of potential costs or financial losses arising from an enforced realisation, and (iii) identification and costs of alternative financing tools.[30] Concentration risk policies must include the analysis of the possible risk of contagion between concentrated counterparties.[31]

The risk management system must also (where appropriate) include stress tests and scenario analysis for all relevant risks exposures.[32]

In addition, and as a part of the risk management system, Solvency II requires that life insurance undertakings conduct the ORSA.[33] In relation to the

[26] Solvency II Delegated Regulation, art. 260(1)(b).

[27] EIOPA Guidelines (2014c), para. 1.62(a)-(c) and (e).

[28] Solvency II, art. 44(3), and Solvency II Delegated Regulation, art. 260(1)(c)(i).

[29] Solvency II Delegated Regulation, art. 260(1)(d).

[30] EIOPA Guidelines (2014c), para. 1.63(a)-(d).

[31] Solvency II Delegated Regulation, art. 260(1)(e).

[32] Solvency II Delegated Regulation, art. 259(3).

[33] Solvency II, recital 36 and art. 45, and Solvency II Delegated Regulation, art. 262. The ORSA must include at least (i) the overall solvency needs based on the specific risk profile, approved risk tolerance limits and the business strategy, (ii) continuous compliance with capital requirements and requirements regarding technical provisions, (iii) the significance of deviations of the life insurance undertaking's risk profile from the assumptions underlying the SCR standard formula or SCR internal model, cf. Solvency II, art. 45(1).

overall solvency needs, the ORSA must, inter alia, assess the risks that the life insurance undertaking is - or could be - exposed to, as well assess the nature and quality of own fund items or other resources appropriate to cover those identified risks.[34] At level 3, EIOPA's guidelines state that a life insurance undertaking must provide a quantification of capital needs and a description of other means needed to address *all material risks*, irrespective of whether the risks are *quantifiable or not*.[35] The ORSA does not entail a parallel internal model and does not produce a capital requirement in addition to - or different from - the SCR or MCR.[36] Pursuant to EIOPA (2018e), the ORSA supplements the prudent person principle as it must address liquidity risk and concentration risk if the insurance undertaking is - or could be - exposed to those risks at a material level.[37] However, the ORSA was not initially designed as a macroprudential tool that targeted e.g. herding behaviour and common exposures of life insurance undertakings.[38]

As shown above, Solvency II's pillar 2 includes qualitative requirements regarding asset–liability management, investment risk and liquidity risk as well as the ORSA. In combination with the prudent person principle, these pillar 2 requirements must be kept in mind when reading this dissertation's chapter 12, where Solvency II's treatment of liquidity risk is compared to the treatment of liquidity risk in the finalised Basel III.

In the next chapter, the components of credit risk (and their role in market risk) will be defined in order to ensure consistency in the risk-based comparison of quantitative pillar 1 requirements in Solvency II and the finalised Basel III.

[34] Solvency II Delegated Regulation, art. 262(1).
[35] EIOPA Guidelines (2014b), para. 1.19.
[36] Solvency II, recital 36 and art. 45(7).
[37] Pp. 33 and 41-42.
[38] EIOPA (2018e), pp. 42, 48 and 51.

Chapter 4

Definitions - Credit Risk and Market Risk

At level 1, Solvency II defines various forms of risk, including underwriting risks, market risk and credit risk.[1] Solvency II's definition of credit risk explicitly includes counterparty default risk, spread risk and market risk concentrations.[2] The finalised Basel III also includes credit risk, counterparty credit risk and market risk (which includes credit spread risk).[3]

Definitions of the insurance underwriting risks, including life underwriting risk, are exclusive to Solvency II as the business of direct insurance is subject to an authorisation under Solvency II.[4] However, Solvency II and the finalised Basel III overlap in relation to the risk types credit risk and market risk. The components of credit risk (and their role in market risk) must therefore be defined in order to ensure consistency when the risk types are assessed in the comparison of Solvency II and the finalised Basel III. Counterparty credit risk is defined in chapter 5.2 below in relation to repos.

Credit risk is generally divided into the following components:

- default risk - the risk of losses due to an obligor's default (i.e. non-delivery of a contractual obligation by the obligor counterparty).[5]

- credit spread risk - the risk of a change in the mark-to-market value[6] of a credit exposure due to a change in a credit spread, e.g. the spread between

[1] Solvency II, art. 13(30)-(32), 101(4) and 105(2)-(6).

[2] Solvency II, art. 13(32).

[3] See BCBS Basel III (2017)/BCBS Consol. Basel III (2019), RBC20.4 and 20.6 and CRE50.1, and BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR21-22, and MAR30-33.

[4] Solvency II, art. 14(1), 104(1) and 105(3).

[5] Basel I, para. 8, BCBS (2009b), p. 6, BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR33.19, BCBS (2009c), para. 11, EIOPA (2014c), section 2.5, EIOPA (2018d), p. 6, and CEIOPS QIS3 (2007), para. I.3.89.

[6] In general, when calculating the present value (PV) of a single future cash flow at the time period (t), a discount rate is applied upon the value of the future cash flow, to derive the

the risk-free interest rate and a bond's yield[7] that reflects the perceived credit risk.[8] Credit spreads capture the expected loss from default and are a measure of the mean of the distribution of default losses.[9]

- jump-to-default risk - the risk of a sudden default.[10] As a part of market risk, jump-to-default risk constitutes the incremental loss from defaults above the mark-to-market losses caused by changes in credit spreads.[11]

- migration risk - the risk of losses due to an internal/external rating downgrade or upgrade.[12] Migration risk accordingly captures the risk that a change in a rating triggers mark-to-market losses on a credit exposure.[13]

If a credit exposure is held to maturity and not marked-to-market, it is generally not be exposed to market prices and therefore not exposed to market risk factors, including credit spread risk and migration risk.[14] However, the credit exposure remains exposed to default risk as the counterparty may not fulfil its contractual obligations, e.g. the payment of the agreed interest and repayment of the principal.[15]

If a credit exposure is traded and marked-to-market, it will be subject to market risk factors. In the finalised Basel III, "market risk" is defined as the risk of losses in on- and off-balance sheet risk positions arising from movements in market prices.[16] Market risk can be divided into (i) general/systematic market

present value (i.e. $PV = \frac{Cashflow_t}{(1+rate)^t}$), and when calculating the present value of several cash flows, the present value of each cash flow, at each time period (t), is calculated whereafter the individual present values are summed to produce the present value of all the cash flows (i.e. the sum of the discounted future cashflows, $PV_{cashflows} = \sum_{t=1}^{M} \frac{Cashflow_t}{(1+rate_t)^t}$) cf. e.g. Alexander (2008b), p. 11, and EIOPA (2014a), p. 17. The present value of a bond is accordingly the discounted value of its future cash flows where the final cash flow includes a coupon payment and the principal amount (i.e. $PV_{bond} = \frac{Coupon_1}{(1+R)^1} + \frac{Coupon_2}{(1+R)^2} + ... + \frac{Coupon_M + Principal}{(1+R)^M}$), cf. e.g. Macaulay (1938), p. 48, and Hopewell and Kaufman (1973), p. 751.

[7] In relation to a bond selling at a specified price, Macaulay (1938), pp. 26 and 48, defines "yield" as the rate of interest which, when used to obtain the present values of the various future payments, will make the sum of such present values equal the specified price of the bond.

[8] Cf. e.g. BCBS (2009b), p. 15, BCBS (2012), section 4.5.4, BCBS (2013a), section 1.2(i) and 3.4(v), BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR21.20, and MAR31.7, Solvency II, art. 105(5)(d), EIOPA (2014c), section 2.5, EIOPA (2018d), p. 6, EIOPA (2018b), para. 1040, CEIOPS QIS3 (2007), para. I.3.89, CEIOPS (2005b), para. 10.91 and 10.96-10.98, CEIOPS (2009a), para. 4.55, and CEIOPS (2010c), para. 3.176.

[9] BCBS (2013a), p. 11, i.e. $EL = PD * LGD$ (see chapter 10.5).

[10] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR10.19.

[11] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR22.1, MAR33.30 and MAR33.33, and BCBS (2013a), section 1.2(i).

[12] See e.g. BCBS (2009c), para. 11, BCBS (2012), section 4.5.4, EIOPA (2018d), p. 6, EIOPA (2014c), section 2.5, and CEIOPS QIS3 (2007), para. I.3.89.

[13] BCBS (2016), p. 2.

[14] E.g. BCBS (2009b), pp. 6-7 and 16, and Omnibus II, recital 31 (regarding the matching adjustment in Solvency II).

[15] E.g. BCBS (2009b), pp. 6-7.

[16] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR10.1, and MAR11.1.

risk, which is the tendency of an exposure's value to change with the change in the value of the broader market, which can be represented via indices, and (ii) idiosyncratic risk, which is the risk associated with a specific exposure, e.g. default risk and maturity.[17] The finalised Basel III also defines a "risk position" as the portion of the current value of an exposure that may be subject to losses due to movements in a "risk factor", which is defined as a principal determinant of the change in value of an exposure (i.e. the market rates and prices that affect the value of the exposure).[18] A market risk exposure's "sensitivity" is an estimate of the change in value of the exposure due to a change in one of its risk factors.[19]

In the finalised Basel III, market risk capital requirements are accordingly based on how positions in the trading book (as described in chapter 9.1) are exposed to specific risk factors - i.e. variables - whose movements may cause losses to the current value of those positions.[20] The finalised Basel III provides that trading book exposures are subject to daily "fair value" valuations and that any valuation changes must be recognised in the profit and loss ("P&L") account.[21] As described in chapter 10.6.1, credit spread risk is a prescribed market risk factor (that also incorporates credit migration risk) and valuation changes, due to e.g. credit spread risk, will accordingly be reflected on a daily basis in a bank's trading book.[22]

Solvency II's solvency requirements are based on an economic valuation of the whole balance sheet and are to make optimal use of information provided by financial markets and generally available data on insurance risks.[23] At level 1, assets must be valued at the amount for which they could be exchanged between knowledgeable willing parties in an arm's length transaction.[24] Similarly, liabilities must be valued at the amount for which they could be transferred, or settled, between knowledgeable willing parties in an arm's length transaction.[25] Level 2 provides a valuation hierarchy where the "default valuation method" is quoted market prices in active markets for the same assets or liabilities.[26] EIOPA (2018e) considers the "market-consistent" balance sheet valuation as a "foundation principle" where the riskiness of exposures is *continuously* reflected in the value of exposures and where the risks and their interactions are considered together with risk mitigation techniques.[27] Market risk will accordingly also be continuously reflected in the "market consistent" balance sheet of

[17]See e.g. BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR31.26(2).

[18]BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR10.9-10, and MAR31.1.

[19]BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR10.13 and e.g. MAR21.1(2).

[20]BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR10.10, and e.g. MAR20.4, MAR21, and MAR31.1-3.

[21]BCBS Basel III (2019)/BCBS Consol. Basel III (2019), RBC25.4.

[22]BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR21.1(1) and (2) and MAR31.3, and BCBS (2013a), section 1.2(i).

[23]Solvency II, recital 45 and e.g. EIOPA (2013), p. 20.

[24]Solvency II, art. 75(1)(a).

[25]Solvency II, art. 75(1)(b).

[26]Solvency II Delegated Regulation, recital 7 and art. 10(2).

[27]P. 42 (box 6).

Solvency II.[28]

In short, a credit exposure is subject to default risk and - if it is intended to be traded and marked-to-market - it will also be exposed to market risk factors, including e.g. credit spread risk and migration risk. Part V of this dissertation will show the structural differences between how Solvency II and the finalised Basel III approach credit risk and market risk. Subsequently, part VI will compare how Solvency II and the finalised Basel III approach default risk, jump-to-default risk, credit spread risk and migration risk in terms of quantitative pillar 1 requirements. As described in chapter 9.1, market liquidity risk entails that credit exposures, which are assumed to be liquid and primarily exposed to market risk, may also become increasingly subject to default risk when exposure horizons increase due to market illiquidity. Chapter 10.6.1 will accordingly also include how the finalised Basel III addresses market liquidity risk.

[28]Solvency II Delegated Regulation, recital 7.

Chapter 5

Repos and Literature

This chapter will describe repos and their functions as well as how the associated risks have been identified in literature. In chapter 8, this literature will be used to define a scenario that enables a risk-based approach for comparing quantitative pillar 1 requirements in Solvency II and the finalised Basel III.

In EU law, a repurchase transaction ("repo") is, inter alia, defined as a transaction governed by an agreement by which a counterparty transfers securities subject to a commitment to repurchase them (or substituted securities) at a specified price on a future date specified (or to be specified by the transferor).[1] The transaction is a repo for the counterparty selling the securities and a reverse repo for the counterparty buying them.[2]

Functionally, a repo is a collateralised credit exposure as the repo buyer lends the repo seller cash and receives financial instruments as collateral.[3] While a repo is similar to a "traditional" cash loan secured by collateral, it is subject to the financial collateral arrangements regime of the Financial Collateral Directive if it fulfils certain requirements.[4]

As shown in figure 5.1, under the Global Master Repurchase Agreement ("GMRA"), the repo seller agrees to sell financial instruments (i.e. securities financial collateral) to the repo buyer on the purchase date against the repo buyer's payment of the purchase price (the cash financial collateral) to the repo seller.[5] On the repurchase date, the GMRA provides that the repo buyer sells equivalent financial instruments (i.e. returns the securities financial collateral) to the repo seller against the repo seller's payment of the repurchase price which is the sum of the initial purchase price (i.e. the loan repayment) and a price differential.[6] The price differential is referred to as the repo rate and is based on the daily application of an agreed per annum percentage rate on the purchase

[1] SFT Regulation, art. 3(9).
[2] SFT Regulation, art. 3(9).
[3] See e.g. ESRB (2016a), p. 4, and ESRB (2017a), para. 21.
[4] Financial Collateral Directive, recitals 3 and 13 and art. 1 and 2(1)(b).
[5] Para. 1(a) and 3(c).
[6] Para. 2(qq) and (rr) and 3(f).

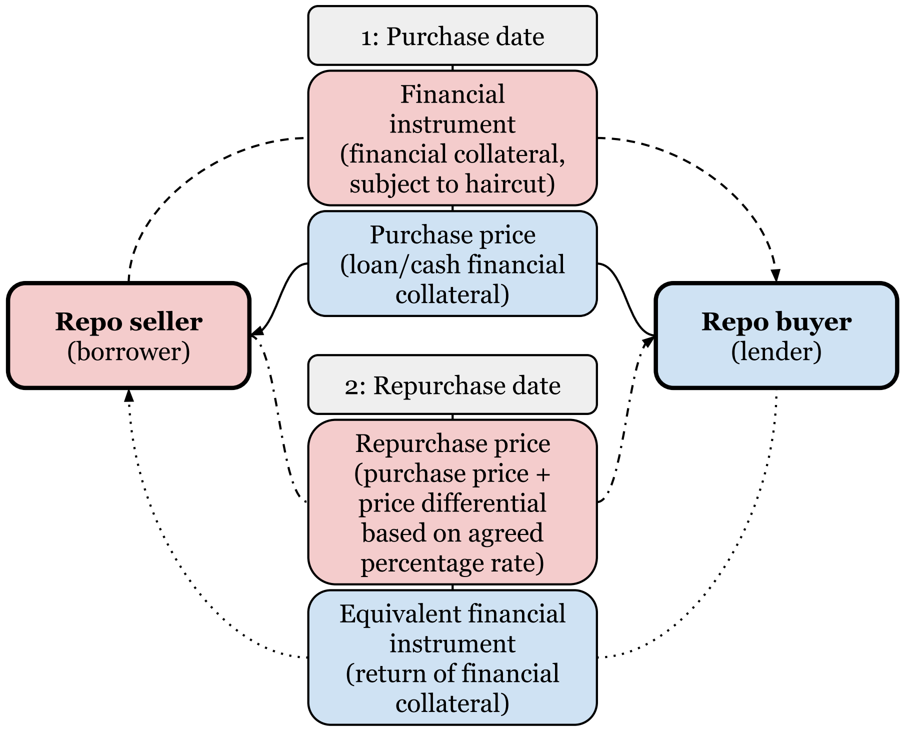

Figure 5.1: Cash-driven repo as a collateralised lending transaction.

price for the number of days between the purchase date and the repurchase date.[7] Repos can be "fixed term" or "terminable upon demand" and the repo rate constitutes interest on the cash loan provided via the purchase price.[8] Income on financial instruments used as financial collateral is generally transferred or credited to the repo seller or the poster of financial collateral.[9]

Repos share similarities with other SFTs in the form of buy-sell back transactions and securities lending transactions.[10] The EU's definition of buy-sell back transactions and sell-buy back transactions is similar to the definition of repos except that repos are governed by a repo master agreement while buy-sell back transactions are subject to separate contracts.[11] In a functionally similar fashion, securities lending is, inter alia, defined as a transaction by which a counterparty transfers securities subject to a commitment that the borrower will return equivalent securities on a future date or when requested to do so by the

[7]GMRA, para. 2(kk) and (ll) and 3(b)(iv) and (d), and e.g. ESRB (2016a), p. 4, and ESRB (2017a), para. 12.
[8]GMRA, para. 2(vv) and 3(b)(iii), and Ruchin (2011), p. 458.
[9]GMRA, para. 5.
[10]See e.g. ESMA (2016), para. 21 and 22.
[11]SFT Regulation, art. 3(8) vs. 3(9), and ESMA (2016), para. 21.

transferor.[12] The transaction is securities lending for the counterparty transferring the securities and securities borrowing for the counterparty to which they are transferred.[13] Pursuant to ESMA (2016), repos are typically very short-term, and the main type of SFTs used in the EU, while securities lending constitutes a smaller market and tend to have long tenure.[14]

Ruchin (2011) distinguishes between

- cash-driven or regular repos, where the main motivation is to provide cash to the seller of financial instruments, and
- securities-driven or special repos, where the main motivation is to provide financial instruments to the buyer.[15]

This dissertation will focus on cash-driven repos. However, in terms of functions and risks, cash-driven repos and cash-driven securities lending are to a large degree similar.[16] This dissertation's findings regarding the regulation of repos are accordingly transferable to securities lending.

Financial collateral arrangements are essential for understanding the risks associated with repos, especially counterparty credit risk and how margin and haircut requirements can create liquidity risk and give repo-based leverage a procyclical nature. Chapter 5.1 will therefore describe the functions of financial collateral arrangements and how the associated risks have been identified in literature.

5.1 Financial Collateral Arrangements

As a part of the European Commission Action Plan (1999), the Financial Collateral Directive created a regime for certain counterparties' provision of financial collateral - to secure financial obligations - under both security interest structures and title transfer structures, including repos.[17] The allowed counterparties include, inter alia, central banks, credit institutions, insurance undertakings, UCITS and CCPs.[18] Financial collateral includes cash, financial instruments

[12] SFT Regulation, art. 3(7).
[13] SFT Regulation, art. 3(7).
[14] Para. 138, 144, 147 and 152.
[15] Pp. 451 and 458-459.
[16] See e.g. EIOPA Guidelines (2014d), guideline 8. Ruchin (2011) (pp. 452 and 458-459) distinguishes between (i) cash-driven securities lending, where the main motivation is to provide cash to the securities lender, and (ii) securities-driven or regular securities lending, where the main motivation is to provide specific financial instruments to the securities borrower. In securities-driven securities lending, the securities borrower will typically compensate the securities lender for borrowing financial instruments and in cash-driven securities lending, the securities lender will typically - and similar to interest on a loan - pay a fee on the received cash collateral, cf. FSB (2012c), pp. 19-20, ESRB (2016a), p. 4, and Ruchin (2011), pp. 458-59.
[17] Financial Collateral Directive, recitals 2 and 3 and art. 1 and 2(1)(a)-(f), and European Commission Action Plan (1999), section 5 and strategic objective 1.
[18] Financial Collateral Directive, art. 1(2).

and credit claims.[19] Credit claims were included in the list of allowed financial collateral to increase the pool of available collateral.[20] Financial obligations are, inter alia, obligations which are secured by a financial collateral arrangement and which give a right to cash settlement and/or delivery of financial instruments.[21]

The Financial Collateral Directive's financial collateral arrangements include *title transfer* financial collateral arrangements and *security* financial collateral arrangements.[22] A title transfer financial collateral arrangement - which explicitly include repos - is defined as an arrangement under which a collateral provider transfers full ownership of, or full entitlement to, financial collateral to a collateral taker for the purpose of securing or otherwise covering the performance of relevant financial obligations.[23] The GMRA provides that the parties are obliged to ensure that all right, title and interest in any purchased financial instruments[24] and any margin financial instruments[25] pass to the party to which transfer is being made.[26] A security financial collateral arrangement (in the form of e.g. pledges or charges) is defined as an arrangement under which a collateral provider provides financial collateral by way of security to - or in favour of - a collateral taker, and where the full or qualified ownership of, or full entitlement to, the financial collateral remains with the collateral provider when the security right is established.[27]

The reason behind the distinction between "title transfer" and "security" financial collateral arrangement is that the Financial Collateral Directive aimed to eliminate the re-characterisation of title transfer financial collateral arrangements (including repos) as security interests.[28] In cases where the perfection requirements for a repo were different from the requirements for a pledge, a re-characterisation could entail that the requirements for a pledge would not be satisfied and that the repo collateral arrangement could be void.[29]

The Financial Collateral Directive was to create a sound and efficient legal regime for limiting credit risk and provide rapid and non-formalistic enforcement procedures in order to safeguard financial stability and limit contagion effects in case of a default of a counterparty to a financial collateral arrangement.[30]

[19] Financial Collateral Directive, art. 1(4)(a).

[20] Financial Collateral Directive, art. 1(4)(a), and Directive 2009/44/EC, recital 5 and art. 2(4)(c).

[21] Financial Collateral Directive, art. 2(1)(f).

[22] Financial Collateral Directive, art. 2(1)(a)-(c).

[23] Financial Collateral Directive, art. 2(1)(b). ESMA (2016), para. 19, states that title transfer financial collateral arrangements also include securities lending.

[24] And any equivalent financial instruments.

[25] And any equivalent margin financial instruments.

[26] Para. 6(e) and (f).

[27] Financial Collateral Directive, art. 2(1)(c), and Financial Collateral Directive Proposal, section 2.1 and section 3, regarding art. 3.

[28] Financial Collateral Directive, recital 13 and art. 6, and Financial Collateral Directive Proposal, section 2.1.

[29] Financial Collateral Directive Proposal, section 3, regarding art. 7.

[30] Financial Collateral Directive, recital 17, and Financial Collateral Directive Proposal, section 2.4.

Stability would be enhanced as the proper use of financial collateral would reduce the risk that one counterparty's failure could cause other counterparties to not be able to meet their own obligations.[31] The Financial Collateral Directive therefore aims to ensure that certain provisions of EU member states' insolvency law do not apply to financial collateral arrangements. Such non-applicable insolvency law provisions are those that would inhibit the effective realisation of financial collateral or cast doubt on the validity of:

- the provision of additional financial collateral in the form of "top-up" collateral,
- substitution of financial collateral, and
- bilateral close-out netting.[32]

The provision of additional collateral and bilateral close-out netting are essential functions in relation to shadow banking, including liquidity risk and the possibly procyclical nature of repo-based leverage. Chapter 5.1.1 accordingly describes margin calls and haircuts while close-out netting is described in chapter 5.1.2.

While the Financial Collateral Directive aimed to ensure financial stability, FSB (2013c) argues that the ensuing "safe harbour" status of repos - via the right to terminate the contract, set off and realise financial collateral - actually increases systemic risk as it may, inter alia,

- increase the money-like liquidity of repos, which entails the risk of runs, and
- facilitate fire sales of financial collateral.[33]

The risk of runs and selected literature are described in chapter 5.1.1.1 while fire sales and selected literature are described in chapter 5.1.1.2. In order to illustrate how maturity and liquidity transformation occurs via repos, chapter 5.1.3 will describe reuse and cash collateral reinvestment, including the case of AIG, which is presumably the primary example of shadow banking in life insurance.

5.1.1 Margin Calls and Haircuts

By marking-to-market, both counterparties can calculate the current market value of their credit exposures and the current market value of financial collateral used to secure the credit exposures.[34] Any resulting credit risk, in the form of a net exposure, can be limited via the posting of "top-up" (or additional) financial collateral.[35]

[31] Financial Collateral Directive Proposal, section 2.4.

[32] Financial Collateral Directive, recital 5 and art. 7 and 8.

[33] P. 18.

[34] Financial Collateral Directive, recital 16, and Financial Collateral Directive Proposal, section 3, regarding art. 9.

[35] Financial Collateral Directive, recital 16, and Financial Collateral Directive Proposal, section 3, regarding art. 9.

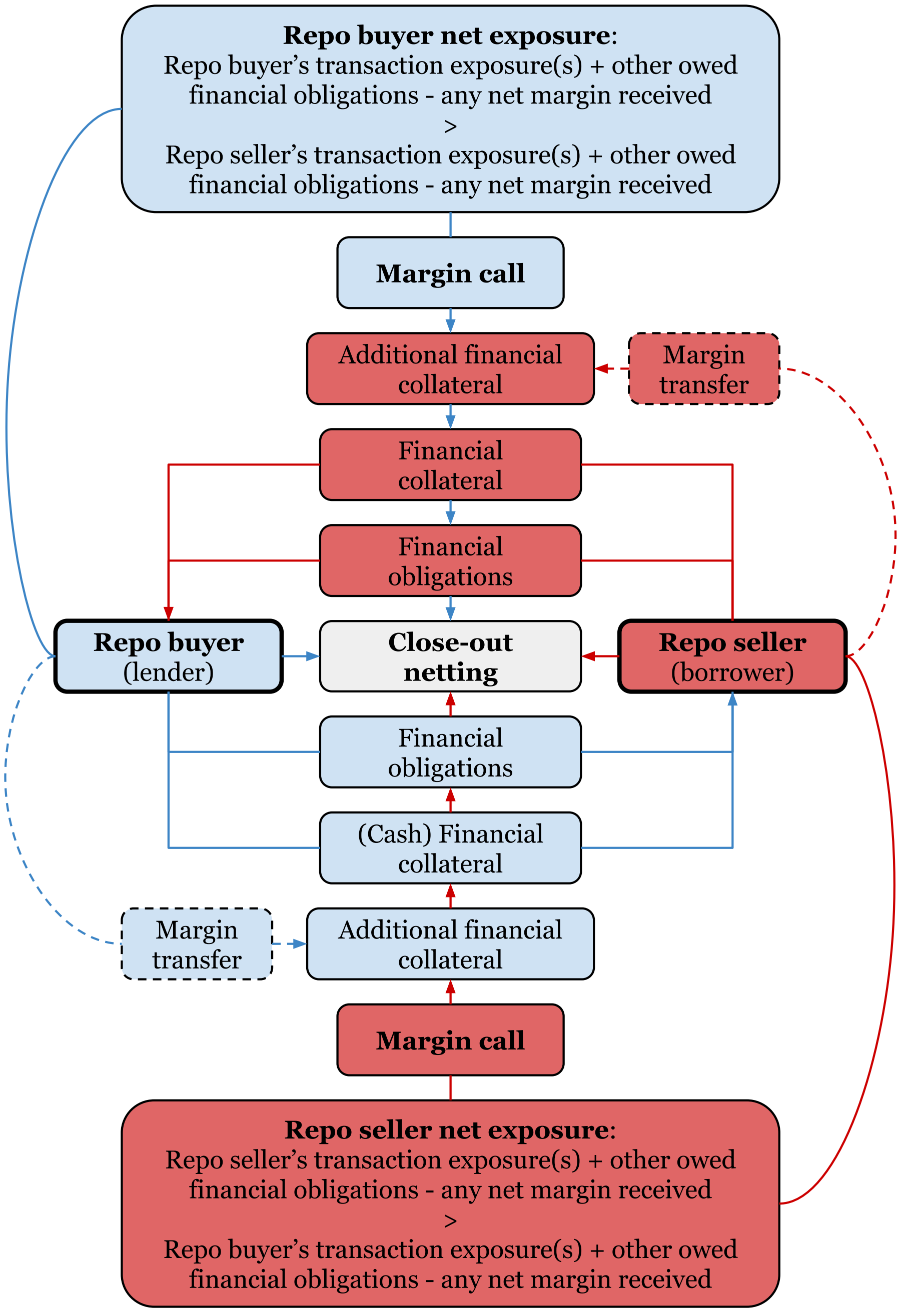

Figure 5.2: Margin calls in financial collateral arrangements.

Margin is a term that generally refers to the calling and posting of financial collateral to reduce credit exposures.[36] As illustrated in figure 5.2, should a party have a net exposure under the GMRA, it may issue a margin call and require the other party to conduct a margin transfer in an aggregate amount or value at least equal to the net exposure.[37] A net exposure is present for e.g. the repo buyer if the (i) aggregate of the repo buyer's transaction exposures[38] plus any other amounts payable to the repo buyer minus any net margin provided to the repo buyer exceeds (ii) the aggregate of repo seller's transaction exposures plus other amounts payable to the repo seller minus any net margin provided to the repo seller.[39]

As also described in chapter 5.2 below, in case of a default by the repo counterparty, the received financial collateral (i.e. margin) may have to be liquidated under stressed market conditions which may entail a reduction in its liquidation value that leads to an increased credit risk exposure.[40] Haircuts can accordingly be applied upon the financial collateral to protect against credit risk, including fluctuations in the liquidation value of the financial collateral.[41] Haircuts can e.g. address the potential decline in the value of the financial collateral between the final margin call and the realisation of the financial collateral in case of the repo seller's default.[42]

The Financial Collateral Directive obliges EU member states to ensure that an obligation to provide financial collateral or additional financial collateral (in order to take account of net exposures due to changes in the value of the financial collateral or in the amount of the financial obligations) is not treated as invalid, reversed or declared void under certain insolvency provisions and principles of the EU member states.[43]

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[36] See e.g. EMIR art. 41(1), GMRA, para. 4(a), ESMA (2016), para. 24, and ESRB (2017a), para. 51-53.

[37] GMRA, para. 4(a). See also Financial Collateral Directive Proposal, section 3, regarding art. 9.

[38] The transaction exposure can be calculated in two ways: ***(1)*** The repurchase price is multiplied with a margin ratio (the market value of the purchased financial collateral divided by the purchase prise) whereafter the market value of the financial collateral is subtracted, cf. GMRA, para. 2(bb) and 2(xx)(A). If the resulting amount is greater than zero, the repo buyer has a transaction exposure equal to the amount; if the amount is less than zero, the repo seller has a transaction exposure equal to the absolute value of the amount, cf. GMRA, para. 2(xx)(A). ***(2)*** The repurchase price is reduced by an adjusted value of the financial collateral, cf. GMRA, para. 2(xx)(B). The adjusted value of the financial collateral is calculated by applying an agreed haircut on the market value of the (equivalent) financial instruments, cf. GMRA, para. 2(xx)(B). If the resulting amount is greater than zero, the repo buyer has a transaction exposure equal to the amount; if the amount is less than zero, the repo seller has a transaction exposure equal to the absolute value of the amount, cf. GMRA, para. 2(xx)(B).

[39] GMRA, para. 4(c).

[40] See e.g. EMIR, art. 46(1), EMIR Delegated Regulation, art. 41(2), International Capital Market Association (2012), para. 3.1, ESMA (2016), para. 26, ESRB (2016a), p. 4, ESRB (2017a), para. 51-53.

[41] See e.g. EMIR, art. 46(1), EMIR Delegated Regulation, art. 41, GMRA, para. 2(xx)(B), International Capital Market Association (2012), para. 3.1, ESMA (2016), para. 24-26, ESRB (2016a), p. 4, and ESRB (2017a), para. 51-52.

[42] See e.g. EMIR, art. 46(1), FSB (2012c), p. 16, and ESRB (2017a), para. 53.

[43] Financial Collateral Directive, art. 8(3).

5.1.1.1 Run on Repo and Liquidity Risk

A repo seller's failure to make a margin transfer constitutes an event of default under the GMRA.[44] This allows the repo buyer to designate an early termination date upon which the repurchase date occurs.[45] Access to financing via repos accordingly depends on the repo seller's ability to meet mark-to-market-based margin calls that may entail haircuts on the financial collateral.

Gorton and Metrick (2012) argue that financial collateral is an analogue to deposit insurance and that a "run on repo" occurred - during the financial crisis - in the form of unprecedented high repo haircuts and the cessation of repo lending (i.e. a 100% haircut) on many forms of collateral due to lenders' fears regarding the creditworthiness of counterparties and having to seize and sell financial collateral.[46] Gorton and Metrick (2012) state that an increase in haircuts is tantamount to a withdrawal from the bank that forces deleveraging.[47] Copeland et al. (2014) distinguish between the bilateral repo market and tri-party repo market and find differences in the behaviour of margins in each market.[48] Based on evidence from the tri-party repo market, they show that there was no system-wide run on repo during the financial crisis.[49] They find that margins barely moved in the tri-party repo market and that funding was very stable for dealers, except for Lehman Brothers, whose tri-party repo book and collateral posting decreased sharply in the days leading up to its bankruptcy.[50] They also show a substantial decline in the use of asset-backed securities and corporate bonds as collateral in the tri-party repo market during the financial crisis.[51] Instead of increasing margin, Copeland et al. (2014) argue that a run may manifest itself in the form of the cash collateral provider simply not refinancing the cash loan upon the repo's maturity (i.e. rollover risk), which was generally overnight/one business day.[52]

However, liquidity risk in relation to financial collateral arrangements is not purely associated with the financial crisis. In relation to the near collapse of the hedge fund Long-Term Capital Management ("LTCM") in 1998, President's Working Group (1999) describes how mark-to-market valuation of financial collateral and margin requirements imposed cash flow and liquidity strains on LTCM.[53] As LTCM was subject to losses and liquidity pressures, its repo and OTC derivative counterparties sought as much financial collateral as possible, through the daily mark-to-market valuation and margining process, which caused additional liquidity strains on LTCM.[54]

Accordingly, in addition to a repo buyer's refusal to roll over a repo, the risk

[44] GMRA, para. 10(a)(iv).
[45] GMRA, para. 10(b) and (c).
[46] Pp. 426-429. See also FSB (2012c), section 5.2.
[47] P. 429.
[48] Pp. 2368-2359.
[49] Copeland et al. (2014), pp. 2324 and 2373.
[50] Copeland et al. (2014), pp. 2356-2357, 2360-2364, 2370 and 2373.
[51] Copeland et al. (2014), pp. 2354-2355 (figure 5).
[52] Pp. 2364 and 2368-2369.
[53] Pp. 4, 12-14 ad 18.
[54] President's Working Group (1999), pp. 4, 12-14 and 18.

of a "run on repo" - via daily margin calls and haircuts - may constitute funding liquidity risk to the repo seller. As they become due, the margin calls have to be met with sufficient and available financial collateral and a failure to make a margin transfer constitutes an event of default that triggers close-out netting which is described in chapter 5.1.2 below.[55] FSB (2013c) accordingly labels the ability of repos to create short-term, money-like liabilities (that facilitate credit growth, maturity and liquidity transformation as well as leverage outside liquidity and capital regulation) as a *pure shadow banking risk*.[56] As shown in chapter 6.3, the "top five" Danish life insurance undertakings have repo liabilities and financial collateral arrangements on their balance sheets which entails that they may be exposed to the liquidity risk described above. In order to determine whether these repo activities may constitute shadow banking, part VII of this dissertation compares how Solvency II and the finalised Basel III address liquidity risk.

5.1.1.2 Leverage and Procyclicality

As described in chapter 1, leverage can generally be defined as the ratio between a capital measure and an exposure measure that reflects the financing of assets and exposures via, inter alia, liabilities.[57] "Procyclicality" can be defined as the tendency of financial variables to fluctuate together with the economic cycle.[58]

In relation to the mark-to-market balance sheets of U.S. investment banks, Adrian and Shin (2010) show how leverage - defined simply as the ratio of total assets to equity - is procyclical in the sense that leverage is large when assets are large.[59] When asset values increase, it enables the taking on of additional liabilities to purchase assets which may put an upward pressure on asset values.[60] When asset values fall, the loss impacts the undertaking's equity and the undertaking can adjust its leverage ratio - i.e. deleverage - by selling assets to repay liabilities, which entails that falls in asset values may lead to a sale of assets that in turn puts a downward pressure on asset values.[61] Adrian and Shin (2010) also show that repos and other collateralised financing increase when total assets increase and that balance sheets adjustments were made through repos.[62]

Macaulay (1938) describes in general terms how a fall in the value of bonds

[55] GMRA, para. 4(a) and 10(a)(iv) and (b)-(d).
[56] FSB (2013c), section 1.1(i).
[57] FSB (2013d), annex 1, economic function # 2, EBA (2014a), footnote 1, BCBS Consol. Basel III (2019), LEV20.3 and BCBS Basel III (2014a), para. 6. In relation to derivatives, leverage can viewed in terms of "economic leverage" that reflects a heightened price sensitivity to market fluctuations, cf. President's Working Group (1999), appendix A-2.
[58] FSB (2012c), section 5.2, footnote 30. ESRB (2017a), para. 73, defines procyclicality as the mutually reinforcing mechanisms that amplify fluctuations in financial markets which, in turn, may result in negative feedback loops with the real economy.
[59] Pp. 426-428.
[60] Adrian and Shin (2010), pp. 422-424. See also ESRB (2017a), para. 74 and 79.
[61] Adrian and Shin (2010), pp. 423-424.
[62] Pp. 428-430.

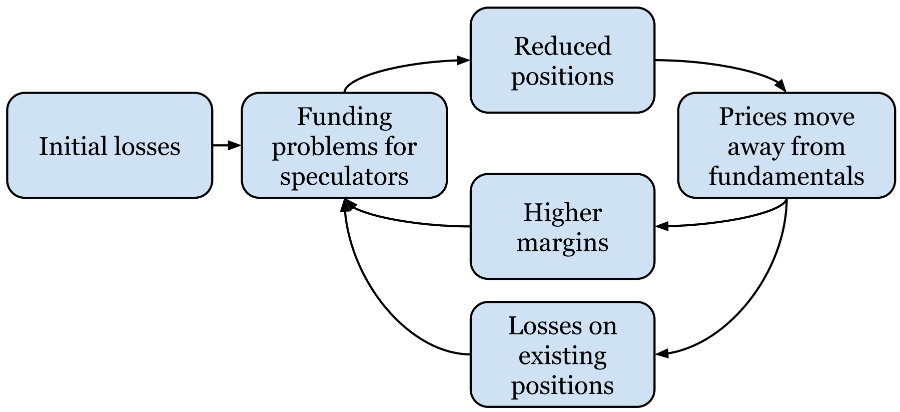

Figure 5.3: The liquidity spirals in Brunnermeier and Pedersen (2009).

leads to one of the "vicious circles of the business cycle".[63] If the bonds have been used as collateral for loans, then that collateral must be increased or a part of the loan must be repaid.[64] If the repayment is done via the distressed selling some of the bonds, then such selling tends to lower the price of the bonds.[65] More recently, Brunnermeier and Pedersen (2009) compare margin requirements to a capital requirement and state that - as financing providers can reset margins in each period - speculators face funding liquidity risk due to the risk of higher margins or losses on existing exposures.[66] They show that margins increased for S&P 500 futures during the liquidity crises of 1987, 1990, 1998 and 2007, and state that destabilising margins (i.e. margins that increase in illiquidity) force speculators to delever their positions in times of crisis, which leads to procyclical market liquidity provision.[67] When speculators hit their capital constraints, they reduce their positions and market liquidity declines whereby prices may be driven more by funding liquidity considerations than movements in the actual fundamentals of the prices.[68] As depicted in figure 5.3, Brunnermeier and Pedersen (2009) accordingly describe the liquidity spirals that reinforce each other and consist of (i) a margin spiral, wherein a funding shock leads to higher margins that tighten speculators' funding and cause deleveraging, and (ii) a loss spiral, wherein a funding shock increases market illiquidity that causes losses on initially held positions which forces speculators to sell and thereby cause a further price drop.[69]

Brunnermeier and Pedersen (2009) refer to LTCM as an example of rising

[63] P. 41.
[64] Macaulay (1938), p. 41.
[65] Macaulay (1938), p. 41.
[66] Pp. 2201-2202.
[67] Brunnermeier and Pedersen (2009), pp. 2202-2203.
[68] Brunnermeier and Pedersen (2009), p. 2203.
[69] Pp. 2204-2205.

margin requirements in 1998.[70] As also described in chapter 6.3.3, LTCM's trading strategy may be of relevance to this dissertation as it may possibly be a "classic" example of using repo transactions to finance investments in spread risk. President's Working Group (1999) describes how LTCM conducted convergence trades wherein offsetting positions in two related financial instruments were taken with the anticipation that the spread between the two financial instruments (e.g. the spread between two similar government debt issuings or between corporate debt and government debt) would move in a favourable direction.[71] Similarly, Edwards (1999) describes how LTCM pursued a strategy based on the anticipated narrowing of spreads between less liquid and undervalued bonds (including Danish mortgage backed securities) and liquid overvalued bonds, where even a small reduction in spreads would entail profits due to leverage.[72] LTCM gained exposure to, inter alia, government bonds, mortgage-backed securities and corporate bonds via repos and reverse repos while exposures to spreads were gained via interest rate swaps with high notional values.[73] President's Working Group (1999) estimates LTCM's (assets-to-equity) leverage ratio to have been 25-to-1 in 1998 while Edwards (1999) describes a leverage ratio of more than 20-to-1.[74] Contrary to LTCM's strategy, which was based on historically high levels of spreads narrowing, the spreads widened and LTCM was subject to cash flow and liquidity strains due to the mark-to-market valuation of financial collateral and margin requirements.[75] In addition, market illiquidity and the large size of LTCM's positions in certain markets entailed that LTCM faced difficulties in reducing its exposures and that a liquidation of LTCM's positions would have been disorderly as well as have adverse market effects on the exposures of LTCM's creditors and other market participants.[76] In relation hereto, and before the financial crisis, it was accordingly pointed out that hedge funds could be forced to sell their exposures at any price, in order to meet margin and collateral calls, and cause a collapse in the market prices of the assets which could impact the balance sheets of other undertakings with similar exposures.[77]

The procyclical nature of leverage and margin requirements accordingly lies in how increasing asset values (and lower margin requirements) during upswings increase a repo seller's access to leverage via financial collateral based on those increasing asset values.[78] When asset values subsequently decrease (and margin requirements increase) in accordance with the cycle, the access to leverage, via

[70] Pp. 2202-2204.
[71] President's Working Group (1999), pp. 10-11, including footnote 13, and appendix A-5
[72] Pp. 197-198.
[73] President's Working Group (1999), p. 11 and appendix A-2, and Edwards (1999), p. 198.
[74] President's Working Group (1999), pp. 12 and 14, and Edwards (1999), p. 198.
[75] President's Working Group (1999), p. 4, 12-14, 16 and 18.
[76] President's Working Group (1999), pp. 14, 16 and 18. Edwards (1999), p. 206, also presents the "copycat problem" or herd behaviour wherein financial undertakings have similar positions and are forced to simultaneously reduce the positions in a liquidity crisis.
[77] Edwards (1999), pp. 199-200 and 202.
[78] See also ESRB (2016a), p 10, and ESMA (2016), para. 43 and 45, and ESRB (2017a), section 3.2.

the financial collateral, is accordingly decreased.[79] A decrease in the access to leverage may force the repo seller to delever via fire sales which may put a downward pressure on asset values and cause (i) losses on such assets held on the balance sheet of the repo seller as well as other undertakings exposed to the assets and (ii) an increase in margin requirements in relation to those assets which further reduces the access to funding and leverage based on those assets.[80] In line with the above, FSB (2013c) labels

- the tendency of repos to increase the procyclicality of leverage (due to the direct relationship between procyclical financial collateral values and the access to funding) and
- the risk of fire sales of collateral

as risks that span *both* banking and shadow banking.[81] As mentioned, chapter 6.3 documents how the "top five" Danish life insurance undertakings have repo liabilities and financial collateral arrangements on their balance sheets. In addition, chapter 6.3.3 documents how at least one of the Danish life insurance undertakings has conducted leveraged repo transactions, via a wholly-owned hedge fund, to invest in short-term interest rate and spread risk.[82]

In order to determine whether life insurance undertakings' repo-based leverage may constitute shadow banking, part VIII of this dissertation will compare how Solvency II and the finalised Basel III address leverage and procyclicality. As described in chapter 8, the comparison is based on a scenario that relies on the liquidity spiral in Brunnermeier and Pedersen (2009) and the run on repo in Gorton and Metrick (2012).

5.1.2 Close-Out Netting and Master Netting Agreements

The access to bilateral close-out netting under the Financial Collateral Directive allows counterparties to manage and reduce their credit exposures on a net basis.[83] Under a close-out netting agreement, counterparties can continuously calculate their net credit exposure by (i) combining the estimated current exposures under all outstanding transactions with a counterparty and (ii) setting off reciprocal items to produce a single aggregated amount.[84] The single net aggregated amount can be compared with the current value of financial collateral to identify any non-secured credit exposure.[85]

In relation to LTCM as described above, President's Working Group (1999) states that without close-out and netting (i.e. set-off), the counterparties will

[79] See also ESRB (2016a), p. 10, ESMA (2016), para. 32, 39 and 44-45, and ESRB (2017a), para. 74-75 and 80.
[80] See also ESRB (2017a), para. 80.
[81] Section 1.2(i)-(ii).
[82] See information regarding PFA Investment Fund in PFA Pension (2016a), pp. 71, 86 and 87, and PFA Pension (2017a), pp. 69 and 85-87.
[83] Financial Collateral Directive, recital 14.
[84] Financial Collateral Directive, recital 14.
[85] Financial Collateral Directive, recital 14.

face uncertainty as to whether the contracts will be performed and thereby face "uncontrollable" market risk.[86] When a contract is closed-out (or terminated) upon an event of default, the non-defaulting counterparty can remove uncertainty regarding performance, fix the value of the transaction and hedge itself against its exposures.[87]

When close-out netting is effectuated due to an agreed enforcement event[88], the reciprocal obligations of the parties are accelerated (i.e. become immediately due) and expressed as an obligation to pay an amount representing their estimated current value.[89] An account is then taken of what is due from each party to the other in respect of the obligations and a net sum - equal to the balance of the account (i.e. a single net amount representing the difference between the estimated current values of the two parties' obligations) - becomes payable by the party from whom the larger amount is due to the other party.[90]

Under the GMRA, all repo transactions are considered to constitute a single business and contractual relationship and are made in consideration of each other.[91] A default in the performance of any obligation under a repo transaction accordingly constitutes a default in respect of all repo transactions under the GMRA.[92] As mentioned in chapter 5.1.1.1 above, an event of default (including the failure of the repo seller to pay the repurchase price on the repurchase date and the failure to make a margin transfer) entitles the non-defaulting party to designate the early termination date in respect of all outstanding repo transactions covered by the GMRA.[93] The early termination date then constitutes the repurchase date for each transaction and the obligations are accelerated in line with the Financial Collateral Directive.[94] The default market values of the financial obligations and financial collateral are established by the non-defaulting party and an account is taken of what is due from each party to the other under the GMRA.[95] The sums due from one party are set off against the sums due from the other and only the balance of the account is be payable by the party having the claim valued at the lower amount.[96] As described in chapter 11 regarding counterparty credit risk and repos, the finalised Basel III recognises the netting effect of master netting agreements that cover repos.

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[86] P. 19.

[87] President's Working Group (1999), pp. 19-20.

[88] Financial Collateral Directive, art. 2(1)(l), defines and "enforcement event" as an event of default or any similar event as agreed between the parties on the occurrence of which, under the terms of a financial collateral arrangement or by operation of law, the collateral taker is entitled to realise or appropriate financial collateral or a close-out netting provision comes into effect.

[89] Financial Collateral Directive, art. 2(1)(n)(i). The obligations may also be terminated and replaced by an obligation to pay the amount.

[90] Financial Collateral Directive, art. 2(1)(n)(ii), and Financial Collateral Directive Proposal, section 3, regarding art. 8.

[91] GMRA, para. 13.

[92] GMRA, para. 13.

[93] GMRA, para. 10(a) and (b).

[94] GMRA, para. 10(c).

[95] GMRA, para. 10(d)(i) and (ii).

[96] GMRA, para. 10(d)(ii).

In addition to the recognition of close-out netting, the Financial Collateral Directive ensures the effective liquidation or realisation of financial collateral.[97] Realisation in a title transfer financial collateral arrangement is enabled by its nature, as the collateral provider transfers full ownership of, or full entitlement to, the financial collateral for the purpose of securing or otherwise covering the performance of its financial obligations.[98] Realisation in a security financial collateral arrangement can, subject to its terms, be done by (i) selling or appropriating financial instruments and credit claims and by setting off their value against the relevant financial obligations, and (ii) setting off any amount of cash financial collateral against the financial obligations.[99] Subject to the terms of the financial collateral agreement, the realisation is not to be subject to any prior notice of the intention to realise, an approval by any court, public officer or other person, a public auction or the elapsing of time periods.[100]

As mentioned above, rapid and non-formalistic enforcement procedures in relation to close-out netting under financial collateral arrangements are assumed to safeguard financial stability and limit contagion effects in case of a default.[101] It reduces the potential size of credit exposures and lowers the probability of "domino effects" as the non-defaulting party can - in case of a default - liquidate the financial collateral quickly without being subjected to any waiting period that could impair the value of the financial collateral and result in the non-defaulting party being unable to fulfil its obligations to other counterparties.[102] In general, close-out netting and realisation of financial collateral accordingly entails that repos are not subject to an "automatic stay" but instead subject to a "safe harbour" treatment in case of winding-up proceedings or reorganisation measures.[103] As mentioned, FSB (2013c) describes how this safe harbour treatment may actually increase systemic risk by, inter alia, increasing the "money-likeness" of repos.[104] Close-out netting may accordingly constitute a liquidity risk. This dissertation will primarily focus on liquidity risk from a going-concern perspective and accordingly focus on the liquidity risk associated with rollover risk as well as margin calls and haircuts as described above in chapters 5.1.1.1 and 5.1.1.2.

[97]Financial Collateral Directive, recitals 5 and 14 and art. 4 and 7.

[98]Financial Collateral Directive, art. 2(1)(b) and 6.

[99]Financial Collateral Directive, art. 4(1)(a)-(c). Appropriation is subject to the conditions of art. 4(2).

[100]Financial Collateral Directive, art. 4(4).

[101]Financial Collateral Directive, recital 17. See also President's Working Group (1999), pp. 17 and 19.

[102]Financial Collateral Directive Proposal, section 3, regarding art. 5, and President's Working Group (1999), pp. 19, 20 and 21.

[103]Financial Collateral Directive, art. 4 and 7, Financial Collateral Directive Proposal, section 3, regarding art. 5, and FSB (2013c), section 4.2. See also President's Working Group (1999), p. 19.

[104]Section 4.2.

5.1.3 Reuse and Cash Collateral Reinvestment

While a title transfer financial collateral arrangement entails the transfer of full ownership of, or full entitlement to, financial collateral, the terms of a security financial collateral arrangement may include the "right of use".[105] It is assumed that a right of use (or reuse) of financial collateral increases liquidity in the financial market.[106] When a financial collateral taker exercises such a right of use, the financial collateral taker incurs an obligation to transfer equivalent financial collateral at the latest on the due date for the performance of the financial obligations.[107] As described in chapter 6.3.3, life insurance undertakings may use repos for liquidity management, including to obtain financial instruments that can be used to fulfil margin requirements in other transactions.

FSB (2013c) defines "reuse" as any use of securities delivered in one transaction in order to collateralise another transaction and states that reuse can be used to facilitate leverage.[108] The FSB recommended that financial intermediaries should provide sufficient disclosure to clients in relation to such "rehypothecation" of assets to ensure that clients can understand their exposures in the event of a failure of the intermediary.[109] In line with the FSB, the EU's SFT Regulation requires, inter alia, that reuse[110] is subject to the providing counterparty's prior express consent and that the providing counterparty has been duly informed in writing of the risks and consequences that may be involved in (i) giving consent to reuse under a security collateral arrangement or (ii) concluding a title transfer collateral arrangement.[111] In addition, the SFT Regulation states that the exercise of reuse must be done in accordance with the terms of the collateral arrangement, and the financial instruments, which are received under a collateral arrangement, must be transferred from the account of the providing counterparty.[112]

As this dissertation focuses on cash-driven repos, where a repo seller enters into a repo to obtain cash financing, the focus will not be on reuse but instead on cash collateral reinvestment. In cash collateral reinvestment, the repo seller

[105] Financial Collateral Directive, art. 5(1). The right of use does not apply to credit claims, cf. art. 5(6).
[106] Financial Collateral Directive, recital 19.
[107] Financial Collateral Directive, art. 5(2).
[108] Section 3.2.
[109] FSB (2013c), section 3.2, recommendation 7.
[110] SFT Regulation, art. 3(12), defines "reuse" as the use by a receiving counterparty - in its own name and on its own account or on the account of another counterparty (including any natural person) - of financial instruments received under a collateral arrangement, including under a transfer of title or an exercise of a right of use in accordance with the Financial Collateral Directive but not including the liquidation of a financial instrument in the event of default of the providing counterparty. Collateral arrangements under the SFT Regulation include title transfer collateral arrangements (i.e. a title transfer financial collateral arrangement under the Financial Collateral Directive) and security collateral arrangements (i.e. a security financial collateral arrangement under the Financial Collateral Directive), cf. art. 3(13)-(15) of the SFT Regulation.
[111] SFT Regulation, recital 2 and art. 15.
[112] SFT Regulation, art. 15(2).

reinvests the cash financial collateral received under repos.[113] In addition to liquidity risk (due to rollover risk, margin calls and haircuts) as well as the market risk on the assets that are invested in, such cash collateral reinvestment may entail liquidity risk, due to liquidity and maturity transformation, if the cash financial collateral is borrowed short-term and reinvested in assets that are long-term and/or illiquid.[114]

As described in chapter 1, the primary example of such liquidity risk and shadow banking in life insurance is presumably AIG.[115] In this case, an AIG non-insurance subsidiary lent out securities (provided by AIG life insurance subsidiaries) in return for cash financial collateral which it reinvested in long-term and illiquid investments.[116] Similar to LTCM, this activity made AIG subject to runs by securities borrowers (i.e. the cash lenders) as they could demand their cash financial collateral returned on short notice when they became aware of AIG being subject to, inter alia, margin calls under credit default swaps.[117] Reinvestment of cash financial collateral is accordingly associated with shadow banking if the reinvestment is made into long-term, or low credit quality or illiquid assets.[118] Conversely, it is not associated with shadow banking if the reinvestment is made into liquid and high credit quality assets.[119]

In order to assess whether such repo-based liquidity and maturity transformation by life insurance undertakings may constitute shadow banking, part VII will compare how Solvency II and the finalised Basel III address liquidity risk.

5.2 Counterparty Credit Risk and CVA Risk

In a "regular" credit risk exposure, due to e.g. a direct loan, credit risk is *unilateral* as the lender is exposed to the risk of loss if the borrower defaults, but the borrower is not exposed to the risk of loss if the lender defaults.[120] If this "regular" credit exposure is collateralised, and the collateral is not exchanged prior to default, then the credit risk exposure remains unilateral.[121]

However some collateralised transactions, including repos and other SFTs, are associated with counterparty credit risk, which is defined as the risk that the counterparty to a transaction could default before the final settlement of the

[113] FSB (2013c), sections 1.1(ii) and 3.1.
[114] FSB (2013c), sections 1.1 and 3.1.
[115] IAIS (2011), para 18 and appendix A7, FSB (2012c), section 5.6, IAIS (2017), p. 14, EIOPA (2017c), p. 46, and EIOPA (2018f), p. 44.
[116] IAIS (2011), para 18 and appendix A7, IAIS (2017), p. 14, FSB (2012c), section 5.6, EIOPA (2017c), p. 46, EIOPA (2018f), p. 44, and McDonald and Paulson (2015), p. 85.
[117] IAIS (2011), para 18 and appendix A7, IAIS (2017), p. 14, FSB (2012c), section 5.6, EIOPA (2017c), p. 46, EIOPA (2018f), p. 44, and McDonald and Paulson (2015), pp. 86-87 and 102.
[118] IAIS (2013b), para. 14 and 18.
[119] IAIS (2013b), para. 14 and 18.
[120] BCBS Consol. Basel III (2019), CRE51.3, and BCBS Basel III (2017), Standardised approach for credit risk, para. 3, footnote 2. See also Basel II, para. 52, footnote 16.
[121] BCBS Consol. Basel III (2019), CRE51.3(1), footnote 1.

transaction's cash flows.[122] In repos and other SFTs, there is a *bilateral* risk of loss due to, inter alia, the exchange of collateral as a part of the transaction.[123] This bilateral risk of loss is considered the "key concept" in counterparty credit risk.[124] In describing this concept, cash-driven repos (as well as cash-driven securities lending transactions) can be divided into the following forms of risk:

- The repo seller/borrower has assets - financial instruments - on its balance sheet which it sells or transfers as securities financial collateral via a financial collateral arrangement. Although the assets are sold or transferred as financial collateral, they remain on the balance sheet of the repo seller (see chapter 6.3.1.1) which entails that the repo seller remains exposed to any credit risk and market risk associated with those assets.[125]

- As the repo seller/borrower sells or transfers the assets as securities financial collateral to the repo buyer/lender, the repo seller/borrower also incurs the risk that the repo buyer/lender (which holds the securities financial collateral) may default and not return the (equivalent) securities financial collateral.[126]

- At the same time, the repo buyer/lender is exposed to the risk that the repo seller/borrower (the receiver of the cash financial collateral) defaults and does not pay the repurchase price (i.e. does not return the cash financial collateral) and any other financial obligations owed by the repo seller/borrower under the financial collateral arrangement.[127]

- As the value of the securities financial collateral is subject to credit risk and/or market risk, the repo buyer/lender is also exposed to possible fluctuations in the mark-to-market value of the purchased or received securities financial collateral (as a fall in the mark-to-market value of that securities financial collateral may entail that the repo buyer's/lender's exposure becomes under-collateralised and that the liquidation value of the financial collateral is less than the exposure value).[128]

- The repo seller/borrower is exposed to the risk that the received cash financial collateral may not be sufficient to cover the loss of the sold or

[122] BCBS Consol. Basel III (2019), CRE50.1 and CRE51.2, and BCBS Basel III (2017), Standardised approach for credit risk, para 3, footnote 2.

[123] BCBS Consol. Basel III (2019), CRE50.1 and CRE51.2-3 (including footnote 1), and BCBS Basel III (2017), Standardised approach for credit risk, para. 3, footnote 2.

[124] BCBS Consol. Basel III (2019), CRE51.2-3, and BCBS Basel III (2017), Standardised approach for credit risk, para. 3, footnote 2.

[125] E.g. BCBS Consol. Basel III (2019), CRE22.25 and CRE32.20, and BCBS Basel III (2017), Standardised approach for credit risk, para. 139, Internal ratings-based approach for credit risk, para. 89, and EIOPA Guidelines (2014d), para. 1.27(a).

[126] E.g. GMRA, para. 10(a)(ii), BCBS Consol. Basel III (2019), CRE51.3(2)(a) and (3)(b), and EIOPA Guidelines (2014d), para. 1.27(b).

[127] E.g. GMRA, para. 10(a)(i), BCBS Consol. Basel III (2019), CRE51.3(2)(b) and (3)(a), and EIOPA Guidelines (2014d), para. 1.27(b).

[128] GMRA, para. 4(c) and CRE51.3(2)(b), and EIOPA Guidelines (2014d), guideline 8, including para. 1.27(a).

transferred securities financial collateral, including exposures due to fluctuations in the mark-to-market value of the sold or transferred securities financial collateral (as an increase in the mark-to-market value of that securities financial collateral may entail that the repo seller's/borrower's financial obligations become overcollateralised which, in relation to offsetting, amounts to an uncollateralised exposure towards the repo buyer/lender).[129]

As described in the points above, the market value of a repo is uncertain and can vary over time, with the movement of underlying market factors, and therefore be positive or negative to either counterparty.[130] If the repo - or a portfolio of repos - has a positive economic value to one party, at the time of default and before the final settlement of the cash flows, then that party would suffer an economic loss.[131] In line with the points above, counterparty credit risk is considered a "hybrid" between credit risk and market risk that depends on changes in the counterparty's creditworthiness and movements in underlying market risk factors.[132]

Counterparty credit risk generally entails

- a current exposure (or replacement cost) in the form of the *current* market value of a transaction, or portfolio of transactions, with a counterparty that would be lost upon the immediate default of the counterparty, and
- a random potential future exposure in the form of an increase of the exposure over a given period after the counterparty's default.[133]

In general, variation margin is collected to cover current exposures while initial margin is collected to cover the potential future exposure, e.g. in the interval between the last margin collection and the liquidation of positions following a default.[134] In a CCP-cleared repo, the initial margin is generally small, in comparison to e.g. derivatives, due to the initial exchange of cash financial collateral against securities financial collateral (that is subjected to a haircut).[135]

In repos under the GMRA, the exposure is initially collateralised on the purchase date via the repo seller's transfer or selling of the financial instruments against the repo buyer's payment of the purchase price.[136] The initial margin in a repo is a percentage premium added to the market value of sold or transferred financial collateral in order to calculate the purchase price.[137] As in a haircut,

[129] E.g. GMRA, para. 4(c), BCBS Consol. Basel III (2019), CRE51.3(2)(a) and (3)(b), and EIOPA Guidelines (2014d), guideline 8, including para. 1.27(a).
[130] BCBS Consol. Basel III (2019), CRE50.1 and CRE51.5, and BCBS Basel III (2017), Standardised approach for credit risk, para. 3, footnote 2.
[131] BCBS Consol. Basel III (2019), CRE50.1, and BCBS Basel III (2017), Standardised approach for credit risk, para. 3, footnote 2. See also President's Working Group (1999), pp. 6-7.
[132] Financial Stability Institute (BIS) (2018), p. 1.
[133] BCBS Consol. Basel III (2019), CRE50.26, CRE51.5 and CRE52.3, and EMIR Delegated Regulation, art. 1(5) and (6). See also President's Working Group (1999), pp. 6-9, 15, 19 and 21, and ESRB (2017a), para. 51-53.
[134] See e.g. EMIR Delegated Regulation, art. 1(5) and (6), and ESRB (2017a), para. 51-53.
[135] ESRB (2017a), para. 63.
[136] GMRA, para. 1(a) and 3(c), and President's Working Group (1999), p. 21.
[137] International Capital Market Association (2012), para. 2.3-2.5.

the purchase price is usually set below the market value of the financial collateral in order to ensure overcollateralisation and express the probable future liquidation value of the financial collateral.[138] The premium is expressed via the GMRA's "margin ratio" wherein the market value of the securities financial collateral (at the time of the entering into of the transaction) is divided by the agreed purchase price.[139] In addition, the GMRA ensures that a counterparty may - in the case of a net exposure at any time - issue a margin call and require the other counterparty to provide additional financial collateral via a margin transfer.[140]

If a repo is fair-valued, a counterparty in the repo is also exposed to the mark-to-market losses associated with a deterioration in the creditworthiness of the other counterparty.[141] In the finalised Basel III, this risk of mark-to-market losses, due to the expected counterparty credit risk, is referred to as credit valuation adjustment ("CVA") risk.[142] Such CVA risk captures the risk of losses, arising from a change in CVA values, in response to changes in credit spreads of counterparties and market risk factors that drive the prices of SFTs.[143] In general, CVA is an adjustment of the default risk-free prices of derivatives and SFTs due to a potential default by a counterparty and it is considered the market price of counterparty credit risk.[144] As described below, the finalised Basel III's capital requirements for market risk accordingly include capital requirements for CVA risk (in addition to capital requirements for counterparty credit risk exposures in the banking book and trading book) that apply to primarily derivatives but also to SFTs that are fair-valued for accounting purposes.[145] However, derivative transactions with CCPs and other SFTs are not subject to the capital requirement for CVA risk.[146]

As repos entail counterparty credit risk, part VI will compare how Solvency II and the finalised Basel III address such counterparty credit risk in addition to credit risk and market risk. Due to limitation issues, the comparison will only focus on counterparty credit risk capital requirements and not CVA risk. However, CVA risk would be equally relevant if life insurance undertakings traded their repos.

[138] International Capital Market Association (2012), para. 2.5 and 3.1.

[139] GMRA, para. 2(bb), and International Capital Market Association (2012), para. 2.3 and 2.4.

[140] GMRA, para. 4(a).

[141] BCBS Consol. Basel III (2019), CRE50.32, BCBS Basel III (2017), Minimum capital requirements for CVA risk, para. 1-3, Basel III, para. 14(b) and 99, and Financial Stability Institute (BIS) (2018).

[142] BCBS Consol. Basel III (2019), CRE50.32 and MAR50.2 and 50.4, BCBS Basel III (2017), Minimum capital requirements for CVA risk, para. 2, and Basel III, para. 14(b) and 99.

[143] BCBS Consol. Basel III (2019), CRE50.32 and MAR50.2 and 50.4, BCBS Basel III (2017), Minimum capital requirements for CVA risk, para. 2, and Basel III, para. 14(b) and 99.

[144] BCBS Consol. Basel III (2019), CRE50.32 and MAR50.2, BCBS Basel III (2017), Minimum capital requirements for CVA risk, para. 1, and BCBS (2015b), p. 1.

[145] BCBS Consol. Basel III (2019), RBC20.6(2) and 20.9(2) and MAR50.2 and 50.5, BCBS Basel III (2017), Minimum capital requirements for CVA risk, para. 1-3, and Basel III, para. 14(b) and 99.

[146] BCBS Consol. Basel III (2019), MAR50.5, and BCBS Basel III (2017), Minimum capital requirements for CVA risk, para. 3, and Basel III, para. 99.

Part III

Indications of Shadow Banking in Life Insurance

Chapter 6

Shadow Banking and Life Insurance

As discussed in chapter 1, "traditional" insurance is not associated with banking-like credit intermediation, the use of short-term funding, maturity transformation, liquidity transformation, exposures to liquidity risk and runs, excessive leverage, or systemic risk.

However, chapter 6.1 will describe the FSB's two-step approach for identifying shadow banking.[1] In line with the FSB's step 1, chapter 6.2 will then document the aggregated alternative credit investments of Danish life insurance undertakings. In addition, and in line with the FSB's step 2, chapter 6.3 will document the repo activities of the "top five" Danish life insurance undertakings. The documented alternative credit investments of Danish life insurance undertakings (i.e. non-bank credit intermediation), as well as the documented individual and aggregated repo activities of the "top five" Danish life insurance undertakings, may amount to possible systemic risk developments and indications of shadow banking in Danish life insurance.

In order to reflect developments in the perception of life insurance and shadow banking, chapter 6.1.1 will show how global, EU and member state supervisors are aware of life insurance undertakings' (alternative) credit investments. In addition, chapters 6.1.1 and 14 will show how life insurance undertakings' repo activities are viewed as non-insurance activities and considered a potential source of systemic risk.

Chapter 6.3 will also document non-compliance with the collateral reporting obligation and chapter 6.3.2 will accordingly discuss the implications of such non-compliance, including a lack of compliance with the prudent person principle and non-transparency in relation to the life insurance undertakings' possible shadow banking, liquidity profiles and available unencumbered assets. Finally, chapter 6.3.3 will attempt to shed some light on the possible purposes of repos in life insurance.

[1] FSB (2011c), section 1.

6.1 Shadow Banking and the Two-Step Identification Approach

As mentioned in chapter 1, FSB (2011c) broadly defines shadow banking as "the system of credit intermediation that involves entities and activities outside the regular banking system".[2] Figure 6.1 illustrates how the FSB's identification of shadow banking entails a two-step approach:

- Step 1: a wide net looks at all *non-bank credit intermediation*. The FSB's global shadow banking monitoring reports accordingly first "macro-map" all non-bank financial intermediation (including "other financial intermediaries"[3], insurance corporations and pension funds) via the monitoring universe of non-bank financial intermediation ("MUNFI") which functions as a starting point for assessing involvement in shadow banking.[4] As also mentioned in chapter 1, the wide net focuses on credit intermediation that takes place in an environment where prudential regulatory standards and supervisory oversight are either not applied or are applied to a materially lesser or different degree than is the case for regular banks engaged in similar activities.[5]

- Step 2: the focus is then narrowed to the subset of non-bank credit intermediation where there are (i) developments that increase *systemic risk* and/or (ii) indications of *regulatory arbitrage* that is undermining the benefits of financial regulation. Developments that increase systemic risk include - in particular - maturity transformation, liquidity transformation, imperfect credit risk transfer and/or leverage. In accordance with the five economic functions framework[6], the FSB's global shadow banking monitoring reports produce an estimate of the *narrow measure* of shadow banking.[7]

As described in chapter 2.1.1, the FSB has divided its approaches to shadow banking into, inter alia,

[2] FSB (2011c), section 1. Based on the FSB's approach, European Commission (2013b) similarly defines shadow banking as a system of credit intermediation that involves entities and activities outside the regular banking system, cf. p. 3, footnote 7. It includes entities which (i) raise funding with deposit-like characteristics, (ii) perform maturity and/or liquidity transformation, (iii) allow credit risk transfer and (iv) use direct or indirect leverage.

[3] All financial institutions that are not central banks, banks, insurance corporations, pension funds, public financial institutions, or financial auxiliaries. In the shadow banking monitoring reports, the "other financial intermediaries" are money market funds, hedge funds, other investment funds, real estate investment trusts and real estate funds, trust companies, finance companies, broker-dealers, structured finance vehicles, central counterparties, and captive financial institutions and money lenders, cf. FSB (2017b), p. 16, footnote 37, and FSB (2018), p. 2, footnote 5.

[4] See e.g. FSB (2017b), pp. 2 and 6-7 and section 2, and FSB (2018), pp. 2 and 6-7 and section 2.

[5] FSB (2011c), p. 3.

[6] See chapter 2.1.1.

[7] See e.g. FSB (2017b), pp. 2 and 6-7 and section 4, including pp. 43 an 46, and FSB (2018), pp. 2 and 6-7 and section 4, including pp. 45-47.

- the policy framework for securities lending and repos which specifically targets the risks associated with SFTs.[8] This policy framework led to the regulatory framework for haircuts on non-centrally cleared SFTs, which includes the numerical haircut floors framework that is intended to limit the build-up of excessive and possibly procyclical leverage outside the banking system.[9] The numerical haircut floors framework is described in chapter 13.2.

- the policy framework for shadow banking entities (other than money market funds) which includes the five economic functions used to identify the narrow measure of shadow banking.[10]

If SFT-based shadow banking risks are identified, and there is an overlap between the two policy frameworks, then the FSB's initiatives regarding securities lending and repos serve as the primary policy framework.[11] This dissertation accordingly relies on the FSB's initiatives, regarding securities lending and repos, when associating life insurance undertakings' repos with shadow banking.

When using repos as an indicator of shadow banking, it must be kept in mind that maturity transformation and liquidity transformation is difficult to document as the balance sheets of the "top five" Danish life insurance undertakings do not allow the tracking of any reinvestment of received cash financial collateral. The FSB states that a more thorough assessment of potential maturity transformation should be conducted if there are more short-term instruments included in liabilities than in assets.[12] However, this approach may not be viable as life insurance undertakings' traditional life insurance liabilities and assets are generally large enough to outsize the identified repo activities, which may in themselves be significant. The same applies to liquidity transformation which the FSB considers "very difficult" to measure.[13] The FSB states that assessments of liquidity transformation can be based on information on the secondary market depth of assets and other liquidity indicators, e.g. margins and haircuts as well as bid-ask spreads in stressed and normal times.[14] However, the identification of life insurance undertakings' illiquid assets will not reflect whether the assets are financed by short-term and liquid repo liabilities or long-term and less liquid insurance liabilities.

The reinvestment of cash financial collateral into liquid and high credit quality assets (e.g. government bonds) is assumed to not amount to shadow bank-

[8] FSB (2013c), sections 1.1 and 1.2.

[9] FSB (2013c), annex 2, FSB (2014c), pp. 1-2, and FSB (2015c), pp. 1-2.

[10] FSB (2013d). The economic functions are (i) management of collective investment vehicles with features that make them susceptible to runs, (ii) loan provision that is dependent on short-term funding, (iii) intermediation of market activities that is dependent on short-term funding or on secured funding of client assets, (iv) facilitation of credit creation and (v) securitisation-based credit intermediation and funding of financial entities, cf. FSB (2013d), section 2, FSB (2017b), p. 43, and FSB (2018), p. 45.

[11] FSB (2013d), p. 12, including footnote 19.

[12] FSB (2011c), p. 11.

[13] FSB (2011c), p. 11.

[14] FSB (2011c), p. 11.

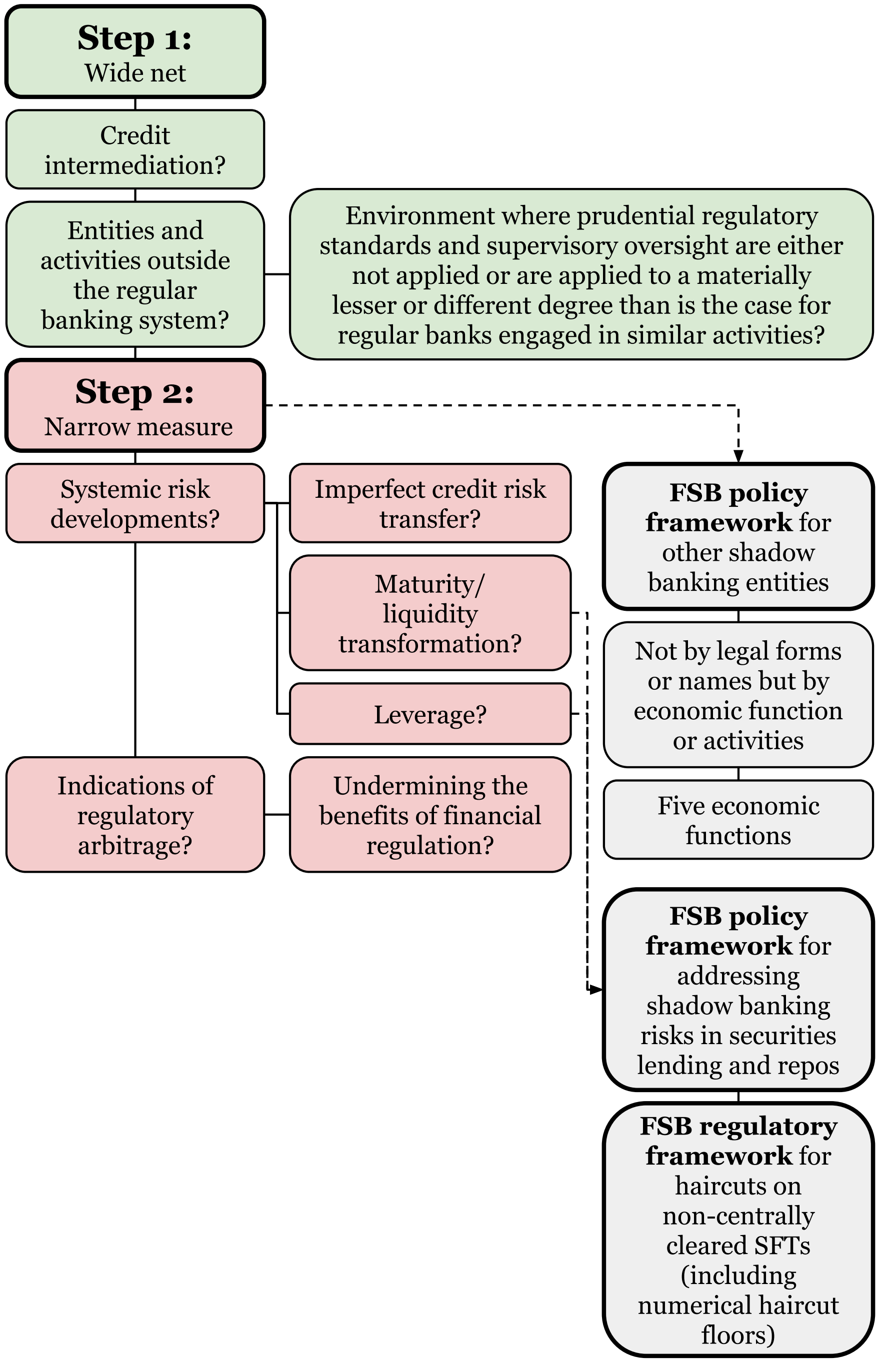

Figure 6.1: An illustration of the FSB's two-step approach for identifying shadow banking in FSB (2011c). The illustration also includes the related (i) policy framework for strengthening oversight and regulation of (other) shadow banking entities in FSB (2013d), (ii) policy framework for addressing shadow banking risks in securities lending and repos in FSB (2013c) and (iii) regulatory framework for haircuts on non-centrally cleared SFTs (including the numerical haircut floors framework) in FSB (2015c).

ing.[15] However, as documented in chapter 6.3, the repo activities may still be large enough to have systemic risk implications, especially when viewed from an aggregated perspective that may reflect the collective behaviour described in chapter 1.

6.1.1 Global and EU Approaches to Shadow Banking and Life Insurance

From a global perspective, life insurance undertakings have generally not been associated with the credit intermediation that would place them in the FSB's wide measure of all non-bank credit intermediation (i.e. step 1) or activities that would place them in the FSB's narrow measure of shadow banking (i.e. step 2).[16]

Initially, the FSB excluded life insurance undertakings and pension funds from the narrow measure of shadow banking in step 2.[17] The FSB focused on credit intermediation that involved, inter alia, maturity transformation, liquidity transformation and/or leverage and viewed "simple life insurance businesses" as usually not involving such activities or securities lending.[18] The FSB has also stated that pension funds' generally long-term investment horizons can be expected to make a positive contribution to financial stability and that pension funds have relatively low levels of liquidity transformation and financial leverage.[19]

However, the FSB's shadow banking monitoring reports have since 2013 recognised credit intermediation - including direct lending, higher-yielding fixed income exposures and leveraged finance - by insurance corporations and pension funds.[20] When the shadow banking monitoring report in FSB (2013a) examined the direct lending by non-banks, it noted that direct lending by insurance companies and pension funds was less likely to present shadow banking risks given their low leverage and long-dated liabilities.[21] However, while emphasising that they do not take deposits, the FSB noted that increasing similarities between insurance companies' and pension funds' activities and banking activities may

[15] IAIS (2013b), para. 18, example a. See also FSB (2015c), p. 8.

[16] IAIS (2011), para. 68, and regarding the MUNFI see FSB (2012b), pp. 3 (footnote 2) and 7-9, FSB (2013a), p. 1 (footnote 6) and 8, FSB (2014b), p. 1 (footnote 6) and pp. 5-6, 8 (footnote 24) and 19, and FSB (2015a), pp. 2, 4 (including footnote 13) and 17-18 (including footnotes 34 and 35), FSB (2017b), pp. 45-46, and FSB (2018), p. 46-47. Regarding the narrow measure of shadow banking see FSB (2015a), pp. 17-18, where the association of insurance companies and pension funds with shadow banking was limited to the facilitation of credit creation. Facilitation of credit creation is the fourth economic function and includes guarantees as well as insurance and credit default swaps on credit and financial products, cf. FSB (2013d), section 2.4 and p. 27, FSB (2015a), p. 15, FSB (2017b), pp. 65-66, and FSB (2018), pp. 68-69.

[17] FSB (2013d), p. 3, and FSB (2011b), p. 3 (footnote 4).

[18] FSB (2017b), pp. 45-46, FSB (2013d), p. 3, and FSB (2011b), p. 3 (footnote 4).

[19] FSB (2017b), p. 15.

[20] See e.g. FSB (2013a), annex 3, FSB (2014b), section 2.1, FSB (2015a), section 4.1, FSB (2017b), section 2.2, p. 26 (footnote 68) and annex 7 (footnote 157), and FSB (2018), section 2.2 and p. 29.

[21] Annex 3, p. 44.

entail the need to adapt their supervision to reflect their expanded scope of activities and the related risks (including credit risk and liquidity risk) in order to avoid unintended regulatory arbitrage.[22] In addition, the shadow banking monitoring report in FSB (2017b) stated that insurance corporations and pension funds were involved in direct lending and taking advantage of the funding gap left by banks that had retreated primarily as a result of the Basel III framework.[23] From a global perspective, the FSB is accordingly aware of life insurance undertakings' credit exposures as well as regulatory arbitrage.

During the early phase of the EU's Solvency II project, where the relevance of banking rules for insurance was discussed, European Commission (2001) stated that insurance companies basically sought to invest their funds in low-risk and diversified instruments and that they did not perform a "lending" role comparable to that of the banks and did therefore not carry out "sophisticated internal analysis" of their counterparties' default risk.[24] Subsequently, when discussing guaranteed products and quantitative limits on assets, CEIOPS (2007b) similarly found that the business models of banks and insurance undertakings differed significantly as banks would use the received money to sell loans, which earned a higher yield than the guarantees given, while insurance undertakings invested premiums on capital markets to receive higher returns than the guarantees given.[25] As also discussed in detail in relation to credit risk and liquidity risk in chapters 10.3 and 12.1, the Solvency II project seems to have relied on the perception of traditional insurance.

After the financial crisis, and in a reply to the European Commission's green paper on shadow banking, EIOPA (2012) concurred with the FSB that "traditional insurance business" would not fall under the definition of shadow banking but also stated that the definition (i.e. all credit intermediation which involves entities and activities outside the regular banking system) was "rather general".[26] EIOPA found it important to distinguish insurance undertakings' investment activities from credit intermediation and stated that a central part of insurance undertakings' core activity was investments in bonds (e.g. sovereign or corporate bonds) but that they also invested in other credit related assets.[27] However, this activity was not to be viewed as credit intermediation or understood as shadow banking although it exposed insurance undertakings to credit risk.[28] At the same time, EIOPA recognised insurance undertakings' mortgage lending and direct lending to corporates as well as their "limited" repos and securities lending.[29] Subsequently, the European Commission, ESRB and EIOPA have focused on insurance undertakings' (direct) loans, illiquid assets and the "search for yield".[30] The EU and FSB are accordingly aware of life insurance

[22] FSB (2013a), annex 3, p. 44.
[23] P. 26.
[24] Para. 27.
[25] Para. 2.6.
[26] EIOPA (2012), p. 1, and European Commission (2012).
[27] EIOPA (2012), p.1.
[28] EIOPA (2012), p. 1.
[29] EIOPA (2012), pp. 1-2.
[30] European Commission (2013b), pp. 5-6, ESRB (2015), p. 11, EIOPA (2017b), pp. 3 and

undertakings' (alternative) credit investments.

Level 2 of Solvency II includes pillar 2-based risk management requirements for life insurance undertakings' lending.[31] With some amendments, these pillar 2 requirements for loans replicate CRD IV's wording regarding the organisation and treatment of credit risk and counterparty risk in banking.[32] They include requirements regarding the credit-granting process, the methodologies for assessing the credit risk of exposures and portfolios, the administration and monitoring of loan portfolios, and loan portfolio diversification.[33] However, in its supervision of credit management, Danish FSA (2018b) mentioned that there was a need to strengthen credit competences when life insurance undertakings moved into the areas of traditional banking.[34]

From an asset perspective, including Solvency II itself, it accordingly seems uncontroversial to associate life insurance undertakings with bank-like credit intermediation. This association is further supported by recent EU initiatives in relation to insurance undertakings' investments in unrated bonds and loans. As a part of the Capital Markets Union Action Plan, the EU wanted to support insurance undertakings' exposures to long-term assets and SMEs, including privately placed corporate debt.[35] EIOPA was accordingly requested to provide advice regarding "unjustified constraints" to financing in insurance undertakings' prudential requirements.[36] In accordance with the Capital Markets Union Action Plan, this advice was to treat insurance undertakings' investments, which support jobs and growth, "appropriately" and remove barriers to their investments in unrated bonds and loans in order to improve their ability to invest in private placement offerings.[37]

As described in chapter 10.3.2 below, this Solvency II review included that EIOPA was to provide specific and risk-sensitive criteria that would allow unrated bonds and loans to be subject to the possibly lower capital requirements for rated bonds and loans in credit quality step 2 and 3 of the spread risk submodule.[38] In relation hereto, EIOPA (2017a) stated that unrated corporate debt, issued by non-financial and non-real estate corporates, represented a low single digit percentage of all investments by European insurance undertakings.[39] In addition, EIOPA (2018b) found it reasonable to assume that insurance undertakings' exposures to low credit quality debt was rather limited in accordance with the prudent person principle.[40] Based on EIOPA's advice, the European

21-23, EIOPA (2017c), pp. 46-47, 50 and 55, and EIOPA (2018c), pp. 56-59 and 64-65.

[31] Solvency II Delegated Regulation, art. 260(1)(c)(iii) and 261.

[32] CRD IV, art. 79, vs. Solvency II Delegated Regulation, art. 261(1).

[33] Solvency II Delegated Regulation, art. 261(1).

[34] P. 9.

[35] European Commission (2015a), section 4.2, and European Commission (2017a), pp. 7 and 20

[36] European Commission (2017c), sections 1.1 and 3. See also European Commission (2017a), pp. 7 and 20.

[37] European Commission (2015a), section 4.2, and European Commission (2017c), sections 1.1 and 3.

[38] European Commission (2017c), sections 1 and 3.1.

[39] EIOPA (2017a), para. 707.

[40] EIOPA (2018b), para. 1003. See also EIOPA (2017a), para. 637.

Commission amended the Solvency II Delegated Regulation to accommodate life insurance undertakings' investments in unrated bonds and loans.[41]

In accordance with the FSB's step 1, chapter 6.2 will present the alternative credit investments of Danish life insurance undertakings and show how they are monitored on an annual basis by the Danish FSA.

As reflected above, it seems that traditional insurance assets are generally associated with capital markets as well as sovereign or corporate bonds. In addition, it seems like insurance undertakings' shadow banking activities are often determined from a purely asset-based perspective that differentiates between traditional life insurance assets and alternative credit investments, including direct loans. However, as described in relation to the definition of shadow banking, and as initially discussed in chapter 1, the identification of shadow banking cannot only be asset-based as shadow banking entails systemic risk developments due to e.g. maturity transformation, liquidity transformation and/or leverage. Life insurance undertakings' exposures to illiquid direct loans or bonds do presumably not constitute shadow banking if such loans or bonds are financed by long-term and less liquid life insurance liabilities. However, if such illiquid direct loans or bonds are financed by short-term and liquid liabilities, then maturity and liquidity transformation may be taking place. Shadow banking should accordingly be discussed and determined from a perspective that captures both assets and liabilities.

In relation to liabilities, the IAIS includes life insurance undertakings' repos in its global definition of non-insurance activities and considers them to be a potential source of systemic risk.[42] As described in chapter 14, when imposing the higher loss absorbency requirement upon G-SIIs, the IAIS' assessment methodology for identifying G-SIIs includes indicators that capture non-insurance activities as well as short-term borrowing, repos, securities lending, maturity transformation, liquidity risk and fire sales.[43] In addition, the IAIS' holistic framework identifies liquidity risk (including SFTs and liquidity transformation) as a microprudential concern that may become a macroprudential concern due to fire sales that trigger a decrease in asset prices and significantly disrupt trading or funding in key financial markets or cause significant losses or funding problems for other undertakings with similar exposures.[44] In the EU, EIOPA (2018e) also distinguishes between "traditional insurance" and banking-like activities and EIOPA (2017c) focuses on how e.g. bank-like activities may propagate or amplify shocks to the rest of the financial system and the real economy, and EIOPA identifies, inter alia, SFTs and direct lending as

[41] Commission Delegated Regulation (EU) 2019/981, recitals 2, 5 and 28 and art. 1(37) (new art. 176a-176c in the Solvency II Delegated Regulation). See also EIOPA (2018b), section 10.5, including para. 1048, 1072, 1073, 1075, 1076, 1081, 1085 and 1086 and section 10.5.3.

[42] IAIS (2016b), section 2, including para. 2.3. See also IAIS (2013a), para. 13 and 29 and p. 16, IAIS (2013b), para. 14 and 18, and IAIS (2011), para. 4 and 18 and section 3.2 (including para. 29, 31, 32 and 37 and table 1) and appendix A7.

[43] IAIS (2016a), para. 25 and p. 14 (table 2) and para. 80, IAIS (2016b), section 2, and IAIS (2013a), para. 29 and p. 16.

[44] IAIS (2018a), para. 33-37, 49-52 and 58 and p. 21 (figure 1). See also IAIS (2017), para. 33-34, 41-44, and p. 14 (regarding AIG).

activities-based systemic risk drivers.[45]

Similar to the IAIS and EIOPA, the FSB has also been aware of the possible SFT activities by life insurance undertakings and discussed how those activities could warrant an inclusion of pension funds' and insurance companies' assets within the narrow measure (i.e. step 2) of shadow banking.[46] The FSB has noted how pension funds use repos to finance part of their bond holdings, including "repo-ing" out holdings of high-quality long-term assets, to raise cash for liquidity management or return enhancement purposes, and achieve some degree of leverage when doing so.[47] As described in chapter 13.2, the FSB's separate workstream for SFTs includes the numerical haircut floors framework that applies to certain non-centrally cleared SFTs and covers both "bank-to-non-bank transactions" and "non-bank-to-non-bank transactions".[48] Insurance companies may - on an exceptional basis - be excluded from the numerical haircut floors framework if they are subject to capital and liquidity requirements and have access to central bank facilities "as appropriate".[49]

This dissertation's approach to documenting life insurance-based shadow banking, via Danish life insurance undertakings' alternative credit investments and repos, accordingly seems supported at both the global and EU level. However, as also stated in relation to the research question in chapter 1, Danish life insurance undertakings' alternative credit investments and repo activities do not amount to shadow banking if these bank-like activities and risks are subject to prudential regulatory standards that are similar to the prudential regulatory standards that apply upon banks that conduct similar activities and are exposed to similar risks. As shown next, the EBA seems to have excluded insurance undertakings from its definition of shadow banking entities without applying an explicit risk-based or activities-based approach.

6.1.2 The EU's Definition of Shadow Banking Entities

In the EU, shadow banking is generally associated with investment funds and "other financial institutions".[50] As described in chapter 7.1 below, the AIFM Directive, UCITS Directive, MMF Regulation, EMIR and SFT Regulation are all considered shadow banking regulation.[51]

In its reply to the European Commission's Green Paper on shadow banking, EIOPA (2012) found that the FSB's definition of shadow banking would include entities and activities that were already supervised and regulated and

[45] EIOPA (2018e), p. 21, and EIOPA (2017c), pp. 5, 27-28, 30, 43-44, 46 and 49.

[46] FSB (2015a), p. 17 (footnote 35), and e.g. FSB (2017b), section 2.5 and p. 37.

[47] FSB (2012c), p. 7.

[48] FSB (2015c), pp. 2-4 and 11-12.

[49] FSB (2015c), p. 4 (footnote 11). See also FSB (2017b), p. 28.

[50] EBA Guidelines (2015), section 2.1.2, para. 14-15, and section 3, para. 11, and ESRB (2018), pp. 13.14 (table 2). Investment funds include e.g. money market funds and alternative investment funds. Other financial institutions include e.g. financial vehicle corporations, financial corporations engaged in lending, and security and derivative dealers.

[51] See e.g. European Commission (2013b), p. 3, sections 2 and 3, and p. 15, and European Commission (2017b), pp. 1 and 8-9. Se also EBA Guidelines (2015), section 2.1.2, para. 13-16,

posed little additional risk to overall financial stability.[52] EIOPA wanted the definition limited to accurately capture activities that were not properly regulated or not subject to effective supervision.[53] As mentioned above, EIOPA recognised that mortgage lending and direct lending to corporates - as well as the "limited" repos and securities lending - could fall within the definition of shadow banking but stated that those activities were subject to supervision and Solvency II, including the economic risk-based solvency requirements and total balance sheet approach.[54] EIOPA also stated that even if shadow banking activities are carried out by regulated entities, their shadow banking activities should be monitored to identify possible systemic risks.[55] However, ESRB (2018) excluded insurance undertakings and pension funds from its monitoring of shadow banking and the financial stability report in EIOPA (2018c) did not subject life insurance undertakings' SFTs to specific monitoring.[56]

In EU banking regulation, the CRR states that shadow banking entities carry out banking activities "outside a regulated framework" and mandates the EBA to issue guidelines regarding limits on credit institutions' exposures to shadow banking entities.[57] EBA Guidelines (2015) accordingly defines shadow banking entities as entities that

- carry out credit intermediation activities[58], and
- are neither within the scope of prudential consolidation nor subject to solo prudential requirements under specified EU legislation (or equivalent third country legal frameworks).[59]

The EBA also views shadow banking entities as (i) generally unregulated, or not subject to the same standards of prudential regulation as core regulated entities such as (credit) institutions, (ii) not providing protection to investors from these entities' failures and (iii) not having access to central banks' liquidity facilities.[60]

Similar to EIOPA, the EBA excludes insurance undertakings from its definition of shadow banking entities while stating that they are subject to an "appropriate and sufficiently robust prudential framework".[61] However, the EBA did not seem to determine whether Solvency II actually addresses maturity transformation, liquidity transformation or leverage when excluding insurance undertakings from shadow banking entities. Via the risk-based comparison that

[52]EIOPA (2012), p. 1. See also European Commission (2012).
[53]EIOPA (2012), p. 1.
[54]EIOPA (2012), p. 2.
[55]EIOPA (2012), p. 2.
[56]ESRB (2018), pp. 1, 3, 5, 13-14 and 16, and EIOPA (2018c), pp. 70-73.
[57]CRR, art. 395(2).
[58]Defined as bank-like activities involving maturity transformation, liquidity transformation, leverage, credit risk transfer or similar activities.
[59]EBA Guidelines (2015), section 2.1.2, para. 7, and section 3, para. 8 and 11.
[60]EBA Guidelines (2015), section 2.1.2, para. 27.
[61]EBA Guidelines (2015), section 2.1.2 , para. 10, and section 3, para. 8 and 11 (definition of "excluded undertakings"). See also EBA (2014a), pp. 1 (footnote 3) and 4, EBA (2014b), para. 4 (footnote 4) and 46-49, and EBA (2015), para. 8 and 9.

is defined in chapter 8, this dissertation will show that the Solvency II-based exclusion of life insurance undertakings from shadow banking entities does not seem warranted in relation to, inter alia, liquidity risk or leverage.

6.2 Step 1: Alternative Credit Investments by Danish Life Insurance Undertakings

Although this dissertation does not focus on life insurance liabilities, some context is useful in relation to alternative investments. EIOPA has found significant increases in unit-linked and index-linked business and EIOPA has, in several publications, described how unit-linked products seem to be a response to the low interest rate environment where risks are shifted from life insurance undertakings to policyholders.[62] In Denmark, Danish FSA (2018b) confirmed the trend of moving away from traditional pension products with guaranteed benefits towards non-guaranteed market rate products (in Da: "markedsrenteprodukter") where the policyholder bears, inter alia, the investment risk.[63] In 2017, 42.7% of pension-related Danish technical provisions were in market rate products.[64] The Danish FSA has stated that alternative investments constitute a greater share in the generally non-guaranteed market rate products than the generally guaranteed average-rate products (in Da: "gennemsnitsrenteprodukter") where the life insurance undertaking bears the investment risk.[65] Danish FSA (2017b) views Solvency II as - to a high degree - more structured towards guaranteed products than non-guaranteed products.[66]

In line with step 1 of the FSB's approach for identifying shadow banking, this chapter presents data regarding Danish life insurance undertakings' alternative credit investments.[67] This chapter only documents alternative credit investments and does not focus on insurance liabilities. However, the developments within alternative investments must be viewed in relation to the changes in life insurance products, including non-guaranteed market rate products. If such non-guaranteed market rate products constitute long-term and illiquid liabilities, they can be used to finance long-term and illiquid assets without bank-like maturity and liquidity transformation.

Pursuant to the Danish FSA, alternative investments are - in comparison to traditional investments - characterised by being traded on a shallow, illiquid and non-transparent market as well as being long-term and associated with different risks.[68] These characteristics and the lack of observable market prices

[62] EIOPA (2017b), pp. 4 and 24-25, EIOPA (2017c), p. 52, and EIOPA (2018c), p. 26.
[63] Pp. 1, 4, 6-7 and 16.
[64] Danish FSA (2018b), pp. 1, 7 and 18.
[65] Danish FSA (2017a), pp. 1 and 3, Danish FSA (2017b), pp. 4 and 6, and Danish FSA (2018b), p. 2.
[66] P. 4.
[67] FSB (2011c), section 1.
[68] Danish FSA (2014b), p. 1, Danish FSA (2016), p. 13, Danish FSA (2017a), p. 9, and Danish FSA (2018b), p. 11.

make it challenging to value such alternative investments.[69] As a subcategory of alternative investments, "alternative credit" includes, inter alia, direct "bank loans", senior secured loans, mezzanine debt, investments in credit funds and collateralised loan obligations.[70] The top figure in figure 6.2 provides aggregated data regarding the total assets and total alternative credit investments of Danish life insurance companies and multi-employer occupational pension funds ("LCMPF") gathered from the market development reports of the Danish FSA.[71]

The value of Danish LCMPF's total alternative credit investments may seem insignificant in comparison to the LCMPF's total assets. However, figure 6.2 shows how the ratio between alternative credit investments in 2012 and 2018 is not matched by an equivalent ratio between total assets in those years.

In life insurance, there seems to be a specific terminology regarding credit exposures. In its separate annual statistics, Danish FSA uses the terms "credit bonds" (in Da: "kreditobligationer") and loans (in Da: "udlån").[72] In relation to average rate products in 2018, credit bonds and emerging market bonds amounted to DKK 119.349 bill. while loans amounted to DKK 11.197 bill.[73] In relation to market rate products in 2018, credit bonds and emerging market bonds amounted to DKK 136.839 bill. while loans amounted to DKK 9.165 bill.[74] The Danish life insurance undertaking PensionDanmark also included loans and "credit bonds" in its annual report and solvency and financial condition report for e.g. 2017.[75] The category "credit bonds" included (i) high-yield bonds, (ii) "secured bank loans", (iii) direct corporate lending and (iv) credit funds.[76] Credit bonds may therefore possibly include alternative credit investments such as high-yield bonds, secured loans, direct lending to corporates, and credit funds. This terminology makes it difficult to distinguish between Danish life insurance undertakings' traditional credit exposures and bank-like alternative credit investments.

As stated above, the amount of Danish LCMPF's total alternative credit investments in figure 6.2 may seem insignificant when viewed in relation to the LCMPF's total assets. However, the risk characteristics may change if this credit intermediation is concentrated within a few significant life insurance undertakings. As an anecdotal example of such possible concentration, PensionDanmark's total assets and sums of high-yield corporate bonds, senior bank debt (or "secured bank loans"), direct corporate lending and investments in credit funds - as provided in annual reports - are shown in the lower figure of

[69] Danish FSA (2016), p. 13, Danish FSA (2017a), p. 9, and Danish FSA (2018b), p. 11.

[70] Danish FSA (2014b), p. 12 and appendix A2.

[71] Danish FSA (2016), p. 14, and Danish FSA (2018b), p. 12. The figures regarding alternative credit investments for the years 2015 and 2016 were increased in Danish FSA (2018b) when compared to the prior Danish FSA (2017a).

[72] Danish FSA (2019b) , table 1.5, and Danish FSA (2018b), p. 22.

[73] Danish FSA (2019b), table 1.5 (both figures are rounded).

[74] Danish FSA (2019b), table 1.5 (both figures are rounded).

[75] PensionDanmark (2017a), pp. 18, 20, 22-23 and 62, PensionDanmark (2017c), pp. 7-8, 24, 29 and 34.

[76] PensionDanmark (2017a), pp. 22-23, and PensionDanmark (2017c), pp. 8 and 24.

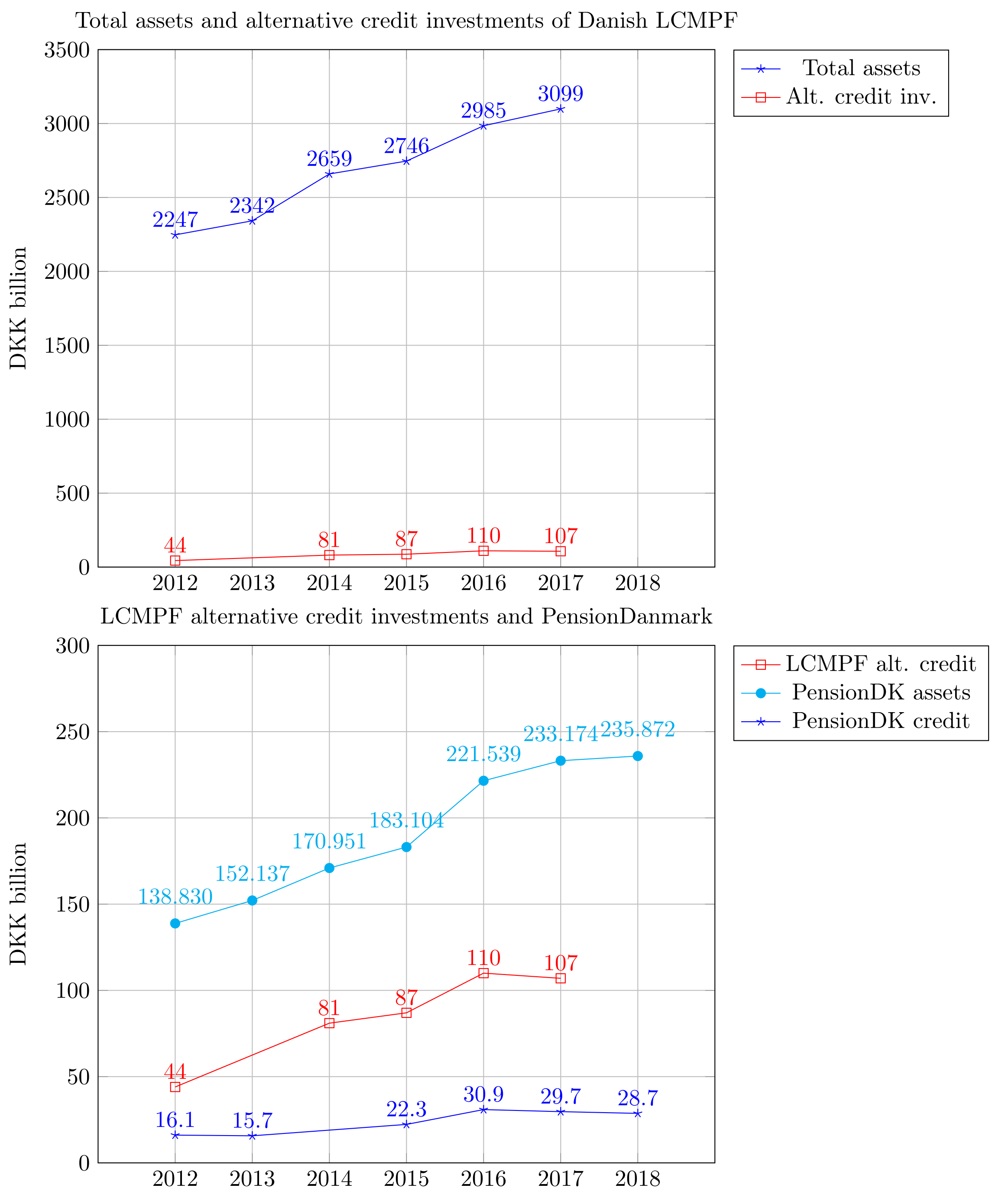

Figure 6.2: *Above:* Alternative credit investments and total assets (rounded) of Danish LCMPF based on the market development reports in Danish FSA (2016) and Danish FSA (2018b), which do not include data on alternative credit investments for 2013. *Below:* The alternative credit investments of Danish LCMPF and data from PensionDanmark's 2012-2018 annual reports regarding (i) specific credit investments (sums of high-yield corporate bonds, senior bank debt, direct corporate lending and investments in credit funds) and (ii) total assets. The specific credit investments were not described in 2014.

figure 6.2 alongside the total alternative credit investments of Danish LCMPF.[77] Concentration may e.g. appear in 2016, where the LCMPF's total alternative credit investments were DKK 110 bill. while PensionDanmark (2016a) showed a sum of DKK 30.9 bill. in relation to high yield bonds, senior bank debt and investments in credit funds.[78] In that year, PensionDanmark's total assets had a value of DKK 221.539 bill.[79]

The described "search for yield" trend and liquidity profile of alternative investments is also reflected in the annual reports of PensionDanmark. In relation to its direct lending that was secured by high-quality collateral[80], PensionDanmark's annual reports stated that such lending would increase the ongoing interest income on the bond portfolio via excess returns compared to Danish government bonds.[81] Due to the high-quality collateral, the excess return was viewed primarily as a liquidity premium to compensate for the lower liquidity in comparison to regular listed bonds.[82] PensionDanmark did not perceive the lower liquidity of such ("bank") loans as a significant challenge due to its significantly increasing assets and "very" long-term investment horizon.[83]

EIOPA is generally aware of insurance undertakings' "search for yield" behaviour, including alternative asset classes, lower credit quality fixed income exposures, increases in maturities, illiquid investments (such as non-listed equity and loans) and illiquidity premiums.[84] EIOPA also describes how there is significant heterogeneity in exposures to "other investments" (including loans) but that the investment type amounted to more than 15% of total assets in Scandinavian countries.[85] Alternative investments may accordingly be a country-specific trait.

The alternative credit investments in figure 6.2 above constitute non-bank

[77] In its annual reports, PensionDanmark generally described certain credit exposures in the form of (i) high-yield corporate bonds, (ii) senior bank debt (or "secured bank loans"), (iii) direct corporate lending and (iv) investments in credit funds that, inter alia, lend directly to corporations, cf. PensionDanmark (2012), p. 23, PensionDanmark (2013), p. 24, PensionDanmark (2015), p. 19, PensionDanmark (2016a), p. 17, PensionDanmark (2017a), p. 23, and PensionDanmark (2018a), p. 23.

[78] PensionDanmark (2016a), p. 17.

[79] PensionDanmark (2016a), pp. 17 and 38. FSB (2018), p. 57, uses the ratio of credit assets to total financial assets as an indicator of credit intermediation.

[80] PensionDanmark's loans also included loans guaranteed by the Danish Export Credit Agency, and long-term project finance loans collateralised by infrastructure assets, which were both categorised as loans with high-quality collateral (in Da: "høj sikkerhed"), cf. PensionDanmark (2017c), p. 29, and PensionDanmark (2017a), pp. 20 and 25. Loans guaranteed by the Danish Export Credit Agency were viewed as equivalent to investing in Danish government bonds, cf. PensionDanmark (2016a)

[81] PensionDanmark (2012), pp. 18 and 25, PensionDanmark (2013), pp. 19 and 27, PensionDanmark (2015), pp. 14-15 and 20, PensionDanmark (2016a), pp. 13 and 19, and PensionDanmark (2017a), pp. 19 and 25.

[82] PensionDanmark (2012), pp. 18 and 25, PensionDanmark (2013), pp. 19 and 27, PensionDanmark (2015), pp. 14-15 and 20, PensionDanmark (2016a), pp. 13 and 19, and PensionDanmark (2017a), pp. 19 and 25.

[83] PensionDanmark (2012), p. 25, PensionDanmark (2013), p. 27, PensionDanmark (2015), p. 20, PensionDanmark (2016a), p. 19, and PensionDanmark (2017a), p. 25.

[84] EIOPA (2017b), pp. 3-5, 8, 9, 11, 12, 15-16 and 21-23, and EIOPA (2018c), Pp. 5, 52 and 56-59.

[85] EIOPA (2017b), p. 21.

credit intermediation that is captured by the wide net in step 1 of the FSB's approach for identifying of shadow banking.[86] In the next chapter, the focus is narrowed in accordance with the FSB's step 2.

6.3 Step 2: Repos

Chapter 5 above described the bank-like risks associated with repos, including maturity and liquidity transformation, liquidity risk, procyclical leverage and the risk of fire sales. Chapter 6.1.1 then showed how repos are associated with systemic risk at both the global and EU level.

In line with step 2 of the FSB's approach for identifying shadow banking, this chapter will document the repos of the "top five" Danish life insurance undertakings. When doing so, chapter 6.3.1.2 provides an aggregated view of the repo activities of the "top five", while chapters 6.3.1.3-6.3.1.7 show the individual balance sheet items and repo activities of the "top five".

As mentioned above, this chapter will also document non-compliance with the collateral reporting obligation and chapter 6.3.2 will accordingly discuss the implications of such non-compliance, including a lack of compliance with the prudent person principle and non-transparency in relation to the life insurance undertakings' possible shadow banking, liquidity profiles and available unencumbered assets. Finally, chapter 6.3.3 will attempt to shed some light on the possible purposes of repos in life insurance.

6.3.1 Repos by the "Top Five" Danish Life Insurance Undertakings

Based on annual reports, this chapter documents the repo activities of the following "top five" Danish life insurance undertakings:

- PFA Pension[87]
- Danica Pension[88]
- Sampension[89]
- Nordea Pension[90] which changed its name to Velliv[91] in 2018
- PensionDanmark[92]

[86] FSB (2011c), section 1.
[87] PFA Pension, forsikringsaktieselskab.
[88] Danica Pension, livsforsikringsaktieselskab.
[89] Sampension KP Livsforsikring A/S which changed its name to Sampension Livsforsikring A/S in 2018.
[90] Nordea Liv og Pension, livsforsikringsselskab A/S.
[91] Velliv, Pension & Livsforsikring A/S.
[92] PensionDanmark A/S.

In 2017, the balance sheet totals of the five above amounted to 52.4% of the balance sheet total of all Danish life insurance companies and multi-employer occupational pension funds.[93] In terms of gross premiums and balance sheet sizes, they were also the top five Danish life insurance undertakings in 2017.[94] Before showing the collected data, chapter 6.3.1.1 will describe life insurance undertakings' balance sheets, especially insurance-specific items (including technical provisions and registered assets) and repo-specific items.

6.3.1.1 The Balance Sheet Items

A specific feature of Solvency II's capital requirements is that the SCR and MCR are supplemented by the obligation of life insurance undertakings to establish technical provisions.[95] At level 1, Solvency II provides that life insurance undertakings must establish technical provisions with respect to all of their insurance obligations towards policyholders and beneficiaries of insurance contracts.[96] Such technical provisions are to ensure that life insurance undertakings can meet their commitments towards policyholders and beneficiaries.[97]

The value of technical provisions must correspond to the current amount the life insurance undertaking would have to pay if it were to transfer its insurance obligations immediately to another insurance undertaking.[98] This value should reflect the amount that another life insurance undertaking would be expected to require to take over and fulfil the underlying insurance obligations.[99]

The calculation of technical provisions must be based on the sum of a *best estimate* and a *risk margin* that - as a starting point - must be valued separately.[100] Pursuant to EIOPA, the best estimate is designed to absorb losses from insurance business while the own funds covering the SCR and MCR should be able to absorb extraordinary losses and thereby withstand shocks as well as ensure the fulfilment of obligations to policyholders.[101] The best estimate must correspond to the probability-weighted average of future cash-flows while taking into account of the time value of money (i.e. the expected present value of fu-

[93] Danish FSA (2018b), p. 22, table A 9.

[94] Danish FSA (2018b), p. 22, table A 9.

[95] Solvency II, recital 53 and title I, chapter VI, section 2, including art. 76(1), and Solvency II Delegated Regulation, title I, chapter III, and art. 264-265. See also EIOPA (2016), para. 64-65.

[96] Solvency II, art. 76(1).

[97] Solvency II, recital 53.

[98] Solvency II, recitals 54 and 55 and art. 76(2).

[99] Solvency II, recital 55.

[100] Solvency II, art. 77(1) and (4)-(5). The calculation of technical provisions must, inter alia, (i) be consistent with the valuation of assets and liabilities, (ii) be market consistent (i.e. make use of and be consistent with information provided by the financial markets and generally available data on underwriting risks), (iii) be in line with international developments in accounting and supervision and (iv) be coordinated, assessed and overseen by the actuarial function, cf. Solvency II, recitals 54 and 58 and art. 48 and 76(3), and Solvency II Delegated Regulation, art. 272. Technical provisions can be calculated via, inter alia, simulation, deterministic and analytical techniques, cf. Solvency II Delegated Regulation, recital 15.

[101] EIOPA (2018e), p. 21, box 3.

ture cash-flows) and using the relevant risk-free interest rate term structure.[102] At level 2, the Solvency II Delegated Regulation states that the rates of the applied basic risk-free interest rate term structure must meet criteria in the form of, inter alia, (i) life insurance undertakings being able to earn the rates in a risk-free manner in practice and (ii) the rates being reliably determined based on financial instruments traded in a "DLT market".[103]

The risk margin must ensure that the value of the technical provisions is equivalent to the amount that other insurance undertakings would be expected to require in order to take over and meet the life insurance obligations.[104] The separately calculated risk margin must be calculated by determining the cost[105] of providing an amount of eligible own funds equal to the SCR necessary to support the insurance obligations over their lifetime.[106] EIOPA accordingly describes the risk margin as an "additional premium" - over the best estimate - that is intended to reflect the SCR capital necessary to support the business under a run-off scenario.[107] When calculating technical provisions, the servicing expenses, inflation and expected payments (including discretionary bonuses) well as the value of financial guarantees and any contractual options included in insurance policies (including lapses and surrenders) must be taken into account.[108]

In short, the discounting of future expected cash flows, via the risk-free interest rate term structure, enables a life insurance undertaking to calculate the present day value of its insurance liabilities.[109] Under Solvency II, insurance claims are to take precedence over other claims against the life insurance undertaking, and such precedence of insurance claims can either be

[102] Solvency II, recital 58 and art. 77(2), and Solvency II Delegated Regulation, title I, chapter III, including section 4. See chapter 4 regarding discounting and the calculation of present values.

[103] Solvency II Delegated Regulation, art. 43. The determination of the risk-free interest rate term structure must be based on information from financial instruments and bonds of the relevant maturities in "DLT markets", i.e. markets that are *deep* (where transactions involving a large quantity of financial instruments can take place without significantly affecting the price of the instruments), *liquid (*where financial instruments can readily be converted through an act of buying or selling without causing a significant movement in the price) and *transparent* (where current trade and price information is readily available to the public, in particular to the insurance or reinsurance undertakings), cf., Solvency II, art. 77a, Solvency II Delegated Regulation, recitals 20 and 21 and art. 1(32)-(34) and 43-48, and EIOPA (2018g), section 4. The relevant risk-free interest rate term structure must be calculated separately for each currency and maturity, cf. Solvency II Delegated Regulation, art. 43, subpara. 2, and art. 44. Level 2 also provides that the basic risk-free interest rates must be derived on the basis of credit risk-adjusted interest rate swap rates for interest rates of the currency or - if interest rate swap rates for the maturity are not available from DLT markets - credit risk-adjusted government bond rates issued in the currency and available in DLT markets, cf. Solvency II Delegated Regulation, recitals 20 and 21 and art. 44-45.

[104] Solvency II, art. 77(3).

[105] I.e. cost-of-capital, the additional rate above the relevant risk-free interest rate that the insurance undertaking would incur.

[106] Solvency II, art. 77(5).

[107] EIOPA (2018e), p. 12.

[108] Solvency II, art. 78 and 79.

[109] See e.g. Solvency II, recital 58, EIOPA (2013), p. 20, EIOPA (2016), para. 64 and p. 16 (box 1), and EIOPA (2018e), p. 12.

- "absolute precedence" - over any other claim - with regard to assets representing the technical provisions, or
- precedence - over any other claim - with regard to the whole of the assets of the life insurance undertaking with only certain prescribed exceptions, including claims by employees and public bodies as well as claims on assets subject to rights in rem.[110]

In case of "absolute precedence", life insurance undertakings are obliged to keep a special register of the assets used to cover the technical provisions (i.e. "registered assets").[111] The total value of the registered assets may at no time be less than the value of the technical provisions.[112] In addition, if a registered asset is subject to a right in rem, in favour of a creditor or a third party, with the result that a part of the value of the asset is not available for the purpose of covering commitments, it must be recorded in the register and the unavailable amount cannot be included in the total value of registered assets.[113]

In line with the above, Danish law provides that a life insurance undertaking must have a group of assets with a total value that at all times at least corresponds to the value of the life insurance undertaking's total technical provisions.[114] In order to secure the presence of sufficient assets, the life insurance undertaking must keep a register which records, inter alia, the registered assets.[115] In addition, and in order to ensure that the value of the registered assets at least corresponds to the value of technical provisions, the value of the registered assets must correspond to the value of the technical provisions with the addition of a margin (in Da: "overdækning").[116] These registered assets may only be used for the satisfaction of policyholders and beneficiaries.[117] Registered assets accordingly entail that policyholders and beneficiaries are a form of secured creditors in relation to insurance claims.

In relation to repos, Danish law provides that a financial asset remains in a life insurance undertaking's balance sheet if it is transferred in a manner whereby the life insurance undertaking retains substantially the risks and the access to the cash flows of the asset.[118] In such a transfer, a liability, equivalent to the consideration received for the transfer, must also be recognised in the balance sheet.[119] Pursuant to Danish FSA (2015) and the comments to the specific provision, a financial asset, which is transferred under a true sales and

[110] Solvency II, art. 275(1)(a) and (b).
[111] Solvency II, art. 275(3) and 276.
[112] Solvency II, art. 276(3).
[113] Solvency II, art. 276(4).
[114] Danish Financial Business Act, sec. 167(1). See also Danish Executive Order no. 11 of 2019, regarding the registration of assets etc.
[115] Danish Financial Business Act, sec. 167(1)(1).
[116] Danish Executive Order no. 11 of 2019, sec. 3.
[117] Danish Financial Business Act, sec. 167(4).
[118] Danish Executive Order no. 937 of 2015 (regarding insurance undertakings' financial reports), sec. 44(5). See also Danish FSA (2015), p. 3. This requirement implemented International Accounting Standard 39, cf. comments to sec. 44(5) of 28 March, 2011.
[119] Danish Executive Order no. 937 of 2015, sec. 44(5). See also Danish FSA (2015), p. 3.

repurchase agreement (i.e. a repo), must remain in the balance sheet of the repo seller.[120] This requirement entails that assets, which have been transferred as financial collateral to the repo buyer, actually remain in the balance sheet of the repo seller.[121] At the same time, the repo seller must recognise the cash financial collateral (the consideration received) as a liability. In annual reports, this liability is typically recognised via the general item "debt to credit institutions" or a specification of debt in relation to repos.[122]

Danish law also prescribes that life insurance undertakings must provide information - for each individual item - if assets have been posted as collateral or other security, including the extent of the pledge and the value of the pledged assets (i.e. the "collateral reporting obligation").[123] Pursuant to Danish FSA (2015), a repo is - from an economic and accounting perspective - to be viewed as a collateralised loan and the life insurance undertaking is to provide information regarding the assets, including bonds, placed as collateral in repos.[124] While the transferred repo collateral (or transferred asset) remains in the balance sheet, the collateral reporting obligation informs the reader of the annual report about what assets actually constitute transferred unavailable repo collateral. In the annual reports, this information is presented in various ways, e.g. in a note regarding assets[125] and/or in a note regarding collaterals.[126]

The collateral reporting obligation has existed since before 2012.[127] This aspect is important as chapter 6.3.1 below will show that repos and financial collateral arrangements have not been - or been incorrectly - reported in annual reports of Danish life insurance undertakings. This non-compliance has even occurred after the decision in Danish FSA (2015), which addressed a lack of reporting of repo collateral in PFA Pension's annual report for 2013. In this decision, the Danish FSA stated that it is important (in Da: "væsentligt") for users of the annual reports to be informed of which balance sheet assets constitute collateral, especially when viewed in relation to (i) the ratio of repos to the total balance sheet value and (ii) the ratio of repos to equity.[128] In addition, the Danish FSA viewed it as important that users of the annual reports are able to assess which parts of the balance sheet are financed by repos or an in-

[120] Danish FSA (2015), pp. 3-4, and Danish Executive Order no. 937 of 2015 (comments to sec. 44(5) of 28 March 2011).

[121] See chapter 5 and e.g. Danish FSA (2015), pp. 4-5.

[122] See e.g. PFA Pension (2017a), p. 77 (note 27), Sampension (2017a), p. 52 (note 6) and PensionDanmark (2017a), p. 47 (note 1). Until 2016, Sampension listed its debt in relation to repos under "other debt" and not "debt to credit institutions", cf. e.g Sampension (2015), p. 78 (note 17), vs. Sampension (2016a), p. 68 (note 16).

[123] Danish Executive Order no. 937 of 2015, sec. 104(2). See also Danish FSA (2015), pp. 4-5.

[124] Pp. 4-5.

[125] See e.g. PFA Pension (2017a), p. 71 (note 16).

[126] In Da: "sikkerhedsstillelser" or "pantsætninger", see e.g. PFA Pension (2017a), p. 78 (note 30), Sampension (2017a), p. 53 (note 19) and Nordea Pension (2017a), p. 45 (note 24).

[127] See Danish Executive Order no. 937 of 2015, sec. 104(2), vs. Danish Executive Order no. 16 of 2011, sec. 104(2).

[128] Danish FSA (2015), Pp. 4-5.

crease in customers.[129] Although the decision did not explicitly address shadow banking, the last view obviously differentiated between insurance (i.e. customers) and non-insurance repo activities. This differentiation seems similar to the IAIS' and EIOPA's macroprudential approach to life insurance undertakings' SFT-based non-insurance activities.[130]

In short, a correct reporting of repos entails

- an asset item in the form of the transferred asset (i.e. posted repo collateral) that remains in the balance sheet,
- a liability item in the form of the consideration received for the transfer (i.e. received cash financial collateral), and
- a note regarding the posted repo collateral.

Chapters 6.3.1.3 to 6.3.1.7 below present data from the 2012-2018 annual reports of the "top five" Danish life insurance undertakings. The data collected from the annual reports are:

- assets.
- equity.
- technical provisions ("tech. prov.").
- registered assets ("reg. assets").
- adjusted liabilities ("adj. liab."), wherein assets are reduced by equity to produce liabilities whereafter the liabilities are reduced by technical provisions and any subordinated liabilities (due to the specific nature of subordinated liabilities) to produce adjusted liabilities. Technical provisions are accordingly used as a proxy for "traditional" insurance activities while adjusted liabilities are coarsely used to indicate non-insurance funding that may indicate non-traditional insurance and non-insurance activities.[131]
- the item "debt to credit institutions" ("debt to CI"). Debt to credit institutions may include repo debt without a specification of the amount of repo debt.[132] It may also indicate non-reported repo debt as reported values regarding repo collateral (or subsequently reported repo debt values) seem to follow debt to credit institutions.

[129] In Da: "reel kundevækst", cf. Danish FSA (2015), p. 5.

[130] See chapters 1, 6.1.1 and 14.

[131] See IAIS (2013a), p. 16, and IAIS (2013b), p. 16. As an indicator of non-traditional insurance and non-insurance activities, IAIS (2013a), p. 16, inter alia, (i) subtracted all policyholder liabilities (technical provisions) from total balance sheet liabilities and (ii) compared to result with total balance sheet liabilities.

[132] See e.g. PensionDanmark (2017a), p. 47 (note 1), and PensionDanmark (2018a), p. 53 (note 18). Until 2016, Sampension listed its debt in relation to repos under "other debt" and not "debt to credit institutions", cf. e.g Sampension (2015), p. 78 (note 17), vs. Sampension (2016a), p. 68 (note 16).

- the specific mentioning of debt in relation to repos ("repo debt").[133]
- the specific mentioning - in a note - of collateral sold/posted in relation to repos ("repo coll.").[134]
- subordinated liabilities ("sub. liab.").[135]

In relation to shadow banking and repos, the primary data points are "debt to credit institutions", "repo debt" and "repo collateral". The other data above are used to put the repo data in context of the size of the balance sheet. As shown below, registered assets constitute a significant part of the total assets of all five life insurance undertakings. These registered assets may only be used for the satisfaction of policyholders and beneficiaries and can therefore not simultaneously be used as financial collateral in repos to obtain leverage.

Similar to geographical differences in relation to life insurance undertakings' exposures to banks and alternative investments, Danish life insurance undertakings' repos and financial collateral arrangements may be a country-specific trait.[136] EIOPA (2018e) provides an overview of "non-insurance liabilities to own funds" leverage ratios that shows how Denmark had the highest percentages in both 2016 and 2017.[137] Below, the figures regarding the "top five" Danish life insurance undertakings also indicate how the item "adjusted liabilities" (that does not include subordinated liabilities) generally follows repos and exceeds equity. In addition, the figures show how the "spread" between registered assets and total assets increases when repo activities increase.

Danish FSA (2014a) conducted an inquiry regarding the Danish repo market which targeted larger Danish credit institutions and life insurance undertakings. Despite a request, the outcome has not been made available to the public. Overall transparency and aggregated data on the use of SFTs by life insurance undertakings will presumably not be available until it is provided in accordance with the SFT Regulation's reporting obligation.[138] However, before presenting the individual repo activities of the "top five" Danish life insurance undertakings, chapter 6.3.1.2 will provide an aggregated view of their repo activities. This aggregated view may reflect the activities- and behaviour-based sources of systemic risk that were initially discussed in chapters 1 and 6.1.1.

6.3.1.2 Aggregated View of Repos and Alternative Credit Investments

In order to provide an overall view of repos and possible activities- and behaviour-based sources of systemic risk, figure 6.3 aggregates the five life insurance un-

[133] See e.g. PFA Pension (2017a), p. 77 (note 27), and Sampension (2017a), p. 52 (note 16).

[134] In relation to only Nordea Pension, values for bonds posted as collateral for liabilities in relation to the settlement of financial instruments ("pledged bonds") are included as they seem to follow debt to credit institutions and seem to be "replaced" by repo collateral.

[135] In Da: "ansvarlig lånekapital".

[136] See EIOPA (2017b), p. 21, regarding "other investments", and EIOPA (2018c), pp. 71-72, regarding exposures to banks.

[137] P. 13, figure 3.

[138] SFT Regulation, art. 4. See also ESMA (2016), para. 14, 48, 165-166, and 178-179.

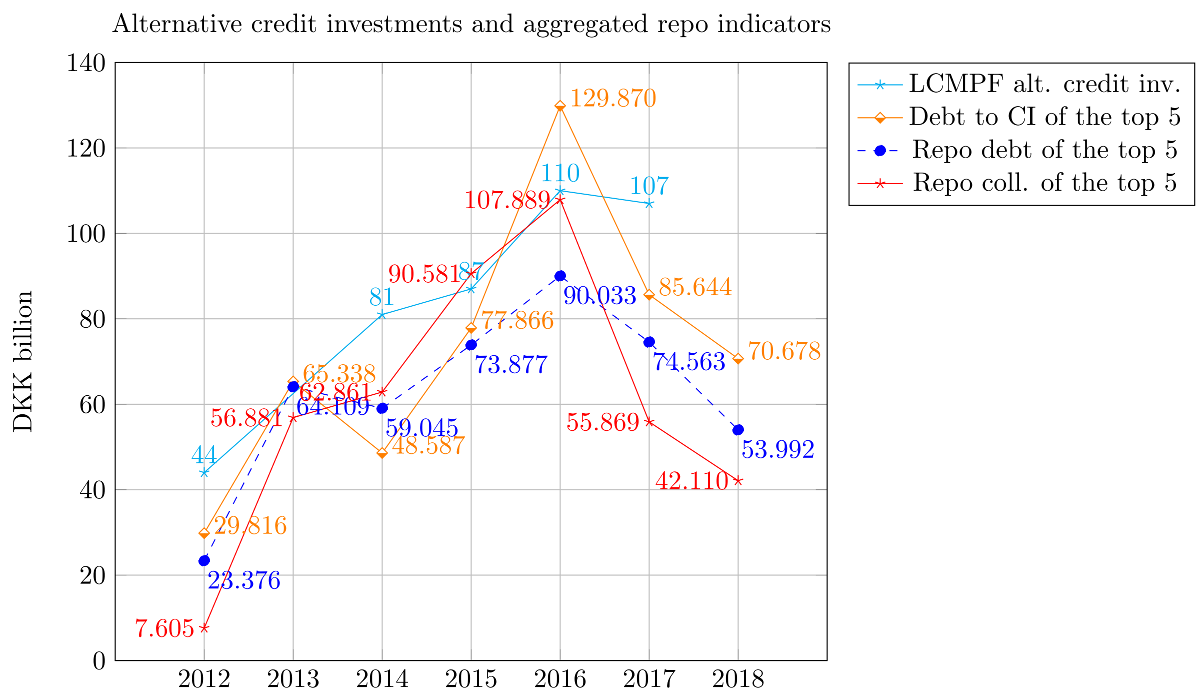

Figure 6.3: The figure shows the (i) total alternative credit investments of Danish life insurance companies and multi-employer occupational pension funds ("LCMPF"), (ii) aggregated debt to credit institutions of the top five, (ii) aggregated repo debt of the top five and (iii) and aggregated repo collateral of the top five.

dertakings' three repo indicators "debt to credit institutions", "repo debt" and "repo collateral" for the years 2012-2018. The values used in the aggregation are described in detail below in relation to each of the "top five". The aggregation itself is made in tables 6.1-6.3.

Figure 6.3 shows significant increases in all three repo indicators that top in 2016. From 2012 to 2016, debt to credit institutions and repo collateral[139] both increased more than DKK 100 bill. (approx. EUR 13.4 bill.). The figure may also show the liquid nature of repos as all three indicators fall sharply in 2017. This fall may especially be due to the significant fall in the repo activities of PFA Pension which is shown in chapter 6.3.1.3.

When documenting the repos of the "top five" on an individual basis, the chapters below will show that none of the "top five" has consistently complied with the collateral reporting obligation since 2012.[140] As discussed above and

[139]In 2012, repo collateral is based only on Nordea Pension's pledged bonds in relation to financial instruments (see chapter 6.3.1.6).

[140]In the case of Nordea Pension, the non-compliance may be in the form of reporting pledged

in chapter 6.3.2, such non-compliance entails a lack of transparency regarding liquidity risk and non-insurance activities, including what part of the balance sheet is financed by repos.[141] Chapter 12.2 also discusses how such non-compliance indicates uncertainty in relation to the prudent person principle, which provides that a life insurance undertaking may only invest in assets and instruments whose risks it can properly identify, measure, monitor, manage, control and report.[142] In addition, when repo debt is only reported via an inclusion in the overall item "debt to credit institutions", repo debt may be "mixed" with other types of debt or constitute the entire amount of debt to credit institutions.[143] Such non-specific reporting entails additional non-transparency regarding life insurance undertakings' possible exposures to liquidity risk.

In line with step 1 of the FSB's approach for identifying shadow banking, chapter 6.2 above documented non-bank credit intermediation in the form of the total alternative credit investments of Danish life insurance companies and multi-employer occupational pension funds ("LCMPF"). These total alternative credit investments also appear in light blue in figure 6.3, which shows how the repo indicators increase alongside the total alternative credit investments. In line with the FSB's step 2, this chapter has documented developments - in the form of aggregated repo activities - that may indicate the activities- and behaviour-based sources of systemic risk that were described in chapters 1 and 6.1.1. However, as described in relation to the overall research question in chapter 1, the alternative credit investments and repo activities do not amount to shadow banking if these bank-like activities and associated risks are subject to prudential regulatory standards that are similar to the prudential regulatory standards that apply upon banks that conduct similar activities and are exposed to similar risks.

As shown above, the Danish FSA monitors Danish life insurance undertakings' alternative investments (including alternative credit investments) and specifically targets their migration into traditional banking via credit and lending.[144] When looking at figure 6.3, it becomes evident that the repo indicators of only the "top five" are somewhat at the same level - or above - the alternative credit investments of the entire LCMPF sector. A total balance sheet approach in insurance supervision would presumably require that a supervisory focus is directed at both the alternative credit investments and repo activities. However, despite the decision in Danish FSA (2015), regarding PFA Pension's lack of reporting of repo collateral in 2013, the following chapters will document a lack of compliance with the collateral reporting obligation after 2015.

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bonds in relation to financial instruments and not repos.

[141]See e.g. Danish FSA (2015), pp. 4-5.

[142]Solvency II, art. 132(2), European Commission (2017b), p. 9, and EIOPA (2018e), pp. 51-52.

[143]As shown in the figures in chapters 6.3.1.3-6.3.1.7, when repo debt is reported, it generally follows or is equal to debt to credit institutions.

[144]See e.g. Danish FSA (2014b), pp. 1, 6, 8 and 12 as well as appendix 2a, Danish FSA (2016), p. 14, and Danish FSA (2018b), pp. 9 and 12.

	2012	2013	2014	2015	2016	2017	2018
PFA Pension	15.204	44.317	21.388	39.003	47.275	21.747	2.656
Danica Pension	7.414	8.682	7.153	7.487	15.57	18.03	15.36
Sampension	0	0	0	2.26	27.216	23.126	24.388
Nordea Pension	7.191	12.161	19.892	28.679	27.559	13.918	18.394
PensionDanmark	0.007	0.178	0.154	0.437	12.25	8.823	9.88
Total	29.816	65.338	48.587	77.866	129.87	85.644	70.678

Table 6.1: Debt to credit institutions in DKK bill. As described in chapter 6.3.1.5, Sampension moved repo debt from "other debt" to debt to credit institutions in 2016. As described in chapter 6.3.1.6, Nordea Pension changed its name to Velliv in 2018.

	2012	2013	2014	2015	2016	2017	2018
PFA Pension		43.932	21.186	38.641	46.206	21.602	2.718
Danica Pension							
Sampension			20.816	22.307	21.372	11.676	17.06
Nordea Pension	7.605	12.949	20.859	29.633	28.109	13.832	13.981
PensionDanmark					12.202	8.759	8.351
Total	7.605	56.881	62.861	90.581	107.889	55.869	42.11

Table 6.2: Repo collateral in DKK bill. Blank spaces reflect no note regarding repo collateral in the annual report for the year or in the subsequent annual report. As described in chapter 6.3.1.6, Nordea Pension's possible repo collateral in 2012-2014 are pledged bonds in relation to financial instruments, and Nordea Pension changed its name to Velliv in 2018.

	2012	2013	2014	2015	2016	2017	2018
PFA Pension		44.317	21.388	39.003	47.275	21.747	2.656
Danica Pension			7.148	7.482	15.542	18.028	15.358
Sampension	23.376	19.792	30.509	27.392	27.216	20.87	22.126
Nordea Pension						13.918	13.852
PensionDanmark							
Total	23.376	64.109	59.045	73.877	90.033	74.563	53.992

Table 6.3: Repo debt in DKK bill. Blank spaces reflect no note regarding/specifying repo debt in the annual report for the year or in the subsequent annual report. As described in chapter 6.3.1.4, Danica Pension's repo debt is from the group annual reports. As described in chapter 6.3.1.6, Nordea Pension changed its name to Velliv in 2018 and repo debt for 2017 and 2018 are from Velliv's annual report for 2018.

6.3.1.3 PFA Pension

In line with the other four life insurance undertakings, the upper figure of figure 6.4 shows how the majority of PFA Pension's assets (in light blue) are registered assets (in orange). The lower figure shows how repos have been used in a fluctuating fashion by PFA Pension since 2013. It is not clear whether any possible repo debt was included in debt to credit institutions prior to 2013 and the DKK 15.204 bill. of debt to credit institutions for 2012 are from PFA Pension's 2013 annual report (as the 2012 annual report did not report the item).[145] As described above, Danish FSA (2015) concluded that the 2013 annual report of PFA Pension did not provide information regarding the extent and value of assets, including bonds, that were posted as collateral in repos.[146] This lack of compliance with the collateral reporting obligation occurred while PFA Pension had DKK 44.3 bill. of debt in relation to repos in 2013 (see the lower figure).[147] Danish FSA (2015) also noted that the repos constituted 11% of the "balance" and 918% of equity in 2013.[148]

In the lower figure, repo debt and repo collateral values in 2013 are accordingly from the subsequent 2014 annual report.[149] The lower figure shows how repo debt (in blue) follows debt to credit institutions (in orange). It also shows how repo debt exceeds repo collateral (in red) during certain years. In relation to investment assets associated with market rate products, the annual reports for 2016-2018 note that sold bonds, related to repo debt, are included in the bond portfolio.[150] This may indicate that repo transactions are not a part of a closed circuit but associated with generating returns to policyholders.

In Danish FSA (2015), PFA Pension stated that the repo transactions allowed it to obtain a return on its significant bond holdings and that the terms of the repos were typically less than one month.[151] As described in chapter 6.3.3 below, PFA Pension has provided insight into the use of repos, including leveraged repo transactions - via a wholly-owned hedge fund - to invest in short-term interest rate and spread risk.[152] However, in 2017 and 2018, PFA Pension's repos decreased significantly and the annual report for 2018 does not include similar information regarding the hedge fund.[153] As described below in chapter 6.3.1.8, PFA Pension's solvency and financial condition reports do not explicitly address repos in relation to liquidity risk.[154]

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[145] PFA Pension (2012), pp. 26 and 46 (note 27), and PFA Pension (2013), pp. 29 and 47 (note 21). See also Danish FSA (2015), p. 3.
[146] Danish FSA (2015), p. 2.
[147] Danish FSA (2015), pp. 2-3
[148] P. 5.
[149] PFA Pension (2014), pp. 48 (note 17) and 54 (notes 30 and 33).
[150] PFA Pension (2016a), p. 73 (note 20), PFA Pension (2017a), p. 72 (note 20), and PFA Pension (2018a), p. 78 (note 20).
[151] P. 3.
[152] PFA Pension (2016a), pp. 71, 86 and 87, and PFA Pension (2017a), pp. 69, 85 and 87.
[153] PFA Pension (2018a), pp. 12-13, 77 (note 16), 83 (note 27) and 84 (note 30) and 91.
[154] See item C.4 in PFA Pension (2016b), PFA Pension (2017b) and PFA Pension (2018b).

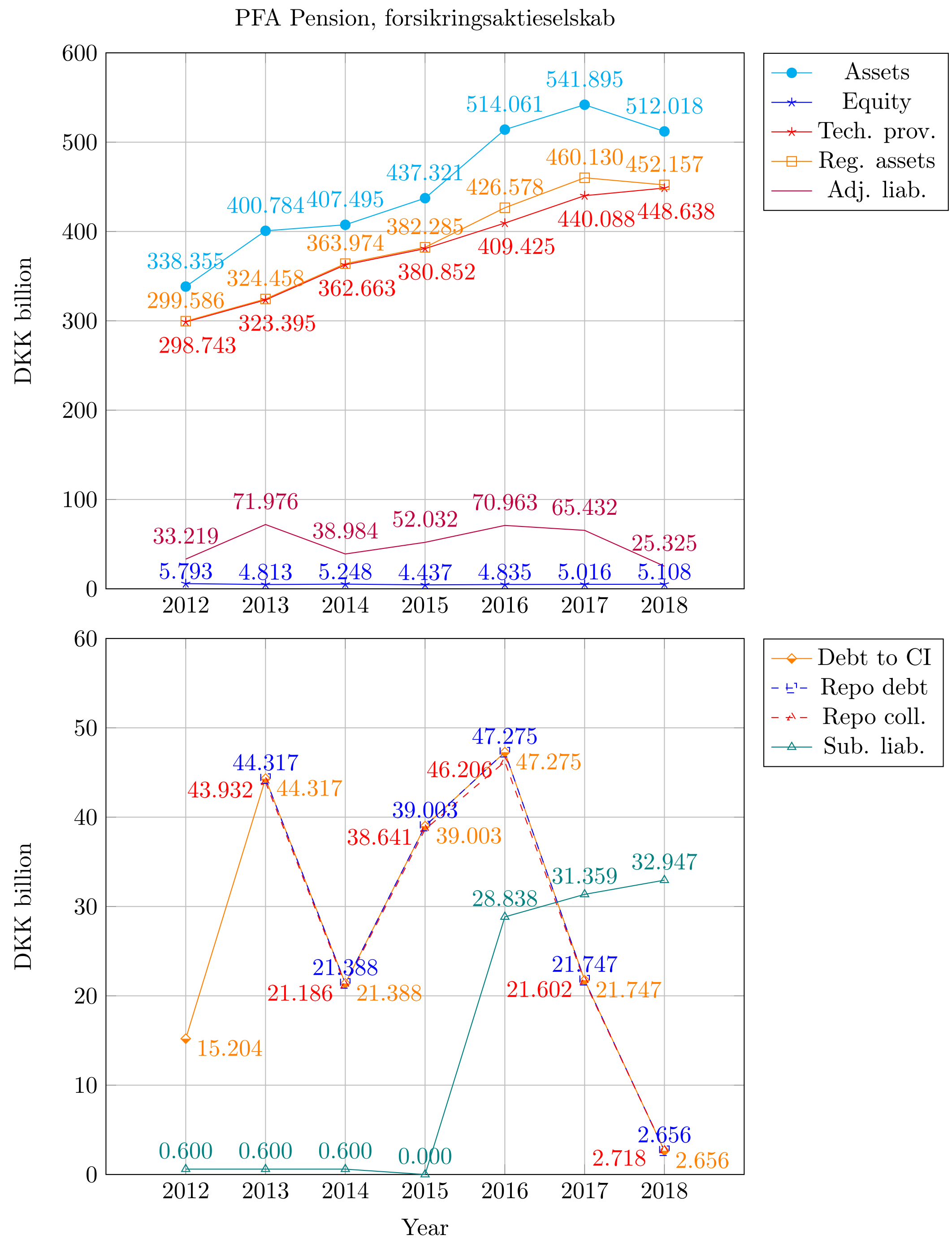

Figure 6.4: Data from PFA Pension's annual reports for 2012-2018.

6.3.1.4 Danica Pension

Similar to the other four life insurance undertakings, the upper figure of figure 6.5 shows how Danica Pension's registered assets (in orange) constitute the majority of assets (in light blue). The lower figure shows how the Danica Pension *group* has had repo debt since 2014 and that repo debt increased in the period from 2014 to 2017.[155] The other data in both the upper and lower figure are from Danica Pension. The repo debt of the Danica Pension *group* seems to follow Danica Pension's debt to credit institutions and it is not clear whether the lower figure's debt to credit institutions in 2012 and 2013, for Danica Pension, included repo debt.[156]

The lower figure indicates a lack of compliance with the collateral reporting obligation for 2014-2018 as the repo debt values are not accompanied by a note regarding repo collateral.[157] In addition, and as described in chapter 6.3.1.8, Danica Pension's 2016-2018 group solvency and financial condition reports do not explicitly address repos in relation to liquidity risk.[158] However, the 2018 group solvency and financial condition report describes how a relatively large holding of, inter alia, Danish mortgage credit bonds functions as a liquidity buffer and is to be sold or used as collateral in a stress scenario.[159]

[155] See Danica Pension (2015), p. 44 (note 27, regarding repo debt in both 2014 and 2015), Danica Pension (2016), p. 43 (note 26), and Danica Pension (2017), p. 44 (note 27). Danica Pension (2014), p. 17, shows DKK 7.153 bill. of debt to credit institutions for Danica Pension but does not include a note regarding the item.

[156] See Danica Pension (2012), p. 15, and Danica Pension (2013), p. 17.

[157] See Danica Pension (2015), p. 45 (note 30 for both 2014 and 2015), Danica Pension (2016), p. 44 (note 29), Danica Pension (2017), p. 45 (note 30), and Danica Pension (2018), p. 47 (note 30) regarding collateral posted by the Danica Pension group for 2014-2018. See Danica Pension (2015), p. 70 (note 20 for both 2014 and 2015), Danica Pension (2016), p. 68 (note 17), Danica Pension (2017), p. 70 (note 17), and Danica Pension (2018), p. 71 (note 17) regarding collateral posted by Danica Pension for 2014-2018. See also Danish FSA (2015), pp. 4-5.

[158] See C.4 in Danica (2016), Danica (2017) and Danica (2018).

[159] Danica (2018), C.4.

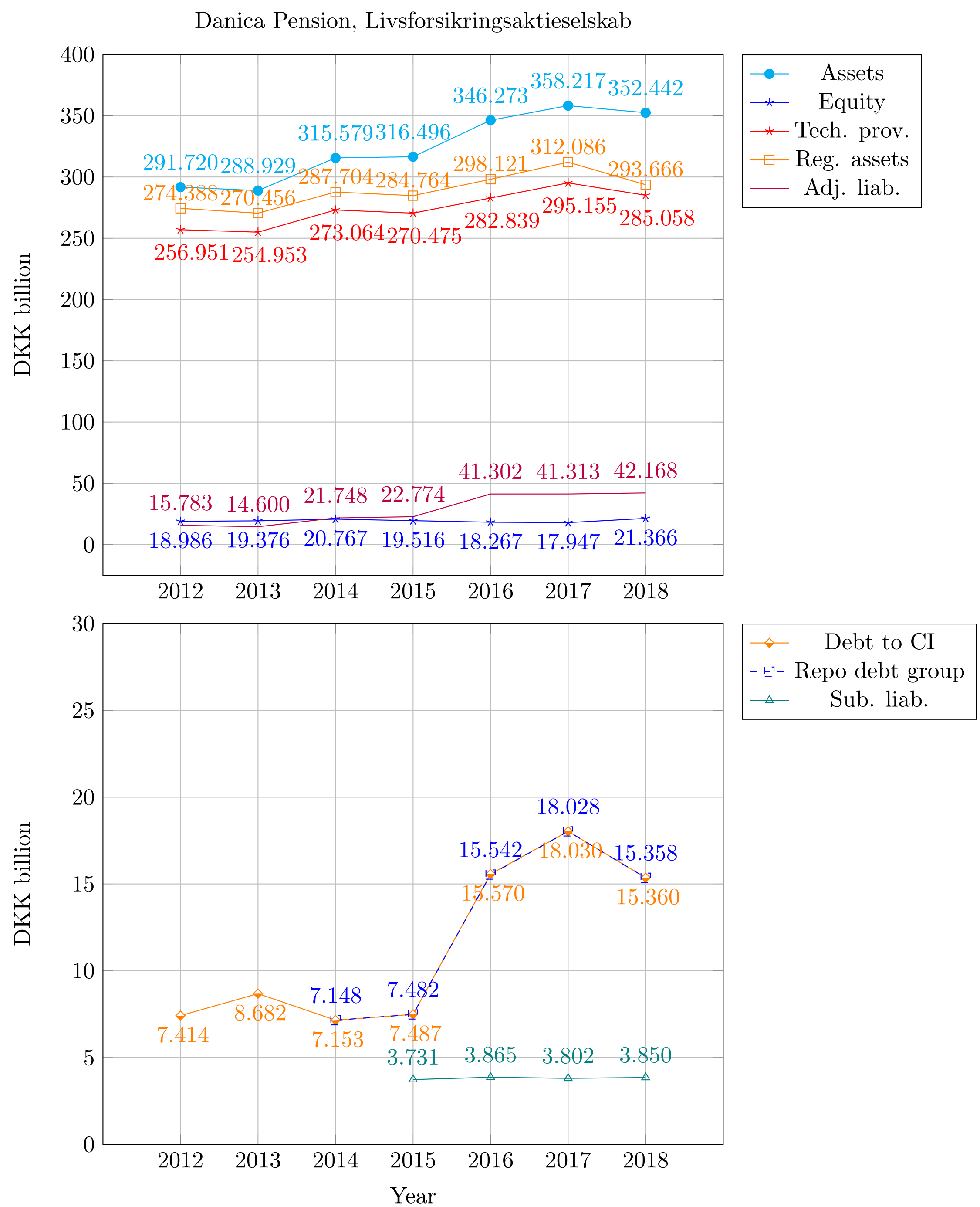

Figure 6.5: Data from Danica Pension's annual reports and group annual reports for 2012-2018.

6.3.1.5 Sampension

In line with the other four life insurance undertakings, the upper figure of figure 6.6 shows how registered assets (in orange) constitute the majority of assets (in light blue). The subordinated liabilities, which appear in 2016 in the lower figure, were previously reported as “bonuskapital” under technical provisions.[160]

The lower figure shows how repos have been used in a somewhat fluctuating fashion by Sampension since 2012. The lower figure also shows how repo debt (in blue) was moved from “other debt” to debt to credit institutions in 2016.[161] Similar to PFA Pension, repo debt exceeds repo collateral (in red).

The lower figure indicates that Sampension may not have consistently complied with the collateral reporting obligation. In 2012, 2013 and 2014, the annual reports showed repo debt values that were not accompanied by a note regarding repo collateral.[162] Repo collateral was not reported until 2015, which was the year of the decision in Danish FSA (2015) regarding PFA Pension’s lack of compliance with the collateral reporting obligation. The repo collateral in the year 2014 was accordingly obtained from the 2015 annual report.[163] In addition, and as described in chapter 6.3.1.8, Sampension’s 2016-2018 solvency and financial condition reports do not explicitly address repos in relation to liquidity risk.[164]

Sampension (2013) described how repos and reverse repos were used extensively in the ongoing liquidity management, including for the purpose of obtaining better returns on liquid assets and collateral provided by counterparties in relation to derivatives.[165] When describing returns and assets in relation to both market rate products and average rate products, Sampension (2015) mentioned repos which may indicate that repo-based strategies were not a part of a closed circuit but associated with generating returns to policyholders.[166] It also mentioned that returns on government bonds included repo-financed purchases of government bonds in the interest rate hedging portfolio.[167]

[160] Sampension (2016a), pp. 51 and 53.
[161] Sampension (2016a), p. 53
[162] See Sampension (2012), pp. 63 (note 17) and 65 (note 19), Sampension (2013), pp. 60 (note 17) and 62 (note 19), and Sampension (2014), pp. 74 (note 17) and 75 (note 19). See also Danish FSA (2015), pp. 4-5.
[163] Compare Sampension (2014), p. 75 (note 19), to Sampension (2015), p. 79 (note 19).
[164] See C.4 in Sampension (2016b), Sampension (2017b) and Sampension (2018).
[165] P. 20.
[166] Pp. 29 and 32 (regarding “3 i 1 livspension”) and 33 (regarding “traditionel gennemsnitsrente”).
[167] Sampension (2015), p. 81 (note 2 to note 22).

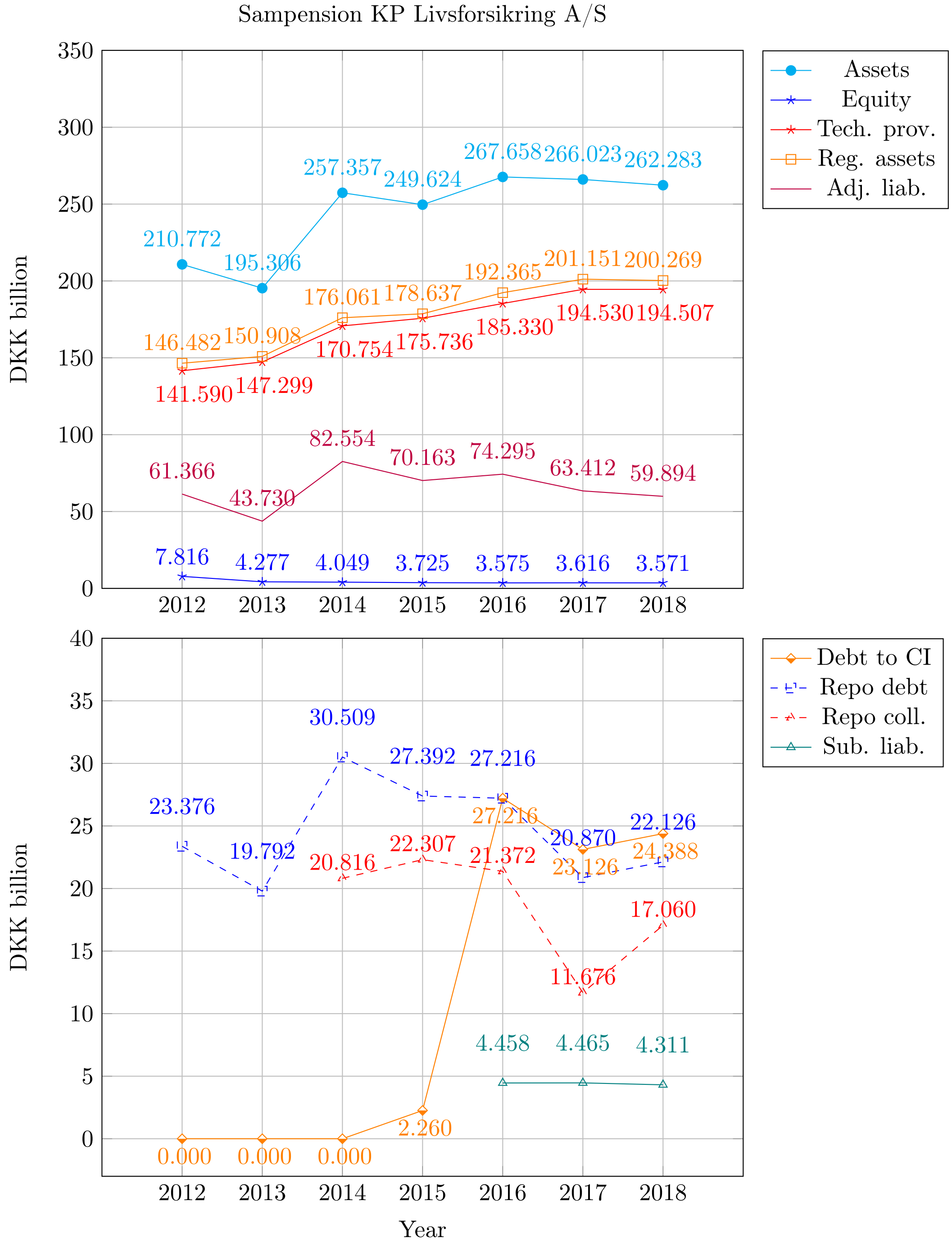

Figure 6.6: Data from Sampension's annual reports for 2012-2018.

6.3.1.6 Nordea Pension and Velliv

As mentioned above, Nordea Pension changed its name to Velliv in 2018. Similar to the other four life insurance undertakings, the upper figure of figure 6.7 shows how the majority of assets (in light blue) are registered assets (in orange). The lower figure shows how debt to credit institutions increased from 2012-2015 whereafter it began to decrease. It also shows that repo collateral has been posted since 2015. However, Nordea Pension did not report repo collateral until the 2016 annual report, and repo collateral in 2015 was accordingly obtained from the 2016 annual report.[168] In addition to the "usual" data points, the lower figure includes "pledged bonds" (in light blue) that were bonds posted as collateral for liabilities in relation to the settlement of financial instruments.[169] These pledged bonds have been included as the value of pledged bonds (DKK 29.633 bill.) in the 2015 annual report was equal to the value of repo collateral - for the year 2015 - in the 2016 annual report.[170] This is reflected in the lower figure for the year 2015 where pledged bonds and repo collateral have the same values. Pledged bonds in the years prior to 2015 may therefore possibly have included repo collateral. This possibility is further supported by how pledged bonds follow debt to credit institutions (which may include repo debt) until 2015, whereafter repo collateral follows debt to credit institutions.

The lower figure accordingly indicates that Nordea Pension may not have consistently complied with the collateral reporting obligation or at least not complied in a transparent manner that allowed the user of the annual report to assess which parts of the balance sheet were financed by repos.[171] Pursuant to Danish FSA (2015), a repo is - from an economic and accounting perspective - to be viewed as a collateralised loan and the life insurance undertaking is to provide information regarding the assets, including bonds, placed as collateral in repos.[172] Repo collateral was not explicitly reported by Nordea Pension until 2016 and it may have been reported in an incorrect or non-precise manner in the preceding years.

The lack of transparency is enforced by no explicit reporting of repo debt. There was e.g. no specification of repo debt in the 2015 annual report, which included the value of pledged bonds that was equivalent to the 2016 annual report's repo collateral for the year 2015. Repo debt, for 2017 and 2018, are from Velliv's annual report for 2018.[173]

As described in chapter 6.3.1.8 below, Nordea Pension's 2016-2017 solvency and financial condition reports, as well as Velliv's 2018 solvency and financial condition report, do not explicitly address repos in relation to liquidity risk.[174]

[168] Compare Nordea Pension (2015), p. 49 (note 26) to Nordea Pension (2016a), p. 46 (note 24).
[169] See e.g. Nordea Pension (2015), p. 49 (note 26).
[170] Compare Nordea Pension (2015), p. 49 (note 26, for 2015) to Nordea Pension (2016a), p. 46 (note 24, for 2015).
[171] Danish FSA (2015), pp. 4-5.
[172] Pp. 4-5.
[173] Velliv (2018a), note 28.
[174] See C.4 in Nordea Pension (2016b), Nordea Pension (2017b) and Velliv (2018b).

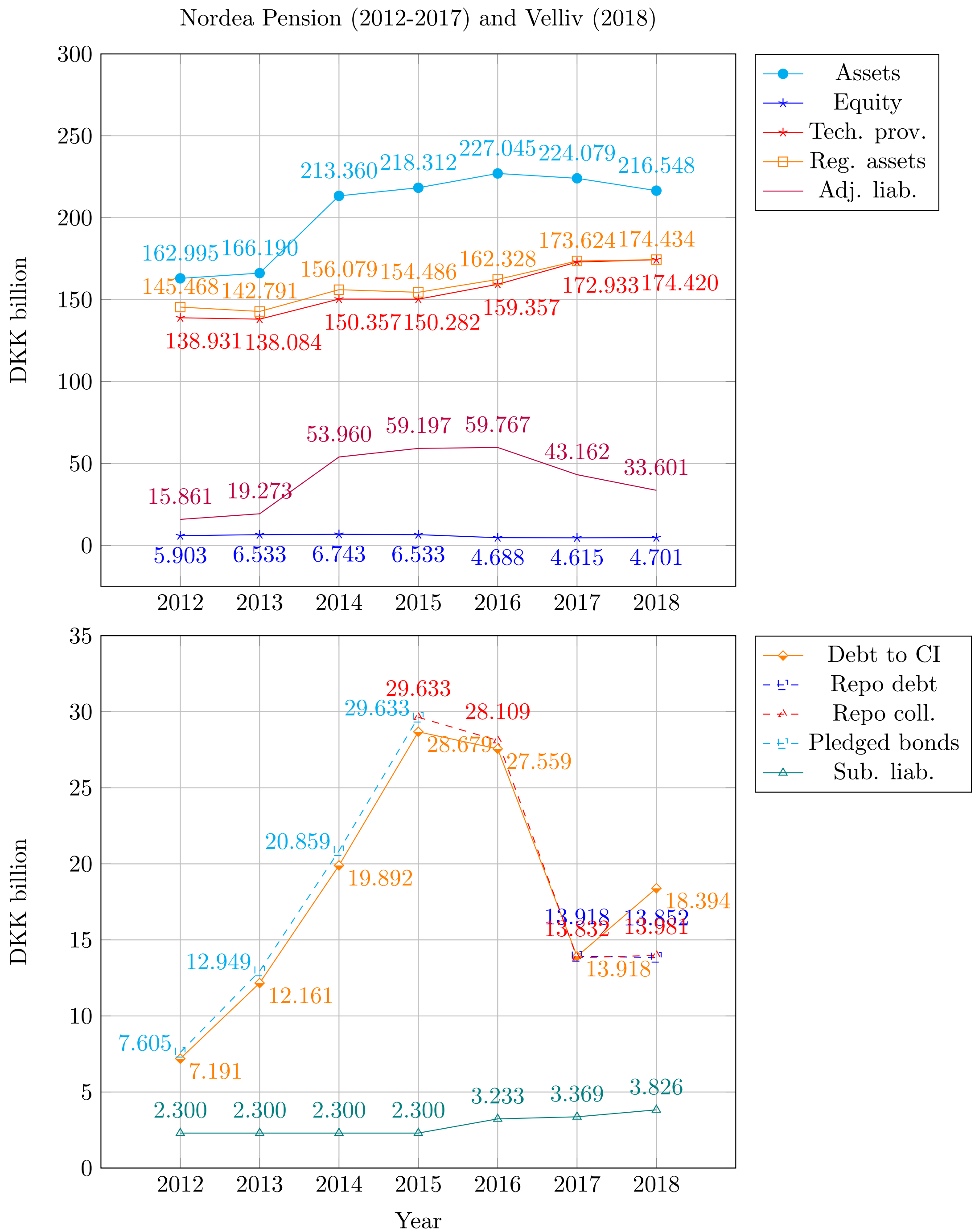

Figure 6.7: Data from Nordea Pension's annual reports for 2012-2017 and Velliv's annual report for 2018. Repo debt for 2017 and 2018 are from Velliv's annual report for 2018.

6.3.1.7 PensionDanmark

In line with the other four life insurance undertakings, the upper figure of figure 6.8 shows how registered assets (in orange) constitute the majority of assets (in light blue). However, and unlike the four others, technical provisions seem to exceed registered assets.

The lower figure shows how debt to credit institutions (in orange) increased significantly in 2016 and that repo collateral (in red) has been posted since 2016. However, the significant increase in debt to credit institutions in 2016 was not accompanied by a note regarding collateral or a note that specified the type of debt.[175] This lead me to enquire about whether the reported debt to credit institutions was non-collateralised - and not repos with financial collateral - while referring to the collateral reporting obligation.[176] In its reply, PensionDanmark stated that there should have been a note regarding debt to credit institutions but that the item had not previously been considered significant (in Da: "væsentlig") and therefore not included a note.[177] Subsequently, the 2017 annual report of PensionDanmark specified (i) that debt to credit institutions included, inter alia, repos and (ii) that - in the year 2016 - repo collateral amounted to DKK 12.202 bill.[178] Repo collateral in the year 2016 was accordingly obtained from the 2017 annual report.[179] The 2017 annual report specified that debt to credit institutions included repos while the 2018 annual report includes a note which states that debt to credit institutions includes, inter alia, repo debt.[180] However, repo collateral seems to follow debt to credit institutions.

There seems be little doubt that there was non-compliance with the collateral reporting obligation in relation to repo collateral in 2016.[181] This entailed a lack of transparency in relation to, inter alia, what parts of the balance sheet were financed by repos and what balance sheet assets were repo collateral.[182] Accordingly, PensionDanmark has not consistently complied with the collateral reporting obligation during the period. In addition, and as described in chapter 6.3.1.8 below, PensionDanmark's 2016-2018 solvency and financial condition reports do not explicitly address repos in relation to liquidity risk.[183]

The 2017 and 2018 annual reports mentioned that bonds - that were assets associated with market rate products - included bonds traded as a part of repos.[184] This may indicate that repo-based strategies are not a part of a closed

[175] PensionDanmark (2016a), pp. 39 and 52 (note 13).
[176] See the email response, including my email as of 27 June, 2017, in PensionDanmark (2017b).
[177] PensionDanmark (2017b), email as of 10 August, 2017.
[178] PensionDanmark (2017a), pp. 46, 47 (note 1), 51 (note regarding bonds in note 8) and 57 (note 14). See also PensionDanmark (2018a), p. 53 (note 18).
[179] PensionDanmark (2017a), pp. 51 (note regarding bonds in note 8) and 57 (note 14).
[180] PensionDanmark (2017a), note 1, and PensionDanmark (2018a), note 18.
[181] See also Danish FSA (2015), pp. 4-5.
[182] Danish FSA (2015), pp. 4-5.
[183] PensionDanmark (2016b), p. 26, PensionDanmark (2017c), p. 25, and PensionDanmark (2018b), p. 27.
[184] PensionDanmark (2017a), pp. 51 (note regarding bonds in note 8), and PensionDanmark (2018a), p. 52 (note regarding bonds in note 16).

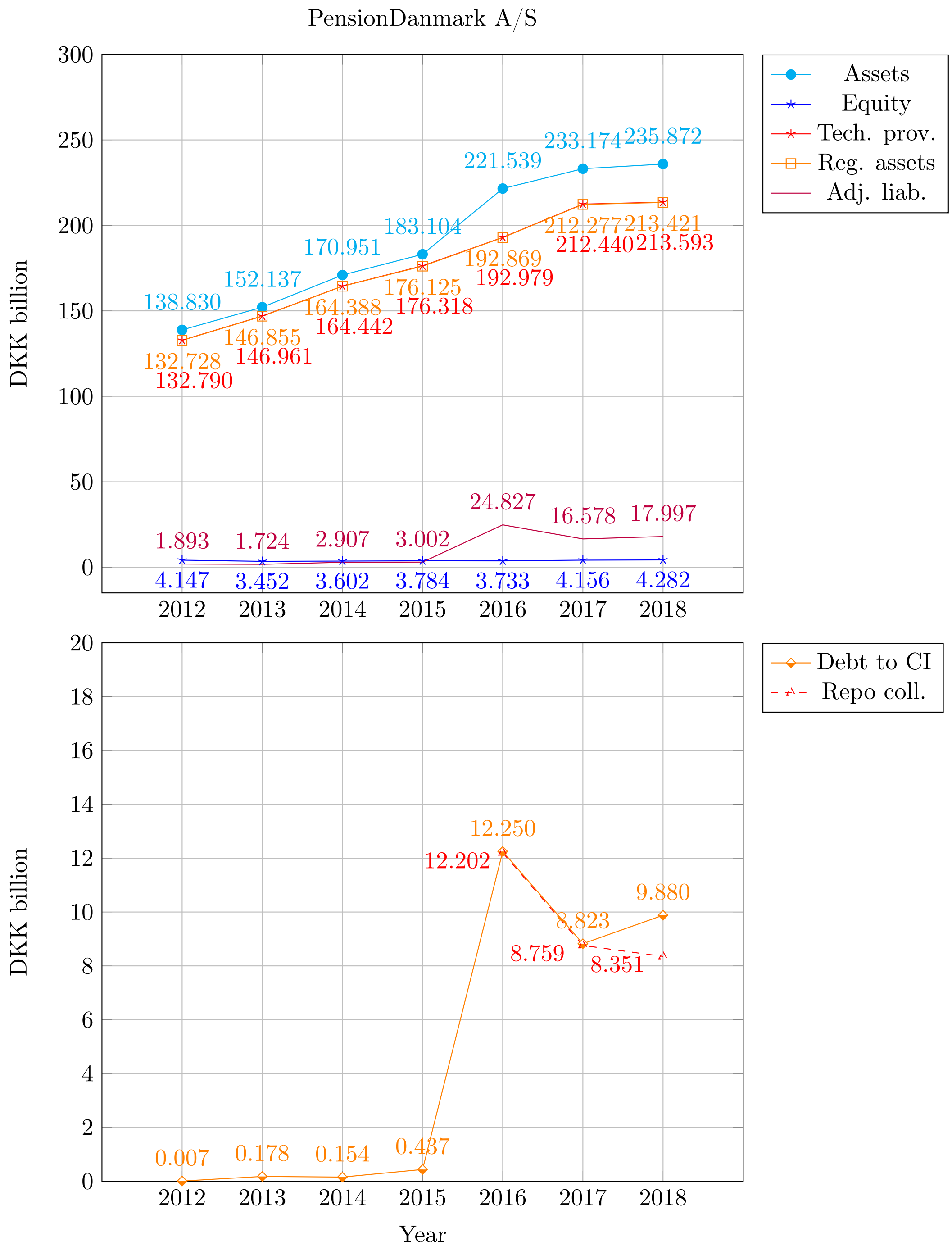

Figure 6.8: Data from PensionDanmark's annual reports for 2012-2018.

circuit but associated with generating returns to policyholders.

6.3.1.8 The Reporting of Liquidity Risk in Solvency and Financial Condition Reports

When using annual reports to assess repos and shadow banking, it must be noted that information regarding credit intermediation, SFTs and financial collateral are a part of life insurance undertakings' reporting obligations to supervisors under Solvency II. At level 2, the Solvency II Delegated Regulation provides that the regular supervisory report by a life insurance undertaking must include

- qualitative and quantitative information regarding its risk profile, including information regarding market risk, credit risk, liquidity risk and other material risks.[185]
- information regarding sold/re-pledged/provided collateral and collateral arrangements.[186]
- information regarding securities lending and repos.[187]
- information regarding the volume and nature of any loan portfolio.[188]

In addition, while annual reports may not reflect transparency in relation to repos and financial collateral, or compliance with the collateral reporting obligation, the associated risks may have been addressed in the Solvency II-prescribed solvency and financial condition reports that have been produced since 2016.[189] However, the five Danish life insurance undertakings' 2016-2018 solvency and financial condition reports do not explicitly address the risks associated with repos under the item "liquidity risk" (i.e. item C.4), regardless of the presence of repos in their annual reports.[190] Instead, they seem to focus on liquidity risk in relation to lapse risk and surrenders in "traditional" life insurance as well as financial collateral requirements in relation to derivatives. The liquidity risk item, in the produced solvency and financial condition reports, include - inter alia - the following:

- For 2016-2018, PFA Pension describes (i) the possible need to sell assets in relation to additional collateral requirements associated with the market value developments of financial instruments, (ii) collateral requirements in relation to derivatives due to market movements and (iii) a stress test

[185] Solvency II Delegated Regulation, art. 309(1).
[186] Solvency II Delegated Regulation, art. 309(2)(b)-(d).
[187] Solvency II Delegated Regulation, art. 309(2)(f).
[188] Solvency II Delegated Regulation, art. 309(3).
[189] Solvency II Delegated Regulation, title I, chapter XII, sections 1-3, and annex XX.
[190] PFA Pension (2016b), p. 62, PFA Pension (2017b), pp. 60-61, PFA Pension (2018b), pp. 54-55, Danica (2016), pp. 47-48, Danica (2017), pp. 51-52, Danica (2018), pp.52-53, Sampension (2016b), p. 26, Sampension (2017b), p. 27, Sampension (2018), p. 27, Nordea Pension (2016b), p. 20, Nordea Pension (2017b), p. 18, Velliv (2018b), pp. 29-30, PensionDanmark (2016b), p. 26, PensionDanmark (2017c), p. 25, and PensionDanmark (2018b), p. 27.

scenario with a significant rise in posted collateral.[191] Leveraged repo transactions are described in its description of subsidiaries for 2016 and 2017 but there is no mentioning of repos under liquidity risk despite the presence of both repo debt and repo collateral in PFAs annual reports for 2016-2018 (which show a significant drop in repo debt from the peak of DKK 47.275 bill. in 2016).[192]

- For 2016-2018, and in line with the perception of traditional insurance, the Danica group stated that life insurance undertakings are not exposed to liquidity risk to the same degree as banks as they have registered assets.[193] In addition, no separate stress tests for liquidity risk were conducted.[194] There was no mentioning of repos despite the presence of repo debt in Danica Pension's group annual reports for 2016-2018 (where repo debt peaked at DKK 18.028 bill. in 2017). However, the 2018 group solvency and financial condition report describes how a relatively large holding of, inter alia, Danish mortgage credit bonds functions as a liquidity buffer and is to be sold or used as collateral in a stress scenario.[195]

- For 2016-2018, Sampension stated that (i) funding risk was modest as it was a long-term investor with investments that were not debt-financed, and (ii) that it had a large amount of investment assets, with a high credit quality, that could be used to secure liquidity and reduce market liquidity risk significantly.[196] Repos were not mentioned despite the presence of both repo debt and repo collateral in Sampension's annual reports for 2016-2018 (where repo debt peaked at DKK 27.216 bill. in 2016).

- Without going into detail, Nordea Pension (2016b), Nordea Pension (2017b) and Velliv (2018b) mentioned that "alternative sources of financing" were included in the management of liquidity risk.[197] Repos were not addressed although Nordea Pension's annual repos showed repo collateral for 2016 and 2017 (which peaked at DKK 28.109 bill. in 2016) while Velliv's annual report for 2018 included repo collateral for 2018 as well as repo debt for both 2017 (for Nordea Pension) and 2018 (for Velliv).

- Despite a very significant increase in repos in 2016 (that was not reported in accordance with the collateral reporting obligation until 2017), PensionDanmark (2016b) and PensionDanmark (2017c) did not address repos

[191] PFA Pension (2016b), p. 62, and PFA Pension (2017b), pp. 60-61, and PFA Pension (2018b), pp. 54-55.
[192] PFA Pension (2016b), p. 11, and PFA Pension (2017b), p. 11, and PFA Pension (2018b), pp. 54-55.
[193] Danica (2016), p. 47, Danica (2017), p. 51, and Danica (2018), p. 75.
[194] Danica (2016), 48, and Danica (2017), p. 52, and Danica (2018), p. 75.
[195] Danica (2018), C.4.
[196] Sampension (2016b), p. 26, Sampension (2017b), p. 27, and Sampension (2018), p. 27.
[197] Nordea Pension (2016b), p. 20, Nordea Pension (2017b), p. 18, and Velliv (2018b), p. 30.

under liquidity risk.[198] Similarly, PensionDanmark (2018b) did not address repos under liquidity risk despite the presence of repos in the annual report for 2018.

As shown above, the solvency and financial condition reports do not inform the reader about non-insurance activities, in the form of repos, and how the associated liquidity risk is addressed. In the next chapter, it will illustrated how the non-reporting of repos and financial collateral affects the liquidity profile of a life insurance undertaking, including perceptions of the availability of unencumbered assets.

6.3.2 Why is the Reporting of Repos and Financial Collateral an Issue?

The prudent person principle prescribes that life insurance undertakings may only invest in assets and instruments whose risks it can properly identify, measure, monitor, manage, control and report.[199] As discussed in chapter 12.2, the prudent person principle is to address liquidity risk and ensure the liquidity of a life insurance undertaking's assets. A lack of compliance with the collateral reporting obligation may accordingly reflect a lack of compliance with the prudent person principle.

Repos are not insurance obligations to be covered by technical provisions and they are not risk types to be covered by prescribed underwriting risks in the SCR.[200] As described above in chapters 1, 5 and 6.1.1, and below in chapter 14, repos are labeled non-insurance activities that are associated with liquidity risk and systemic risk.

In addition to modifications of assumptions regarding liquidity risk, life insurance undertakings' repo activities may necessitate a modification to the general assumptions regarding life insurance undertakings' assets and availability, e.g. that they have a large amount of assets on hand - relative to liabilities - in comparison to banks.[201] Chapter 6.3.1 reflected how the majority of the five Danish life insurance undertakings' assets are registered assets and chapter 6.3.1.1 described how registered assets may only be used for the satisfaction of policyholders and beneficiaries.[202] Life insurance undertakings can accordingly not use registered assets - the majority of their assets - as financial collateral in

[198] PensionDanmark (2016b), p. 26, and PensionDanmark (2017c), p. 25. PensionDanmark does not include data regarding repos in the PensionDanmark (2016a) annual report. However, the PensionDanmark (2017a) annual report, p. 57, note 14, stated that - *in 2016* - bonds, with a value of DKK 12.202 bill., were placed as collateral in repos and remained on the balance sheet. See also the PensionDanmark (2017b) email that confirms a lack of compliance with the collateral reporting obligation.

[199] Solvency II, art. 132.

[200] Solvency II, art. 76, 101(4)(a)-(c), 104(1)(a)-(c) and 105(2)-(4), and Solvency II Delegated Regulation, title I, chapter V, section 1, subsection 7, and sections 2-4.

[201] IAIS (2010), para. 9.

[202] Solvency II, art. 275(1)(a) and (3) and 276, and Danish Financial Business Act, sec. 167(4).

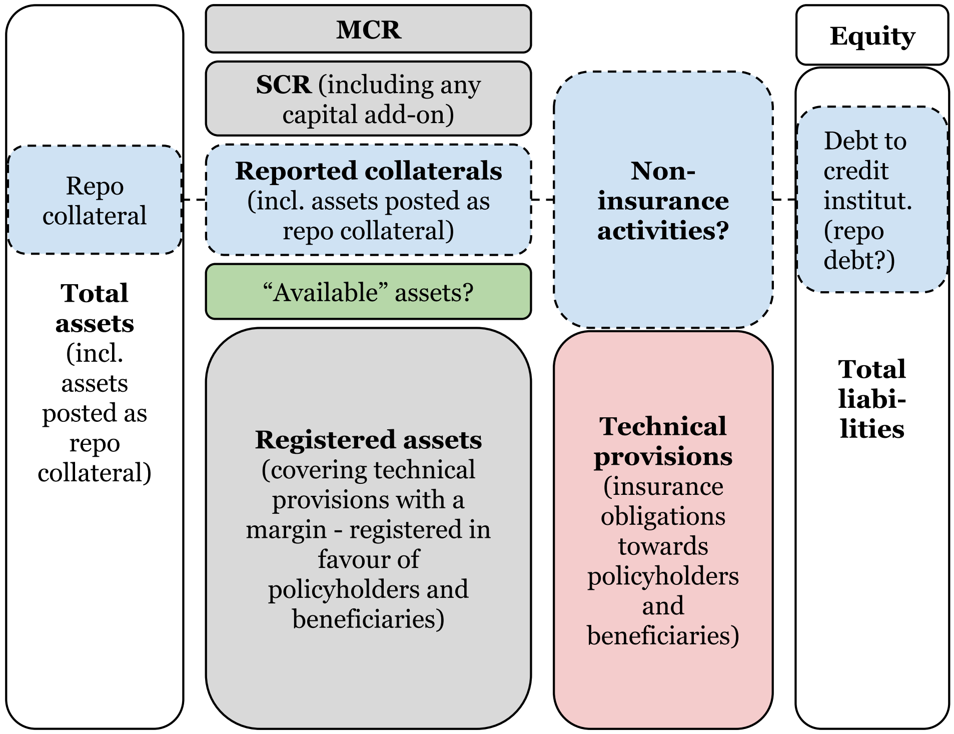

Figure 6.9: A non-scaled illustration of how the perception of “available” unencumbered assets (in green) will depend on compliance with the collateral reporting obligation (in blue), including reported repo collateral that remains as assets on the balance sheet.

repos or use them to meet non-insurance liquidity outflows, unless the life insurance undertaking wants to allow the registered asset become subject to a right in rem and subtract its value from the total value of registered assets.[203] As reflected in grey to the left in figure 6.9, the amount of assets, which can meet non-insurance liquidity outflows, should accordingly be reduced by registered assets.

To the left, figure 6.9 also illustrates how non-compliance with the collateral reporting obligation entails a lack of transparency regarding which assets constitute repo collateral (in blue) or registered assets (in grey) or “available” unencumbered assets (in green). Repo collateral (i.e. an asset that has been transferred) remains on the balance sheet under total assets. Non-compliance with the collateral reporting obligation will therefore signal a larger value of “available” unencumbered assets than is actually the case. Such non-compliance may accordingly mislead policyholders, creditors and investors regarding the amount of available assets - beyond registered assets - that are capable of sup-

[203]Solvency II, art. 276(4). See also Danish Executive Order no. 11 of 2019, sec. 4(1)(2).

porting liquidity outflows and decreases in value. In relation to the balance sheet treatment of repos, chapter 6.3.1.1 described the decision in Danish FSA (2015), which stated that it is important for users of the annual reports to be informed of which balance sheet assets constitute collateral.[204] In relation to non-insurance activities, the Danish FSA also viewed it as important that users of the annual reports are able to assess which parts of the balance sheet are financed by repos or an increase in customers.[205] This is also illustrated in figure 6.9.

In addition to registered assets and repo collateral, figure 6.9 illustrates how life insurance undertakings must hold eligible own funds[206] to cover the SCR, as well as eligible *basic* own funds[207] to cover the MCR.[208] At level 1 and 2, Solvency II regulates the components of own funds as well as the eligibility of - and quantitative limits applicable upon - types of own funds that can cover the SCR and MCR.[209] Level 1 provides that own fund items are to be classified into tiers 1, 2 and 3 and such classification depends upon (i) whether they are basic own fund items or ancillary own-fund[210] items and (ii) the possession of certain characteristics and features.[211] These characteristics and features include "permanent availability"[212], "subordination"[213], "sufficient duration"[214], "absence of incentives to redeem"[215], "absence of mandatory servicing costs"[216] and "absence of encumbrances"[217] Based on the characteristics and features at level 1, the Solvency II Delegated Regulation provides a list of own-fund items for each tier of either basic own funds or ancillary own funds as well as features that such items must fulfil.[218] Tier 1, 2 and 3 basic own fund items must all be

[204]Pp. 4-5.
[205]Danish FSA (2015), pp. 4-5.
[206]Own funds comprise the sum of (i) basic own funds (the excess of assets over liabilities and subordinated liabilities) and (ii) ancillary own funds (items other than basic own funds which can be called up to absorb losses) that are subject to supervisory approval, cf. Solvency II, art. 87-90.
[207]The excess of assets over liabilities and subordinated liabilities, cf. Solvency II, art. 88.
[208]Solvency II, art. 100 and 128.
[209]Solvency II, title I, chapter VI, section 3, and Solvency II Delegated Regulation, title I, chapter IV. EIOPA (2018b) (section 19) conducts a comparison of the treatment of own funds requirements in Solvency II and CRR for credit institutions.
[210]Items, other than basic own funds, which can be called up to absorb losses, cf. Solvency II, art. 89.
[211]Solvency II, art. 93-94, and Solvency II Delegated Regulation, title I, chapter IV, section 2.
[212]Defined as when the item is available, or can be called up on demand, to fully absorb losses on a going-concern basis, as well as in the case of winding-up, cf. Solvency, art. 93(1)(a).
[213]Defined as - in the case of winding-up - the total amount of the item is available to absorb losses and the repayment of the item is refused to its holder until all other obligations (including insurance and reinsurance obligations towards policyholders and beneficiaries of insurance and reinsurance contracts) have been met, cf. Solvency II, para. 93(1)(b).
[214]See definition in Solvency II, para. 93(2).
[215]Defined as free from requirements or incentives to redeem the nominal sum, cf. Solvency II, para. 93(2)(a).
[216]Defined as free from mandatory fixed charges, cf. Solvency II, para. 93(2)(b).
[217]Defined as clear of encumbrances, cf. Solvency II, para. 93(2)(c).
[218]Solvency II, art. 93-97, and Solvency II Delegated Regulation, title I, chapter IV, section 2.

free from encumbrances and EIOPA Guidelines (2014a) state that encumbrances are to be assessed on the basis of the economic effect and that encumbrances include, inter alia, rights of set off, restrictions and charges.[219] Basic own funds, which are used to over the MCR and SCR, can therefore not also be used as financial collateral.

A life insurance undertaking's "non-insurance liquidity profile" should accordingly be based on the subtraction of

- registered assets,
- basic own funds, and
- other encumbered assets (including posted repo collateral)

from the life insurance undertaking's total assets. If the collateral reporting obligation has been complied with, the remaining assets will presumably indicate the life insurance undertaking's ability to support non-insurance liquidity outflows, including outflows due to repos.

In order to ensure sufficient liquidity and address any maturity and liquidity transformation via repos, chapter 12.4.3 of this dissertation proposes a liquidity coverage ratio and a net stable funding ratio which are based on the finalised Basel III but adapted to only capture life insurance undertakings' non-insurance activities.

6.3.3 The Possible Purposes of Repos in Life Insurance

Life insurance undertakings generally have significant holdings of bonds which can be "repoed" to raise cash for liquidity management, leverage and/or increasing returns.[220] As described above, the reinvestment of cash financial collateral into liquid and high credit quality assets is assumed to form a part of traditional insurance and generally *not* amount to shadow banking.[221] However, it is not possible to track the exact purposes Danish life insurance undertakings' repo activities. The balance sheets of the annual reports may reflect consolidation and do generally not enable the tracking of the repo-financed exposures or reinvestment of cash financial collateral. This chapter will, via anecdotal examples, attempt to shed some light on the possible purposes of life insurance undertakings' repos and repo-based leverage. While some of the anecdotal examples may relate to hedge funds, they are presented as life insurance undertakings may pursue similar repo-financed strategies via "internal" hedge funds and thereby become exposed to the same risks.

Repos can be used to "monetise" assets into cash or liquid securities that can be used to fulfil margin requirements towards CPPs and other counterparties. In addition, repos may be used in intra-group liquidity and financial collateral

[219] Solvency II, art. 93(2)(c) and 94, Solvency II Delegated Regulation, art. 71(1)(o), 73(1)(i) and 77(1)(h), andEIOPA Guidelines (2014a), guideline 13.
[220] FSB (2012c), p. 7.
[221] IAIS (2013b), para. 18, example a. See also FSB (2015c), p. 8.

management, e.g. the transfer of a certain type of financial collateral from a life insurance undertaking to a group-connected bank.[222] As an example from outside the "top five", the public Danish pension scheme ATP stated, in ATP Group (2017), that it provided and received assets as collateral in relation to repos and reverse repos as well provided and received assets in relation to clearing and other counterparties in financial transactions.[223] ATP also stated that it did not engage in actual financing activities but used repos and reverse repos as a part of its cash management (in Da: "likviditetsstyringen") and that such repos and reverse repos had a maturity of less than one year.[224]

As mentioned in chapter 6.3.1, Sampension (2013) similarly described how repos and reverse repos were used extensively in the ongoing liquidity management, including for the purpose of obtaining better returns on liquid assets and collateral provided by counterparties in relation to derivatives.[225] In Danish FSA (2015), PFA Pension stated that the repo transactions allowed PFA Pension to obtain a return on its significant bond holdings and that the term of the repos was typically less than one month.[226] Sampension (2015) mentioned repos when describing returns and assets in relation to both market rate products and average rate products.[227] Similarly, PensionDanmark (2017a) mentioned that bonds - which were assets related to market rate products - included bonds sold in repos.[228] This may indicate that repo-based strategies are not always a "closed circuit" but associated with generating returns to policyholders. When doing so, the life insurance undertakings do not seem to specify what the relationship is between repo collateral and registered assets.

PFA Pension's annual reports include a more detailed look into how PFA Pension conducted leveraged repo transactions (via a wholly owned hedge fund named PFA Investment Fund) to invest in short-term interest rate and spread risk.[229] That wholly owned hedge fund primarily invested long/short in government bonds, mortgage credit bonds, index-linked bonds, swaps and derivatives issued by countries in the EU, Switzerland and Norway and its main focus was on the Nordic interest market.[230] The Nordea group includes the Nordea Dedicated Investment Fund which has a sub-fund (the Nordic Rates Opportunity Fund) whose strategies seem similar to the wholly owned hedge fund of PFA Pension. The sub-fund focuses on Nordic fixed income markets, including Nordic covered bonds and government-guaranteed debt securities.[231] At least two-thirds of the total assets of the sub-fund must be invested in securities

[222] See e.g. IAIS (2017), para. 45, regarding lending of financial collateral.
[223] Pp. 114 (note 27) and 87 (note 12).
[224] ATP Group (2017), p. 74.
[225] P. 20.
[226] P. 3.
[227] Pp. 29 and 32 (regarding "3 i 1 livspension") and 33 (regarding "traditionel gennemsnitsrente").
[228] PensionDanmark (2017a), pp. 51 (note regarding bonds in note 8).
[229] PFA Pension (2016a), pp. 71, 86 and 87, and PFA Pension (2017a), pp. 69, 85 and 87.
[230] PFA Pension (2016a), pp. 71, 86 and 87, and PFA Pension (2017a), pp. 69, 85 and 87.
[231] Nordea Dedicated Investment Fund (2019), p. 14. See also Nordea Dedicated Investment Fund (2018), p. 22.

with a minimum rating of A-/A3 or equivalent, while a maximum of 10% of the net assets can be invested in bonds with a rating lower than BBB-/Baa3 or equivalent and/or in non-rated bonds.[232] The sub-fund pursues direct and derivatives-based long and short positions and uses sell-buy back transactions[233] (similar to repos) to leverage its exposure in order to increase the expected return.[234] It is categorised as "highly leveraged" meaning that its exposure may be much larger than "100%" (of presumably the net asset value).[235] The sub-fund's applied leverage techniques are considered able to, inter alia, amplify the effects of adverse market movements.[236]

From a historical perspective, the leveraged (repo) strategies of the two funds above may share similarities with "classic" hedge fund spread investment strategies. Chapter 5.1.1.2 described how LTCM conducted *convergence* trades wherein offsetting positions in two related financial instruments were taken with the anticipation that the spread between the two financial instruments would narrow and that a small reduction in spreads would entail profits due to leverage.[237] LTCM gained exposure to, inter alia, government bonds, mortgage-backed securities and corporate bonds via repos and reverse repos while exposures to spreads were gained via interest rate swaps with high notional values.[238] Krishnamurthy (2002) describes the convergence trade based on the spread between the newly issued on-the-run "new bond" and the previously issued (replaced) off-the-run "old bond".[239] The "new bond" is associated with a (liquidity) premium that constitutes a spread to the "old bond" which narrows over time until the next auction date where a new "new bond" is issued.[240] In order to bet on the spread convergence, the "new bond" is shorted - while the "old bond" is purchased - on the auction date and this position is held until the issuance of a new "new bond" in the subsequent auction.[241] The "old bond" purchase can be financed via a repo and the "new bond" can be shorted by purchasing it in a reverse repo where the repo seller can earn a "specials" premium if there is a demand for the "new bond".[242] This premium is reflected in the repo rate that the repo seller (i.e. "new bond" lender) pays on the received cash

[232]Nordea Dedicated Investment Fund (2019), p. 14.
[233]Under the SFT Regulation, art. 3(8), a sell-buy back transaction is a transaction in which a counterparty buys or sells, inter alia, securities while agreeing to sell or to buy back securities of the same description - at a specified price - on a future date. It is not governed by a repurchase agreement or reverse-repurchase agreement, cf. SFT Regulation, art. 3(8) and (9).
[234]Nordea Dedicated Investment Fund (2019), p. 14.
[235]Nordea Dedicated Investment Fund (2019), pp. 14 and 29-30, and Nordea Dedicated Investment Fund (2017), pp. 13 and 25-26. See also Nordea Dedicated Investment Fund (2018), p. 37.
[236]Nordea Dedicated Investment Fund (2019), p. 14.
[237]President's Working Group (1999), pp. 10-11, including footnote 13, and appendix A-5, and Edwards (1999), pp. 197-198.
[238]President's Working Group (1999), p. 11 and appendix A-2, and Edwards (1999), p. 198. See also Krishnamurthy (2002) regarding "the bond/old-bond spread".
[239]Pp. 463-464.
[240]Krishnamurthy (2002), pp. 463-464.
[241]Krishnamurthy (2002), pp. 465 and 469.
[242]Krishnamurthy (2002), pp. 465 and 469-472.

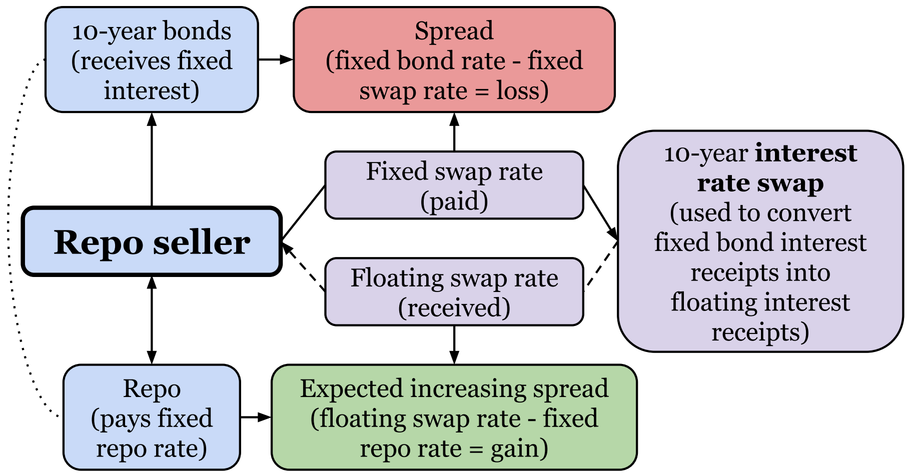

Figure 6.10: Illustration of "oldest trade in the book" based on Kosowski and Neftci (2015).

financial collateral as the demand for the new bond entails that the repo rate, paid by the repo seller, falls below the riskless rate and allows the repo seller to obtain cash financing below the riskless rate.[243]

In relation to spread *divergence*, Kosowski and Neftci (2015) describe the "oldest trade in the book" which allows the repo seller to take advantage of increasing spreads between the obtainable repo rate and a variable interest rate under a swap.[244] As illustrated in figure 6.10, this transaction entails that the repo seller purchases e.g. 10-year fixed-rate bonds and finances the purchase by placing them as financial collateral in a repo and paying a fixed repo rate (in blue).[245] The repo seller simultaneously enters into a 10-year interest rate swap under which it pays a fixed swap rate and receives a floating swap rate (in purple).[246] The repo seller incurs a loss (the red box) by having to pay the spread between the received fixed bond rate and the paid fixed interest swap rate. However, the transaction is expected to be profitable if (i) that loss is less than the spread between the received floating interest swap rate and the paid fixed repo rate and (ii) the spread between the received floating interest swap rate and the paid fixed repo rate increases (the green box).[247]

One risk in relation to repo-leveraged investment in spread risk is obviously that spreads do not converge - or diverge - in accordance with the assumptions of the strategy.[248] In addition, the repo-based leverage applied in those strategies

[243] Krishnamurthy (2002), pp. 470-471.
[244] P. 162.
[245] Kosowski and Neftci (2015), p. 162.
[246] Kosowski and Neftci (2015), p. 162.
[247] Kosowski and Neftci (2015), p. 162.
[248] See e.g. President's Working Group (1999), pp. 12 and 16 and appendix A-5, and Edwards (1999), pp. 198-199, in relation to LTCM.

may entail exposures to liquidity risk that leads to the fire sales and systemic risk that were described in the preceding chapters.[249]

If the leveraged strategies above are conducted via "isolated" funds, then an assessment of shadow banking and regulatory arbitrage becomes a question of how any applicable fund-specific or market-based regulation addresses the activities and associated risks in comparison to the finalised Basel III.[250] Before defining this dissertation's scope and method for comparing Solvency II and the finalised Basel III, this fund-based aspect is discussed next in chapter 7.

[249]See chapters 1, 5, 6.1.1 and e.g. Kosowski and Neftci (2015), chapter 5.5.1.1.
[250]See also EBA Guidelines (2015).

Part IV

Challenges, Scope and Comparison Method

Chapter 7

Interpretation and Legal Challenges

Recent EU case law includes a number of similar judgements regarding the legality of a decision by the ECB, which did not allow the exclusion of certain exposures - to the public French Caisse des Dépôts - in the calculation of the Basel III-based leverage ratio. The General Court stated that in addition to the wording of the CRR, the purposes of - and logic behind - the leverage ratio, as well as the purposes and context of the related exemptions regarding excluded exposures, had to be identified and considered.[1] In the judgements, the General Court relied upon the recitals of the CRR, as well as Basel III, as the recitals of the CRR refer to the BCBS' work in relation to the leverage ratio.[2]

Obviously, the finalised Basel III cannot be used as preparatory works if it has not been implemented into EU law. However, when answering the overall research question, this dissertation will identify the purpose and context of - and logic behind - pillar 1 requirements in Solvency II (or the absence of such pillar 1 requirements) and compare those to the purpose and context of - and logic behind - the finalised Basel III's pillar 1 requirements. As stated above, this dissertation's comparison of Solvency II and the finalised Basel III is carried out while being fully aware of the legal fact that the finalised Basel III only amounts to global standards as well as that the BCBS does not possess any formal supranational authority and that its decisions do not have legal force.[3]

[1] T-768/16 (2018) (BNP Paribas v. European Central Bank), para. 39, 40, 50, 60, 66, 82 and 85, T-758/16 (2018) (Crédit Agricole SA v. European Central Bank), para. 39, 40, 50, 60, 66, 82 and 85, T-757/16 (2018) (Société Générale v. European Central Bank), para. 36, 44, 54, 74, 91, 106 and 109, T-751/16 (2018) (Confédération Nationale du Crédit Mutuel v. European Central Bank), para. 37, 45, 55, 79, 96, 113 and 116, T-745/16 (2018) (BPCE v. European Central Bank), para. 36, 44, 54, 74, 91, 107 and 110, and T-733/16 (2018) (La Banque Postale v. European Central Bank), para. 38, 46, 56, 77, 95, 113 and 116.

[2] CRR, recitals 92 and 93, T-768/16 (2018), para. 42, T-758/16 (2018), para. 42, T-757/16 (2018), para. 46, T-751/16 (2018), para. 47, T-745/16 (2018), para. 46, and T-733/16 (2018), para. 48.

[3] BCBS Charter (2018), section 3.

In addition to the challenges related to the comparison of Solvency II and the global standards in the finalised Basel III, there is a challenge in relation to the delimitation of this dissertation and market-based regulation of shadow banking. Chapter 7.1 will therefore describe the EU's other shadow banking initiatives in a very short fashion to provide context for the comparison of Solvency II and the finalised Basel III.

7.1 Entity-Based and Market-Based Regulation

EIOPA (2018e) describes how investment funds are heavily used by insurance undertakings and that this is often for unit-linked and index-linked insurance business.[4] In addition, chapter 6.3.3 described the possible purposes of life insurance undertakings' repos, including a wholly owned fund. Life insurance undertakings may accordingly conduct credit intermediation and possibly shadow banking indirectly via funds. An example of this could be if a life insurance undertaking invests in a fund that obtains repo-based leverage and grants direct loans or purchases high-yield bonds. As described above in chapter 6.3, the nature of such possible shadow banking may not appear in a clear fashion in the balance sheet of the life insurance undertaking, especially if it is subject to consolidation. The regulation of life insurance undertakings' "indirect" shadow banking via funds is accordingly relevant for this dissertation.

At the global level, the economic functions-based identification of shadow banking in FSB (2013d) targets, inter alia, (i) collective investment vehicles that are involved in credit intermediation and have features that make them susceptible to runs and (ii) loan provision that is dependent on short-term funding, including repos.[5] These two economic functions are accordingly to capture maturity transformation, liquidity transformation and/or leverage.[6]

[4] P. 61-62.

[5] Sections 2.1 and 2.2 and annex 1, economic functions #1 and #2.

[6] FSB (2013d), sections 2.1 and 2.2 and annex 1, economic functions #1 and #2.

In the EU, the AIFM Directive[7], UCITS Directive[8], MMF Regulation[9] and SFT Regulation are all considered shadow banking regulation.[10] The MMF Regulation is a "pure" shadow banking initiative and was adopted to address the shadow banking risks related to money market funds, including the risk of runs on money market funds and the associated risk of contagion within the short-term funding market that finances financial institutions, corporations and governments [11]

Another part of the European Commission's main shadow banking measures is EMIR, which has the primary purposes of mitigating OTC derivative-based risks to financial stability and improving the transparency of derivative contracts.[12] EMIR is to be consistent with the G20's initiatives regarding the clearing and reporting of OTC derivative contracts.[13] While repos and other SFTs are not derivatives under EMIR, or subject to the mandatory clearing, CPP-cleared SFTs become subject to EMIR as CCPs are governed by EMIR, including EMIR's prudential requirements regarding margin and collateral.[14]

[7]In relation to managers of alternative investment funds (e.g. hedge funds and private equity funds), the AIFM Directive regulates, inter alia, (i) risk management in relation to credit risk, leverage levels, collateral reuse and systemic risk, (ii) liquidity management, (iii) disclosure and reporting in relation to risk profiles (including market risk, liquidity risk and counterparty risk), leverage and systemic risk, (iv) stress tests and (v) the ability of member states' competent authorities to impose limits on the level of leverage - or other restrictions - to limit the extent that leverage can contribute to the build up of systemic risk in the financial system or risks of disorderly markets, cf. AIFM Directive, recitals 2, 3, 10, and 49-51 and art. 1, 15(2)-(4), 16, 23(1)(a) and (5), 24(2), (4) and (5), and 25(3).

[8]In order to ensure, inter alia, sufficient liquidity and avoid counterparty risk, the UCITS Directive includes requirements regarding (i) eligible investments, (ii) diversification and concentration, (iii) exposures to derivatives, (iv) leverage related to derivatives as well as repos and securities lending and (v) the recalling of financial collateral under repos and securities lending entered into as a part of authorised efficient portfolio management, cf. UCITS Directive, recitals 5, 36-50 and art. 49-55, Commission Directive 2010/43/EU, art. 41, and ESMA Guidelines (2014), section X, para. 30-35. See also Commission Directive 2007/16/EC, art. 11, regarding the definition of efficient portfolio management. The UCITS Directive also imposes, inter alia, quantitative limits on leverage as it limits a UCITS' borrowing to 10% of its value, cf. UCITS Directive, art. 83(2).

[9]The MMF Regulation includes, inter alia, (i) a list of the financial assets that money market funds may - and may not - invest in (including repos and securities lending), (ii) diversification and concentration requirements, (iii) requirements regarding the credit quality of assets, (iv) maturity limitations and requirements for assets and minimum amounts of liquid assets and (v) a prohibition on external support (including liquidity guarantees) to money market funds in order to limit the risk of contagion from money market funds to the rest of the financial sector, cf. MMF Regulation, recitals 20-40 and 49 and art. 1, 9-25, 34 and 35.

[10]European Commission (2013b), p. 3, sections 2 and 3, and p. 15, and European Commission (2017b), pp. 1 and 8-9. Se also EBA Guidelines (2015), section 2.1.2, para. 13-16.

[11]MMF Regulation, recitals 3-7, COM/2013/0615 final, section 1, and European Commission (2013b), section 3.2 and p. 15.

[12]EMIR, recital 4, and European Commission (2013b), section 2.2, p. 15.

[13]EMIR, recitals 5-8 and 90, and G20 (2009b), p. 9, para. 13. EMIR introduced (i) clearing and bilateral risk-management requirements for OTC derivative contracts, (ii) reporting requirements for derivative contracts and (iii) requirements for the performance of activities of CCPs and trade repositories, cf. EMIR, art. 1(1) and titles II-IV and VI-VII.

[14]EMIR, art. 1 and title IV, chapter 3. See also ESRB (2016a), pp. 4-5, ESMA (2016), para. 25, 104 and 142, and ESRB (2017a), para. 27.

Pursuant to the shadow banking monitor in ESRB (2018), CCPs represent the largest repo liability/counterparty of euro area banks while insurance corporations and pension funds seem to be a constant - but significantly smaller - repo liability/counterparty of those banks.[15]

In addition to regulating (counterparty) credit risk, EMIR plays an essential role in the regulation of leverage as EMIR implicitly limits the leverage that entities can obtain via CCP-cleared SFTs. Similar to the FSB's numerical haircut floors framework for non-centrally cleared SFTs, the implicit leverage limitation lies in EMIR's requirements regarding margin and haircuts on financial collateral which explicitly address counterparty credit risk and also effectively limit the amount that an entity can borrow against the value of the posted financial collateral.[16] Both banks' and life insurance undertakings' CPP-cleared SFTs are accordingly subject to EMIR's requirements, which ensure a form of regulatory "equivalence" when funding and leverage is obtained via CPP-cleared SFTs.[17]

A "complete" comparison of the regulation of life insurance and the regulation of banking would entail that all market-based regulation (that targets the activities) and entity-based regulation (e.g. Solvency II and the finalised Basel III) are included to capture the regulation of both "direct" and "indirect" shadow banking.[18] Such a comparison is not viable within the limits of this dissertation. In addition, the extensive nature of Solvency II and the finalised Basel III entails that a comparison of only those two entity-based forms of regulation must be subjected to significant limitations. In order to delimit the comparison, chapter 8 presents a scenario that enables a risk-based approach for comparing Solvency II and the finalised Basel III.

[15] Pp. 44 and 64, chart 38.

[16] EMIR, art. 41 and 46, and EMIR Delegated Regulation, chapters VI and X. See chapter 13.2 in relation to how haircuts can limit SFT-based leverage.

[17] EMIR, art. 1(2).

[18] See FSB (2015c), section 3.5, regarding the definitions of market regulation and entity-based regulation.

Chapter 8

Scope and Comparison Method

As described in chapters 1 and 6, the FSB's broad definition of shadow banking includes the criterion "entities and activities outside the regular banking system" which implies focusing on credit intermediation that takes place in an environment where prudential regulatory standards and supervisory oversight are either not applied or are applied to a materially lesser or different degree than is the case for regular banks engaged in similar activities.[1] The indications of life insurance undertakings' possible shadow banking in chapter 6 above can accordingly only amount to shadow banking if the life insurance undertakings and the activities constitute such "entities and activities outside the regular banking system". In order to determine whether this is the case, and based on the implementation-related arguments in chapter 1.1, this dissertation compares Solvency II and the finalised Basel III.

However, Solvency II and the finalised Basel III constitute extensive regulatory regimes and delimitation is needed. As described in chapter 13.2, the FSB has produced the numerical haircut floors framework which states that insurance undertakings may - on an exceptional basis - be excluded if they are subject to regulatory capital and liquidity requirements and have access to central bank facilities "as appropriate".[2] The FSB's minimum standards for cash financial collateral reinvestment by securities lenders also exclude financial intermediaries if they are subject to capital requirements and requirements regarding liquidity and maturity transformation.[3] The comparison of Solvency II and the finalised Basel III should accordingly include requirements regarding capital and liquidity.

Further limitations are needed as capital requirements are used to capture many risk types, including risk types that are not associated with credit in-

[1]FSB (2011c), p. 3.
[2]FSB (2015c), p. 4 (footnote 11).
[3]FSB (2013c), section 3.1.2.

termediation and shadow banking, e.g. equity risk and insurance underwriting risk. Chapter 5 described repos, including how the FSB categorises the use of repos to create short-term and money-like liabilities (that facilitate credit growth, maturity transformation, liquidity transformation and leverage outside the reach of liquidity and capital regulation) as a pure shadow banking risk.[4] It was also described how the FSB categorises

- the tendency of repos to increase the procyclicality of leverage (due to the direct relationship between procyclical financial collateral values and the access to funding), and
- the risk of fire sales of collateral,

as risks that span both banking and shadow banking.[5] In addition, chapters 1, 6.1.1 and 14 describe how the IAIS and EIOPA associate life insurance undertakings' repos and other SFTs with liquidity risk and non-insurance that could lead to systemic risk via collective behaviour and fire sales that trigger price spirals, haircut spirals and reductions in available funding.

The shadow banking and systemic risk associated with life insurance undertakings' repo-based non-insurance activities seem to reflect the deleveraging process in Adrian and Shin (2010), the liquidity spirals of Brunnermeier and Pedersen (2009), and the "run on repo" in Gorton and Metrick (2012) that were all presented in chapter 5. When the "run on repo" is inserted as a funding problem in the liquidity spirals, it may produce a scenario that presumably reflects the views of the FSB, IAIS and EIOPA. This is done in figure 8.1 below where the liquidity spiral is in blue. The scenario enables an illustration of the associated risks which have also been inserted into the liquidity spiral. In grey, the figure also illustrates the repo (with liabilities on the left and assets on right) and the associated risk types. In addition, the direct relationship between procyclical financial collateral values and the access to repo funding (and its role in liquidity risk and deleveraging) is in red.

As shadow banking entails non-bank credit intermediation, the scenario in figure 8.1 can be limited to the regulation of credit exposures, including alternative credit investments and credit exposures that are used as financial collateral. Due to limitation issues, this dissertation will focus on credit exposures in the form of bonds and loans as well as repos, including the use of bonds as financial collateral in repos. In addition, the focus will be on exposures to sovereigns, banks and corporates. Exposures to securitisations and derivatives are generally not included as such an inclusion would add substantial layers due to, inter alia, the finalised Basel III's separate treatment of securitisations and the additional requirements for market risk on options.[6]

The specific risk types illustrated in figure 8.1 can be described via the following steps:

[4] FSB (2013c), section 1.1.

[5] FSB (2013c), section 1.2.

[6] See e.g. BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR21-23, BCBS Consol. Basel III (2019), CRE40-43 , BCBS Basel III (2016a) and BCBS Basel III (2018).

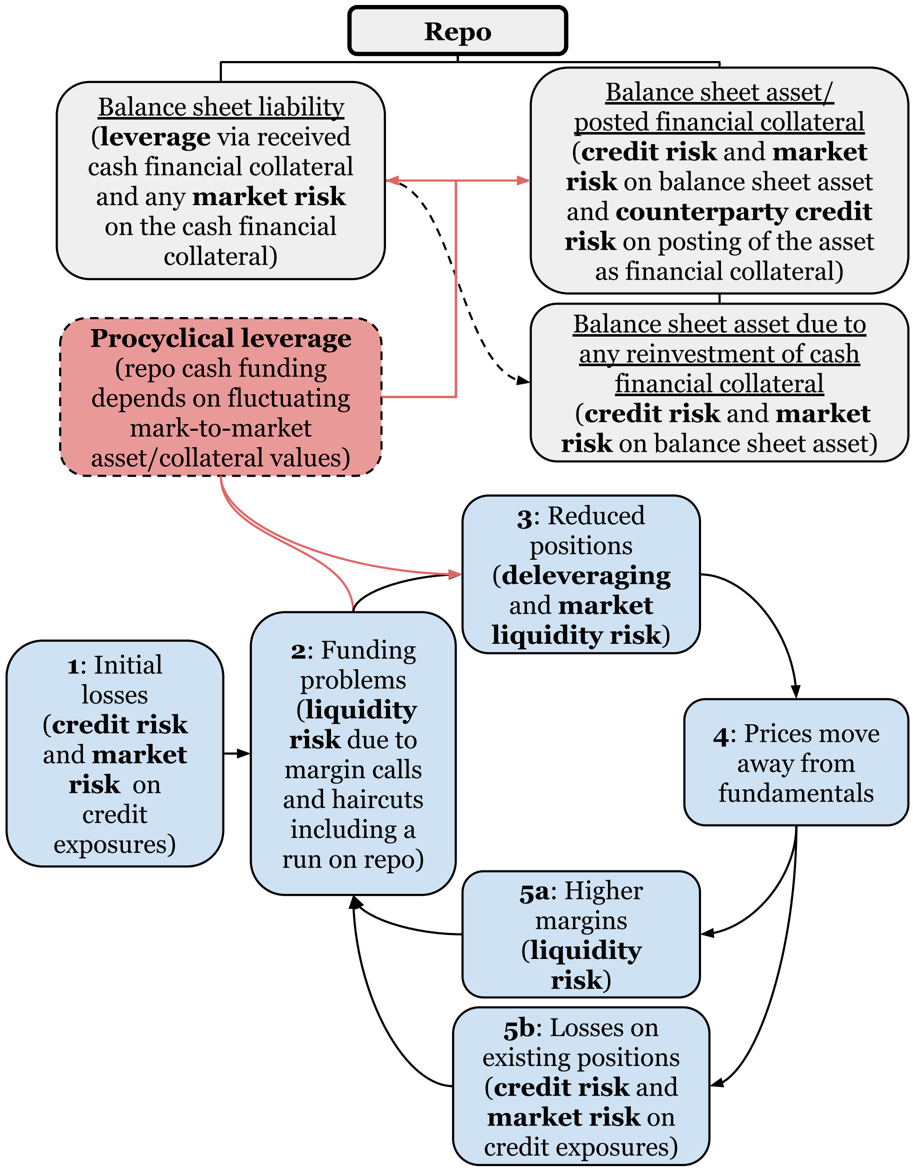

Figure 8.1: The scenario and related risks based on Brunnermeier and Pedersen (2009), Adrian and Shin (2010), Gorton and Metrick (2012), FSB (2013c), EIOPA (2017c) and IAIS (2018a).

- Step 1 (in blue): the life insurance undertaking suffers losses on balance sheet assets and the losses on (alternative) credit exposures could be due to *credit risk* and *market risk*. The differences/similarities between credit risk and market risk were described in chapter 4, and this dissertation will focus on default risk, credit spread risk and migration risk.

- Step 2: the life insurance undertaking is subject to funding problems. If the losses in step 1 are related to financial collateral, which the life insurance undertaking has posted in the repo, then *liquidity risk* and *procyclical leverage* may manifest themselves in step 2 via e.g. repayment demands, margin calls and a run on repo.

- Step 3: the life insurance undertaking is forced to delever via fire sales in order to obtain liquidity to meet non-insurance liquidity outflows due to repayment demands, margin calls or the run on repo. As the liquidity in the markets for the specific exposure may be impaired or without sufficient market depth, the life insurance undertaking may not be able to reduce the position without mark-to-market losses as it has compensate the buyer via a liquidity premium.[7] The life insurance undertaking is accordingly also exposed to *market liquidity risk*.

- Step 4: asset values are affected by the deleveraging and fire sales. This may entail entity-/activities- and collective behaviour-based sources of *systemic risk* as fire sales can trigger a decrease in asset prices and significantly disrupt trading or funding in key financial markets.[8] Due to the fire sales, step 5a entails liquidity risk (via additional margin calls and runs on repos) for entities that rely on the assets for secured funding, while step 5b entails losses for the deleveraging life insurance undertaking and entities with similar exposures, which lead to a (re-)activation of step 2.

As described in chapter 5.2, repos also entail bilateral *counterparty credit risk*, which is reflected in grey to the right in the repo in figure 8.1.

In short, based on the FSB's definition of shadow banking, chapter 1.1 defined this dissertation's overall research question as follows:

> *Does Solvency II subject life insurance undertakings' bank-like risk exposures to requirements that are similar to the finalised Basel III's requirements for banks that are exposed to similar risks?*

In line with the scenario in figure 8.1 above, this overall research question will be answered by comparing how Solvency II and finalised Basel III address the following:

- credit risk (in the form of default risk, credit spread risk and migration risk) and counterparty credit risk (see part VI).

[7] See e.g. BCBS (2008b), p. 1, footnote 2, BCBS (2012), annex 1, section 2.2.1, BCBS (2013a), p. 4 and section 3.1, and BCBS (2016), section 2.2(c).

[8] See IAIS (2018a) and EIOPA (2017c).

- liquidity risk (see part VII).
- leverage and the associated procyclicality (see part VIII).
- systemic risk (see part IX).

By relying on the scenario above, this dissertation adopts a risk-based approach that focuses on the assumed risk exposures regardless of the legal or institutional form of the activities or the entity that may perform those activities.[9] As described in chapter 1.1, this approach may be in line with the Solvency II project's initial intentions regarding banking regulation and regulatory arbitrage. The approach may also be in line with the EU's recent efforts to ensure cross-sectoral consistency, e.g. during the Solvency II review, where consistency was aimed for while considering differences in the business model of the sectors and diverging elements in the determination of capital requirements.[10] During the review, EIOPA (2018b) stated that the risks, in case of a CCP's default, were not different for insurance undertakings and banks.[11] EIOPA accordingly saw difficulties in arguing for a less restrictive approach in Solvency II and stated that changes in banking regulation should entail a review of the relevant treatment in Solvency II.[12]

The global cross-sectoral approach to systemic risk similarly supports this dissertation's risk-based approach. When developing global policy measures to address systemic risk, the IAIS cooperates with the BCBS to avoid inconsistencies that cannot be explained by the specificities of each financial sector.[13] The IAIS has e.g. considered Basel III's risk-based capital requirements, leverage limits and liquidity standards as possible elements in its approaches to systemic risk in insurance.[14]

Before conducting the risk-based comparison, part V will describe the overall structural differences between pillar 1 requirements in Solvency II and the finalised Basel III. In short, these are:

- overall capital requirements.
- risk measures and calibration.
- aggregation and diversification effects.

Due to the structural differences, the comparison of Solvency II and the finalised Basel III will not entail an application of pillar 1 requirements upon a defined scenario in order to assess the respective value differences in the calculated pillar 1 requirements. Instead, the comparison will be limited to assessing whether

[9] IAIS (2018a), para. 23, and IAIS (2017), para. 16 and 34. See also EIOPA (2012), p. 2.
[10] Commission Delegated Regulation (EU) 2019/981, recital 29, and European Commission (2016), section 3.2.8.
[11] Para. 1476.
[12] EIOPA (2018b), para. 1476 and 1488. See also para. 1511.
[13] IAIS (2017), para. 12, 22 and 25, and annex B, p. 34, and IAIS (2018a), including para. 10 and 143.
[14] IAIS (2017), para. 22.

the risk types and leverage are subject to *quantitative pillar 1 requirements*. If a quantitative pillar 1 requirement exists for the risk type in both Solvency II and the finalised Basel III, then the requirement will be regarded as "similar" and the risk type will not be viewed as being addressed to a materially lesser or different degree.

In relation to counterparty credit risk and leverage, the focus will be on repos that are *not* CCP-cleared. Chapters 7.1, 11 and 13.2 describe how EMIR's requirements regarding CCPs, margin and haircuts explicitly address counterparty credit risk and effectively limit the amount that a life insurance undertaking can borrow against the value of the posted financial collateral.[15] Both banks' and life insurance undertakings' CPP-cleared SFTs are subject to EMIR's requirements which ensure a form of regulatory "equivalence".[16]

The application of the FSB' numerical haircut floors framework and the EBA's definition of shadow banking entities both rely on the access to central bank (liquidity) facilities.[17] The access to central bank facilities does not constitute a regulatory arbitrage possibility for life insurance undertakings but it does generally constitute a part of the "lender of last resort" framework for banks.[18] However, life insurance undertakings' access to central bank facilities is not of a theoretical nature as it occurred during the financial crisis. In 2008, the Federal Reserve Bank of New York provided financial assistance to AIG when it became subject to, inter alia, runs via collateral calls on securities lending transactions and credit default swaps.[19] Due to limitation issues, life insurance undertakings' access to central bank facilities will not be included in the comparison.

This dissertation's comparison of how Solvency II and finalised Basel III address the specific risks, via pillar 1 requirements, may reveal that Solvency II's approach to a specific risk type is based on a pre-financial crisis perception of traditional life insurance that does not address shadow banking-based risks or regulatory arbitrage. However, during the Solvency II project, CEIOPS (2007a) stated that it is important to recognise that a coherent solvency framework cannot rely solely on minimum quantitative requirements.[20] CEIOPS also stated that from an insurance undertaking's perspective, it does not - and should not

[15]EMIR, art. 41 and 46, and EMIR Delegated Regulation, chapters VI and X.

[16]EMIR, art. 1(2).

[17]FSB (2015c), p. 4 (footnote 11), and EBA Guidelines (2015), section 2.1.2, para. 27.

[18]Bagehot (1892), pp. 196-199 and 204-207, stated that - in times of panic, where the Bank of England was the sole lender - the Bank of England was to advance, freely and vigorously, to the public out of the reserve, and such loans should be made at "very high" interest rates (to operate as a heavy fine) on "all good banking securities" and as largely as the public asked for them.

[19]McDonald and Paulson (2015), pp. 85-87, 93-94 and 102, and e.g. Credit Agreement dated 22 September, 2008, between American International Group and Federal Reserve Bank of New York, as well as Federal Reserve Bank of New York (2019), which describes Maiden Lane II LLC (that acquired residential mortgage-backed securities from AIG and thereby alleviated the securities lending-induced capital and liquidity pressures on AIG) and Maiden Lane III LLC (that acquired multi-sector collateralised debt obligations from AIG counterparties and thereby alleviated the CDS-induced capital and liquidity pressures on AIG).

[20]Para. 2.60.

- make a difference under which pillar certain risks are handled.[21] Accordingly, elements of all three pillars - and their interplay - had to be taken into consideration and be combined with the insurance undertaking's own assessment of risks.[22] As described in chapter 3.2, Solvency II similarly states that some risks may only be properly addressed through governance requirements rather than through the quantitative requirements in the SCR.[23] This dissertation's comparison of only pillar 1 requirements should accordingly be viewed in this light as quantitative requirements only constitute one out of three pillars in both Solvency II and the finalised Basel III.

[21] CEIOPS (2007a), para. 2.60.
[22] CEIOPS (2007a), para. 2.60 and 2.65.
[23] Solvency II, recital 29.

Part V

Structural Differences in Pillar 1 Requirements

Chapter 9

Capital, Calibration and Aggregation

In the beginning of the Solvency II project, European Commission (2001) discussed the relevance of banking rules for the insurance sector and pointed out that banking regulation, in the proposed Basel II, essentially focused on asset risk and not traditional insurance risks.[1] However, it was decided that the Solvency II project would use a Basel II-type three pillar structure as the starting point for the development of Solvency II, which was to be adapted to the needs of insurance.[2]

Solvency II and the finalised Basel III are accordingly based on the following pillars:

- pillar 1 - quantitative requirements, including capital requirements,
- pillar 2 - qualitative requirements, including the supervisory review and risk management, and
- pillar 3 - disclosure and reporting to supervisory authorities.[3]

However, an overall challenge to the comparison of quantitative pillar 1 requirements is that Solvency II reflects the "needs" of insurance. During the recent Solvency II review, EIOPA (2018b) stated that a stand-alone comparison of transaction-based capital requirements in Solvency II and CRR (that did not reflect the entire finalised Basel III) may not be "very meaningful" as the overall designs of the capital requirements are "very different".[4] This chapter will

[1] Section 1 and para. 19-21.

[2] See e.g. European Commission (2003), para. 7, European Commission (2004c), p. 3, European Commission (2004a), p. 2, European Commission (2004b), p. 2, European Commission (2005), p. 2, and European Commission (2006), para. 2.

[3] Basel III, para. 7, Basel II, para. 4 and 11, p. 6 and parts 2, 3 and 4, Solvency II, including title I, chapters III-VI, Solvency II Proposal, section 5(a), (b) and (d), and European Commission (2015b), section 2.

[4] EIOPA (2018b), para. 1513. See also European Commission (2015b), section 9.

therefore identify the relevant "structural" differences in pillar 1 requirements and describe how these differences make both overall and transaction-based pillar 1 capital requirements non-comparable.

In its call for advice during the Solvency II project, European Commission (2004d) discussed the development of a mathematical model that would capture insurance undertakings' major risk exposures and which could be calibrated.[5] The European Commission stated that the main parameters to be chosen in the calibration of the model were the risk measure (a "percentile" or the "probability of ruin") and the time horizon.[6] As a starting point, an analysis was to be made of a capital requirement that captured the relevant risks and was calibrated to a 1/200 probability of ruin within one year.[7] In addition, when the different risks were to be aggregated, their dependencies were to be analysed in order to decide how correlation effects were to be taken into account.[8] Based on a lack of correlation between risk factors, as described in chapter 9.4 below, diversification effects generally entail a reduction in overall capital requirements when risk factor-based capital requirements are aggregated to produce a portfolio-level capital requirement.[9]

The European Commission's approach above reflects two overall and fundamental differences between Solvency II and the finalised Basel III:

- the chosen risk measures, and
- the aggregation of capital requirements for specific risk types.

The following chapters will firstly describe the overall and aggregated capital requirements in the finalised Basel III and Solvency II whereafter the differences in risk measures and calibration, as well as the aggregation of risk factor-level capital requirements, are described. As stated in chapter 8 above, the overall structural differences entail that the comparisons in parts VI-IX will be limited to assessing whether the specific risk type is subject to quantitative pillar 1 requirements.

9.1 The Finalised Basel III's Banking Book, Trading Book, Total Capital Ratio and Buffers

As shown in this chapter and chapter 10 below, the Basel framework's banking book and trading book have traditionally entailed fundamentally different approaches to credit risk and market risk. Solvency II's treatment of default risk and credit spread risk was initially developed in the light of Basel II and viewed as aligned with Basel II's banking book and trading book. However, it will be

[5] Section 4.1.
[6] European Commission (2004d), section 4.1 and 4.3.
[7] European Commission (2004d), section 4.1 and 4.3-4.4.
[8] European Commission (2004d), section 4.4.
[9] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR10.22, and Solvency II, art. 13(37). See also CEIOPS (2005b), para. 10.44 and 10.138-139, regarding diversification.

shown how the finalised Basel III changed the approaches for capturing default risk, credit spread risk and migration risk in the trading book.

Basel I, the first Basel framework from 1988, primarily addressed credit risk (i.e. default risk).[10] Basel I included an 8% target standard ratio of capital to risk-weighted assets for international banks.[11] Capital adequacy was based on the "risk-weight approach" where assets (and certain off-balance sheet exposures) are weighted according to their "riskiness".[12] BCBS (1996) amended Basel I by adding capital requirements for market risk.[13] The market risk capital requirement applied to the current market value (or marked-to-market value) of positions in banks' "trading books" and included, inter alia, debt instruments and equities.[14] The introduction of the market risk capital requirement led to the distinction between (i) trading book positions that were subject to the market risk capital requirements and (ii) non-trading book positions (or "normal banking activities") in the "banking book" which were subject to Basel I's credit risk capital requirements.[15] The trading book's market risk capital requirement was an additional capital requirement that was calculated separately from the banking book's credit risk capital requirement.[16] As described in chapter 9.3.2 below, the introduction of the trading book occurred during a period where trading book positions were relatively simple risk positions, which were traded in liquid markets, and it was implicitly assumed that trading book exposures could be exited or hedged within a 10 day horizon.[17]

Basel II revised Basel I and introduced the three pillar structure as well as, inter alia, supplemented credit risk capital requirements (in the banking book) and market risk capital requirements (in the trading book) with a capital requirement for operational risk.[18]

While building on the three pillars of Basel II, the finalised Basel III maintains a minimum total capital ratio of 8% of the total risk-weighted assets that are defined below.[19] However, the finalised Basel III redefines the boundary between the banking book and trading book as Basel II's trading intent-based

[10] Basel I, para. 8 and 31.

[11] Basel I, para. 44.

[12] Basel I, para. 28. As examples, claims on central governments and central banks (denominated in national currency) were assigned a 0% risk weight, while claims on banks (incorporated in the OECD) were assigned a 20% risk weight, cf. Basel I, annex 2.

[13] Section I, para. 1.

[14] BCBS (1996), section I, para. 1, 2 and 5 and part A.1, para. 1.

[15] BCBS (1996), section I, para. 1-4.

[16] BCBS (1996), section I, para. 1. The total capital ratio's numerator was certain eligible capital while the denominator became the sum of (i) the sum of risk-weighted assets in the banking book and (ii) the measure of market risk in the trading book multiplied by 12.5, cf. BCBS (1996), section II, para. 3. The reciprocal of a minimum capital ratio of 8% is 12.5 (i.e. 100/8). This multiplication ensured consistency in the capital requirements for credit risk (in the banking book) and market risk (in the trading book).

[17] BCBS (2012), section 2.3 and annex 1, sections 1 and 2.1.1, BCBS (2013a), p. 4, and BCBS (2019b), section 2.3(b).

[18] Basel II, para. 4, 5, 9, 11 and 19(i) and p. 6 and parts 2-4.

[19] BCBS Consol. Basel III (2019), RBC20.1, BCBS Basel III (2017), Output floor, para. 2, and Basel III, para. 7 and 50.

boundary was deemed "inherently subjective" and susceptible to arbitrage.[20] Depending on the Basel II-defined trading intent, a credit exposure could be placed in the trading book or banking book and boundary arbitrage consisted of exposures being moved between the banking book and trading book in order to achieve lower capital requirements, e.g. the allocation of exposures to the trading book, before the financial crisis, and migration of exposures to the banking book during the financial crisis.[21] During the "fundamental review of the trading book", the BCBS considered the removal of the boundary between the trading book and banking book but kept it for practical reasons as a removal would entail a fundamental reconsideration of the credit risk capital requirements for the banking book.[22]

The finalised Basel III defines market risk as the risk of losses in on- and off-balance sheet risk positions arising from movements in market prices.[23] Exposures in the trading book are subject to daily "fair value" valuations and any valuation changes must be recognised in a profit and loss account.[24] The redefined boundary entails, inter alia, criteria[25] for the allocation of exposures to the trading book as well as that certain exposures are generally presumed to be trading book exposures or automatically allocated to the trading book or banking book.[26] The banking book comprises all instruments that are not in the trading book and all other assets of the bank.[27] In addition, the transfer of exposures between the trading book and banking book has become subject to restrictions, a prohibition on regulatory arbitrage, and a pillar 1 capital requirement equal to any reduction of capital requirements due to a transfer.[28]

During liquid and (very) short-term horizons, trading book exposure defaults are viewed as idiosyncratic and negligible in a well-diversified portfolio.[29] Instead, a well-diversified portfolio of liquid trading book exposures is - over a short-term horizon - associated with market risk due to mark-to-market changes in the value of the portfolio exposures.[30] As described in chapter 4, such mark-to-market changes may be changes in the discounted present value of an exposure due to credit spread risk and interest rate risk.[31] However, the longer the exposure horizon, the more non-diversifiable systematic risk and default risk

[20] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), RBC25, BCBS (2019b), sections 2.1, 2.3 and 3.1, and BCBS (2012), p. 2, sections 1.1 and 2.3, and annex 1, section 2.1.1.

[21] Basel II, para. 683(i), 685 and 687, BCBS (2012), p. 2 and sections 1.1, 2.3 and 3.1, and annex 1, section 2.1.1, and BCBS (2019b), sections 2.1 and 2.3,

[22] BCBS (2012), p. 2 and section 3.1.

[23] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR10.1 and MAR11.1.

[24] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), RBC25.4.

[25] I.e. purposes in the form of (i) short-term resale, (ii) profiting from short-term price movements, (iii) locking in arbitrage profits, or (iv) hedging risks arising from instruments meeting the purposes in (i)-(iii), cf. BCBS Basel III (2019)/BCBS Consol. Basel III (2019), RBC25.5.

[26] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), RBC25.5-10.

[27] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), RBC20.5 and RBC25, including 25.1 and 25.7-8.

[28] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), RBC25.14-16.

[29] BCBS (2009b), pp. 2 and 8 and section 4.

[30] BCBS (2009b), section 4.

[31] See e.g. BCBS (2009b), section 2.

are perceived to increase.[32] Changes in market liquidity may accordingly lead a liquid trading book exposure (primarily exposed to market risk) to become a "held-to-maturity position" that is dominated by default risk and similar to a banking book exposure.[33]

During the financial crisis, arbitrage between the trading book and banking book was also related to market liquidity risk as some banks moved trading book exposures to the banking book when they became illiquid and subject to mark-to-market losses.[34] Contrary to the initial perception of the liquidity of trading book exposures, banks' trading books included large (structured) credit exposures that became illiquid as well as subject to default risk and substantial mark-to-market losses.[35] Basel II's internal models approach for market risk did not capture the credit risk (in the form of default risk and credit migration risk) or market liquidity risk associated with those trading book positions.[36] As shown in chapter 10.6 below, this aspect led the finalised Basel III's trading book to explicitly capture default risk, via a separate default risk capital requirement, and market liquidity risk via liquidity horizons for market risk factors.[37] The default risk capital requirement is consistent with - or calibrated in accordance with - the banking book's credit risk capital requirement in order to reduce discrepancy in capital requirements for similar risk exposures.[38]

As shown to the left in figure 9.1 below, the finalised Basel III accordingly "dilutes" the traditional distinction between credit risk and market risk capital requirements as it captures default risk explicitly in both the banking book and trading book. This aspect is included in chapters 9.2 and 10 below, which show how Solvency II was developed in the light of Basel II and referred to the separation of default risk (in the banking book) and market risk (in the trading book) when deciding to apply a spread risk capital requirement upon bonds and loans.[39]

CVA risk - the market price of counterparty credit risk - was a greater source of losses on OTC derivatives than losses due to outright counterparty defaults during the financial crisis.[40] While Basel II captured counterparty credit risk, it did not capture CVA risk.[41] The finalised Basel III's capital requirements for market risk accordingly include a capital requirement for CVA risk (in addition

[32] BCBS (2009b), pp. 2 and 8 and section 4.

[33] BCBS (2009b), p. 8 and section 4.

[34] BCBS (2012), annex 1, sections 2.1.1 and 2.2.1.

[35] BCBS (2019b), section 2.3(b) and (c), BCBS (2012), p. 3, sections 2.1 and 3.3, and annex 1, section 2.2.1, BCBS (2013a), section 1.3, BCBS (2009c), para. 1, BCBS (2009d), para. 3, and BCBS (2009b), pp. 8, 16 (footnote 28) and 18.

[36] BCBS (2019b), section 2.3(b) and (c), and BCBS (2012), sections 1.2 and 2.1, and annex 1, section 2.2.1.

[37] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR10.20, MAR21 (including 21.40), MAR22 and MAR33 (including 33.4, 33.12, 33.16 and 33.18-39.). See also BCBS (2019b), section 3.2(ii), and BCBS (2013a), p. 11.

[38] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR20.4(2) and MAR33.18-21. See also BCBS (2013a), pp. 11 and 30.

[39] See CEIOPS (2007a), para. 5.83, and CEIOPS (2007d), para. 1.1.

[40] Basel III, para. 14(b), and BCBS (2015b), p. 1.

[41] Basel III, para. 14(b), BCBS (2015b), p. 1, and Basel II, e.g. para. 52.

to capital requirements for counterparty credit risk exposures in the banking book and trading book) that apply primarily to derivatives but also to SFTs that are fair-valued for accounting purposes.[42] However, derivative transactions with CCPs and other SFTs are not subject to the capital requirement for CVA risk.[43]

In addition to the above, the financial crisis entailed a loss of confidence in risk-weighted capital ratios due to a variability in risk-weighted assets and capital ratios reported under internal approaches and methods for calculating risk-weighted assets.[44] As illustrated in figure 9.1, the finalised Basel III's total risk-weighted assets are therefore subject to an output floor and are the sum of the following three components:

- *risk-weighted assets for credit risk* - which are the sum of (i) risk-weighted assets for credit risk on banking book exposures, (ii) risk-weighted assets for counterparty credit risk on banking book exposures and trading book exposures, (iii) risk-weighted assets for equity investments in funds that are held in the banking book, (iv) risk-weighted assets for securitisation exposures in the banking book, (v) risk-weighted assets for exposures to CCPs in the banking book and trading book and (vi) risk-weighted assets for the risk posed by unsettled transactions and failed trades in the banking book and trading book.[45]

- 12.5[46] multiplied by the *risk-weighted assets for market risk* (which are the sum of (i) risk-weighted assets for market risk on exposures in the trading book and for foreign exchange risk and commodities risk for exposures in the banking book and (ii) risk-weighted assets for CVA risk in the banking book and trading book).[47]

- 12.5 multiplied by the *risk-weighted assets for operational risk*.[48]

The finalised Basel III's minimum capital requirement can accordingly be summarised as:

[42] BCBS Consol. Basel III (2019), RBC20.6(2) and 20.9(2) and MAR50.2 and 50.5(2), BCBS Basel III (2017), Minimum capital requirements for CVA risk, para. 1-3, and Basel III, para. 14(b) and 99.

[43] BCBS Consol. Basel III (2019), MAR50.5, and BCBS Basel III (2017), Minimum capital requirements for CVA risk, para. 3, and Basel III, para. 14(b) and 99.

[44] BCBS Consol. Basel III (2019), RCB20.11, and BCBS Basel III (2017), Introduction, para. 2, and Output floor, para. 1.

[45] BCBS Consol. Basel III (2019), RCB20, including 20.1, 20.4 and 20.6-8.

[46] The reciprocal of a minimum capital ratio of 8% is 12.5 (i.e. 100/8). This multiplication ensured consistency in the capital requirements for credit risk (in the banking book) and market risk (in the trading book), cf. BCBS (1996), section II, para. 3, and Basel II, para. 44.

[47] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), RCB20 (including 20.1, 20.4, 20.9), MAR20.1, MAR33.46 and MAR50.1.

[48] BCBS Consol. Basel III (2019), RCB20 (including 20.1, 20.4 and 20.10) and OPE25, including 25.2. See also BCBS Basel III (2017), Minimum capital requirements for operational risk, para. 13 (footnote 5).

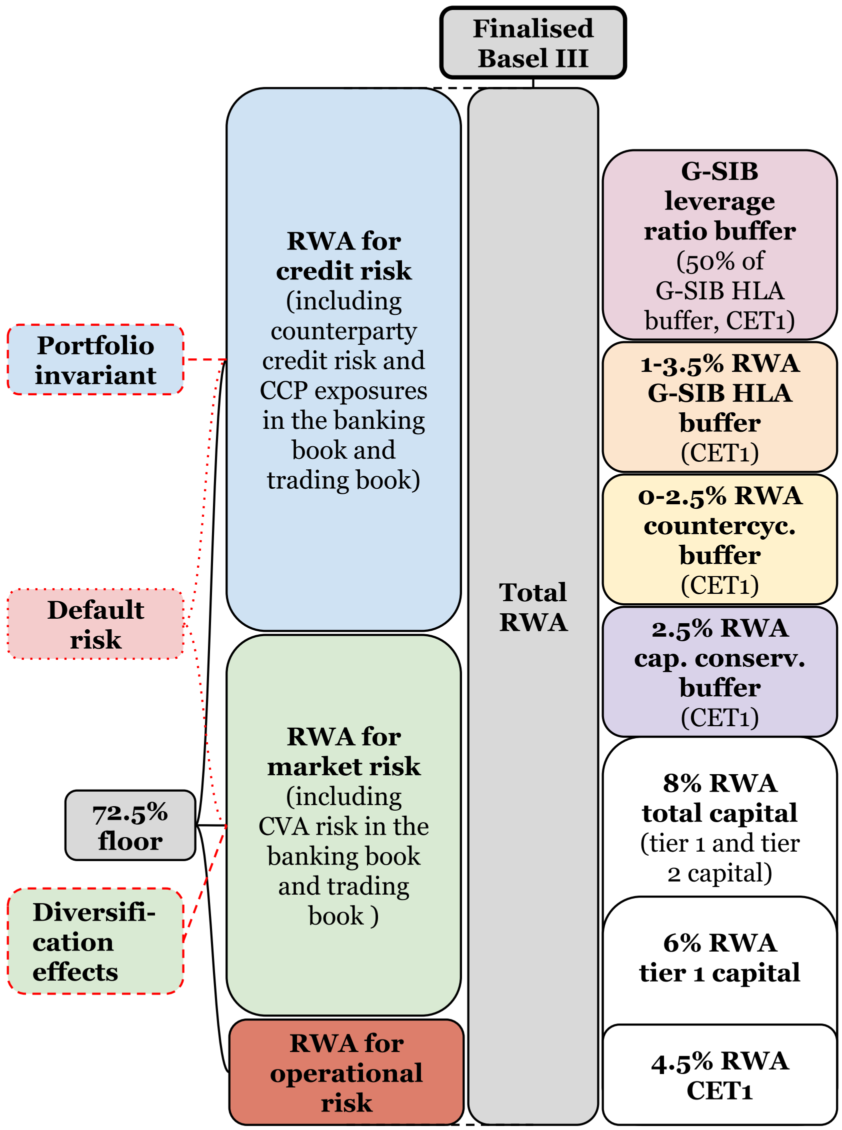

Figure 9.1: Simplified non-scaled illustration of the finalised Basel III's total risk-weighted assets ("RWA") and components of regulatory capital, including common equity tier 1 ("CET1"), buffers and higher loss absorbency ("HLA") requirement.

$$8\% \leq \frac{TotalCapital}{RWA_{credit} + RWA_{market} * 12.5 + RWA_{operational} * 12.5}$$

The output floor entails that total risk-weighted assets are the higher of

- the total risk-weighted assets calculated using the approaches that the bank is allowed to use (including the standardised approaches and internal approaches that are described in chapter 10), and
- 72.5% of total risk-weighted assets that are calculated via *only* standardised approaches (i.e. 72.5% of an output floor base).[49]

The output floor is to ensure that capital requirements do not fall below a certain percentage of the finalised Basel III's standardised approaches-based capital requirements and to maintain a level playing field between banks that use internal approaches and banks that use the standardised approaches.[50]

Obviously, the minimum capital requirement includes items that are not relevant for this dissertation's scope. In relation to the comparison of pilar 1 capital requirements for credit risk and counterparty credit risk in part VI, the relevant items are as follows:

- On-balance sheet financial collateral and reinvestment into credit exposures can entail exposures to credit risk in the banking book or market risk in the trading book. In line with this dissertation's scope, the relevant items in the *risk-weighted assets for credit risk* are risk-weighted assets for credit risk on banking book exposures while the relevant item of *risk-weighted assets for market risk* is risk-weighted assets for market risk on exposures in the trading book.
- Repos can be placed - and give rise to counterparty credit risk - in either the banking book or trading book. In line with the scope, the relevant item of *risk-weighted assets for credit risk* are risk-weighted assets for counterparty credit risk on banking book exposures and trading book exposures.

These items will accordingly be included in the comparison of how the finalised Basel III and Solvency II approach credit risk and counterparty credit risk.

Solvency II's own funds requirements were briefly described in chapter 6.3.2. As reflected to the right in figure 9.1 above, the finalised Basel III's total capital - in the amount of at least 8.0% of risk-weighted assets - consists of the sum of tier 1 capital and tier 2 capital.[51] Basel III amended the allowed components

[49] BCBS Consol. Basel III (2019), RBC20.4 and 20.11. See also BCBS Basel III (2017), Output floor, para. 4 and 6.

[50] BCBS Consol. Basel III (2019), RBC20.11, BCBS Basel III (2017), Output floor, para. 1, and BCBS (2017), p. 11. See also BCBS (2014b), section 1.2.

[51] BCBS Consol. Basel III (2019), RBC20.1 and CAP10, Basel III, para. 50, and BCBS Basel III (2017), Output floor, para. 2. Basel III phased out tier 1 hybrid capital instruments with redemption incentives and eliminated tier 3 capital that could only be used to cover market risk, cf. Basel III, para. 9.

of regulatory capital and ensured that tier 1 capital (which has to be at least 6.0% of risk-weighted assets) was predominantly common equity tier 1 (which has to be at least 4.5% of risk-weighted assets) while additional tier 1 (i.e. the remaining tier 1 capital base) must be comprised of, inter alia, paid-in, unsecured and perpetual instruments that (i) have full discretion to - at all times - cancel dividends or coupons and (ii) are subordinated to depositors, general creditors and subordinated debt of the bank.[52] Any tier 2 capital is to provide loss absorption on a gone-concern basis and, inter alia, be paid-in, unsecured and subordinated to depositors and general creditors of the bank as well as have a minimum original maturity of at least five years.[53]

In addition to the total capital ratio of 8%, and as shown to the right in figure 9.1 above, the finalised Basel III includes

- the capital conservation buffer to ensure that banks build up capital buffers outside periods of stress.[54] The capital conservation buffer amounts to 2.5% of risk-weighted assets and must be made up of common equity tier 1 that is separate from, and in addition to, common equity tier 1 used in the total capital ratio.[55]

- that banks may be subject to a countercyclical buffer that varies between 0 and 2.5% of risk-weighted assets and is made up of common equity tier 1.[56]

- that G-SIBs are subject to a higher loss absorbency requirement of 1 to 3.5% of risk weighted-assets, which is to be met with common equity tier 1.[57] This approach to systemic risk is compared to the treatment of G-SIIs in chapter 14.

- that G-SIBs are subject to a leverage ratio buffer requirement that must be met with tier 1 capital.[58] The leverage ratio buffer is set at 50% of the G-SIB's higher-loss absorbency requirement.[59]

The capital requirements in the finalised Basel III are accordingly linked to the total risk-weighted assets. As shown to the left in figure 9.1 above, the risk-

[52] Basel III, para. 8-10 and Part 1, including para. 49, 50, 54 and 55, BCBS Consol. Basel III (2019), RBC20.1 and CAP10.9-11.

[53] Basel III, para. 49(2) and 58, and BCBS Consol. Basel III (2019), RBC20.1 and CAP10.1 and 10.16.

[54] BCBS Consol. Basel III (2019), RBC30.1-5, and Basel III, Part 1.III.

[55] BCBS Consol. Basel III (2019), RBC30.2, and Basel III, para. 129.

[56] BCBS Consol. Basel III (2019), RBC30.6-23, and Basel III, A.4 and Part I.IV, including para. 142.

[57] BCBS Consol. Basel III (2019), RBC40 (including 40.1 and 40.4), Basel III, A.5, and BCBS (2018), including para. 46. See also FSB (2010b), section II.

[58] BCBS Consol. Basel III (2019), LEV40.1 and LEV90.1, and BCBS Basel III (2017), Leverage ratio, para. 8 and 14.

[59] BCBS Consol. Basel III (2019), LEV40.2, and BCBS Basel III (2017), Leverage ratio, para. 9.

weighted assets for credit risk, in the banking book, are portfolio invariant[60] (or stand-alone) while risk-weighted assets for market risk, in the trading book, are portfolio-based and include diversification effects during aggregation of risk factor-based capital requirements.[61] As shown in chapter 9.4 below, this makes a comparison of risk-weighted assets for credit risk fundamentally different from Solvency II's SCR standard formula, which includes capital requirements for credit risk and diversification effects during aggregation. Chapter 9.4 will also show how risk-weighted assets for market risk are aggregated in a fundamentally different fashion than in Solvency II's SCR standard formula. The finalised Basel III's revised standardised approach and revised internal models approach both recognise diversification benefits, between risk factors, when aggregating risk factor-based capital requirements to produce the overall capital requirement for market risk in the trading book.[62]

In short, the finalised Basel III's minimum capital requirements are accordingly based on total risk-weighted assets which include, inter alia, the sum of:

- risk-weighted assets for credit risk in the banking book that are portfolio invariant.
- risk-weighted assets for market risk in the trading book that include diversification effects and capture default risk (via a separate default risk capital requirement) and market liquidity risk (via liquidity horizons).
- risk-weighted assets for operational risk.

The aggregation of these three items does not include diversification effects. Solvency II's own funds requirements are based on the SCR, which - as described next - constitutes a single risk measure that recognises diversification effects and does not include a trading book or banking book.

9.2 Solvency II's SCR, Total Balance Sheet Approach and Different Approach to Credit Risk and Market Risk

In the Solvency II project's first wave of advice to the European Commission, CEIOPS (2005a) stated that the standardised approach for credit risk in CRD (which implemented Basel II into EU law) was to be considered and that consistency with banking regulation was important.[63] However, CEIOPS also stated

[60] BCBS (2005), section 3, defined portfolio invariance, in the IRB approach to credit risk, as where a capital requirement only depends on the risk of an exposure and not on the portfolio it is added to.

[61] BCBS (2012), annex 1, section 2.1.1, which describes the difference in Basel II's credit risk capital requirements and market risk capital requirement.

[62] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), e.g. MAR20.4(1)(d), MAR21.4 and. 21.54-57, and MAR33.10 and 33.16(2).

[63] Para. 88. See also para. 86 and 89 as well as CRD, recital 37.

that the overriding consideration was whether the treatment of insurance undertakings' assets was adequate in view of their liabilities and risk profile.[64] CEIOPS proposed that the SCR should apply to *all assets and liabilities* and be sensitive to the combined effects of investment risk and asset-liability mismatching as well as address the types of risk where material correlation effects could be expected between assets and liabilities.[65] Subsequently, in the second wave of advice, CEIOPS (2005b) stated that asset-liability mismatch risk was significant in life insurance and that such asset-liability mismatch risk could manifest itself through the main risk exposures of insurance undertakings.[66] CEIOPS accordingly proposed that the "quantifiable aspects" of the asset-liability mismatch risk were addressed via the SCR in pillar 1.[67] Similarly, in relation to the treatment of market risk in a standard formula, CEIOPS recommended that assets and liabilities should be considered simultaneously whenever movements in market prices affected both of them.[68] It was accordingly recommended that the main components of market risk were addressed and that this could be done via stress tests, which were shock-based changes in risk factors that were reflected in a change of available capital.[69]

CEIOPS' advice accordingly entailed that Solvency II was to reflect the whole balance sheet and capture the risks associated with both assets and liabilities - and their interaction - in pillar 1 capital requirements.[70] In line with the advice, Solvency II's SCR is based on an *economic valuation of the whole balance sheet*, which is also known as the "total balance sheet approach".[71] At level 1, Solvency II's general provisions for the SCR provide that the SCR must correspond to the VaR of the basic own funds, subject to a confidence level of 99.5% over a one-year period, and be calibrated to ensure that all quantifiable risks are taken into account.[72] The general provisions for the SCR also prescribe that the SCR must cover *at least*

- non-life underwriting risk,
- life underwriting risk,
- health underwriting risk,
- market risk - the risk of loss or of adverse change in the financial situation resulting, directly or indirectly, from fluctuations in the level and in the volatility of market prices of *assets*, *liabilities* and financial instruments,

[64] CEIOPS (2005a), para. 88.
[65] CEIOPS (2005a), para. 105 and 109.
[66] Para. 10.23, 10.25, and 10.26.
[67] CEIOPS (2005b), para. 10.26 and 10.31.
[68] CEIOPS (2005b), para. 10.156.
[69] CEIOPS (2005b), para. 10.84, 10.86, 10.156 and 10.157.
[70] See also European Commission (2001), section 1 and para. 19-21.
[71] Solvency II, recital 45. See also IAIS (2018b), ICP 17 (para. 17.1) and IAIS (2018c), para. 85 (footnote 13).
[72] Solvency II, art. 101(3)

- credit risk - the risk of loss or of adverse change in the financial situation, resulting from fluctuations in the credit standing of issuers of securities, counterparties and any debtors, and
- operational risk.[73]

Solvency II's SCR accordingly captures both liability risk and asset risk, including credit risk and market risk, via a single aggregated VaR that is described in chapter 9.3 below. Chapter 9.1 above showed how the finalised Basel III bases capital requirements on *risk-weighted assets*, including the separated risk-weighted assets for credit risk and risk-weighted assets for market risk.

The SCR is to cover credit risk and market risk but Solvency II does not include a banking book or a trading book. Solvency II's definition of credit risk explicitly includes "counterparty default risk", "spread risk" and "market risk concentrations".[74] As illustrated in figure 9.2, the basic SCR (in the SCR standard formula) has, *inter alia*,

- the *counterparty default risk module*, which is to reflect possible losses due to unexpected default, or deterioration in the credit standing, of the counterparties and debtors over the following 12 months.[75]
- the market risk module's *spread risk sub-module*, which is to capture the sensitivity of the values of assets, liabilities and financial instruments to changes in the level or in the volatility of credit spreads over the risk-free interest rate term structure.[76]
- the market risk module's *market risk concentrations sub-module*, which is to capture additional risks stemming either from a lack of diversification in the asset portfolio or from large exposure to default risk by a single issuer of securities or a group of related issuers.[77]

As also discussed above in chapter 4, Solvency II's definition of credit risk accordingly captures but default risk and market risk. In terms of market risk factors, the inclusion of spread risk - in the market risk module - bears similarities with the inclusion of credit spread risk as a risk factor in the finalised Basel III's risk-weighted assets for market risk.[78] However, in the finalised Basel III, a credit exposure (e.g. a bond or loan) is to be allocated to the banking book or trading book and be subject to default risk capital requirements in the banking book or explicit capital requirements for both credit spread risk and default risk in the trading book.[79] This is also illustrated to the left in figure 9.2.

Chapter 10.3.1 describes the interaction between Solvency II's spread risk sub-module and the counterparty default risk module, including the distinction

[73] Solvency II, art. 101(4) and 13(31)-(32).
[74] Solvency II, art. 13(32).
[75] Solvency II, art. 103(a), 104(1)(e) and 105(6).
[76] Solvency II, art. 103(a), 104(1)(d) and 105(5)(d).
[77] Solvency II, art. 103(a), 104(1)(d) and 105(5)(f).
[78] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR21.1(1), and MAR31.3.
[79] See chapters 9.1 and 10.

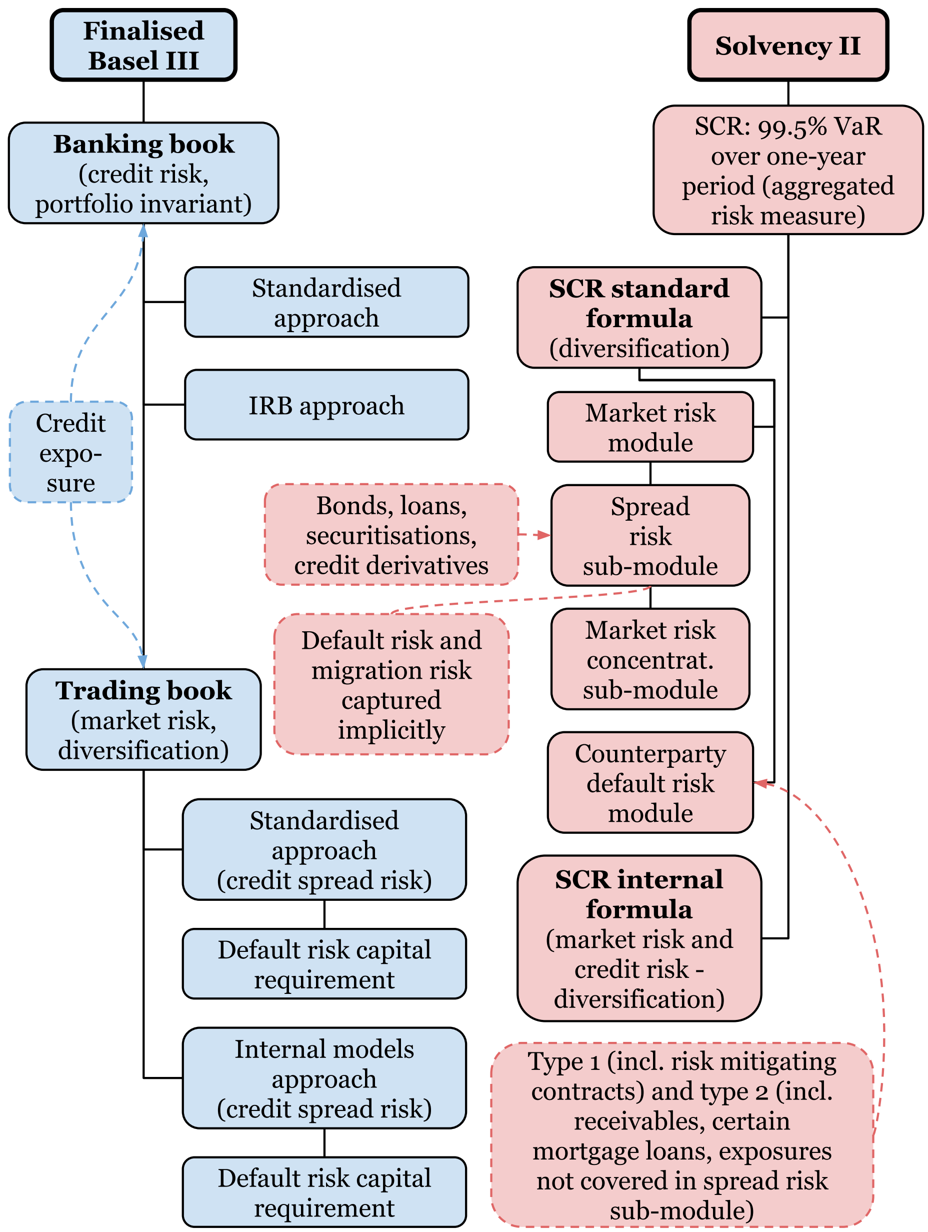

Figure 9.2: An illustration of the different approaches to the components of credit risk.

between type 1 and type 2 exposures. As illustrated in figure 9.2, the spread risk sub-module captures

- spread risk on *bonds and loans* (other than residential mortgage loans that meet prescribed requirements),
- spread risk on *securitisation positions,* and
- spread risk on *credit derivatives.*[80]

The counterparty default risk module captures, inter alia, *risk-mitigating contracts*[81], *receivables* and *any other credit exposures* that are not covered in the spread risk sub-module, including certain residential mortgage loans that are type 2 exposures and meet prescribed requirements.[82] However, mortgage loans, which do not meet the prescribed requirements, are not subject to the counterparty default risk module.[83]

The allocation of a credit exposure to a specific Solvency II risk module is accordingly based on the exposure type. Regardless of the life insurance undertaking's intended exposure period or the liquidity of the exposure, Solvency II subjects bonds and loans to spread risk capital requirements while e.g. the residential mortgage loans (that meet the prescribed requirements) are subject to default risk capital requirements. However, similar to the daily fair values in the finalised Basel III's trading book, Solvency II includes a "market consistent" valuation approach which provides that assets are to be valued at the amount for which they could be exchanged between knowledgeable willing parties, in an arm's length transaction, and level 2 provides a valuation hierarchy where the default valuation method is quoted market prices in active markets for the same assets.[84]

Part VI conducts a detailed comparison of the treatment of credit risk and counterparty credit risk in Solvency II and the finalised Basel III. When doing so, the logic behind the spread risk sub-module and counterparty default risk module as well as divergence from banking regulation will be identified. It can be noted that market risk is generally the greatest risk type exposure of Danish life insurance undertakings while counterparty default risk is one of the smallest.[85]

In relation to bonds and loans, which are placed in the significant market risk module, Solvency II seems to apply a Basel II-like trading book approach where bonds and loans are marked-to-market and subject to spread risk capital requirements regardless of the intended exposure period or the liquidity of the

[80] Solvency II Delegated Regulation, title I, chapter V, section 5, subsection 5, including art. 175-179.

[81] Including reinsurance arrangements, special purpose vehicles, insurance securitisations and derivatives.

[82] Solvency II, art. 105(6) and Solvency II Delegated Regulation, art. 189(1), (2)(a), (3)(a) and (c), (6)(a) and (d), and 191. See also EIOPA (2014c), section 7.

[83] Solvency II Delegated Regulation, art. 189(6)(d).

[84] Solvency II, recital 45 and art. 75, and Solvency II Delegated Regulation, recital 7 and art. 10(2).

[85] Danish FSA (2018b), p. 5, regarding the risk exposures of Danish life insurance undertakings in 2016 and 2017.

bond or loan. However, as described next in chapter 9.3, Solvency II's SCR must correspond to the 99.5% VaR over a *one-year period* which entails that the actual calibration of spread risk capital requirements may reflect credit risk over a longer exposure period than the traditional trading book.[86] In addition, chapter 10.3 will show how Solvency II's spread risk sub-module captures default risk and migration risk *implicitly* via the *one-year 99.5%* VaR calibration of the applied spread risk stress factors.[87] However, as also described in the next chapter and chapter 10, the finalised Basel III subjects credit exposures to *explicit one-year 99.9%* VaR-calibrated default risk capital requirements regardless of whether they are placed in the banking book or trading book.

9.3 Differences in Risk Measures and Calibrations

This chapter will firstly describe the basic elements of a loss distribution and the risk measure Value-at-Risk ("VaR"). Subsequently, Solvency II's and the finalised Basel III's risk measures will be compared in order to determine how pillar 1 capital requirements are calibrated for specific risk types.

In its advice to the European Commission during the Solvency II project, CEIOPS described how the changes in the level of a life insurance undertaking's available capital (i.e. excess of assets over liabilities) will depend on the time horizon and the risk exposures of both assets and liabilities.[88] As the future level of available capital is a random or stochastic[89] variable, CEIOPS discussed how the future level could be described by a probability distribution[90] that measures the likelihood of all possible outcomes.[91] As illustrated in figure 9.3, a probability distribution can be described via four "moments"[92]:

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[86] Solvency II, art. 101(3) and 104(4).

[87] EIOPA (2014c), section 2.5. See also CEIOPS (2009a), para. 4.70 and 4.84, CEIOPS (2010c), para. 3.179, and CEIOPS (2010a), para. 4.118.

[88] CEIOPS (2005b), para. 10.4, and CEIOPS (2006b), para. 9.

[89] In statistical terms, a random variable (X) is a variable whose future values (x) are stochastic (i.e. unknown/uncertain), cf. Alexander (2008a), pp. 71 and 75. Stochastic is derived from "stochazesthai" (the art of guessing) or "stochastikos" (skilled at aiming), cf. McNiel et al. (2015), p. 5.

[90] Solvency II, art. 13(38), defines a "probability distribution forecast" as a mathematical function that assigns - to an exhaustive set of mutually exclusive future events - a probability of realisation. The future level of a life insurance undertaking's available capital is a continuous random variable (X) as it can take any value (x) within a range of real numbers, cf. Alexander (2008a), pp. 71 and 75-76, CEIOPS (2005b), para. 10.4 and 10.5, and CEIOPS (2006b), para. 9-10. The nature of a continuous random variable (X) entails that probability assessments of possible values (x) are limited to intervals that the value may fall within, cf. Alexander (2008a), p. 71. A probability measure (defined as a set of all outcomes and their associated probabilities) of a random variable can be represented via a probability distribution function which gives the probability that X takes a value less than or equal to x (i.e. the cumulative distribution function, $F(x) = P(X \leq x)$), cf. Alexander (2008a), pp. 75-76.

[91] CEIOPS (2005b), para. 10.4, and CEIOPS (2006b), para. 9-10. See also International Actuarial Association (2004), para. 5.51.

[92] Alexander (2008a), pp. 78-83, J.P.Morgan and Reuters (1996), pp. 66-68, and Linsmeier and Pearson (2000), p. 53. As described in e.g. BCBS (1995), para. I.4, and BCBS (1996),

- the expected value or mean (μ) of the random variable.[93]
- variance (σ^2), which measures the dispersion of values of the random variable around the expected value (i.e. the width of the distribution).[94] The square root of the variance - the standard deviation (σ) - also measures dispersion.
- skewness, which is asymmetry of the random variable's distribution around the expected value. Positive skewness entails that the tail to the right of the expected value is heavier while negative skewness entails that the tail to the left of the expected value is heavier. In figure 9.3, the distribution is symmetrical around the expected value.
- kurtosis, which reflects a distribution's flatness or peakedness compared to the "bell-shaped" normal distribution in figure 9.3.

Figure 9.3 shows the normal probability density function of a random variable where the area under the blue curve equals 1 (i.e 100%).[95] The area to the left of a specific value on the horizontal axis equals the (cumulative) probability that the random variable takes a value less than or equal to that value.[96] A probability distribution can also be described via quantiles.[97] The 0.995 quantile -

part. B.4(d), the estimators of moments used in the calculation of VaR are generally inferred from historical observations of values during a sample period, which constitute sample values. Alexander (2008a), pp. 78-81 and 120-121, describes how a sample of observed values may be viewed as an individual independent random variable with is its own sample mean ($\overline{x}$) (the arithmetic average of the observations in the sample) and sample variance (s^2). A collection of samples accordingly entails a collection of random variables ($X_1 ... X_n$) with sample means, and these sample means may be viewed as constituting a sampling random variable ($\overline{X}$) with a distribution that depends on the number of samples. The mean of this sampling random variable can be used as an estimator of the true mean (µ). The "central limit theorem" states that the distribution of the sample mean (formulated as $\overline{X}_n = \frac{X_1 + ... + X_n}{n}$) will converge to a normal distribution as the number of observations (n) move toward infinity (i.e. n→∞). Accordingly, if the sample is random and sufficiently large, the sample means are assumed to be approximately normally distributed. The larger the number of observations, the smaller becomes the variance of the sample mean (i.e. $V(\overline{X}_n) = \frac{\sigma^2}{n}$). The standard error (the standard deviation for a sample mean with a sampling distribution) is $\frac{\sigma}{\sqrt{n}}$.

[93] Alexander (2008a), pp. 78-79, which - for a continuous random variable with a density function - formulates the expected value as $\mu = E(X) = \int_{-\infty}^{\infty} x f(x) dx$. For a given sample, with n observations, the sample mean is formulated as $\overline{x} = n^{-1} \sum_{i=1}^{n} x_i$

[94] Alexander (2008a), pp. 79-81, which - for a continuous random variable with a density function - formulates the variance as $\sigma^2 = V(X) = \int_{-\infty}^{\infty} (x - \mu)^2 f(x) dx$. For a given sample, with n observations, the sample variance is formulated as $s^2 = (n-1)^{-1} \sum_{i=1}^{n} (x_i - \overline{x})^2$.

[95] Alexander (2008a), pp. 76-77.

[96] Alexander (2008a), pp. 76-77, describes how the area to the left of a value (x), in a density function for a continuous random variable (X), equals the probability that X takes a value less than or equal to x (i.e. the cumulative probability).

[97] As described in Alexander (2008a), pp. 76-77 and 83-84, the total area under the curve

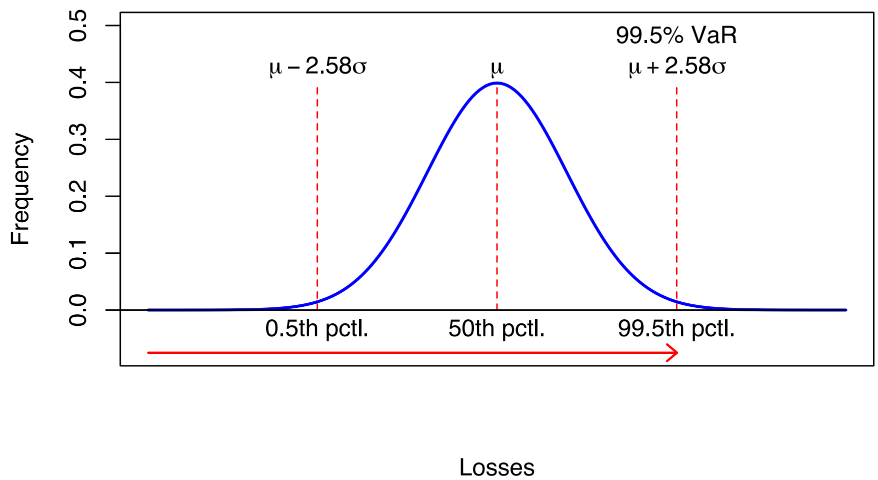

Figure 9.3: Value-at-risk, with a one-tailed confidence level of 99.5%, based on a normal probability density function.

or 99.5th percentile - of a distribution is a specific value of the random variable below which 99.5% of the distribution's values lie (and which 0.5% of the distribution's values lie above).[98] The 99.5th percentile is also illustrated in figure 9.3 where the area to the left of the 99.5th percentile equals 0.995. The 99.5th percentile can accordingly be used as a measure of risk as it reflects the amount of the value and the probability of that amount being exceeded (i.e. 0.5%).[99]

A risk measure can generally be defined as a function that assigns an amount of capital to a probability distribution, and VaR is a risk measure that assesses the probability of ruin at a specified quantile of the distribution.[100]

If a random variable is normally distributed (as illustrated in figure 9.3 via the bell-shaped blue curve with symmetry around the expected value (μ)), then

of a continuous random variable's (X's) density function is 1 (i.e. 100%) and a possible value (x) divides the area under the curve into an area to the left of x and an area to the right of x. Accordingly, when the area to the left of x is α, then the area to the right of x is 1-α. The realisation of x_α is a quantile of the distribution of X if the cumulative probability of X being less and or equal to x_α equals α (i.e. P(X$\leq x_\alpha = \alpha$)).

[98] I.e. P(X$\leq$x) = 0.995, see Alexander (2008a), pp. 75-77 and 83-84, and J.P.Morgan and Reuters (1996), p. 68.

[99] J.P.Morgan and Reuters (1996), pp. 68-69.

[100] Solvency II, art. 13(39), European Commission (2004d), section 4.4, CEIOPS (2005b), para. 10.5 and 10.11, and CEIOPS (2006b), para. 10. International Actuarial Association (2004), para. 5.53, and McNiel et al. (2015), p. 64, similarly define VaR as a quantile of a (loss) distribution.

the entire distribution can be described through only the expected value and variance (σ^2).[101] In addition, standard normal transformation allows the transformation of a normal distribution into the *standard* normal distribution which has an expected value of 0 and a standard deviation (σ) of 1.[102] Accordingly, if a random variable (e.g. future losses on a portfolio or the future level of available capital) can be assumed to be normally distributed, then standardisation allows the use of the distinct properties of the standard normal distribution. These properties include the cumulative probabilities and percentiles, e.g. that the expected value +/- 2.58 standard deviations equal the 0.5th and 99.5th percentiles of the standard normal distribution (where the area below the curve, and between those percentiles, is 0.99 or 99%).[103] This is also illustrated in figure 9.3.

A confidence level (or confidence interval) is an interval within which a value of a random variable may lie with a certain probability.[104] A confidence level can be one-tailed or two-tailed.[105] As mentioned, figure 9.3 illustrates the normal probability density function where the total area under the symmetric blue curve equals 1 (i.e. a cumulative probability of 100%).[106] It also shows how

- the expected value +/- 2.58 standard deviations equal the 0.5th and 99.5th percentiles of the standard normal distribution and an area of 0.99 (out of the total area of 1), which entails that the value of the random variable will lie in the two-tailed interval 99% of the time and only lie outside the interval 1% of the time (i.e. a two-tailed 99% confidence level).[107]

- the expected value + 2.58 standard deviations equals the 99.5th percentile of the standard normal distribution and an area of 0.995 of the total area of 1 (i.e. a cumulative probability of 99.5%), which entails that the value of the random variable will lie in the one-tailed interval 99.5% of the time and only exceed the interval 0.5% of the time (i.e. a one-tailed 99.5%

[101] Alexander (2008a), pp. 90-91, and J.P.Morgan and Reuters (1996), p. 67.

[102] I.e. $Z = \frac{X-\mu}{\sigma}$, where X is a normally distributed random variable with expected value (μ) and variance (σ^2), cf. Alexander (2008a), p. 90, and J.P.Morgan and Reuters (1996), pp. 68-69.

[103] The standard normal distribution includes the table of cumulative probabilities of the different values z that the standard normal random variable Z may take (e.g. P(Z≤-2.58) = 0.005 and the value -2.58 is the 0.5th percentile of the standard normal distribution; P(Z≤-2.33) = 0.01 and -2.33 is the 1st percentile; P(Z≤0) = 0.5 and 0 is the 50th percentile; P(Z≤2.33) = 0.99 and 2.33 is the 99th percentile; P(Z≤2.58) = 0.995 and 2.58 is the 99.5th percentile), cf. Alexander (2008a), pp. 90-92 and 118-120, J.P.Morgan and Reuters (1996), pp. 69-71, and Linsmeier and Pearson (2000), p. 53.

[104] E.g. P(A<X<B) = 0.995 for the confidence interval of 99.5%, cf. Alexander (2008a), p. 119, and J.P.Morgan and Reuters (1996) pp. 70-71.

[105] As described in Alexander (2008a), pp. 119-120, and J.P.Morgan and Reuters (1996), pp. 69-71, in a two-tailed confidence level, the interval is between two finite values (e.g. $P(\mu\text{-}2.58\sigma < X < \mu + 2.58\sigma) = 0.99$). In a one-tailed confidence level, the interval runs from minus infinity to a finite value, or from a finite value to plus infinity, e.g. $P(-\infty < X < \mu + 2.58\sigma) = 0.995$).

[106] Alexander (2008a), pp. 76-77.

[107] Alexander (2008a), pp. 76-77, 83-84 and 119-120, and J.P.Morgan and Reuters (1996), pp. 69-71.

confidence level).[108] This is illustrated via the red arrow in the bottom of figure 9.3 and is simply referred to as e.g. a "99.5% VaR".

VaR presumably stems from the measurement of market risk on a trading portfolio and J.P.Morgan and Reuters (1996) defined VaR as a measure of the maximum potential change in value of a portfolio of financial instruments with a given probability over a pre-set horizon.[109] J.P.Morgan and Reuters (1996) simply based the calculation of VaR on the expected value and standard deviation of the portfolio returns as they relied on the assumption that the portfolio returns were normally distributed.[110] In simplified terms, by assuming normal distribution, the properties of the standard normal distribution enables the identification of the level of economic capital (i.e. the expected value + 2.58 standard deviations) that an undertaking must have in order to limit the probability of ruin to 0.5% (i.e. a one-tailed confidence level of 99.5%).[111] If the distribution is not normal, then the "quantile factor", which is applied to the standard deviation to achieve the confidence level, may e.g. be increased to address a heavy tail.[112]

In addition to a confidence level, the calculation of e.g. VaR relies on inputs in the form of (i) a holding or exposure period, during which the value of exposures can change, and (ii) a historical time horizon (or observation period) over which risk factor values are observed.[113] In order to calibrate a risk measure to capture certain scenarios, observation periods may be required to be of a minimum length and include historical data (regarding e.g. risk factors and their correlations) from a period of significant financial stress.[114] In the following chapters, it will be shown how Solvency II and the finalised Basel III rely on different exposure periods in their risk measures for various risk types.

When the risk factors associated with an exposure or portfolio of exposures have been identified, then the exposures can be decomposed into the individual marked-to-market cash flows that are exposed to each individual risk factor, whereafter the confidence level-calibrated values, for each exposure to each of the risk factors, can be aggregated into an overall VaR in the light of the correlation

[108] Alexander (2008a), pp. 76-77, 83-84 and 119-120, J.P.Morgan and Reuters (1996), pp. 69-71, Linsmeier and Pearson (2000), pp. 53-54, and International Actuarial Association (2004), para. 5.53.

[109] J.P.Morgan and Reuters (1996), p. 6, and Linsmeier and Pearson (2000), pp. 47-48. BCBS (1995), section I, para. 1, similarly defined VaR as representing an estimate of the likely maximum amount that could be lost on a bank's portfolio with a certain degree of statistical confidence.

[110] E.g. pp. 6-8 and 66-71. J.P.Morgan and Reuters (1996), p. 45, defines "return" as when a price change is defined relative to some initial price. See also Linsmeier and Pearson (2000), p. 53.

[111] See e.g. J.P.Morgan and Reuters (1996), pp. 6-8 and 66-71, Linsmeier and Pearson (2000), pp. 53-54, International Actuarial Association (2004), para. 6.12, and CEIOPS (2005b), para. 10.3-10.4.

[112] International Actuarial Association (2004), para. 6.12.

[113] BCBS (1995), para. I.3.

[114] See e.g. BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.5 and 33.7, regarding the expected shortfall, and MAR33.20(2) regarding the VaR-based default risk capital requirement.

between the risk factors.[115] Such aggregation can be done in accordance with standard portfolio theory.[116]

Both Solvency II and the finalised Basel III rely on risk measures and their confidence levels to calibrate capital requirements for specific risk types. As described in the following chapters and chapter 10, the standardised approaches in Solvency II's and the finalised Basel III's capital requirements for market risk entail that

1. calibrated stress factors or risk weights are applied to exposures to prescribed risk factors, whereafter

2. risk factor capital requirements are aggregated via several aggregation steps, which are based on prescribed correlation parameters that reflect correlation between the risk factors, to produce overall capital requirements.[117]

The overall differences in the aggregation of capital requirements and diversification effects are presented in chapter 9.4.

9.3.1 Solvency II and VaR

During the Solvency II project, VaR was proposed as a possible risk measure and CEIOPS defined VaR as a risk measure that assesses the probability of ruin at a specified quantile of the distribution.[118] CEIOPS believed that a 99.5% confidence level roughly corresponded to a "secure financial strength ("'BBB") rating".[119]

At level 1, Solvency II provides that the SCR is to correspond to the VaR of the basic own funds subject to a confidence level of 99.5% over a one-year period.[120] In other words, the SCR is the economic capital to be held by a life insurance undertaking in order to ensure that ruin occurs no more often than once in every 200 cases or, alternatively, that it will be in a position - with a probability of at least 99.5% - to meet its obligations to policyholders and beneficiaries over the following 12 months.[121]

As initially reflected via the red arrow in figure 9.3 above, the SCR assigns a capital requirement to the 99.5th percentile VaR of the basic own funds over a

[115] J.P.Morgan and Reuters (1996), p. 7 and chapter 6.1, and Linsmeier and Pearson (2000), pp. 53-56.
[116] J.P.Morgan and Reuters (1996), p. 7, where the VaR, in relation to exposures to two risk factors (i and j), is calculated as $VaR = \sqrt{\sigma^2_{riskfactor_i} + \sigma^2_{riskfactor_j} + (2 * Correlation_{(i,j)} * \sigma_{riskfactor_i} * \sigma_{riskfactor_j})}$.
[117] See e.g. Solvency II, art. 103 and 104 and annex IV, and BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR20.4 and MAR21.3.
[118] European Commission (2004d), section 4.4, CEIOPS (2005b), para. 10.5 and 10.11, and CEIOPS (2006b), para. 10.
[119] CEIOPS (2007a), para. 2.40.
[120] Solvency II, art. 101(3).
[121] Solvency II, recital 64.

one-year period.[122] This requirement is a part of the level 1 general provisions for the SCR and applies to both the SCR internal model and the SCR standard formula.[123]

The SCR standard formula is to reflect the risk profile of most insurance undertakings and is calibrated to simulate a 99.5% confidence level VaR via pre-defined stress events.[124] Accordingly, the SCR standard formula's aggregation of one-year 99.5% VaR-calibrated risk type capital requirements entails the aggregation of quantiles of the probability distributions for the respective prescribed risk factors.[125] As the SCR internal model is to deliver a more "true" undertaking-specific VaR, level 1 enables a life insurance undertaking to calculate its own probability distribution for the SCR that must comply with statistical standards and the general provisions for the SCR.[126]

9.3.2 Risk Measures in the Finalised Basel III

VaR initially found its way into the Basel framework's regulation of market risk when Basel I was amended by BCBS (1996) to incorporate market risk in the trading book in addition to credit risk in the banking book.[127] The amendment included the standardised approach (which was based on a building block approach that captured specific risk[128] and general risk[129]) and the internal models approach for measuring market risk.[130] The internal models approach was subject to minimum quantitative standards, including a daily VaR with a one-tailed 99th percentile confidence interval and a minimum holding period of 10 trading days.[131] The historical observation period, used to calculate the VaR, was a minimum of one year.[132] This daily 10-day 99% VaR remained a quantitative standard in Basel II, where it was assumed that market risk exposures were liquid and could therefore be exited or hedged over a 10-day horizon without affecting market prices.[133]

[122] Solvency II, art. 101(3).

[123] Solvency II, recital 26 and art. 100, 104(3)-(4), 111(1)(c) and 122.

[124] Solvency II, recital 26, CEIOPS (2005b), para. 10.9, 10.122 and 10.123, CEIOPS (2006b), para. 29, CEIOPS (2007a), para. 2.26, European Commission QIS4 (2008), para. TS.VIII.A.5, European Commission QIS5 (2010), para. SCR.1.9, EIOPA (2014b), para SCR 1.9, and EIOPA (2014c), pp. 7-9.

[125] Solvency II, art. 103 and 104(3)-(4) and annex IV, and CEIOPS (2010b), para. 3.9. See also International Actuarial Association (2004), para. 5.51.

[126] Solvency II, art. 100, 101, 121 and 122(2), Solvency II Delegated Regulation, art. 228-238, and e.g. CEIOPS (2005b), para. 10.9.

[127] BCBS (1996), section I, para. 1.

[128] An adverse movement in the price of an individual security owing to factors related to the individual issuer, cf. BCBS (1996), section 1, para. 11 (including footnote 5) and part A, para. 3.

[129] The risk of loss arising from changes in market interest rates, cf. BCBS (1996), part A, para. 8.

[130] BCBS (1996), section I, para. 9-11 and parts A and B.

[131] BCBS (1996), part B.4(a)-(c).

[132] BCBS (1996), part B.4(d).

[133] Basel II, para. 718(lxxvi), BCBS (2013a), p. 4 and section 1.3, BCBS (2016), section 2.2(c), and BCBS (2019b), section 2.3(b).

The financial crisis led to the trading book's 99% VaR being supplemented with a weekly and "stressed" 10-day one-tailed 99th percentile confidence level VaR that was based on historical data from a continuous 12-month period of significant financial stress.[134] Although losses beyond the 99th percentile of a distribution have a 1/100 probability of occurring, they may occur and be very large.[135] The stressed 99% VaR was introduced via "Basel 2.5" as losses in the trading book were significantly higher than the pillar 1-based minimum capital requirements.[136] Basel II's "regular" 99% VaR did not capture such "tail risk" as it did not go beyond the 99th percentile of the distribution.[137] It was accordingly viewed as creating "perverse" incentives to take on tail risk as exposures beyond the 99th percentile were viewed as riskless from a purely regulatory perspective.[138] In addition, and as discussed in chapter 9.1 and 10, the 10-day 99% VaR was considered unable to adequately capture trading book exposure's credit risk (including default risk and migration risk) and market liquidity risk.[139]

In order to address these trading book issues, the BCBS undertook the fundamental review of the trading book.[140] As a result, the BCBS replaced the VaR with a daily one-tailed 97.5th percentile confidence level "expected shortfall" in the minimum quantitative standards for the internal models approach for market risk.[141] The 97.5% expected shortfall is illustrated in figure 9.4. In simplified terms, expected shortfall is defined as a measure of the average of all potential losses exceeding the VaR at a given confidence level.[142] While VaR calculates the maximum potential loss at a 97.5th percentile confidence level, the 97.5% expected shortfall captures tail risk beyond the 97.5th percentile as it calculates the average of the losses beyond that percentile (i.e. the average of the 2.5% of the losses).[143] The expected shortfall must also be calibrated to a period of stress[144] and capture market liquidity risk via prescribed liquid-

[134] BCBS (2009d), para. 21 (para. 718(lxxvi), including (i) and (k)).

[135] BCBS (2012), annex 1, section 2.2.1.

[136] BCBS (2009d), para. 2, BCBS (2012), annex 1, section 1 and 2.2.1, and BCBS (2016), section 2.2.

[137] BCBS (2012), annex 1, section 2.2.1, BCBS (2013a), p. 3 and section 1.4, BCBS (2016), section 2.2(b), and BCBS (2019b), section 2.3.

[138] BCBS (2012), annex 1, section 2.2.1, BCBS (2013a), p. 5, BCBS (2016), section 2.2(b), and BCBS (2019b), section 2.3(a).

[139] BCBS (2012), annex 1, section 2.2.1, BCBS (2013a), p. 5, and BCBS (2016), section 2.2(a) and (c), and BCBS (2019b), section 2.3(b) and (c). Similar observations were made in relation to VaR and LTCM in President's Working Group (1999), p. 15, which pointed to credit risk, in trading relationships, and the link between market risk, liquidity risk, and credit risk as well an underestimation of both the size of potential shocks to risk factors and their correlation.

[140] See the consultations in BCBS (2012), BCBS (2013a) and BCBS (2014a).

[141] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR 33, including 33.1-33.6.

[142] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR10.18, and BCBS (2012), p. 3.

[143] BCBS (2019b), pp. 6-7 and footnote 8. See also BCBS (2012), p. 3, BCBS (2013a), pp. 3 and 18, and BCBS (2016), section 3.2.

[144] I.e. an expected shortfall on the portfolio where the associated risk factors are experiencing a period of stress.

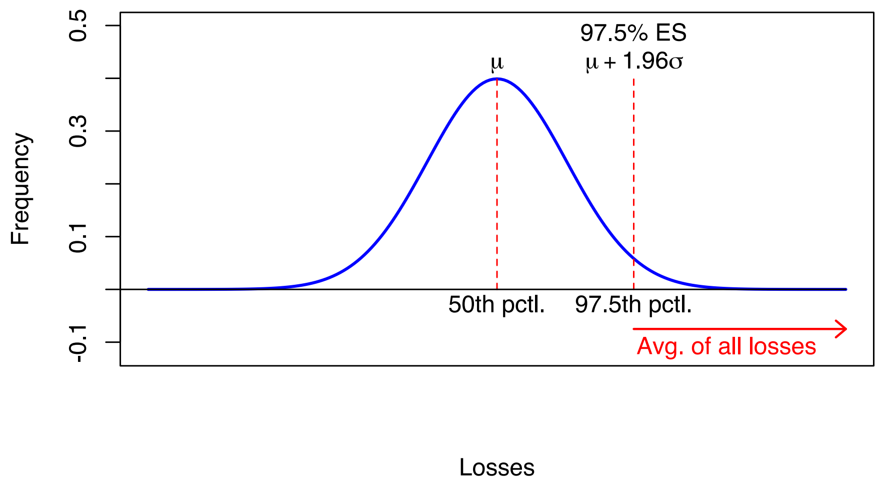

Figure 9.4: Expected shortfall, with a one-tailed confidence level of 97.5%, based on a normal probability density function.

ity horizons[145] for prescribed risk factors that are described in chapter 10.6.1 below.[146]

The internal model approach for market risk is subject to minimum qualitative standards (including market risk management systems and stress tests) and quantitative standards as well as supervisory approval, which is given at an individual trading desk level, and a trading desk[147] is also subject to approval and must have a defined risk scope, trading limits as well as a business strategy and permissible instruments.[148] Risk factors, within in-scope trading desks, must be deemed eligible (or "modellable") to be included in the internal model approach's 97.5% expected shortfall.[149] Non-modellable risk factors are

[145] Defined as the time assumed to be required to exit or hedge a risk position without materially affecting market prices in stressed market conditions, cf. BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR10.20.

[146] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.4-33.6 and 33.12, and BCBS (2019b), p. 7. See also BCBS (2016), section 3.2.

[147] Defined as a group of traders, or trading accounts, that implements a well-defined business strategy operating within a clear risk management structure, cf. BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR12.1. They are also more extensively defined as a group of traders, or trading accounts, in a business line within a bank, that follows defined trading strategies with the goal of generating revenues, or maintaining market presence, from assuming and managing risk, cf. BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR10.3.

[148] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR12.2 and 12.4 and MAR30-33, including 30.1-5, 30.19 and 33.1.

[149] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR30.4(3), MAR31.12, and

subject to a separate stressed capital add-on which is based on a stressed expected shortfall.[150] The 97.5% expected shortfall is not subject to a specific model type and can be based on e.g. a historical simulation.[151] It must be calculated - on a daily basis - for each approved trading desk and at a bank-wide level.[152]

Exposures in trading desks, which are not subject to the internal models approach (i.e. "out of scope trading desks"), are combined and subjected to the standardised approach for market risk in the finalised Basel III that is described in chapters 9.4.2.1 and 10.6 below.[153] The risk weights applied in the standardised approach have been calibrated in line with the internal models approach above, including stressed market conditions.[154]

The 97.5% expected shortfall is accordingly used to calibrate capital requirements for market risk, including credit spread risk, in the finalised Basel III's trading book. This abandoning of VaR, and the adoption of expected shortfall, actually reflects risk measure discussions during the Solvency II project. CEIOPS initially proposed the "tailVaR" risk measure that considers both the probability and the severity of losses beyond the specified quantile.[155] Similar to banks' losses during the financial crisis, CEIOPS considered how insurance undertakings could be exposed to tail risks, which would not be captured via capital requirements, if they were placed beyond the VaR's given confidence level.[156] However, the European Commission chose VaR as the level 1 risk measure in Solvency II.[157]

In the banking book, Basel II's IRB approach for credit risk included a one-year 99.9% confidence level VaR in the risk weight function that produced portfolio invariant credit risk capital requirements.[158] The 99.9% confidence level reflects a regulatory target wherein a bank will - with the likelihood of 99.9% - remain solvent over a one-year horizon and only suffer losses, above this level, on average once in a thousand years.[159] This one-year 99.9% VaR remains a part of the finalised Basel III's IRB approach for credit risk where the risk weight function produces capital requirements for the unexpected losses on credit exposures in the banking book.[160] The IRB approach for credit risk is described in detail in chapter 10.5 below.

MAR33.13

[150] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR30.4(3)(e), MAR31.26(6), and MAR33.16.

[151] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.9.

[152] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.2-3.

[153] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR30.4(2)(c).

[154] BCBS (2019b), p. 9. See also BCBS (2013a), pp. 3 and 18.

[155] CEIOPS (2005b), para. 10.5, 10.6, 10.11 and 10.123, CEIOPS (2006b), para. 1, 7, 11 and 27, and CEIOPS (2007a), para. 2.30 and 2.31. See also International Actuarial Association (2004), para. 5.54.5.55.

[156] CEIOPS (2005b), para. 10.5, CEIOPS (2006b), para. 15 and 16, and CEIOPS (2007a), para. 2.30.

[157] See e.g. European Commission (2005), para. 17, and CEIOPS (2007a), para. 2.31.

[158] Basel II, para. 272, and BCBS (2005), pp. 3, 4 and 6 and section 5.1.

[159] BCBS (2005), pp. 3 and 11.

[160] BCBS Consol. Basel III (2019), CRE30.2 and CRE31.5, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 2 and 53.

In addition to credit spread risk capital requirements, the finalised Basel III's trading book captures jump-to-default risk via a separate default risk capital requirement that is described in chapter 10.6.2.[161] In the standardised approach for market risk, the default risk capital requirement is calibrated in line with the banking book's treatment of credit risk in order to ensure consistency for similar risk exposures in the banking book and trading book.[162] In the internal models approach for market risk, the default risk capital requirement is to be calculated via a separate internal model with a weekly one-tailed 99.9 percentile confidence level VaR over a one-year time horizon (similar to the calibration of the banking book).[163] The finalised Basel III accordingly subjects credit exposures to explicit one-year 99.9% VAR-calibrated default risk capital requirements regardless of whether they are placed in the banking book or trading book.

9.3.3 Summary of Differences in Risk Measures

Figure 9.5 presents an overview of the differences in risk measures. It shows how Solvency II only relies on the one-year 99.5% VaR to calibrate capital requirements for all risk types under both the SCR standard formula and SCR internal model. The finalised Basel III relies on (i) the one-year 99.9% VaR to calibrate capital requirements for default risk and (ii) the liquidity horizon-adjusted 97.5% expected shortfall to calibrate capital requirements for market risk, including credit spread risk.

As described in chapter 10, it must be kept in mind that Solvency II's SCR corresponds to - and is calibrated based on - the VaR of the basic own funds subject to a confidence level of 99.5% over a *one-year* period. The SCR is accordingly calibrated to capture risks, which are assumed to occur within one year, and to capture "market-consistent" losses of basic own funds (i.e. losses caused by changes in market values) over that one-year time horizon.[164] The horizon goes beyond a traditional trading book time horizon and European Commission (2015b) accordingly viewed it as "not meaningful" to compare the SCR to the 10-day 99% VaR in the replaced Basel II's trading book.[165] In addition, the European Commission did not find it meaningful to compare the SCR to Basel II's capital requirements for credit risk in the banking book as they only captured credit risk and not market-consistent price fluctuations.[166]

The SCR's one-year time horizon is also different from the finalised Basel III's internal models approach for market risk, in the trading book, where the 97.5% expected shortfall relies on stress period-based liquidity horizons, for specific risk

[161] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR22 and MAR33.18. See also BCBS (2013a), p. 11.

[162] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR20.4(2). See also BCBS Basel III (2016b), p. 3 and para 47(d).

[163] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33, including 33.18-33.20. See also BCBS (2013a), pp. 11 and 29-30, and BCBS (2005), p. 3 and section 5.1.

[164] Solvency II, recital 64, European Commission (2015b), section 9, CEIOPS (2005b), para. 10.2, 10.4, 10.15, 10.121 and 10.127, and CEIOPS (2007a), para. 2.39.

[165] Section 9.

[166] European Commission (2015b), section 9.

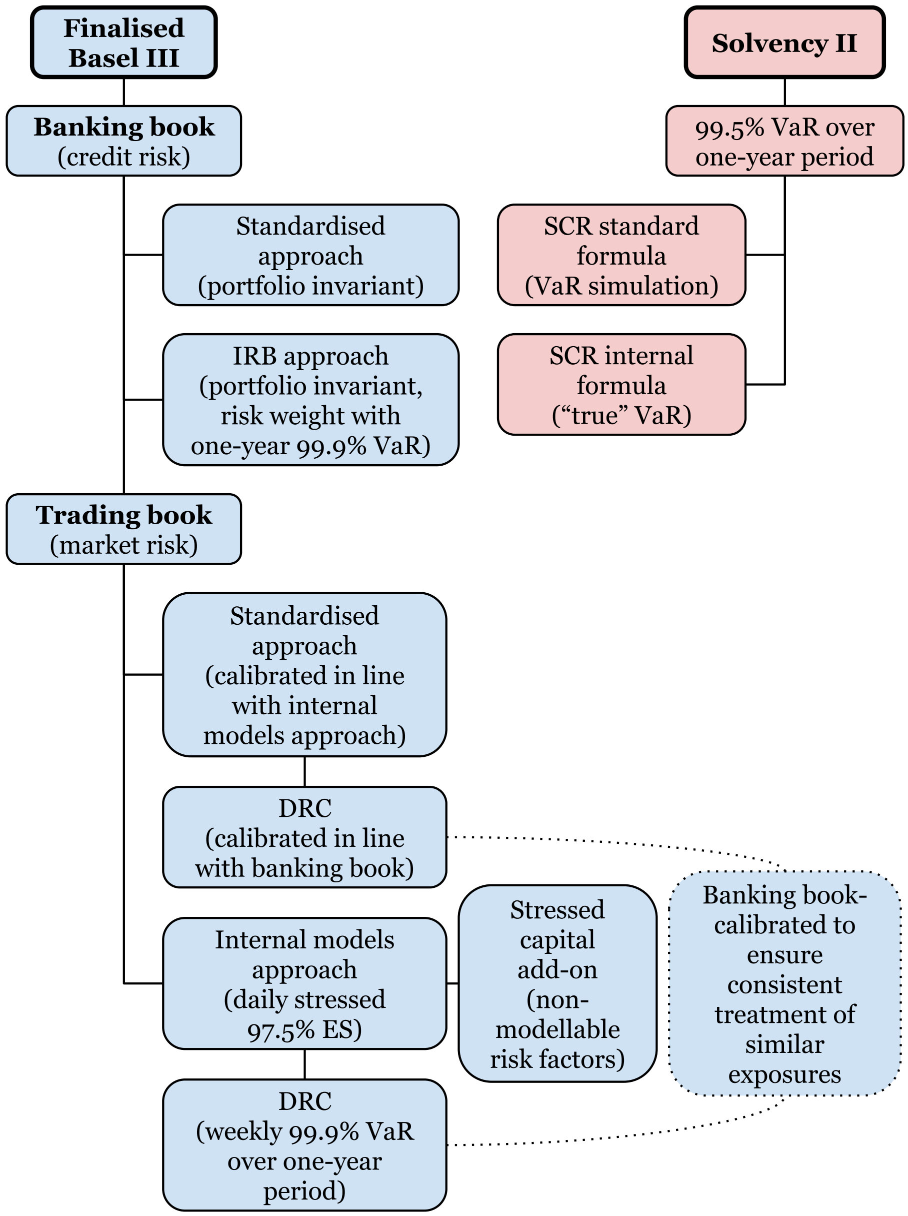

Figure 9.5: Differences in risk measures and calibrations of credit risk and market risk in the finalised Basel III and Solvency II. In the finalised Basel III, the trading book's default risk capital requirement ("DRC") has been calibrated in line with the banking book.

factors, that are scaled from a 10 day base liquidity horizon.[167] However, the finalised Basel III's internal models approach for market risk also introduced the separate default risk capital requirement where the weekly 99.9% VaR is based on a *one-year* time horizon.[168] This is in line with the capital requirement for credit risk, in the banking book, which is also based on a one-year time horizon (or holding period).[169] In addition to the capital requirements for credit spread risk, the finalised Basel III's standardised approach for market risk also includes the separate default risk capital requirement that was calibrated in line with the banking book to reduce the risk of discrepancies in capital requirements for similar risk exposures.[170] The European Commission's perspectives regarding comparisons of time horizons may accordingly have to modified if the market risk capital requirements in the finalised Basel III are fully implemented into EU law.

9.4 Aggregation and Diversification Effects

Covariance and correlation measure the dependency between two random variables, e.g. risk type X and risk type Y.[171] Correlation is a number that always lies between -1 and +1.[172] In simplified terms,

- zero correlation entails no association between the movements of X and Y,
- positive correlation entails that X tends to increase when Y increases, and that X tends to decrease when Y decreases,
- negative correlation entails that X tends to increase when Y decreases, and that X tends to decrease when Y increases.[173]

A high positive correlation (close to 1) indicates that X and Y are strongly dependent and move in the same direction while a high negative correlation (close to -1) indicates that X and Y are strongly dependent but move in opposite directions.[174]

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[167] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.4 and 33.12, and BCBS (2019b), p. 7.

[168] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.20.

[169] BCBS (2013a), section 1.2(i).

[170] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR20.4(2), MAR21, including 21.39, 21.40, 21.51-21.57, and MAR22.

[171] Alexander (2008a), pp. 107-108 and 110-114, where the covariance of two random variables X and Y is formulated as $Cov(X,Y) = E\left[(X-\mu_X)(Y-\mu_Y)\right]$ and $Cov(X,Y) = E(XY) - E(X)E(Y)$, where E(XY) is the expectation of the product XY. Alternatively, covariance can be formulated as $\sigma_{XY} = \mu_{XY} - \mu_X\mu_Y$.

[172] Alexander (2008a), pp. 111-114, where correlation is formulated as $Corr(X,Y) = \frac{Cov(X,Y)}{\sqrt{V(X)V(Y)}}$, and where V(X) and V(Y) is the variance of each of the random variables X and Y. The square root of the product of V(X) and V(Y) produces the product of the standard deviations (as the standard deviation (σ) is the square root of the variance (σ^2)).

[173] Alexander (2008a), pp. 111-112.

[174] Alexander (2008a), pp. 113-114.

Based on a lack of correlation between risk factors, diversification effects generally entail a reduction in overall capital requirements when individual risk factor-based capital requirements are aggregated to produce a portfolio-level or overall capital requirement.[175] Diversification effects were discussed during the Solvency II project where CEIOPS assumed that not all risks would occur at the same time and that the "simple" addition of individual risk factor capital requirements could lead to an overstatement of the appropriate amount of capital.[176] CEIOPS accordingly found that the overall capital requirement could be smaller than the sum of the capital requirements for the individual risks.[177] When structuring the aggregation of the SCR standard formula's risk modules, cross-risk diversification effects would therefore have to be reflected in order to avoid such an overstatement of capital.[178] However, CEIOPS also noted that an assumption of independence between risk factors could underestimate the needed capital requirements if the risk factors were actually positively correlated.[179] In line with CEIOPS' view, Solvency II defines "diversification effects" as a reduction in the risk exposure that results from the fact that the adverse outcome from one risk can be offset by a more favourable outcome from another risk, where those risks are not fully correlated.[180]

As shown in this chapter, the recognition of diversification effects, during the aggregation of risk factor-level capital requirements into an overall capital requirement, constitutes a structural difference between Solvency II and the finalised Basel III. In contrast to the portfolio-invariant credit risk capital requirements in the banking book, European Commission (2015b) stated that Solvency II's stress-based capital requirements for risk types do not translate directly into capital requirements as Solvency II's capital requirements depend on diversification that can reduce overall capital requirements.[181] This structural difference has also constituted a challenge during subsequent efforts to ensure cross-sectoral consistency in financial regulation. During the recent Solvency II review, EIOPA (2018b) found that the risks, in case of a default by a CCP, were similar for banks and insurance undertakings and that it would be difficult to argue in favour of a less restrictive approach in Solvency II.[182] However, EIOPA stated that a stand-alone comparison of transaction-specific capital requirements in CRR (that did not reflect the entire finalised Basel III) and Solvency II "may not be very meaningful" as the overall designs of the capital requirements were "very different".[183] The effective contribution of stand-alone capital requirements, to the overall SCR, would be affected by diversification firstly within a

[175] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR10.22, and Solvency II, art. 13(37).
[176] CEIOPS (2005b), para. 10.44 and 10.138-139
[177] CEIOPS (2005b), para. 10.44.
[178] CEIOPS (2007a), para. 5.31.
[179] CEIOPS (2005b), para. 10.47.
[180] Solvency II, art. 13(37).
[181] Section 9.
[182] EIOPA (2018b), para. 1476, 1488, 1508 and 1511. See also European Commission (2016), section 3.2.8.
[183] EIOPA (2018b), para. 1513.

risk module and then across the risk modules.[184] Next, chapter 9.4.1 will illustrate Solvency II's aggregation and diversification effects whereafter chapter 9.4.2 will show how these are different from the finalised Basel III.

9.4.1 Solvency II and Diversification Effects

As described in chapter 9.2, Solvency II's SCR is based on an economic valuation of the *whole* balance sheet which is generally referred to as the "total balance sheet approach".[185] At level 1, Solvency II's general provisions for the SCR prescribe that the one-year 99.5% VaR-based SCR must be calibrated to ensure that all quantifiable risk exposures are taken into account and that it must cover *at least*

- non-life underwriting risk,
- life underwriting risk,
- health underwriting risk,
- market risk,
- credit risk, and
- operational risk.[186]

Via the total balance sheet approach, Solvency II's SCR captures both liability risk and asset risk (including underwriting risks, credit risk and market risk) in a single aggregated one-year 99.5% VaR. Solvency II's aggregation of risk factor-level capital requirements, into a single aggregated VaR, accordingly includes capital requirements for liabilities in the form of underwriting risks which are exclusive to life insurance undertakings.[187] This is fundamentally different from the finalised Basel III's risk-weighted assets that were described in chapter 9.1.

The aggregation into a single aggregated SCR can be illustrated via the SCR standard formula that is shown figure 9.6. In relation to this formula, CEIOPS (2005b) discussed the "simple" "bottom-up" approach wherein each risk is considered in isolation and subjected to a specific treatment that provides a specific capital requirement component.[188] In relation to the market risk module (as described below), CEIOPS discussed how market risks could be addressed through stress tests in the form of fixed shock-based changes in risk factors that would be reflected via - or simulate - a change in the value of available capital and which would constitute the capital requirement.[189] A

[184] EIOPA (2018b), para. 1536.
[185] Solvency II, recital 45. See also CEIOPS (2005a), para. 105 and 109, CEIOPS (2005b), para. 10.23, 10.25, 10.26 and 10.31, IAIS (2018b), ICP 17 (para. 17.1) and IAIS (2018c), para 85 (footnote 13).
[186] Solvency II, art. 101(3)-(4).
[187] Solvency II, art. 14, 15, 101(4), 104(1), 121(4) and annex IV(1).
[188] CEIOPS (2005b), para. 10.38, 10.42 and 10.136. See also CEIOPS (2007a), para. 5.6.
[189] CEIOPS (2005b), para. 10.86, 10.87 and 10.157.

challenge to that approach was the subsequent combining (or aggregation) of the individual capital components, for the specific risk factors, into an overall capital requirement that did not overstate or understate the overall amount of risk.[190] If independence between two risk factors was assumed, then the resulting capital would understate the actual overall risk if the risk factors were actually positively correlated.[191]

Subsequently, in a two-step aggregation approach, the Solvency II project's second quantitative impact study firstly aggregated capital requirements for individual market risk sub-risk types (via a correlation matrix with prescribed correlation parameters that reflected the relation between the risks) into an overall capital requirement for the market risk module.[192] Secondly, the major risk types, including the market risk module and insurance underwriting risk modules, were aggregated via another correlation matrix to produce an overall capital requirement.[193]

At level 1, and in line with this initial approach, the SCR standard formula is a predefined formula that reflects the risk profile of most insurance undertakings and is calibrated to "simulate" a one-year 99.5% VaR.[194] As illustrated in figure 9.6, level 1 prescribes that the *basic* SCR[195] must consist of at least the individual *risk modules*:

- non-life underwriting risk module (in yellow),
- life underwriting risk module (in yellow),
- health underwriting risk module (in yellow),
- market risk module (in green), which is a combination of capital requirements for the *risk sub-modules* (i) spread risk, (ii) interest rate risk, (iii) equity risk, (iv) property risk (i.e. real estate), (v) currency risk, and (vi) market risk concentrations, and the
- counterparty default risk module (in blue).[196]

When applying the modules, level 2 includes the "look-through approach" which entails that the SCR is to be calculated on the basis of the underlying assets of collective investment undertakings and other funds.[197]

[190] CEIOPS (2005b), para. 10.38.
[191] CEIOPS (2005b), para. 10.47.
[192] CEIOPS QIS2 (2006b), para. 5.39. See also CEIOPS (2010b), para. 3.6.
[193] CEIOPS QIS2 (2006b), para. 5.32.
[194] Solvency II, recital 26, and art. 101(3), 103 and 104(3)-(4) and annex IV, and EIOPA (2014c), pp. 6-8. See also e.g. CEIOPS (2005b), para. 10.9, 10.122 and 10.123, CEIOPS (2006b), para. 29, and CEIOPS (2007a), para. 2.26 and 5.15.
[195] The SCR standard formula consists of (i) the basic SCR, (ii) a capital requirement for operational risk and (iii) an adjustment for the loss-absorbing capacity of technical provisions and deferred taxes, cf. Solvency II, art. 103.
[196] Solvency II, art. 103, 104 and 105 and annex IV. At level 2, the Solvency II Delegated Regulation (art. 87) subsequently added an intangible asset risk module (in purple).
[197] Solvency II Delegated Regulation, art. 84.

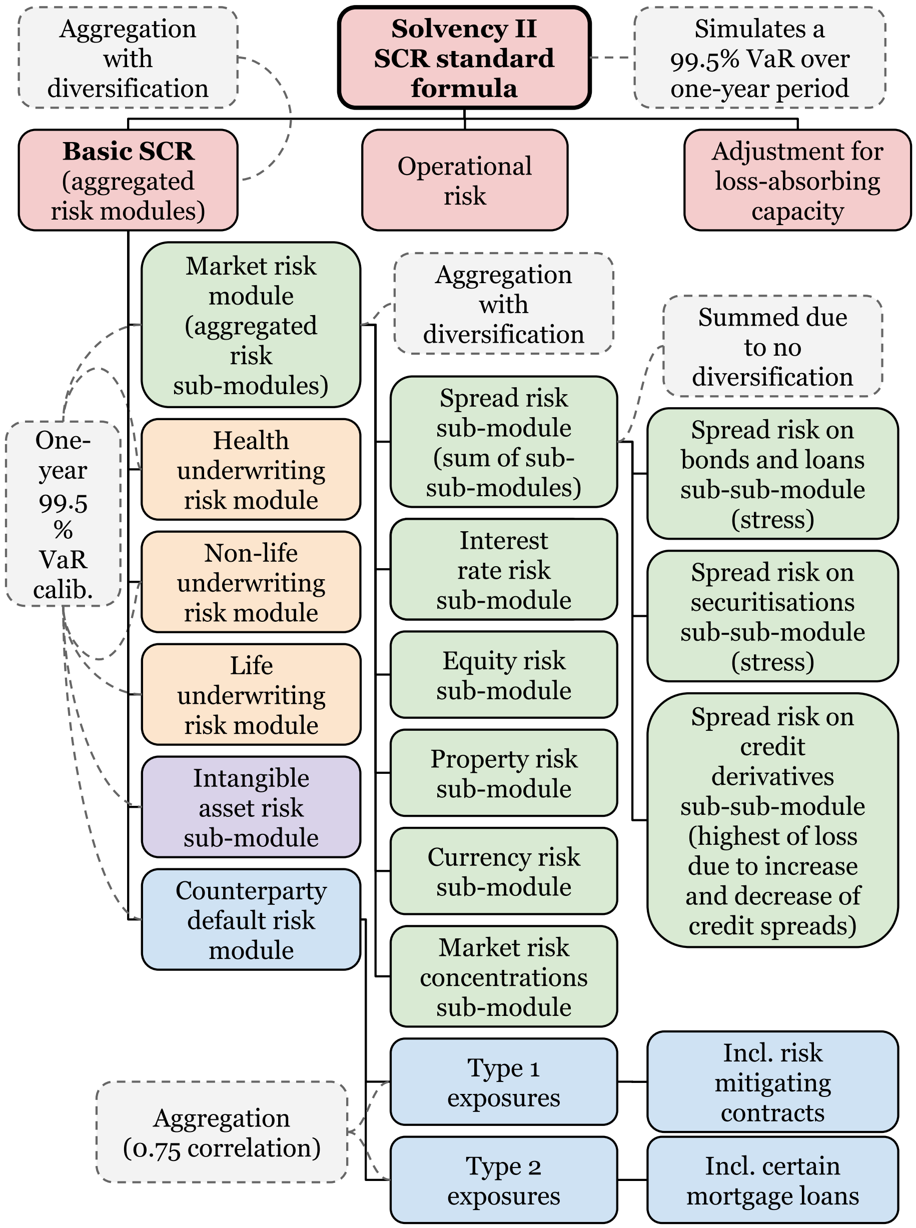

Figure 9.6: Simplified illustration of Solvency II's SCR standard formula that shows how diversification effects are recognised via aggregation of risk (sub-) modules. The illustration focuses on credit risk. The market risk module (including the spread risk sub-module and its sub-sub-modules) is in green while the counterparty default risk module is in blue.

Level 1 includes matrices with correlation coefficients that must be used when aggregating the basic SCR's risk modules above.[198] As an example, a correlation parameter of 0.25 is provided for the market risk module and counterparty default risk module.[199] Level 1 also prescribes that the basic SCR's correlation coefficients must result in an overall SCR that complies with the general provisions for the SCR, as well as that diversification effects were to be considered during the design of each risk module, which could include risk sub-modules.[200] In relation to the capital requirement for the market risk module, level 1 provides the formula for the aggregation of the risk sub-modules while level 2 provides the correlation parameter, e.g. 0.75 between the spread risk sub-module and equity risk sub-module.[201]

As also described in chapter 9.3.1 above, the calibration of capital requirements for each risk module must result in an overall SCR that complies with the general provisions for the SCR.[202] Each individual risk module must therefore be calibrated based on a one-year 99.5% VaR.[203] The subsequent aggregation of the calibrated risk type capital requirements accordingly entails the aggregation of quantiles (or percentiles) of the probability distributions for the respective prescribed risk types.[204] Solvency II's correlation coefficients entail linear correlation although the probability distributions of insurance undertakings' risk type exposures may have tail dependencies (i.e. the possibility of simultaneous adverse outcomes) and not be normally distributed.[205] During the Solvency II project, the proposed correlation coefficients accordingly incorporated any observed high correlations between two risk types during periods of market stress.[206]

As described in chapter 9.2 above, credit risk is addressed via both the spread risk sub-module (in the market risk module) and the counterparty default risk module.[207] Figure 9.6 above also illustrates how level 2 structured the spread

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[198] Solvency II, art. 104(1) and annex IV(1). The basic SCR is formulated as $SCR_{basic} = \sqrt{\sum_{i,j} Corr_{i,j} * SCR_i * SCR_j}$, where SCR_i and SCR_j are the various risk modules and $Corr_{i,j}$ is the prescribed correlation parameter.

[199] Solvency II, annex IV(1).

[200] Solvency II, art. 104(3)-(4) and 111. See also EIOPA (2014c), pp. 6-9, and CEIOPS (2010b), para. 3.15.

[201] Solvency II, annex IV(4), and Solvency II Delegated Regulation, art. 164. The market risk module is formulated as $SCR_{market} = \sqrt{\sum_{i,j} Corr_{i,j} * SCR_i * SCR_j}$, where SCR_i and SCR_j are the capital requirements for the various market risk sub-modules and $Corr_{i,j}$ is the prescribed correlation parameter.

[202] Solvency II, art. 104(3)-(4) and 111. See also EIOPA (2014c), pp. 7 and 10.

[203] Solvency II, art. 104(3)-(4) and 111. See also EIOPA (2014c), pp. 7 and 10.

[204] Solvency II, art. 104(3)-(4) and annex IV, and CEIOPS (2010b), para. 3.9. See also International Actuarial Association (2004), para. 5.51.

[205] EIOPA (2014c), pp. 6 and 8-9, CEIOPS (2010b), section 3.1.3, and International Actuarial Association (2004), para. 6.20.

[206] See e.g. the correlation parameter for spread risk and equity risk in Solvency II Delegated Regulation, art. 164(3), and CEIOPS (2010b), para. 3.65-3.67.

[207] See also Solvency II, art. 13(32).

risk sub-module to include the risk sub-sub-modules:

- spread risk on bonds and loans - where the market value of each bond or loan is subjected to a prescribed stress that has been calibrated based on bond indices.[208]
- spread risk on securitisation positions - where the market value of each securitisation position is subjected to a prescribed stress.[209]
- spread risk on credit derivatives - where the capital requirement is based on the highest value of (i) a loss due to a prescribed increase of the underlying credit spread and (ii) a loss due to a prescribed decrease of the underlying credit spread.[210]

The spread risk sub-module assumes perfect positive correlation between the spreads on exposures in the three spread risk sub-sub-modules and does accordingly not allow diversification.[211] The capital requirement for the spread risk sub-module is therefore simply the sum of the capital requirements for each of the three green sub-sub-modules above.[212] A detailed comparison of the finalised Basel III and the spread risk sub-module is made in chapter 10 below.

As illustrated in blue in figure 9.6 above, the capital requirement for the counterparty default risk module is based on

- a capital requirement for type 1 exposures (including risk-mitigation contracts, e.g. reinsurance arrangements, special purpose vehicles, insurance securitisations and derivatives) and
- a capital requirement for type 2 exposures (including receivables, the specified residential mortgage loans, and credit exposures which are not covered in the spread risk sub-module or a type 1 exposure).[213]

The counterparty default risk module's aggregated capital requirement assumes a correlation of 0.75 between type 1 and type 2 exposures.[214] A detailed comparison of the finalised Basel III and the counterparty default risk module is made in chapter 11 below.

As the SCR internal model is to deliver a more "true" undertaking-specific VaR, the SCR internal model allows a life insurance undertaking to calculate its own probability distribution for the SCR, which must comply with statistical standards and the general provisions for the SCR.[215] Level 1 prescribes that the SCR internal model must cover all material risk exposures and include *at*

[208] Solvency II Delegated Regulation, art. 175, 176 and 180, and EIOPA (2014c), p. 24.
[209] Solvency II Delegated Regulation, art. 175, 178 and 180, and EIOPA (2014c), p. 25.
[210] Solvency II Delegated Regulation, art. 175 and 179.
[211] EIOPA (2014c), section 2.5, i.e. spreads will increase on all exposures in a 1 in 200 years event (the 99.5% confidence level).
[212] I.e., $SCR_{spread} = SCR_{bonds} + SCR_{securitisations} + SCR_{credit.deriv.}$, cf. Solvency II Delegated Regulation, art. 175.
[213] Solvency II Delegated Regulation, art. 189 and 191, and EIOPA (2014c), pp. 70-72.
[214] Solvency II Delegated Regulation, art. 189, and EIOPA (2014c), p. 72.
[215] Solvency II, art. 100, 101, 121 and 122(2), and e.g. CEIOPS (2005b), para. 10.9.

least the risks in the general provisions for the SCR.[216] Level 1 also allows the recognition of diversification effects - within and across risk categories - in the SCR internal model provided that the system, used for measuring the diversification effects, is deemed adequate by the supervisory authority (including the empirical basis for diversification assumptions as well as the taking into account of any non-linear dependence and any lack of diversification under extreme scenarios).[217]

As shown above, Solvency II's total balance sheet approach entails the aggregation of both liability risk and asset risk (including underwriting risks, credit risk and market risk) into a single aggregated one-year 99.5% VaR-based SCR. When the aggregation is performed, Solvency II recognises diversification effects in the SCR standard formula, via prescribed formulas and correlation parameters, or allows diversification effects to be recognised in the SCR internal model. Next, chapter 9.4.2 will illustrate how Solvency II's approach to diversification effects is fundamentally different.

9.4.2 The Finalised Basel III and Diversification Effects

In the finalised Basel III, the banking book's IRB approach for credit risk was initially calibrated to "well-diversified banks".[218] This calibration was due to the desire for portfolio invariance[219], which was based on the view that an assessment of actual portfolio compositions, when determining the capital requirement for each loan, would have been a too complex task for most banks and supervisors.[220] The banking book's portfolio invariance - or "standalone" approach - entails that the finalised Basel III's risk-weighted assets for credit risk are not only asset-based but also simply summed regardless of the portfolio composition. This makes the finalised Basel III's capital requirements for credit risk fundamentally different from Solvency II's SCR, which includes the total balance sheet approach and diversification effects that were described above in chapter 9.4.1.

In relation to risk-weighted assets for market risk, the finalised Basel III introduced the standardised approach and internal models approach for market risk in the trading book.[221] The finalised Basel III's standardised approach for market risk includes the following seven prescribed risk classes and risk factors:

- general interest rate risk ("GIRR"),
- credit spread risk for non-securitisations ("CSR non-sec"),

[216] Solvency II, art. 101, 112, and 121(4), and Solvency II Delegated Regulation, art. 233. The risks are (i) non-life underwriting risk, (ii) life underwriting risk, (iii) health underwriting risk, (iv) market risk; (v) credit risk and (v) operational risk.
[217] Solvency II, art. 121(5) and Solvency II Delegated Regulation, art. 234. See also Solvency II Delegated Regulation, art. 225(1)(e) and 226(e).
[218] BCBS (2005), p. 4.
[219] I.e. where the capital required for any given loan only depends on the risk of that loan and not on the portfolio it is added to.
[220] BCBS (2005), p. 4.
[221] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR11.7.

- credit spread risk for securitisations not included in a correlation trading portfolio ("CSR non-CTP"),
- credit spread risk for securitisations included in the correlation trading portfolio ("CSR CTP")[222],
- equity risk,
- commodity risk, and
- foreign exchange risk ("FX risk").[223]

As described below, the standardised approach relies on these seven risk classes and risk factors when calculating trading book exposures' market risk sensitivities.[224] The internal models approach for market risk must also include the standardised approach's prescribed risk factors but cannot be used to calculate capital requirements for securitisations.[225]

Similar to risk-weighted assets for credit risk, the risk-weighted assets for market risk do not reflect Solvency II's total balance sheet approach. However, in terms of the prescribed risk factors above, there are some similarities that warrant an in-depth comparison of any aggregation and the recognition of diversification effects. Due to their extensive natures, the standardised approach will be compared in chapter 9.4.2.1 whereafter the internal models approach will be compared in chapter 9.4.2.2.

9.4.2.1 Aggregation in the Standardised Approach for Market Risk

Figure 9.7 is a simplified illustration of the finalised Basel III, with a focus on the standardised approach for market risk (in the top left corner). The standardised approach's capital requirement for market risk is the sum of

- a sensitivities-based method capital requirement (in green),
- a default risk capital requirement ("DRC")(in purple), and

[222] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR20.5, defines the correlation trading portfolio as a set of securitisation positions that meet certain requirements, including not being re-securitisation positions.

[223] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR21.1(1).

[224] Sensitivity is defined as an estimate of the change in value of an instrument due to a small change in one of its underlying risk factors, cf. BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR10.13.

[225] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR31.3. The losses suffered, during the financial crisis, on illiquid trading book securitisation exposures, as well as doubts about the ability of internal models to capture the risks associated with securitisations in a comparable fashion, had the consequence that securitisations and their risk factors are excluded and that only the standardised approach can be used to calculate capital requirements for securitisation positions in the trading book, cf. BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR31.3(2), BCBS (2019b), section 2.2, BCBS (2016), section 3.3, and BCBS (2013a), pp. 2-3, 12 and 31, BCBS (2012), annex 1, section 2.2.1.

- a residual risk add-on (in yellow).[226]

As illustrated in green, the sensitivities-based method capital requirement is the sum of the following three capital requirements[227]:

- the delta risk[228] measure - the sensitivities of an instrument to the seven prescribed (delta) risk factors above.[229]
- the vega risk[230] measure - the sensitivities of derivatives to the seven prescribed (vega) risk factors above.[231]
- the curvature risk[232] measure - the incremental risk not captured by the delta risk measure for price changes in an option, calculated via upward and downward shocks due to the seven prescribed (curvature) risk factors above.[233]

Trading book exposures' sensitivities to the seven risk factors (that were presented above) are accordingly calculated as a change in the market value of the exposure as a result of applying a specified shift to each risk factor.[234] In line with this dissertation's scope, this chapter will focus on delta risk (specifically delta credit spread risk) and the separate default risk capital requirement as they apply to credit exposures.[235]

As illustrated in the middle of figure 9.7, the delta risk measure includes the seven prescribed risk factors, including credit spread risk for non-securitisations

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[226] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR20.4. The residual risk add-on is to ensure sufficient coverage of the market risk associated with certain exposures (i.e. "instruments with an exotic underlying" and "instruments bearing other residual risks") and is generally described as a capital requirement for any other risks not addressed by the risk factors included in the sensitivities-based method or the default risk capital requirement, cf. BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR20.4(3) and MAR23 (including 23.2-23.5), and BCBS (2019b), section 3.3(iii).

[227] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR20.4(1) and MAR21.1, 21.3 and 21.7.

[228] Delta risk is defined as the linear estimate of the change in value of a financial instrument due to a movement in the value of a risk factor, cf. BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR10.14.

[229] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR20.4(1)(a), MAR21.4, 21.8-14 and 21.19-24.

[230] Vega risk is defined as the potential loss resulting from the change in value of a derivative due to a change in the implied volatility of its underlying, cf. BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR10.15.

[231] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR20.4(1)(b) and MAR21.4, 21.8-14 and 21.25-26 and 21.38

[232] Curvature risk is defined as the additional potential loss, beyond delta risk, due to a change in a risk factor for financial instruments with optionality, cf. BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR10.16.

[233] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR20.4(1)(c) and MAR21.5, 21.8-14 and 21.31.

[234] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR21.16. See also BCBS (2019b), section 3.3.(i).

[235] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR 21.2 and MAR22.2, and BCBS (2019b), p. 10 and annex, p. 16. Instruments with, inter alia, optionality are subject to vega risk and curvature risk.

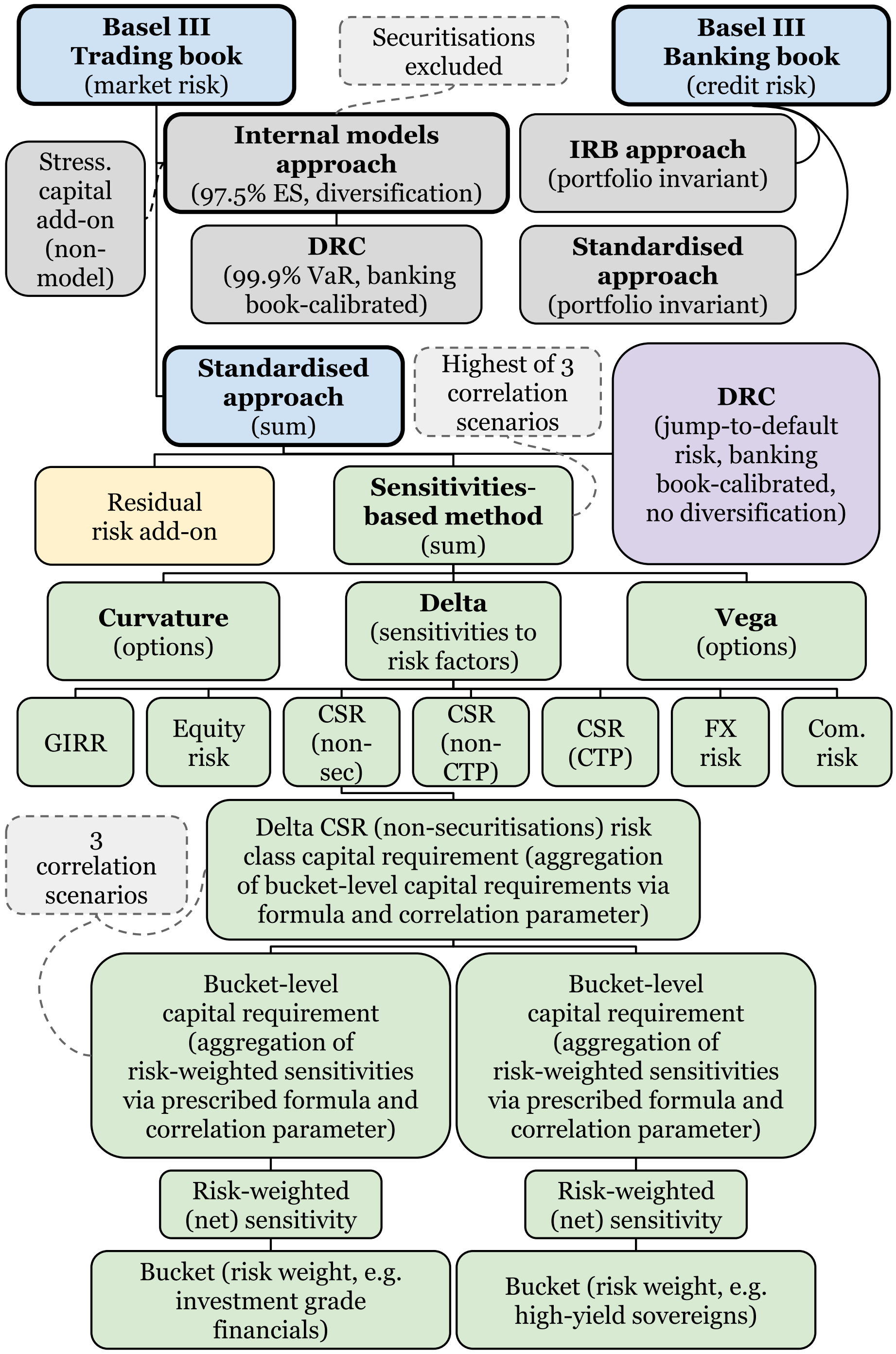

Figure 9.7: Illustration of aggregation and diversification in the finalised Basel III, with a focus on the sensitivities-based method (in green) in the standardised approach for market risk.

(CSR non-sec).[236] The following approach is applied in order to calculate the delta credit spread risk capital requirement for non-securitisations (and other risk class capital requirements):

1. A calculated credit spread risk delta risk sensitivity[237] is allocated to one of 18 credit spread risk buckets that reflect the credit quality and sector of the exposure and provide a prescribed risk weight (the process is illustrated via two buckets at the bottom of figure 9.7).[238] In order to ensure consistency with the internal models approach described below, the risk weights are calibrated to stressed market conditions and modified to reflect longer liquidity horizons for certain risk classes (the risk weights for credit spread risk for non-securitisations are e.g. modified when applied to credit spread risk for securitisations to capture market liquidity risk in the trading book due to increased liquidity horizons).[239]

2. Sensitivities to the same risk factor are netted (the offsetting of exposures with opposite directions, i.e. long vs. short positions) and these net sensitivities are risk-weighted to produce risk-weighted sensitivities.[240]

3. Risk-weighted sensitivities, within the risk bucket, are then aggregated to produce the bucket-level capital requirement.[241] This aggregation is done in accordance with a prescribed formula and correlation parameter.[242] Similar to the risk weights, correlation parameters for credit spread risk are also modified for credit spread risk on securitisations in order to reflect reflect longer liquidity horizons.[243]

4. The bucket-level capital requirements, within the credit spread risk class, are then aggregated - in accordance with a prescribed formula and cross-

[236] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR21.1(1).

[237] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR21.20. As mentioned above, a sensitivity is generally defined as the change in the market value of the instrument, as a result of applying a specified shift to each risk factor, assuming all the other relevant risk factors are held at the current level, cf. BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR21.16 and MAR10.13.

[238] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR21.4, 21.39 and 21.51-21.53.

[239] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR21.40 and 21.58(2), and BCBS (2019b), section 3.3(i). Regarding securitisations and market liquidity risk, see e.g. BCBS (2019b), section 2.3(b) and (c), BCBS (2012), section 2.1 and annex 1, section 2.2.1, BCBS (2009c), para. 1, BCBS (2009d), para. 3, and BCBS (2009b), p. 8, 16 (footnote 28) and 18.

[240] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR21.1, 21.3, 21.4(1)-(3) and 21.51-53. See also BCBS (2019b), annex.

[241] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR21.1, 21.3, 21.4(4) and 21.39. See also BCBS (2019b), annex.

[242] I.e. $K_b = \sqrt{max(0, \sum_k WS_k^2 + \sum_k \sum_{k \neq l} \rho_{kl} WS_k WS_l)}$, where K_b is the risk position for delta bucket b, WS_k and WS_l are risk-weighted sensitivities and ρ_{kl} is the correlation parameter, cf. BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR21.4(3) and (4), 21.39 and 21.54-21.56.

[243] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR21.58(2) and 21.60.

bucket correlation parameter - to produce the delta credit spread risk non-securitisations risk class capital requirement.[244]

Diversification between risk factors is recognised in the aggregation of risk-weighted sensitivities via the prescribed formulas and correlation parameters for the buckets and across the buckets.[245]

In addition, and as illustrated to the left in figure 9.7, the aggregation of bucket-level capital requirements and risk class-level capital requirements - for each prescribed delta, vega and curvature risk class - must be done three separate times based on three different correlation scenarios.[246] In order to reflect periods of financial stress, the three correlation scenarios have correlation parameters that reflect "high", "medium" and "low" correlations between the risk factors and across buckets.[247] For each correlation scenario, the capital requirements for each of the prescribed delta, vega and curvature risk classes are summed, into an overall capital requirement, and the final sensitivities-based method capital requirement is then the largest of the three capital requirements from the three correlation scenarios.[248]

When the finalised Basel III's standardised approach for market risk is compared to Solvency II (as described in chapter 9.4.1), it can obviously be determined that they both recognise diversification effects. However, the prescribed approaches for aggregation are fundamentally different. The finalised Basel III's standardised approach reflects the financial crisis, is more granular in terms of risk types and exposure types, and applies three different correlation scenarios.

As mentioned, the finalised Basel III's standardised approach for market risk also includes the default risk capital requirement that is separate from the delta credit spread risk capital requirements.[249] The purpose of the default risk capital requirement is to capture the jump-to-default risk (i.e. the incremental loss from defaults above the mark-to-market losses caused by changes in credit spreads) that may not be captured by the credit spread risk capital requirements in the sensitivities-based method.[250] The default risk capital requirement accordingly applies to exposures that are subject to default risk, including debt instruments and credit derivatives.[251]

In purple, figure 9.8 illustrates the default risk capital requirement in relation

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[244] I.e. $Delta_{cap.req.} = \sqrt{\sum_b K_b^2 + \sum_b \sum_{c \neq b} \gamma_{bc} S_b S_c)}$, where K_b is the risk position for delta bucket b (see step 3), S_b is the sum of risk-weighted sensitivities in bucket b, S_c is the sum of risk-weighted sensitivities in bucket c, and γ_{bc} is the correlation parameter, cf. BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR21.1, 21.3, 21.4(5), 21.39, and 21.57. See also BCBS (2019b), annex.

[245] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR20.4(1)(d) and MAR21.4, and BCBS (2019b), section 3.3(i).

[246] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR20.4(1)(d) and MAR21.6.

[247] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR20.4(1)(d) and MAR21.6 and 21.7, and BCBS (2019b), section 3.3.(i).

[248] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR21.1, 21.3-4 and 21.6-7. See also BCBS (2019b), section 3.3.(i) and annex.

[249] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR22.

[250] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR22.1, and BCBS (2013a),

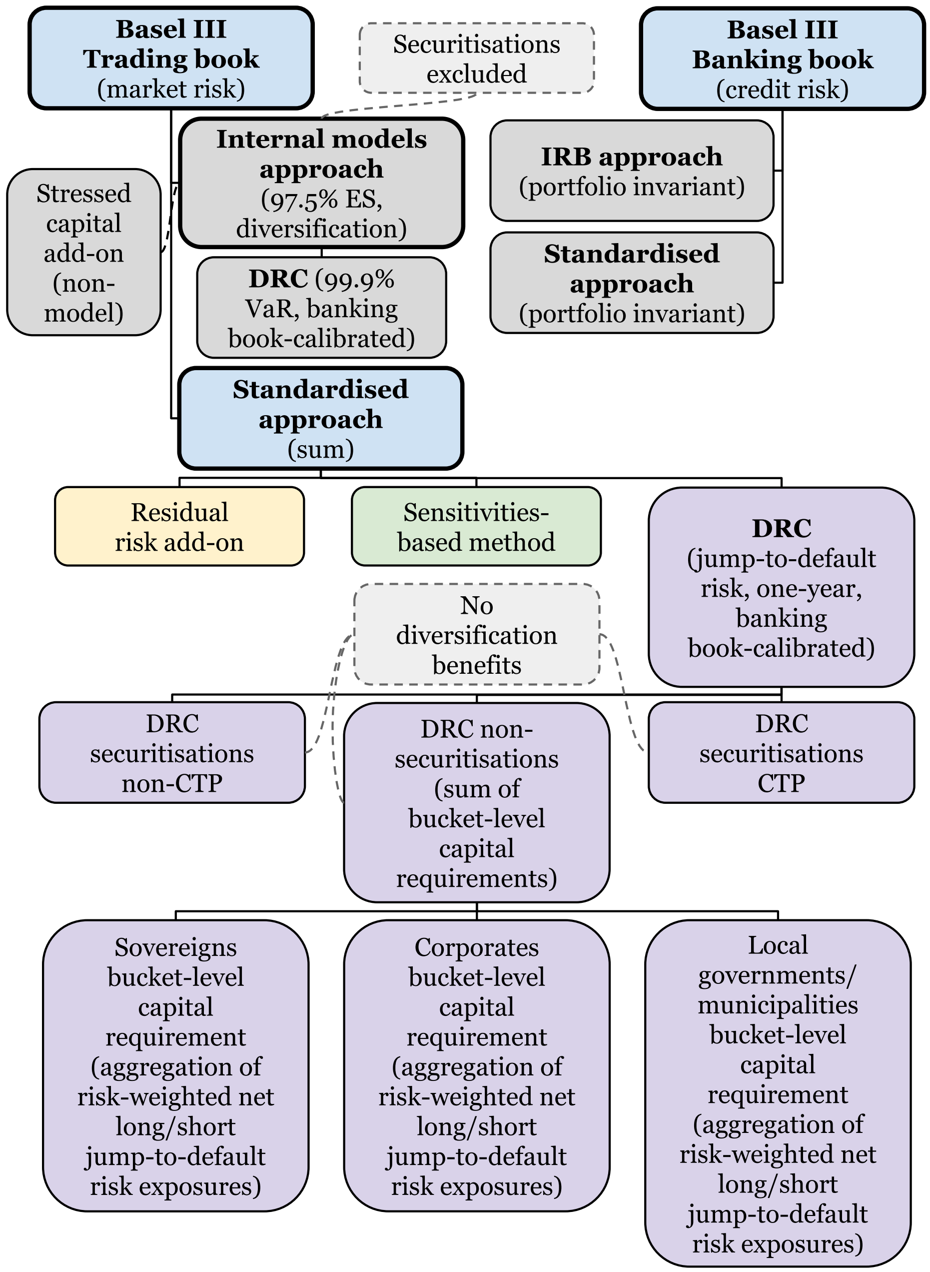

Figure 9.8: Simplified illustration of the default risk capital requirement ("DRC") in the finalised Basel III's standardised approach for market risk.

to non-securitisations. It entails that

1. the gross jump-to-default risk position of each individual exposure is calculated separately (where a long and short exposure to the same counterparty/obligor are treated as two separate exposures).[252] The long or short gross jump-to-default risk position, over the applied *one-year capital horizon*, is calculated by multiplying the exposure's notional amount (e.g. a bond's face value) with a prescribed loss given default (to reflect the loss of principal at default) whereafter any already incurred cumulative mark-to-market loss/gain (i.e. the cumulative profit and loss or "P&L") is added to ensure that only the net loss is included without double counting already incurred market value losses.[253] The P&L is equal to the market value of the exposure minus its notional amount.[254]

2. subject to certain conditions, gross jump-to-default risk exposures to the same counterparty are then subject to offsetting (i.e. gross long positions are offset against gross short positions) that produces net long and/or net short jump-to-default risk exposure amounts to the specific counterparty.[255]

3. net jump-to-default risk exposures are then allocated to buckets with risk weights (as illustrated in the bottom of figure 9.8).[256] For non-securitisation exposures, the buckets are (i) sovereigns, (ii) local governments and municipalities, and (iii) corporates.[257]

4. the net jump-to-default risk exposures in the bucket are then subjected to the prescribed risk-weights that depend on any rating of the exposure (or risk weights for non-rated exposures).[258]

5. the risk-weighted net jump-to-default risk exposures are then aggregated (via the sum of risk-weighted net long jump-to-default risk exposures minus the sum of risk-weighted net short jump-to-default risk exposures) to produce the bucket-level capital requirement.[259] As a part of the ag-

section 1.2(i).

[251] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR20.4(2) and MAR22.2, 22.3, 22.4, 22.7, 22.9, 22.10, 22.12 and 22.14.

[252] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR22.3(1), 22.9 and 22.10. A "long exposure" is defined as a credit exposure that results in a loss in case of a default whereas a short exposure results in a gain in case of a default.

[253] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR22.11-22.15, i.e. $JumpToDefault_{(long)} = max(LGD * notional + P\&L, 0)$ and $JumpToDefault_{(short)} = max(LGD * notional + P\&L, 0)$.

[254] BCBS Basel III (2019)/BCBS Basel III (2019), MAR22.11(2) and 22.14(2).

[255] BCBS Basel III (2019)/BCBS Basel III (2019), MAR22.1, 22.3(2) and 22.19.

[256] BCBS Basel III (2019)/BCBS Basel III (2019), MAR22.3(3) and (4).

[257] BCBS Basel III (2019)/BCBS Basel III (2019), MAR22.22.

[258] BCBS Basel III (2019)/BCBS Basel III (2019), MAR22.3(4) and 22.24.

[259] BCBS Basel III (2019)/BCBS Basel III (2019), MAR22.3(4) and 22.25, i.e. $DRC_{bucket} = max\left[(\sum_{i\epsilon Long} RW_i * netJTD_i) - Ratio_{hedgebenefit} * (\sum_{i\epsilon Short} RW_i * \mid netJTD_i \mid); 0\right]$

gregation, a hedge benefit ratio is applied to reduce the amount of net short positions that can be netted against net long positions in the bucket.[260]

6. the sum of the bucket-level capital requirements then gives the final default risk capital requirement for exposures to non-securitisations.[261]

As described in chapter 9.1 above, the default risk capital requirement was introduced as a response to the financial crisis, where Basel II's risk-weighted assets for market risk did not capture default risk on trading book exposures. In order to ensure consistency for similar risk exposures in the banking book and trading book, the default risk capital requirement has been calibrated in line with the treatment of credit risk in the banking book.[262] It also allows the application of the banking book's 0% risk weights for exposures to sovereigns, public sector entities and multilateral development banks, which are described in chapter 10.[263]

As illustrated in figure 9.8 above, the default risk capital requirement does not recognise diversification benefits between default risk capital requirements for (i) non-securitisations, (ii) non-correlation trading portfolio securitisations and (iii) correlation trading portfolio securitisations.[264] This is somewhat similar to Solvency II's perfect correlation approach to spread risk and the banking book's portfolio invariance.[265]

However, the standardised approach's sensitivities-based method and default risk capital requirement do not entail aggregation and diversification effects that are similar to Solvency II. In addition, and as shown in chapter 10, the logic behind Solvency II's treatment of credit risk (in the spread risk sub-module and counterparty default risk module) is no longer aligned with the finalised Basel III, which explicitly captures both default risk (over a one-year horizon) and credit spread risk on credit exposures in the trading book.

9.4.2.2 Aggregation in the Internal Models Approach for Market Risk

The finalised Basel III also includes the internal models approach for market risk that is subject supervisory approval.[266] As initially described in chapter 9.3.2 above, the internal models approach's capital requirement for market risk includes the

[260] BCBS Basel III (2019)/BCBS Basel III (2019), MAR22.1, 22.3(4), 22.21, 22.23, 22.25 and 22.26, i.e. $Ratio_{hedgebenefit} = \frac{\sum netJTD_{long}}{\sum netJTD_{long} + \sum |netJTD_{short}|}$, where $\sum netJTD_{long}$ is the sum of net non-risk-weighted long jump-to-default risk positions and $\sum \mid netJTD_{short} \mid$ is the sum of net non-risk-weighted short jump-to-default risk positions.

[261] BCBS Basel III (2019)/BCBS Basel III (2019), MAR22.3(5).

[262] BCBS Basel III (2019)/BCBS Basel III (2019), MAR20.4(2).

[263] BCBS Basel III (2019)/BCBS Basel III (2019), MAR22.7 and CRE20.7-15, and BCBS Basel III (2017), para. 7-15.

[264] BCBS Basel III (2019)/BCBS Basel III (2019), MAR22.4.

[265] See also EIOPA (2014c), section 2.5.

[266] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR11.7, and MAR30-33.

- 97.5% confidence level expected shortfall for "modellable" market risk factors,
- stressed capital requirement for "non-modellable" market risk factors, and the
- separate one-year 99.9% confidence level VaR-based default risk capital requirement ("DRC").[267]

The internal models approach is illustrated in green in figure 9.9 below.

While Solvency II includes an "undertaking-wide" approval of the SCR internal model, approval of the finalised Basel III's internal models approach is given at a trading desk level in order to enable supervisory authorities to withdraw such an approval for particular trading desks.[268] Exposures in trading desks, which are not subject to the internal models approach (i.e. "out of scope" or "ineligible" trading desks), are subject to the standardised approach for market risk.[269] During the fundamental review of the trading book, the BCBS was sceptical towards the ability of internal models to adequately capture the risks associated with securitisations.[270] Securitisations and their risk factors have therefore been excluded from the internal models approach and are therefore subject to the standardised approach for market risk.[271]

The internal models approach's 97.5% expected shortfall must be calculated - on a daily basis - for each approved trading desk and at a bank-wide level.[272] It must include the risk factors from the standardised approach above, including credit spread risk (but not the excluded securitisation risk factors).[273] Risk factors, within in-scope trading desks, must be deemed eligible/modellable in order to be included in the 97.5% expected shortfall.[274] Such "modellability" relies on certain principles and the identification of a specific number of "real" prices over certain periods that are representative of the value of the risk factor, including e.g. committed quotes verified by third party vendors, trading platforms or exchanges.[275] Risk factor "modellability" is accordingly to prevent modelling risk by ensuring that a sufficient amount of data is available for the risk factors included in the 97.5% expected shortfall.[276]

As described above, the 97.5% expected shortfall must be calibrated to a period of stress and incorporate liquidity horizons for prescribed risk factors,

[267] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33, including 33.1-3, 33.13-39, and BCBS (2019b), section 3.2.

[268] Solvency II, art. 112, vs. BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR12 and MAR30.1-2 and 30.4, and BCBS (2019b), section 3.2(i).

[269] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR30.4(2)(c), and MAR33, para. 33.40.

[270] BCBS (2013a), p. 3.

[271] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR31.3(2).

[272] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.2-3.

[273] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR31.3.

[274] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR30.4(3) and 30.15, MAR31.12 and MAR33.15.

[275] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR31.12-26.

[276] BCBS (2019b), section 3.2. See also BCBS (2012), p. 5 and section 4.3, and BCBS (2013a), p. 5 and section 2.

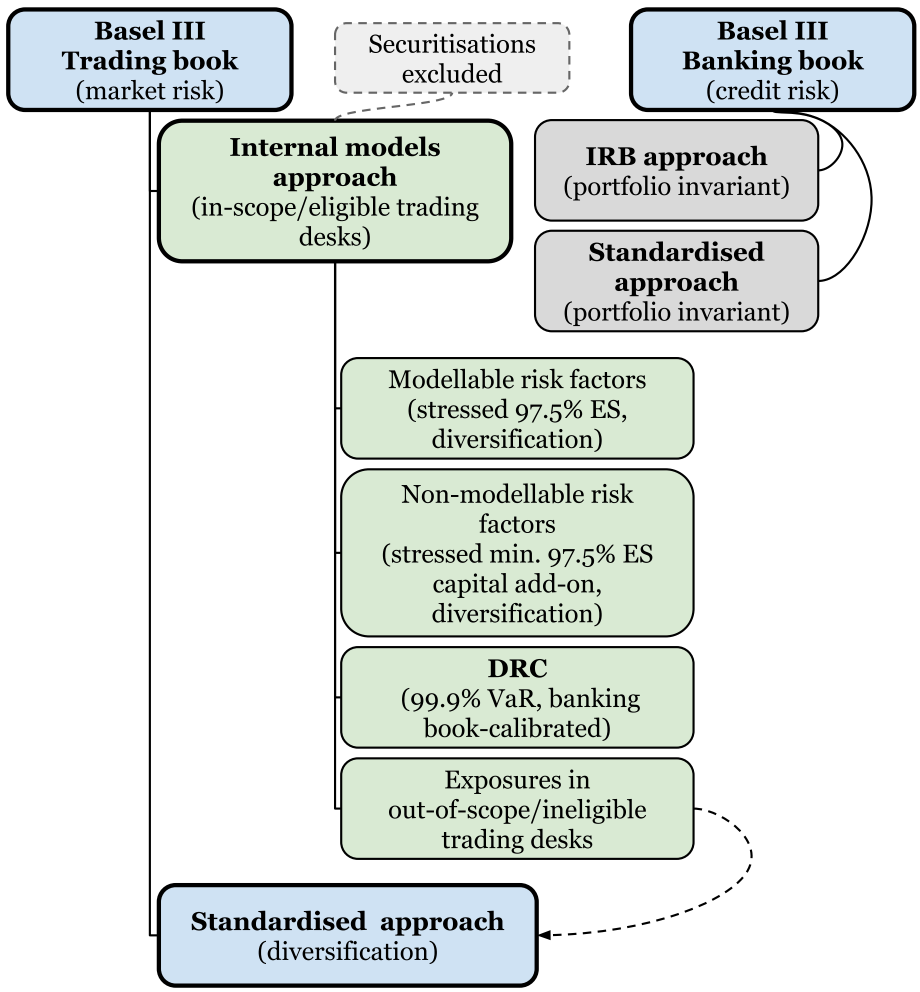

Figure 9.9: Simplified illustration of the finalised Basel III's internal models approach for market risk (in green) in the trading book.

which increase capital requirements for less liquid risk factors (e.g. credit spread risk on high-yield corporate exposures) and address market liquidity risk and migration risk.[277] The stress calibration entails that the expected shortfall is based on input from stressed modellable risk factors with a sufficiently long history of observations and on the most severe 12-month period of stress available, including - as a minimum - the financial crisis of 2007.[278] Modellable risk factors must also allow the 97.5% expected shortfall to reflect the correlation of the risk positions.[279]

While the standardised approach for market risk recognises diversification via prescribed formulas and correlation parameters, the internal models approach allows the (limited) recognition of empirical correlations within risk classes via a prescribed "constrained" aggregation scheme.[280] In this aggregation scheme, partial non-diversifiable *constrained* expected shortfall values for specific risk factor classes[281] are calculated (while all the other specific risk factors are being held constant) and summed to produce an aggregated risk class expected shortfall.[282] The aggregate expected shortfall for modellable risk factors is then based on the weighted average of (i) the sum the separate constrained expected shortfalls for each of the risk classes, where there is no diversification recognition across risk classes, and (ii) an *unconstrained* expected shortfall that allows diversification effects across risk classes.[283]

Non-modellable risk factors, which have insufficient observable market data, are subject to a separate stressed capital add-on which must be calibrated to be at least as prudent as the 97.5% expected shortfall and over a period of stress for each of the non-modellable risk factors.[284] The period of stress must be a 12-month period of stress across all non-modellable risk factors, in the same risk class, and incorporate liquidity horizons.[285] The aggregation of the stressed capital requirements for each non-modellable risk factor includes (limited) diversification effects.[286]

The aggregated capital requirement for the "modellable" market risk factors and the "non-modellable" market risk factors (in in-scope trading desks) is the largest of

[277]BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.4-7 and 33.12, and BCBS (2019b), section 3.2(ii) and (iv).

[278]BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.5-7.

[279]BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR31.26(3).

[280]BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.10 and 33.13-15, and BCBS (2019b), section 3.2(ii).

[281]The specific risk factor classes are interest rate risk, equity risk, foreign exchange risk, commodity risk and credit spread risk.

[282]BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.10 and 33.14.

[283]BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.13-33.15, and BCBS (2019b), section 3.2(ii).

[284]BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR30.4(3)(e), and MAR33.16, and BCBS (2019b), section 3.2.

[285]BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.16, and BCBS (2019b), p. 8.

[286]BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.16(2) and 33.17, and BCBS (2019b), p. 8.

- the sum of the most recent observation of (i) the aggregate capital requirement for modellable risk factors and (ii) aggregate capital requirement for non-modellable risk factors, and
- the weighted averages of both values over the previous 60 days scaled by a multiplication factor that is initially set at 1.5 unless it is adjusted by the supervisory authority based on the performance of the internal model.[287]

Finally, and similar to the standardised approach, the internal models approach includes the separate default risk capital requirement (DRC in figure 9.9 above) for trading book exposures subject to default risk, e.g. credit and equity exposures.[288] Due to the unique relationship between the two risk types, trading desks with exposure to credit spread risk and default risk must be approved by the supervisory authority.[289] In the context of market risk, the default risk capital requirement entails the calculation of an incremental loss amount for each trading book exposure (in excess of the already incurred mark-to-market losses that are incorporated in the current value of the exposure via credit spread risk) that would be suffered in case of a default (i.e. jump-to-default risk).[290] As described in chapters 9.1 and 9.3.2 above, the default risk capital requirement is to be calculated via an internal model with a weekly one-tailed 99.9 percentile confidence level VaR over a one-year time horizon (similar to the banking book).[291] Default risk must be measured for each counterparty/obligor via probabilities of default ("PD") which are subject to a 0.03% floor.[292] If the bank applies the banking book's IRB approach for credit risk, then the data for PDs and loss-given-defaults ("LGDs") must be used.[293] Alternatively, PDs and LGDs must be calculated in consistence with the IRB approach.[294]

The default risk capital requirement limits the correlations that can be used in its calculation.[295] Default correlations must be based on credit spreads (or on listed equity prices) and on data that covers a period of at least 10 years (including a period of stress that is similar to the expected shortfall) as well as be based on a one-year liquidity horizon.[296] Correlations between defaults among counterparties/obligors, including the effect of stress periods on correlations, must be recognised and based on objective data.[297] This weekly default risk capital requirement must also assume constant positions over the one-year horizon[298] and is the greater of (i) the average of the default risk capital re-

[287] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.41-42.
[288] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.18-21.
[289] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.36
[290] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.30 and 33.33. See also BCBS (2013a), section 1.2(i).
[291] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.18-20. See also BCBS (2013a), pp. 11 and 29-30, and BCBS (2005), p. 3 and section 5.1.
[292] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.24.
[293] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.37-38.
[294] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.37-38.
[295] BCBS (2016), p. 5.
[296] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.20(2) and 33.27.
[297] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.27.
[298] With an exception for designated equity sub-portfolios.

quirements calculated over the previous 12 weeks and (ii) the most recently calculated default risk capital requirement.[299]

In short, the overall capital requirement, under the internal models approach for market risk, is the sum of

- for eligible in-scope trading desks: the aggregated capital requirement for the "modellable" market risk factors and "non-modellable" market risk factors plus the default risk capital requirement for default risk exposures, and

- any capital requirement for trading book exposures, in out-of-scope or ineligible trading desks, based the standardised approach for market risk.[300]

Accordingly, while Solvency II's SCR internal model is a single VaR-based risk measure, the finalised Basel III's internal models approach for market risk is based on these prescribed capital requirements that depend on, inter alia, whether the risk factor is modellable and whether the exposure is subject to default risk.

As described in chapters 9.2 and 9.4.1, the SCR internal model is to deliver a more "true" undertaking-specific VaR and allows a life insurance undertaking to calculate its own probability distribution for the SCR, which must comply with statistical standards and the general provisions for the SCR.[301] Solvency II also allows the recognition of diversification effects - within and across risk categories - in the SCR internal model provided that the system used for measuring the diversification effects is deemed adequate by the supervisory authority (including the empirical basis for diversification assumptions as well as the taking into account of any non-linear dependence and any lack of diversification under extreme scenarios).[302] When compared to Solvency II's SCR internal model, the finalised Basel III's internal models approach for market risk seems to impose much more detailed requirements upon, inter alia, the aggregation and diversification effects. In addition, and due to the financial crisis, the finalised Basel III's internal models approach explicitly captures default risk over a one-year time horizon (similar to the banking book) in addition to credit spread risk. It also includes liquidity horizons to address market liquidity risk and migration risk. The finalised Basel III's internal models approach is accordingly more granular and fundamentally different from the overall regulation of Solvency II's SCR internal model.

The next chapter will accordingly summarise how these fundamental differences impact a comparison of quantitative pillar 1 requirements in Solvency II and the finalised Basel III.

[299] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.22-23.

[300] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.41 and 33.43.

[301] Solvency II, art. 100, 101, 121 and 122(2), and e.g. CEIOPS (2005b), para. 10.9.

[302] Solvency II, art. 121(5) and Solvency II Delegated Regulation, art. 234. See also Solvency II Delegated Regulation, art. 225(1)(e) and 226(e).

9.5 How do the Structural Differences Impact the Comparison?

As shown in chapters 9.1-9.4 above, Solvency II and the finalised Basel III are different in terms of

- overall capital requirements,
- risk measures and calibration, and
- aggregation and diversification effects.

Similar to the European Commission's and EIOPA's perspectives regarding Solvency II and CRR (that did not reflect the entire finalised Basel III), these differences entail that comparisons of both overall and transaction-specific capital requirements are not viable when comparing Solvency II and the finalised Basel III.[303]

In relation to the overall capital requirements, Solvency II's SCR is a single aggregated VaR-based risk measure that relies on the total balance sheet approach and captures liability risk and asset risk, including underwriting risks, market risk and credit risk. The finalised Basel III relies on risk-weighted assets for, inter alia, credit risk and market risk. Solvency II also calibrates all capital requirements via the one-year 99.5% VaR. The finalised Basel III calibrates default risk capital requirements, in both the banking book and trading book, via the one-year 99.9% VaR, while it calibrates, inter alia, credit spread risk capital requirements via the liquidity horizon-adjusted 97.5% expected shortfall.

It was also shown how aggregation and diversification effects in Solvency II's SCR standard formula and SCR internal model are fundamentally different from the finalised Basel III. Solvency II's SCR standard formula simulates the one-year 99.5% VaR and entails the aggregation of (sub and sub-sub-) risk modules through up to three aggregation steps that include any allowed diversification effects via aggregation formulas and correlation parameters. Spread risk capital requirements, for e.g. exposures to bonds and loans, are aggregated via spread risk sub-sub and sub modules in the market risk module. In addition, the counterparty default risk module includes certain residential mortgage loans and credit exposures that are not covered by the spread risk sub-module. Capital requirements for credit risk exposures are accordingly aggregated via two separate risk modules in the SCR standard formula, and a credit exposure can only be placed in one of those modules. Solvency II does accordingly not subject one credit exposure to separated and explicit capital requirements for both spread risk and default risk.

In the finalised Basel III, the banking book's capital requirements for credit risk are based on portfolio invariance while the trading book's standardised approach and internal models approach for market risk conduct aggregation in fundamentally different ways than Solvency II. Due to the financial crisis, the

[303] European Commission (2015b), section 9, and EIOPA (2018b), para. 1513 and 1536.

finalised Basel III also captures default risk (or jump-to-default risk) separately from - and in addition to - credit spread risk on a trading book exposure that is subject to default risk.

As described in chapter 8 regarding the scope and comparison method, these structural differences entail that this dissertation's comparison of Solvency II and the finalised Basel III will not apply pillar 1 requirements to a defined scenario in order to assess the respective value differences in the calculated pillar 1 requirements. Instead, the comparison will be limited to assessing whether the in-scope risk types are subject to quantitative pillar 1 requirements. If such a pillar 1 requirement exists for the risk type in both Solvency II and the finalised Basel III, then the risk type will be viewed as addressed in a "similar" fashion. The remaining parts of this dissertation will accordingly compare how Solvency II and finalised Basel III address the following:

- credit risk (in the form of default risk, credit spread risk and migration risk) and counterparty credit risk (see part VI).
- liquidity risk (see part VII).
- leverage and the associated procyclicality (see part VIII).
- systemic risk (see part IX).

The chapters above have obviously revealed that default risk and credit spread risk are regulated in both Solvency II and the finalised Basel III. However, from a risk-type level perspective, chapter 10 will show that those risk types are subject to fundamentally different approaches that rely on different levels of granularity.

Part VI

Credit Risk, Market Risk and Counterparty Credit Risk

Chapter 10

Credit Risk and Market Risk

In relation to credit risk and market risk, the research question is whether Solvency II subjects life insurance undertakings' credit risk exposures to requirements that are "similar" to the finalised Basel III's requirements for such credit risk exposures. As described above and in chapter 8, the comparison is limited to assessing whether credit risk exposures are subject to quantitative pillar 1 requirements. Counterparty credit risk is a risk type that is specifically associated with repos and other SFTs and a comparison of quantitative pillar 1 requirements for counterparty credit risk is made in chapter 11.

Chapter 9 has already revealed that Solvency II includes capital requirements for credit risk and market risk in both the SCR standard formula and SCR internal model.[1] However, as described in chapter 4, credit risk can be divided into the four components:

- default risk,
- credit spread risk,
- jump-to-default risk, and
- migration risk.

While Solvency II may address credit risk as an overall risk type, the individual credit risk components may not be captured or be captured differently. This chapter will therefore determine how these credit risk components are addressed in Solvency II in comparison to the finalised Basel III.

This approach may constitute a very strict interpretation of the FSB's criteria regarding whether prudential regulatory standards are either not applied or are applied to a materially lesser or different degree.[2] Due to its global nature, the FSB's definition of shadow banking may have to be understood in a more overall fashion and therefore in terms of whether credit risk as an "overall risk

[1] Solvency II, art. 101(4)(d) and (e), 104(1)(d) and (e) and 121(4).
[2] FSB (2011c), section 1.

type" is addressed in both Solvency II and the finalised Basel III.[3] In line with the "overall risk type" approach, the European Commission initially found that Solvency II addresses shadow banking issues via

- comprehensive regulation centred on a risk-based and economic approach,
- risk management requirements including the prudent person principle,
- explicit credit risks capital requirements that were as stringent in respect of credit risk as the proposed CRD IV for credit institutions, and
- the total balance sheet approach where all entities and exposures were subject to group supervision.[4]

In relation to, inter alia, insurance undertakings' direct lending, the European Commission has stated that the inherent risks would be sufficiently covered and that opportunities for regulatory arbitrage would be limited due to risk management requirements and capital requirements (including for direct loans) that would be specified at Solvency II's level 2.[5] In a reply to the European Commission's findings, EIOPA (2012) recognised that mortgage lending and direct lending to corporates could fall within the definition of shadow banking but stated that those activities were subject to regulation and supervision, including Solvency II's economic risk-based solvency requirements and total balance sheet approach.[6]

The findings above were made before the finalised treatment of credit risk in the Solvency II Delegated Regulation as well as before the finalised Basel III.[7] In addition, the European Commission's and EIOPA's reference to the economic risk-based approach and total balance sheet approach does not enable a determination of which components of credit risk are subject to explicit quantitative pillar 1 requirements. It does also not address how any capital requirements for credit risk interact with requirements regarding e.g. liquidity risk or leverage.

The alternative investments of life insurance undertakings may necessitate a more granular approach to the components of credit risk. As initially described in chapters 4 and 9.1, short-term exposure horizons entail that defaults on liquid credit exposures are viewed as idiosyncratic and negligible in a well-diversified portfolio.[8] Instead, a well-diversified portfolio of liquid credit exposures is, over a short-term horizon, associated with market risk due to mark-to-market changes in the value of the portfolio exposures.[9] Such mark-to-market changes may be due to e.g. credit spread risk or interest rate risk.[10] However, the longer the exposure horizon, the more non-diversifiable systematic risk and default risk

[3] See e.g. FSB (2013c), section 1.1(i) and p. 12 (including footnote 16), and FSB (2015c), p. 4 (footnote 11) and section 3.1.

[4] European Commission (2012), pp. 8-10, and European Commission (2013b), p. 6.

[5] European Commission (2013b), pp. 5-6.

[6] Pp. 1-2.

[7] European Commission (2012), p. 10, European Commission (2013b), p. 6.

[8] BCBS (2009b), section 4.

[9] BCBS (2009b), section 4.

[10] See e.g. BCBS (2009b), section 2, and BCBS (2013a), section 1.2(i) and 3.4(v).

are perceived to increase.[11] Changes in market liquidity may accordingly lead an assumed liquid credit exposure (primarily exposed to market risk, including credit spread risk) to become a "held-to-maturity position" that is dominated by default risk.[12] During the financial crisis, and contrary to the initial perception of trading book exposures' liquidity, the trading books of banks included large (structured) credit exposures that became illiquid as well as subject to default risk and substantial mark-to-market losses.[13]

A lack of addressing default risk may accordingly entail the risk of not capturing significant losses on credit exposures when market liquidity changes. When assessing Solvency II's approach to credit risk, it must be kept in mind that the SCR is calibrated based on a *one-year* 99.5% VaR.[14] In other words, the SCR is the economic capital to be held by a life insurance undertaking in order to ensure that it is able to meet its obligations to policyholders and beneficiaries over the following 12 months with a probability of at least 99.5%.[15] The SCR is accordingly to capture market-consistent losses of basic own funds (i.e. losses caused by changes in market values) over that one year, which goes beyond a traditional trading book time horizon.[16] As mentioned in chapter 9.3 above, European Commission (2015b) did therefore not view it as "meaningful" to compare Solvency II's SCR to the former 10-day 99% VaR in the replaced Basel II's trading book.[17] The European Commission did also not view it as meaningful to compare the SCR to Basel II's capital requirements for credit risk, in the banking book, as those capital requirements only captured credit risk and not market-consistent price fluctuations.[18]

The SCR's one-year exposure horizon is also different from the finalised Basel III's internal models approach for market risk, in the trading book, where the 97.5% expected shortfall relies on stress period-based liquidity horizons for specific risk factors that are scaled from a 10-day base liquidity horizon.[19] However, as described in chapter 9, the internal models approach for market risk also includes the separate (jump-to-) default risk capital requirement with a weekly 99.9% VaR that is based on a one-year time horizon.[20] This is in line with the capital requirement for credit risk, in the banking book, which is also based on a one-year time horizon.[21] In addition, the finalised Basel III's standardised approach for market risk includes

[11] BCBS (2009b), pp. 2 and 8 and section 4.

[12] BCBS (2009b), p. 8 and section 4.

[13] BCBS (2019b), section 2.3(b) and (c), BCBS (2012), p. 3, sections 2.1 and 3.3, and annex 1, sections 2.1.1 and 2.2.1, BCBS (2013a), section 1.3, BCBS (2009c), para. 1, BCBS (2009d), para. 3, and BCBS (2009b), p. 8, 16 (footnote 28) and 18.

[14] Solvency II, art. 101(3) and 104(3) and (4).

[15] Solvency II, recital 64.

[16] CEIOPS (2005b), para. 10.2, 10.4, 10.15, 10.121 and 10.127, and CEIOPS (2007a), para. 2.39.

[17] Section 9.

[18] European Commission (2015b), section 9.

[19] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.4 and 33.12, and BCBS (2019b), p. 7.

[20] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR33.18-21.

[21] BCBS (2013a), section 1.2(i).

- risk-weights that were calibrated via liquidity adjusted time horizons for each risk class (including credit spread risk), and
- the separate (jump-to-) default risk capital requirement, in addition to the capital requirements for credit spread risk, which was calibrated based on treatment of credit risk in the banking book in order to reduce the risk of discrepancies in capital requirements for similar risk exposures.[22]

The finalised Basel III's introduction of, inter alia, the banking book-calibrated default risk capital requirements in the trading book accordingly makes it relevant to compare how Solvency II and the finalised Basel III address the components of credit risk.

10.1 Comparison Approach

The finalised Basel III's banking book includes the standardised approach and internal ratings-based ("IRB") approach for credit (default) risk which are to be implemented by 1 January, 2022.[23] As described above, the finalised Basel III's trading book includes the standardised approach and internal models approach for market risk which are also to be implemented by 1 January, 2022.[24] Solvency II includes the SCR standard formula and the SCR internal model, which are both to capture credit risk and market risk, while the SCR standard formula is to explicitly capture, inter alia, spread risk and counterparty default risk.[25]

This chapter will firstly describe the Solvency II SCR standard formula's spread risk sub-module and counterparty default risk module. Subsequently, the finalised Basel III's (i) standardised approach and IRB approach for credit risk in the banking book and (ii) standardised approach and internal models approach for market risk in the trading book will be compared to the described parts of Solvency II. The comparisons will be limited to an assessment of if - and how - default risk, credit spread risk and migration risk are subject quantitative pillar 1 requirements. The comparison will therefore only be at the risk factor level and must be viewed in the light of the structural differences that were described above in chapter 9, including overall capital requirements, risk measures and calibration, as well as aggregation and diversification effects. Table 10.1 presents an overview of the comparison in relation to default risk, credit spread risk and migration risk.

As described below, the finalised Basel III's IRB approach for credit risk, in the banking book, includes detailed regulation of its asset classes, risk weight functions and risk components.[26] In addition, chapter 9.4.2.2 above described

[22] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), MAR20.4(2), MAR21.39-40 and 21.51-53, and MAR22.

[23] BCBS Consol. Basel III (2019), CRE20.1-2, and BCBS Basel III (2017), Standardised approach for credit risk, para. 1 and 2.

[24] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR20-23 and MAR30-33.

[25] Solvency II, art. 100, 101(4)(d) and (e), 104(1)(d) and (e), and 105(5)(d) and (6), and 121(4).

[26] I.e. PD, LGD, EAD and M.

			Default risk/jump-to-default risk	**Credit spread risk**	**Migration risk**
Finalised Basel III	**Banking book** (portfolio invariance)	*Standardised approach for credit risk*	?		
		IRB approach for credit risk	?		
	Trading book (prescribed diversification effects during aggregation)	*Standardised approach for market risk*	?	?	?
		Internal models approach (IMA) *for market risk*	?	?	?
Solvency II	**SCR standard formula:** (prescribed diversification effects during aggregation in SCR standard formula)	*Spread risk sub-module*	?	?	?
		Counterparty default risk module (residential mortgage loans)	?		

Table 10.1: Overview of comparison in relation to the capital requirements for the individual components of credit risk.

how the finalised Basel III's internal models approach for market risk, in the trading book, includes minimum quantitative standards regarding, inter alia, liquidity horizons, stress calibrations, aggregation and diversification as well as differentiation between "modellable" and "non-modellable" risk factors. In contrast, Solvency II's SCR internal model is regulated in a very "overall" nature that does not enable a detailed comparison with the finalised Basel III.[27] The adequacy of the SCR internal model and its input seems to generally rely on the approval assessment by the supervisory authority and level 1 and 2 do e.g. not prescribe a particular method for the calculation of the SCR-based probability distribution, provide risk-weight functions or formulas for risk factor capital requirements, or impose quantitative limitations on diversification.[28] As illustrated in the bottom of table 10.1 above, the comparison will therefore focus on Solvency II's SCR standard formula.

In line with this dissertation's scope, the comparisons will focus on credit exposures - in the form of bonds and loans - to sovereigns, banks and corporates. A bond that is used as financial collateral in a repo, and remains in the bank's balance sheet, is subject to either the banking book's capital requirements for credit risk or the trading book's capital requirements for market risk.[29] As described in chapter 6.3.1.1, posted financial collateral in repos also remains in the balance sheet of Danish life insurance undertakings and is subject to market risk capital requirements under Solvency II's SCR standard formula.[30] Similar to prescribed haircut floors, these capital requirements may "loosen" the direct relationship between the financial collateral values and the access to repo funding as they may possibly absorb losses on the assets and maintain the creditworthiness of the repo seller.[31]

Chapter 6.3.3 described how mortgage credit bonds may be used in repo-based strategies. Except for minor differences in wording, the finalised Basel III's definition of covered bonds is aligned with the EU's current definition of covered bonds in the UCTS Directive.[32] The finalised Basel III's standardised approach for credit risk includes risk weights for covered bonds with cover pools

[27]Solvency II states, inter alia, that the SCR internal model (i) must correspond to the 99.5% VaR of the basic own funds over a one-year period, (ii) must cover all quantifiable risks including, inter alia, market risk and credit risk, and (iii) may - in relation to diversification effects - consider dependencies within and across risk categories, provided that supervisory authority approves the system used for measuring such diversification effects, cf. Solvency II, art. 101(3) and (4), 121(4) and (5), and 122(2), and Solvency II Delegated Regulation, art. 226(c), 229(c), 233, 234 and 238.

[28]Solvency II, title I, chapter VI, section 4, subsections 1 and 3, including art. 112(3) and (5), 121(4) and 122(2), and Solvency II Delegated Regulation, title I, chapter VI, including art. 228-238.

[29]BCBS Consol. Basel III (2019), CRE22.25 and CRE32.20, and BCBS Basel III (2017), e.g. Standardised approach for credit risk, para. 139, and Internal ratings-based approach for credit risk, para. 89.

[30]EIOPA Guidelines (2014d), para. 1.27.

[31]See chapter 5.1.1.2.

[32]UCITS Directive, art. 52(4), BCBS Consol. Basel III (2019), CRE20.33 and BCBS Basel III (2017), Standardised approach for credit risk, para. 32. In the EU, COM(2018) 94 final proposes a directive on the issue of covered bonds and covered bond public supervision and includes an amendment to the definition of covered bonds, cf. the proposed art. 28.

that consist of claims secured by certain residential real estate with a loan-to-value ratio of 80% or lower.[33] As described in chapter 10.3.1, the counterparty default risk module, in Solvency's II SCR standard formula, includes retail loans secured by mortgages on residential property (i.e. "mortgage loans").[34] However, mortgage loans in the counterparty default risk module are "direct" loans while covered bonds, which fulfil the EU's definition of covered bonds, are subject to the spread risk sub-module in the SCR standard formula's market risk module.[35] The comparison below will therefore primarily focus on the spread risk sub-module's treatment of loans, bonds and covered bonds while the counterparty default risk module is described in detail in chapter 11 in relation to counterparty credit risk. Before conducting the comparison, chapter 10.2 will explain the cross-sectoral role of external credit risk assessments in the regulation of credit risk.

10.2 The Cross-Sectoral Role of External Credit Risk Assessments

As described in the following chapters, external credit assessments (i.e. credit ratings) are used to determine capital requirements in both Solvency II's SCR standard formula and the finalised Basel III's standardised approach for credit risk. This chapter will briefly describe how Solvency II has aimed to ensure cross-sectoral consistency in the use of external credit assessments.

In relation to the financial crisis, external credit assessment institutions (i.e. credit rating agencies) were considered unable to reflect the worsening market conditions in their credit assessments as well as unable to adjust their credit assessments following the deepening market crisis.[36] In addition, the use of external credit assessments in regulation was viewed as having led market participants to mechanistic reliance on external credit assessments as well as insufficient due diligence and poor risk management.[37] In the light of the financial crisis, the G20 agreed on regulatory oversight and registration of the external credit assessment institutions that produce external credit assessments used for regulatory purposes.[38] Subsequently, the FSB has aimed to end mechanistic reliance on external credit assessments in regulation and to establish stronger internal credit risk assessment practices.[39]

In line with the FSB, the BCBS's consultations, regarding the standardised approach for credit risk, aimed to reduce or remove - where possible - reliance on external credit assessments.[40] However, the BCBS reintroduced external

[33] BCBS Consol. Basel III (2019), CRE20.34(2), and BCBS Basel III (2017), Standardised approach for credit risk, para. 33.
[34] Solvency II Delegated Regulation, art. 191.
[35] Solvency II Delegated Regulation, art. 176 and 180(1).
[36] See e.g. ECAI Regulation, recital 10.
[37] FSB (2010a) and BCBS (2014b), section 1.2.
[38] G20 (2009a), p. 6.
[39] FSB (2010a), principles 1 and 2.
[40] BCBS (2014b), sections 1.2, 1.3 (principle 5) and 2.1.

credit risk assessments for exposures to banks and corporates but supplemented them with a pillar 1 due diligence requirement to ensure that the external credit risk assessment appropriately and conservatively reflects the credit risk of the exposure.[41] The finalised Basel III accordingly includes requirements regarding due diligence as well as the use of external credit assessments and recognition of external credit assessment institutions.[42]

In the EU, the ECAI Regulation includes registration requirements for external credit assessment institutions ("ECAIs") as well as requirements regarding the issuing and use of external credit assessments.[43] Credit institutions and insurance undertakings may only use external credit assessments for regulatory purposes if they are issued by external credit assessment institutions that are established in the EU and registered in accordance with the ECAI Regulation.[44] These entities must also perform their own credit risk assessment and may not rely solely or mechanistically on external credit assessments.[45]

In line with the above, Solvency II regulates life insurance undertakings' use of external credit assessments and aims to reduce their overreliance on external credit assessments.[46] At level 1, Omnibus II amended Solvency II to include external credit assessment institutions and enable the allocation of credit assessments to the SCR standard formula's credit quality steps.[47] The allocation was to be done by the ESAs, via the Joint Committee of the European Supervisory Authorities, and be consistent with the use of external credit assessments in CRR for credit institutions.[48] At level 2, the Solvency II Delegated Regulation regulates the use of external credit assessments and prescribes the seven credit quality steps 0 to 6, while the Solvency II ECA Mapping Regulation maps external credit assessments to the credit quality steps while aiming to ensure consistency with CRR and its level 2 mapping of external credit assessments.[49]

Accordingly, while the finalised Basel III refers directly to external credit assessments, Solvency II refers to credit quality steps to which external credit assessments are mapped. Similar to the finalised Basel III's due diligence requirement, Solvency II's risk management requirements include requirements regarding additional internal assessments of the appropriateness of external credit assessments as well as require own internal credit assessments of certain larger

[41] BCBS (2015c), pp. 1-2 and sections 1.1.1 and 1.1.2.

[42] BCBS Consol. Basel III (2019), CRE20.4-20.6 and 20.20 and CRE21, and BCBS Basel III (2017), Standardised approach for credit risk, part A, including para. 4, and part B, including art. 98.

[43] ECAI Regulation, art. 2 and 4, title II, including art. 6, and title III, including art. 14.

[44] ECAI Regulation, art. 4(1).

[45] ECAI Regulation, art. 5(a).

[46] Solvency II, art. 44(4a), and Solvency II Delegated Regulation, recital 2 and title I, chapter I, section 2, including art. 4(5).

[47] Omnibus II, art. 2(1)(b), (28) and (29), and Solvency II, art. 13(40), 109a and 111(1)(n).

[48] Solvency II, art. 109(a)(1) and 111(1)(n)).

[49] Solvency II Delegated Regulation, art. 3 and 4, and Solvency II ECA Mapping Regulation, recitals 1-4. See also Commission Implementing Regulation (EU) 2016/1799. Solvency II Delegated Regulation, art. 4(1), prescribes that life insurance undertakings may use an external credit assessment, in the SCR standard formula, if it has been issued by an ECAI (or endorsed by an ECAI) in accordance with the ECAI Regulation.

or more complex credit exposures.[50]

10.3 Solvency II's Approach to the Credit Risk Components

This chapter will present the initial logic behind Solvency II's treatment of credit risk exposures in the spread risk sub-module (in the market risk module) and the counterparty default risk module as well as their relationship to the former Basel II's standardised approach and IRB approach for credit risk. Subsequently, chapters 10.4-10.6 will compare Solvency II's treatment of credit risk exposures to the finalised Basel III's capital requirements for credit risk and market risk.

During the early phase of the Solvency II project, where the relevance of banking rules for insurance was discussed, European Commission (2001) found that the draft Basel II contained a "few new ideas" that could be transposed to the insurance sector.[51] However, and contrary to the subsequent development in alternative investments, the European Commission stated that insurance undertakings basically sought to invest their funds in low-risk, diversified instruments and that they did not perform a "lending" role comparable to that of the banks.[52] The European Commission also stated that market risk was a banking-specific risk, as it only concerned the trading book, which had no equivalent in the insurance sector where asset exposures could also be long-term.[53] Somewhat contrary to CEIOPS' alignment perspective below, the European Commission initially concluded that Basel II's market risk approach could not be transposed.[54] In addition, as Basel II's approach to credit risk was viewed as too complicated - and as "counterparty risk (credit risk)" was not considered the major risk of insurance undertakings - it was proposed to develop a standardised approach for credit risk.[55]

During the first wave of advice, CEIOPS (2005a) stated that the adoption of the CRD's (i.e. Basel II's) standardised approach for credit risk was to be considered.[56] However, CEIOPS found that while consistency with the treatment of credit risk in banking regulation was important, the "overriding consideration" had to be whether the resulting treatment of insurance undertakings' assets was adequate in view of their liabilities and risk profile.[57] CEIOPS would therefore assess the materiality of the differences between the credit risk exposures of banks and insurance undertakings as well as the materiality of insurance undertakings' credit risk exposures compared to their other risk exposures.[58]

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[50] Solvency II, art. 44(4a), Solvency II Delegated Regulation, recital 2 and art. 4(5), 259(4) and 260(1)(c)(iii), and Commission Implementing Regulation (EU) 2015/2015.
[51] Para. 27.
[52] European Commission (2001), para. 27.
[53] European Commission (2001), para. 29.
[54] European Commission (2001), para. 58.
[55] European Commission (2001), para. 57.
[56] Para. 21 and 88.
[57] CEIOPS (2005a), para. 88.
[58] CEIOPS (2005a), para. 89.

In the second wave of advice, CEIOPS (2005b) discussed how credit risk consisted of both default risk and the change in the creditworthiness of issuers of securities.[59] CEIOPS accordingly defined credit risk as the risk of loss of value resulting from *default* as well as a change in the creditworthiness of, inter alia, issuers of securities and counterparties, and any other risks normally reflected in *credit spreads*.[60] As credit risk included the loss of value arising from a deterioration in the market's perception of creditworthiness, the market value of an exposure (or marking to model when no market value existed) was proposed as input to the measuring of credit risk.[61] In addition to using external credit assessments similar to Basel II, CEIOPS proposed that credit spreads could be used to reflect the market's perception of credit quality.[62] As higher credit spreads were historically more volatile, they would result in a higher capital requirement for credit risk.[63] Credit spreads could also produce a reasonable proxy for an exposure's credit spreads when actual credit spreads were not available for that exposure.[64]

In the subsequent second quantitative impact study, the tested SCR standard formula accordingly treated credit risk and market risk separately via the credit risk module and a market risk module (that included interest rate risk, equity risk, property risk and currency risk).[65] The credit risk module captured the risk of default as well as the change in the credit quality and relied on external credit ratings-based risk weights, effective duration[66] and market values.[67] Spread risk was accordingly not captured separately but as alongside default risk in the credit risk module.[68]

However, CEIOPS (2007a) found that it was not "intuitive" to capture both default risk and spread risk in the same module.[69] As illustrated in figure 10.1, the third quantitative impact study amended the SCR standard formula and replaced the credit risk module with the separate counterparty default risk module and the spread risk sub-module (in the market risk module).[70] The spread risk sub-module was to capture the risk caused by the volatility of credit spreads over the risk-free interest rate term structure.[71] The counterparty default risk module was to capture the risk of default of a counterparty to risk mitigating

[59] Para. 10.91.

[60] CEIOPS (2005b), para. 10.91.

[61] CEIOPS (2005b), para. 10.96, and 10.160.

[62] CEIOPS (2005b), para. 10.97, 10.98 and 10.160.

[63] CEIOPS (2005b), para. 10.98.

[64] CEIOPS (2005b), para. 10.98.

[65] CEIOPS QIS2 (2006a), para. 5.1, 5.31, 5.37-4.39 and 5.68-5.75.

[66] See chapter 10.3.2.

[67] CEIOPS QIS2 (2006a), para. 5.68, 5.69 and 5.72, i.e. $SCR_{credit1} = \sum_i g(rating_i) * EffectiveDuration_i * MarketValue_i$.

[68] See also CEIOPS (2007a), para. 5.159.

[69] Para. 5.159.

[70] CEIOPS (2007a) , para. 2.44, 5.47, 5.48, 5.82, 5.83, 5.91, 5.99, 5.158-5.165, 5.177-5.191, CEIOPS (2007d), para. 1.1-1.3 and sections 2 and 3, and CEIOPS QIS3 (2007), para. I.3.1, I.3.24, I.3.27-I.3.30, I.3.88-I.3.99, and I.3.114-I.3.126.

[71] CEIOPS QIS3 (2007), para. I.3.88.

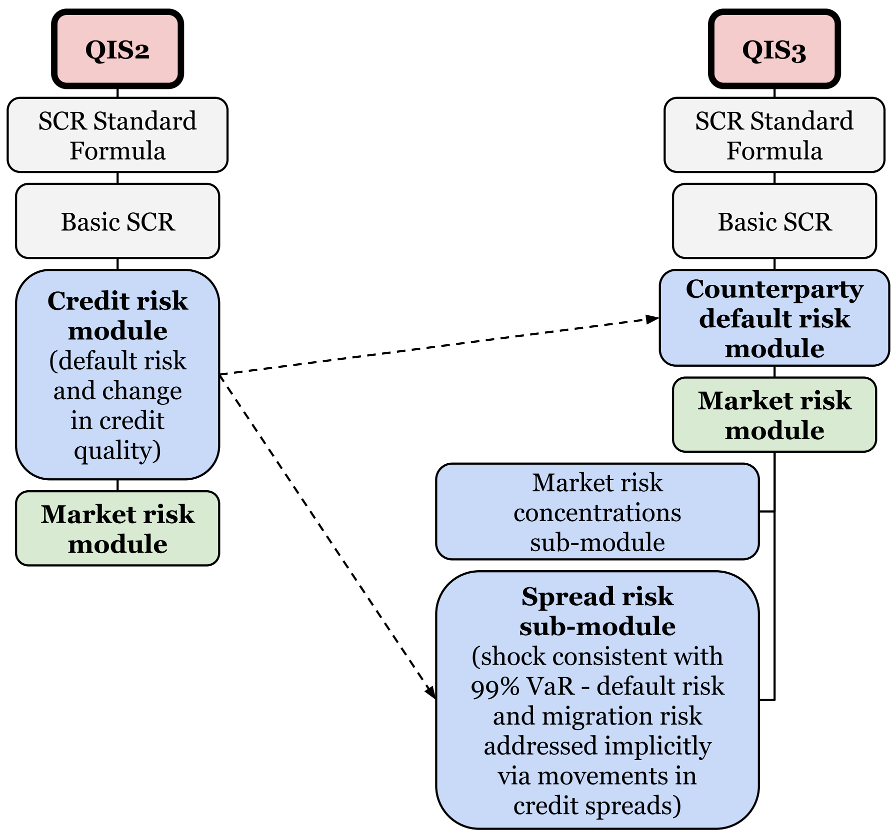

Figure 10.1: An illustration of how the Solvency II project replaced the credit risk module with the counterparty default risk module and the spread risk sub-module.

contracts, including reinsurance and financial derivatives.[72] CEIOPS viewed this approach to credit risk as more closely aligned with banking regulation, where "specific interest rate risk" was treated as a part of the trading book while default risk was a part of the banking book.[73] In addition, when comparing possible approaches for credit risk to banking regulation, CEIOPS (2007d) stated that

> *"Many assets held by insurers are relatively liquid and thus incomparable to the credit risks held by banks in the banking book. This would imply that the trading book regulation is the proper counterpart for some assets also in terms of the level of capital requirements. On the other hand, many assets are held to maturity by insurers. This would imply that the capital requirements should b[e] somewhat consistent with the banking book regulations. In practice, the liquidity of assets held by insurers will be somewhere between the illiquid loans held by banks and the assets held by banks for the purpose of trading."*[74]

CEIOPS was accordingly of the view that insurance undertakings' exposures were liquid (similar to trading book exposures) but also "held to maturity" (similar to banking book exposures).

While it was not viewed as "intuitive" to capture default risk and spread risk in the same module, default risk and migration risk would be included *implicitly* in the spread risk sub-module via the movements in credit spreads.[75] This implicit and partly capturing of default risk and migration risk was viewed as integrated into the calibration of shocks as the credit indices, used for the calibration, would rebalance monthly and reflect a change of their constituents due to downgrades or upgrades.[76] The movements in credit spreads were accordingly to capture the systematic part of default risk and migration risk implicitly while the separate market risk concentrations sub-module would capture specific/idiosyncratic risk components.[77]

Accordingly, at level 1 and 2, Solvency II's SCR standard formula includes capital requirements for

- spread risk on, inter alia, bonds and loans in the *spread risk sub-module* (under the market risk module),

- additional risks stemming from a lack of diversification in the asset portfolio, or from large exposure to default risk by a single issuer of securities or a group of related issuers, in the *market risk concentrations sub-module* (under the market risk module), and

[72] CEIOPS QIS3 (2007), para. I.3.114-I.3.117.

[73] CEIOPS (2007a), para. 5.83. See also CEIOPS (2007d), para. 1.1.

[74] Para. 5.1. The square brackets have been inserted to correct "by".

[75] CEIOPS QIS3 (2007), para. I.3.89, and CEIOPS (2007d), para. 1.2 and 2.2. See also European Commission QIS4 (2008), para. TS.IX.F.2.

[76] CEIOPS QIS3 (2007), para. I.3.89. See also CEIOPS (2007d), para. 1.2 and 2.2.

[77] CEIOPS (2007d), para. 1.2.

- counterparty default risk on, inter alia, any "other credit exposures" which are not covered in the spread risk sub-module (including the specific retail loans secured by mortgages on residential property) in a separate *counterparty default risk module*.[78]

The implicit capturing of default risk and migration risk, via a calibration of the factors of movements in credit spreads, remains a part of the final SCR standard formula's underlying assumptions for the spread risk sub-module.[79]

In the finalised Basel III, the fundamental review of the trading book was met with similar challenges regarding the treatment of credit risk in the trading book's market risk. The BCBS found it difficult to incorporate the measurement of default risk into a fully integrated market risk model and it was decided that the capital requirements for market risk would include two separate components in the form of the capital requirements for credit spread risk (which were to also cover migration risk) and a separate default risk capital requirement.[80] These two components, including the finalised Basel III's separate default risk capital requirement in the trading book, were initially described above in chapter 9 and will be further presented in chapter 10.6 below.

Before comparing Solvency II's SCR standard formula to the finalised Basel III, chapter 10.3.1 will present the logic behind the allocation of credit exposures to either the spread risk sub-module or the counterparty default risk module. As shown, this allocation will determine whether the exposure is subject to a spread risk or default risk treatment. Chapter 9.1 described how the finalised Basel III's redefined boundary between the banking book and trading book entails criteria[81] for the allocation of exposures to the trading book as well as that certain exposures are generally presumed to be trading book exposures or automatically allocated to the trading book or banking book.[82] In the finalised Basel III, the allocation and treatment of a credit exposure accordingly depends on, inter alia, intentions regarding e.g. short-term resale or profiting from short-term price movements.

[78] Solvency II, art. 105(5)(d) and (f) and (6), and Solvency II Delegated Regulation, title I, chapter V, sections 5 (subsections 5 and 6) and 6.

[79] EIOPA (2014c), section 2.5. See also European Commission QIS4 (2008), para. TS.IX.F.2.

[80] BCBS (2013a), section 1.2(i).

[81] I.e. purposes in the form of (i) short-term resale, (ii) profiting from short-term price movements, (iii) locking in arbitrage profits, or (iv) hedging risks arising from instruments meeting the purposes in (i)-(iii), cf. BCBS Basel III (2019)/BCBS Consol. Basel III (2019), RBC25.5.

[82] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), RBC25.5-10. The banking book comprises all instruments that are not in the trading book and all other assets of the bank, cf. BCBS Basel III (2019)/BCBS Consol. Basel III (2019), RBC20.5 and RBC25, including 25.1 and 25.7-8.

10.3.1 Interaction Between Credit Spread Risk and Counterparty Default Risk - Type 1 and 2 Exposures and Mortgage Loans

At level 1, Solvency II prescribes that the counterparty default risk module covers risk-mitigating contracts (such as reinsurance arrangements, securitisations and derivatives), receivables from intermediaries as well as "any other credit exposures which are not covered in the spread risk sub-module".[83] This level 1 definition of the covered exposures entails that both the counterparty default risk module and the spread risk sub-module can cover credit exposures (but not the same type of credit exposure). During the development of level 2 regulation, this overlap - in terms of credit exposures - led to uncertainty in relation to the interaction between the counterparty default risk module and the spread risk sub-module.[84]

As described below in chapter 11.2.1, CEIOPS initially looked towards the treatment of default risk in the banking sector when developing the counterparty default risk module in relation to reinsurance and financial derivatives.[85] CEIOPS (2009d) subsequently amended the counterparty default risk module via the introduction of separate capital requirements for *type 1 exposures* (that included reinsurance arrangements, derivatives and any other risk mitigating contracts that would not be diversified and where the counterparty was likely to be rated) and *type 2 exposures* (that included exposures which were usually diversified and where the counterparty was likely to be unrated).[86] In line with this approach, the final level 2 regulation assumes that type 1 exposures (including risk-mitigation contracts such as derivatives) are not diversified but likely to be rated, while type 2 exposures (including certain mortgage loans as described below) are assumed to be a well-diversified portfolio of small single name exposures without a rating (or unlikely to be rated).[87] The counterparty default risk module was accordingly structured to apply one form of treatment upon non-diversified type 1 credit exposures, which are associated with bilateral counterparty credit risk, and another form of treatment upon other diversified type 2 credit exposures. Pursuant to the SCR standard formula's underlying assumptions, the capital requirements for type 1 and type 2 exposures assume that the behaviour of default probabilities and the loss, in the event of default, are inherently very different for the two exposure types.[88] Solvency II's counterparty default risk capital requirements for type 1 exposures are described in chapter 11.2.1 below in relation to counterparty credit risk.

[83] Solvency II, art. 105(6).

[84] See e.g. CEIOPS (2009a), para. 4.56 and 4.58, CEIOPS (2009d), para. 3.2-3.4, and EIOPA (2011), section 5.5.7.

[85] CEIOPS (2007a), para. 5.180 and 5.186, CEIOPS (2007d), para. 3.2-3.3, and CEIOPS QIS3 (2007), para. I.3.125. See also BCBS (2005), p. 6.

[86] CEIOPS (2009d), para. 3.20-3.23 and 3.179-3.180. See also European Commission QIS5 (2010), SCR.6.3.-6.6.

[87] Solvency II Delegated Regulation, art. 189 and 191, and EIOPA (2014c), pp. 23 and 71-72.

[88] EIOPA (2014c), p. 72.

In relation to the interaction between the spread risk sub-module and the counterparty default risk module, CEIOPS (2009a) proposed that the spread risk sub-module should cover loans guaranteed by mortgages, whereafter CEIOPS (2010a) proposed that direct exposures to borrowers, which were covered by real estate collateral, should be subject to a treatment that was consistent with the standardised approach for credit risk in CRD (that implemented Basel II).[89] However, European Commission (2010) moved "mortgage loans made to policyholders" to the counterparty default risk module as a part of the fifth quantitative impact study.[90] During the subsequent Q&A, the item "mortgage loans made to policyholders" led to uncertainty regarding whether loans (that were not in form of a bond) to other than "policyholder debtors" were to be placed in the counterparty default risk module or the spread risk sub-module. CEIOPS replied that loans with risk structures similar to a bond (i.e. most loan exposures to government institutions and business undertakings) were subject to the spread risk sub-module, while all other loans, especially small-scale loans with individual debtors like policyholders, were subject to the counterparty default risk module.[91]

In the final level 2 regulation, certain retail loans secured by mortgages on residential property (i.e. "mortgage loans") became type 2 exposures in the counterparty default risk module.[92] The definition of "mortgage loans" is similar to the definition of retail exposures, as well as the regulation of exposures secured by mortgages on residential property, in the former CRD's standardised approach for credit risk.[93] However, the credit risk on other loans secured by mortgages, which do not qualify as "mortgage loans", is not covered by the counterparty default risk module.[94]

Based on the above, it seems difficult - from a banking perspective - to determine the overall principles and consistency behind the two risk modules and their treatment of e.g. mortgage loans. Had it been up to CEIOPS' initial advice, then mortgage loans could have ended up in the spread risk sub-module. For the year 2017, Danish FSA (2018b) stated that market risk constituted 83% of the aggregated risk exposure of Danish life insurance companies and multi-

[89] CRD, recital 37, CEIOPS (2009a), para. 4.61 and 4.77, and CEIOPS (2010a), para. 4.144-4.150, 4.165 and 4.175-181. See also CEIOPS (2010c), para. 3.177.

[90] European Commission QIS5 (2010), para. SCR.6.6 and 6.36.

[91] CEIOPS QIS5 Q&A (2010), question no. 91 regarding SCR.6.6.

[92] Solvency II Delegated Regulation, art. 189(3)(c) and 191.

[93] Accordingly, Solvency II's mortgage loans must, inter alia, (i) be to natural persons or a SME, (ii) be one of a significant number of exposures with similar characteristics, whereby the risks, associated with such lending, are substantially reduced, (iii) not exceed EUR 1 million, (iv) be on residential property that is or will be occupied or let by the owner, (v) entail that the value of the property does not materially depend upon the credit quality of the borrower, and (vi) entail that the risk of the borrower does not materially depend upon the performance of the underlying property but on the underlying capacity of the borrower to repay the debt from other sources, cf. Solvency II Delegated Regulation, art. 191 vs. CRD, art. 79(2) and annex VI, part 1, section 9.1. The definition also shares similarities with the asset class for retail exposures in the IRB approach for credit risk, cf. BCBS Consol. Basel III (2019), CRE30.20(2) and (3) and 30.22(2), and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 21 and 22.

[94] Solvency II Delegated Regulation, art. 189(6)(d).

employer occupational pension funds while counterparty risk constituted 1%.[95] Similarly, CEIOPS (2009d) initially found that - in most cases - the default risk originating from type 2 exposures was very small when compared to the overall risk.[96] It was therefore recommended to apply a portfolio-level capital requirement for type 2 exposures instead of attempting to address the individual risk characteristics of each exposure and their interdependencies.[97] CEIOPS proposed a "simple" factor-based approach, where the sum of the values of type 2 exposures (except for certain past-due receivables) could be multiplied with a risk factor that did not depend on the counterparties' probability of default or the size or number of exposures.[98] Based on assumptions regarding (i) the probability of default lying between a rating of BBB and BB, (ii) the portfolio being well-diversified and (iii) that a third of the exposure could be collected in case of default, CEIOPS derived a 15% risk factor for type 2 exposures.[99] In addition, the value of the type 2 exposures were to be reduced by the risk-adjusted value of collateral.[100] The final level 2 counterparty default risk module's treatment of type 2 exposures accordingly multiplies the 15% risk factor with an LGD[101] for the mortgage loan exposures which incorporates the risk mitigating effect of the mortgage after a haircut.[102]

While the counterparty default risk module had its initial roots in Basel II's IRB approach for credit risk, and while the treatment of mortgage loans initially looked towards Basel II's standardised approach for credit risk, the final level 2 treatment of type 2 exposure mortgage loans differs from both the standardised approach and IRB approach in the finalised Basel III, which are described below. As mentioned above, the introduction of type 1 and 2 exposures seems to have led the counterparty default risk module to include bilateral counterparty credit risk in type 1 exposures and default risk in both type 1 and type 2 exposures (where type 2 exposures consist of mortgage loans and other credit exposures that are not covered in the spread risk sub-module and are not type 1 exposures).[103] Solvency II's level 1 structuring of the two risk modules and credit risk also seems to have led to a "where to place it"-approach that entails either (i) the counterparty default risk module's portfolio-based default risk treatment of type 2 exposures or (ii) the spread risk module's market risk treatment of bonds and loans that is described next.

[95] Danish FSA (2018b), p. 5.

[96] Para. 3.42.

[97] CEIOPS (2009d), para. 3.42.

[98] CEIOPS (2009d), para. 3.42-3.46, 3.125-3.127 and 3.2.8.

[99] CEIOPS (2009d), para. 3.125-3.126 and 3.234.

[100] CEIOPS (2009d), para. 3.220.

[101] Defined as $LGD = max(Loan - 80\% * Mortgage_{RiskAdjustedValue}; 0)$

[102] Solvency II Delegated Regulation, art. 192(4), 198 and 202, i.e. $CapitalRequirement_{type2} = 90\% * LGD_{receivables>3months} + \sum_i 15\% * LGD_i$.

[103] Solvency II Delegated Regulation, art. 189 and 191, EIOPA (2014c), p. 70, and e.g. EIOPA Guidelines (2014d), para. 1.27(b).

10.3.2 Spread Risk Sub-Module and Bank-like Credit Exposures

In line with the total balance sheet approach, Solvency II provides that the spread risk sub-module is to capture the sensitivity of the values of assets, liabilities and financial instruments to changes in the level or in the volatility of credit spreads over the risk-free interest rate term structure.[104] In accordance with the defined scope, this chapter will only focus on the treatment of assets in the form of bond and loan exposures to sovereigns, banks and corporates.

At level 2, the spread risk sub-module uses duration and modified duration in the calculation of capital requirements for spread risk on bonds and loans.[105] The duration of a bond's or loan's discounted cash flow is the "longness" or weighted time average of the payments.[106] Generally, the longer the maturity and the lower the coupon payments are relative to the face value, the higher is the "duration" of a bond or loan as it takes a "longer" time period to reach the total of future cash flows.[107] Duration is used to measure sensitivity (i.e. a percentage change in the exposure's price given a percentage change in the interest rate) as the price of a loan or bond varies proportionately with its duration.[108] Higher duration implies a larger change in the price due to a

[104]Solvency II, art. 105(5)(d).

[105]Solvency II Delegated Regulation, art. 176(1)-(4).

[106]EIOPA (2014a), p. 17, and Hopewell and Kaufman (1973), p. 750. CRR, art. 340(3), defines duration as $Duration = \frac{\sum_{t=1}^{M} t \frac{C_t}{(1+R)^t}}{\sum_{t=1}^{M} \frac{C_t}{(1+R)^t}}$, where R is the yield to maturity, C_t is the cash flow or (coupon) payment in time t, M is the total maturity, and $\frac{C_t}{(1+R)^t}$ is the present value of a cash flow in time t. In the formula, each present value of each cash flow is multiplied by the time t required to receive the cash flow and - to derive duration in e.g. years - the sum of all the time periods, each weighted by the present value of the corresponding cash flow, is divided by the present value of the entire series of cash flows, cf. Hopewell and Kaufman (1973), p. 750. Macaulay (1938), pp. 44-45 and 48-49, describes how the number of years to maturity (i.e. the date of the final payment of the bond or loan) does not provide information regarding the sizes of other payments or the date on which they are made. The time element (i.e. "longness") of a bond or loan is defined as "duration" which depends on maturity, the coupon rate and yield. The duration of a bond is defined as an average of the durations of the separate "single payment loans" into which the bond may be broken up. The average of the durations is calculated by weighting the duration of each individual "loan" in proportion to the size of the individual loan (i.e. the ratio of the present value of the individual future cash flow to the sum of all the present values of future cash flows). If two bonds have the same maturity and the same yield - but one has a higher coupon rate - the one with the higher coupon rate represents an essentially shorter term loan as it reaches the total of future cash flows "earlier". Macaulay (1938) exemplifies this by comparing a \$400 bond (with a 6% coupon rate) with a \$500 bond (with a 4% coupon rate) where both mature after 25 years. While the total of future cash flows (i.e. interest and principal) of both bonds amounts to \$1000, the 6% coupon rate entails that the \$1000 are being reached "earlier" than via the 4% coupon rate.

[107]Macaulay (1938), pp. 45 and 49, and BCBS (2004), annex 1, pp. 28-29 and footnote 13.

[108]Hopewell and Kaufman (1973), pp. 750-751, BCBS (2004), annex 1, pp. 28-29 and footnote 13, EIOPA (2014a), p. 17, and EBA (2016), pp. 4-5.

given change in the interest rate.[109] Modified duration is an adjusted version of duration that accounts for a change in the price due to a given change in the yield to maturity.[110] During the Solvency II project, the spread risk shock was the immediate effect, on the net value of asset and liabilities, caused by an instantaneous decrease of a credit exposure's value due to the widening of its credit spread.[111] The one-year 99.5% VaR-calibrated shock factors, which reflected the percentage loss caused by such a widening of the credit spread, were multiplied with the exposure's modified duration and market value.[112]

Similarly, Solvency II's final level 2 capital requirement for spread risk on bonds and loans is equal to the loss in the basic own funds that would result from an instantaneous relative decrease of *stress* in the value of each bond or loan.[113] If an external credit assessment is available, the spread risk sub-module includes a table of stress percentages (which are assigned to credit quality steps), and a specific stress factor may be derived by e.g. multiplying the exposure's modified duration (in years) with a prescribed stress percentage.[114] If an external credit assessment is not available, the spread risk sub-module includes a table of duration-assigned stress percentages, and a specific stress factor may be derived by e.g. multiplying the exposure's duration with a prescribed stress percentage.[115] The incorporation of (modified) duration accordingly entails that the applied stress factor depends on the exposure's market risk sensitivity. The spread risk sub-module also allows adjustments to stress factors if eligible collateral has been posted.[116] Collateralised exposures are described below in chapter 11.2 regarding counterparty credit risk.

As illustrated in green to the right in figure 10.2, the spread risk sub-module captures bond and loans and includes specific treatments for certain exposures:

- Certain covered bonds, which fulfil the EU's definition of covered bonds, are subject to specific stress factors that depend on their credit quality step and duration.[117]

[109] See e.g. BCBS (2004), annex 1, pp. 28-29.

[110] CEIOPS (2007d), p. 5 (footnote 2), and EBA (2016), pp. 4-5. CRR, art. 340(3), defines modified duration as $Duration_{modified} = \frac{Duration}{1+R}$. EIOPA (2014a), p. 18, states that the difference between duration and modified duration is often immaterial.

[111] See e.g. European Commission QIS5 (2010), para. SCR.5.82.

[112] European Commission QIS5 (2010), para. SCR.5.82-85, i.e. $\sum_i MarketValue_i * Mod.Duration_i * F^{up}(rating_i)$. In the subsequent preparatory phase, the spread risk shock on bonds and loans (other than the specific loans secured by residential mortgages placed in the counterparty default risk module) was calculated by multiplying the exposure's market value with the one-year 99.5% VaR-calibrated spread risk factor (that was determined in a matrix via the exposure's credit quality step and duration) that was multiplied with the modified duration, cf. EIOPA (2014b), SCR.5.93-5.98, i.e. $\sum_i MarketValue_i * F^{up}(rating_i; duration_i)$.

[113] Solvency II Delegated Regulation, art. 176(1).

[114] Solvency II Delegated Regulation, art. 176(2) and (3), e.g. $Stress_i = percentage_{CreditQualityStep} * duration_{modified}$. See chapter 10.2 above regarding the mapping of external credit assessments.

[115] Solvency II Delegated Regulation, art. 176(4), e.g. $X\% * duration$.

[116] Solvency II Delegated Regulation, art. 176(5).

[117] Solvency II Delegated Regulation, art. 180(1).

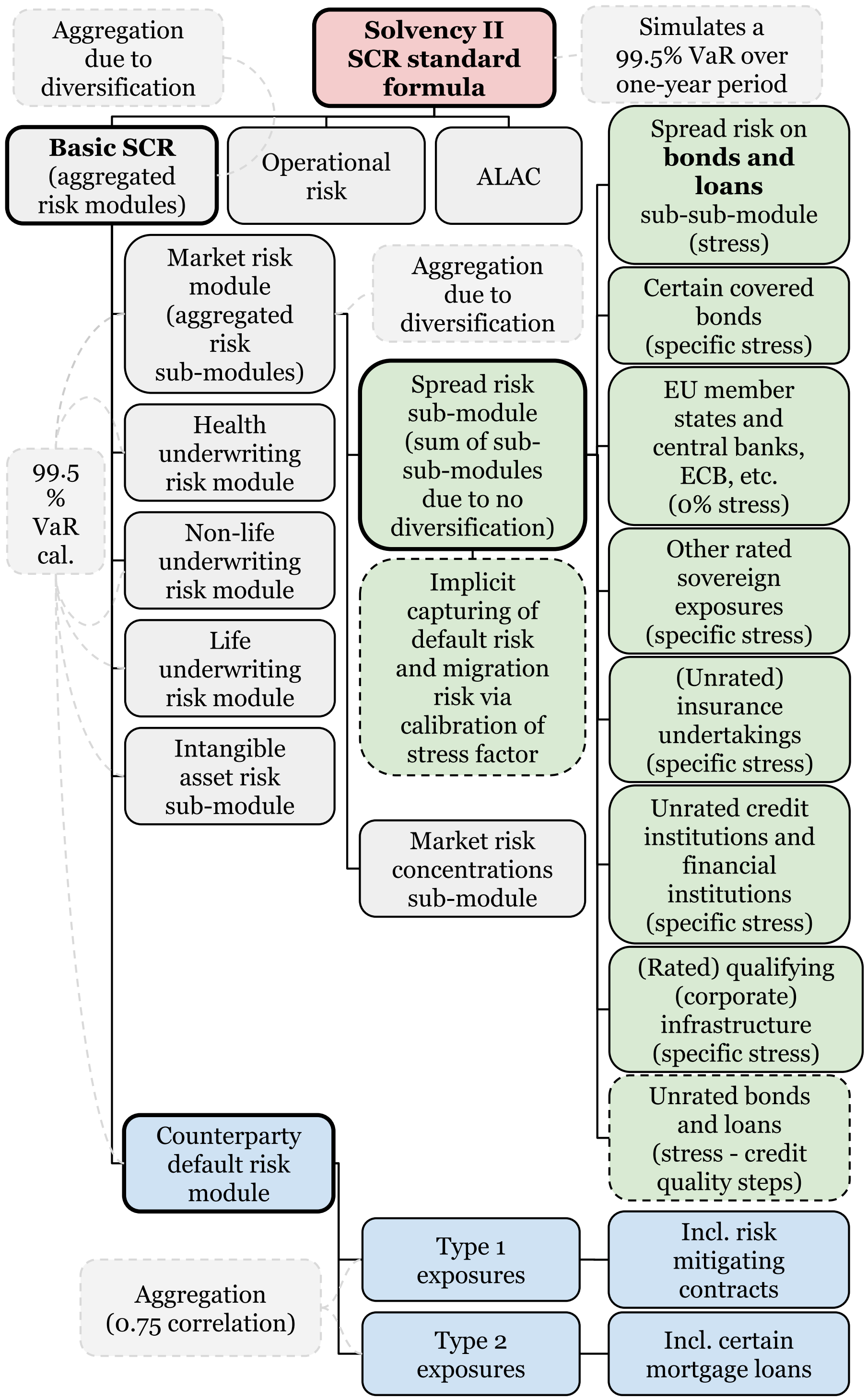

Figure 10.2: Illustration of how the credit risk components (i.e. default risk, credit spread risk and migration risk) are addressed in Solvency II's SCR standard formula. In the spread risk sub-module (in green), default risk and migration risk are captured implicitly via the calibration of the stress factor. "ALAC" is the adjustment for the loss-absorbing capacity.

- Certain bond and loan exposures to, inter alia, the ECB and EU member states' central governments and central banks receive a 0% stress factor.[118] This approach is similar to how exposures to sovereigns may be treated in the finalised Basel III's banking book as described below.[119]
- Certain "other" rated bond and loan exposures to central governments and central banks receive stress factors that depend on the credit quality step and the duration of the exposure.[120]
- Unrated bond and loan exposures to (re-)insurance undertakings, which meet Solvency II's MCR, are subject to stress factors that depend on the insurance undertaking's solvency ratio, which is linked to the credit quality steps and stress factors applicable for bonds and loans that have external credit assessments.[121] Bond and loan exposures to (re-)insurance undertakings, which do no meet the MCR, are subject to stress factors that depend on the exposure's duration and prescribed stress percentages.[122] Unrated bond and loan exposures to a third-country (re-)insurance undertaking, which complies with the third country's Solvency II-equivalent solvency requirements, are subject to stress factors based on the 100% solvency ratio for unrated exposures to (re-)insurance undertakings in the EU.[123]
- Unrated bond and loan exposures to credit institutions and financial institutions, which comply with the solvency requirements in CRR and CRD IV, are subject to stress factors based on the 100% solvency ratio for unrated exposures to (re-)insurance undertakings (in the point above).[124]

In addition, the EU considers life insurance undertakings to be among the largest institutional investors in Europe, with the ability to provide debt funding to long-term infrastructure.[125] As a part of the Capital Markets Union Action Plan, specific qualifying infrastructure investments and qualifying infrastructure corporate investments were accordingly introduced and subjected to specific treatment in the spread risk sub-module.[126] Bond and loan exposures to certain rated "qualifying infrastructure investments" are therefore subject to specific stress factors that depend on the credit quality step and the duration of the exposure.[127] Similarly, bond and loan exposures to certain rated "qualifying infrastructure corporate investments" are subject to specific stress factors

[118] Solvency II Delegated Regulation, art. 180(2).
[119] BCBS Consol. Basel III (2019), CRE20.7 and 20.10, and BCBS Basel III (2017), Standardised approach for credit risk, para. 7 and 10
[120] Solvency II Delegated Regulation, art. 180(3).
[121] Solvency II Delegated Regulation, art. 180(4) and (6).
[122] Solvency II Delegated Regulation, art. 180(5) and (6).
[123] Solvency II Delegated Regulation, art. 180(7).
[124] Solvency II Delegated Regulation, art. 180(8).
[125] Commission Delegated Regulation (EU) 2017/1542, recital 2.
[126] Commission Delegated Regulation (EU) 2017/1542, including recital 2 and art. 1(2), (3) and (8), and Solvency II Delegated Regulation, art. 164a, 164b and 180. See also Commission Delegated Regulation (EU) 2016/467, including recital 2 and art. 1(4).
[127] Solvency II Delegated Regulation, art. 180(11)-(12).

that depend on the credit quality step and the duration of the exposure.[128] Bond and loan exposures to *unrated* qualifying infrastructure investments and unrated qualifying infrastructure corporate investments are subject to stress factors equivalent to a prescribed credit quality step and the exposure's duration.[129]

Solvency II accordingly subjects presumably illiquid and long-term infrastructure credit exposures to spread risk capital requirements. As described in chapter 9.2, it does so while relying on the "market consistent" approach, where the default valuation method is quoted market prices in active markets for the same assets.[130]

As a part of the Capital Markets Union Action Plan, the EU also wanted to support insurance undertakings' exposures to long-term assets and SMEs, including privately placed corporate debt.[131] EIOPA was accordingly requested to provide advice regarding "unjustified constraints" to financing in insurance undertakings' prudential requirements.[132] This advice was to treat insurance undertakings' investments - that support of jobs and growth - "appropriately" and remove barriers to their investments in unrated bonds and loans, as well as in unlisted equity, in order to improve their ability to invest in private placement offerings and private equity.[133] This Solvency II review included that EIOPA was to provide specific and risk-sensitive criteria that would allow unrated bonds and loans to be subject to the possibly lower capital requirements for rated bonds and loans in credit quality steps 2 and 3 of the spread risk sub-module.[134] In the subsequent consultation, EIOPA (2017a) stated that unrated corporate debt, issued by non-financial and non-real estate corporates, represented a low single digit percentage of all investments by European insurance undertakings.[135] In its second set of advice, EIOPA (2018b) also found it reasonable to assume that insurance undertakings' exposures to low credit quality debt was rather limited in accordance with the prudent person principle.[136]

In relation to unrated bonds and loans, the European Commission accordingly amended the Solvency II Delegated Regulation and allowed insurance undertakings to

- use an internal credit assessment approach for credit quality steps of unrated bonds and loans, which includes, inter alia, criteria regarding (i) seniority ranking, (ii) terms and conditions including covenants, (iii) bor-

[128]Solvency II Delegated Regulation, art. 180(14)-(15).
[129]Solvency II Delegated Regulation, art. 180(13) and (16).
[130]Solvency II, recital 45 and art. 75, and Solvency II Delegated Regulation, recital 7 and art. 10(2).
[131]European Commission (2015a), section 4.2, and European Commission (2017a), pp. 7 and 20.
[132]European Commission (2017c), sections 1.1 and 3.
[133]European Commission (2015a), section 4.2, and European Commission (2017c), sections 1.1 and 3.
[134]European Commission (2017c), sections 1 and 3.1. See also Commission Delegated Regulation (EU) 2019/981, recitals 2 and 5.
[135]EIOPA (2017a), para. 707.
[136]EIOPA (2018b), para. 1003. See also EIOPA (2017a), para. 637.

rower characteristics and financial ratios, (iv) thresholds on the yield on the unrated bond or loan in relation to yield indices (that serve as proxies for "market" yield), (v) the redemption payment and interest payments, and (vi) the own internal credit assessment of the exposure that is to consider all material risk factors as well as all relevant quantitative and qualitative information, and

- rely on assessments for the "mapping" of unrated bonds and loans to credit quality steps (which are based on a credit institution's approved IRB approach for credit risk or an insurance undertaking's SCR internal model) in co-investment agreements where joint investments by the insurance undertaking and a credit institution (or another insurance undertaking) are made in certain unrated bonds and loans.[137]

Chapter 10.3 above and chapter 12.1 below describe the Solvency II project's initial perceptions regarding credit risk and liquidity risk, including that the liquidity of insurance undertakings' assets would be somewhere between banks' illiquid loans and trading book exposures.[138] In addition, insurance undertakings invested premiums on the capital market, to receive higher returns than the guarantees given, and their investment process was viewed as more similar to UCITS than the process of producing loans in banking.[139] Contrary to these perceptions, the EU is currently accommodating life insurance undertakings' investments in bank-like unrated bonds and loans while placing these exposures in the spread risk sub-module. When doing so, EIOPA's assumptions regarding unrated credit exposures being in the "single digit" percentages may not reflect country-specific traits, including the development in Danish life insurance undertakings' alternative credit investments, which was documented in chapter 6.2. At the same time, it must be kept in mind that the credit risk, on those alternative credit exposures, may have been passed on to policyholders via non-guaranteed products.

As mentioned in chapter 10.3 above, CEIOPS did not view it as "intuitive" to capture default risk and spread risk in the same credit risk module. This view led to the spread risk sub-module's implicit capturing of default risk and migration risk via the one-year 99.5% VaR calibration of the factors of movements in credit spreads.[140] From a banking perspective, it seems counterintuitive to subject presumably illiquid and long-term unrated credit exposures to primarily spread risk capital requirements. In the finalised Basel III, credits to SMEs and unlisted equities are automatically allocated to the banking book's default risk capital

[137] Commission Delegated Regulation (EU) 2019/981, recitals 2, 5 and 28 and art. 1(37) (new art. 176a-176c in the Solvency II Delegated Regulation). See also C(2019) 1900 final, section 1, and EIOPA (2018b), section 10.5, including para. 1048, 1072, 1073, 1075, 1076, 1081, 1085 and 1086 and section 10.5.3.

[138] CEIOPS (2007d), para. 5.1.

[139] CEIOPS (2007b), para. 2.6. See also European Commission (2001), para. 27.

[140] EIOPA (2014c), section 2.5. See also CEIOPS (2007a), para. 5.159, CEIOPS (2007d), para. 1.2 and 2.2, CEIOPS QIS3 (2007), para. I.3.89, and European Commission QIS4 (2008), para. TS.IX.F.2.

requirements.[141] However, in addition to diversification effects, the question of whether the presumably illiquid and long-term credit exposures are adequately captured in the spread risk sub-module will depend on the actual stress factor calibration, which is to reflect the 99.5% VaR over a *one-year* period. Chapter 10.6 below will show that the finalised Basel III's trading book captures credit spread risk explicitly while migration risk is captured implicitly via liquidity horizons. However, the finalised Basel III's explicit capital requirements for default risk, in both the trading book and banking book, are calibrated over a *one-year* period (similar to Solvency II's calibration) *but* subject to a 99.9% VaR.[142]

As shown in chapter 9 and below, the finalised Basel III's explicit capturing of default risk under all approaches, in both the banking book and trading book, was not present in the former Basel II's trading book. Chapter 10.3 described how CEIOPS' introduction of the spread risk sub-module and counterparty default risk module was viewed as more closely aligned with banking regulation (where "specific interest rate risk" was treated as a part of the trading book while default risk was a part of the banking book).[143] This view is - in principle - not aligned with the finalised Basel III's separate and explicit capturing of default risk, in both the banking book and trading book, via the one-year 99.9% VaR.

10.4 The Finalised Basel III's Standardised Approach for Credit Risk

In the finalised Basel III's standardised approach for credit risk, standardised risk weights are assigned to exposures whereafter the product of the risk weight and the exposure amount (net of specific provisions) gives the risk-weighted asset.[144] Contrary to Solvency II's SCR standard formula, the standardised approach's aggregation of the risk-weighted assets for credit risk is portfolio invariant. As described above, Solvency II's spread risk sub-module also relies on (modified) duration and a market consistent approach where the default valuation method for assets is quoted market prices in active markets for the asset.[145] In addition to these fundamental differences, this chapter will reflect how the finalised Basel III applies a more granular approach to exposure types that are presumably a part of life insurance undertakings' alternative credit investments.

Chapter 10.2 described how the finalised Basel III amended Basel II's standardised approach for credit risk and included a pillar 1 due diligence requirement to ensure an adequate understanding of counterparties' risk profile and charac-

[141] BCBS Consol. Basel III (2019)/BCBS Basel III (2019), RCB25.8.
[142] See also chapter 9.
[143] CEIOPS (2007a), para. 5.83. See also CEIOPS (2007d), para. 1.1.
[144] BCBS Consol. Basel III (2019), CRE20.1, and BCBS Basel III (2017), Standardised approach for credit risk, para. 1.
[145] Solvency II Delegated Regulation, recital 7 and art. 10(2) and e.g. 176, and EIOPA (2018e), p. 42 (box 6).

teristics.[146] Accordingly, in cases where external credit assessments are used to determine risk weights, due diligence is viewed as necessary to assess the risk of the exposure and whether the risk weight applied is appropriate and prudent.[147] In addition, external credit assessments are only allowed if they are provided by recognised external credit assessment institutions that fulfil certain criteria, including objectivity and independence.[148]

The treatment of exposures to *sovereigns* and their *central banks* remains unchanged from Basel II and a 0% risk weight applies to exposures to, inter alia,

- sovereigns and central banks, if they are rated AAA to AA–,
- the ECB, EU, European Stability Mechanism, and European Financial Stability Facility.[149]

This is similar to Solvency II's treatment of exposures to the ECB and EU member states' central governments and central banks as well as to other central governments and central banks.[150]

Exposures to *banks* include securities firms and other financial institutions (e.g. insurance undertakings) if they are subject to prudential standards and supervision equivalent to banks, including capital and liquidity requirements.[151] However, insurance undertakings and other financial institutions are included in the corporate exposure class (described below) if they are not captured by these bank-equivalent exposure criteria.[152] Similar to the definition of shadow banking, the finalised Basel III accordingly provides that national supervisors should determine whether their regulatory and supervisory framework for "other financial institutions", including insurance undertakings, is equivalent to their regulatory and supervisory framework for banks.[153]

As illustrated in yellow in figure 10.3, exposures to banks include a hierarchy of approaches to determine risk weights, which depend on whether the jurisdiction - in which the calculating bank is incorporated - allows the use of external credit risk assessments in the calculation of capital requirements.[154] The hier-

[146] BCBS Consol. Basel III (2019), CRE20.4-6, BCBS Basel III (2017), Standardised approach for credit risk, part A, para. 4-6, and BCBS (2017), p. 2. See also BCBS (2015c), pp. 1-2 and sections 1.1.1 and 1.1.2.

[147] BCBS Consol. Basel III (2019), CRE20.4, and BCBS Basel III (2017), Standardised approach for credit risk, part A, para. 4.

[148] BCBS Consol. Basel III (2019), CRE21, and BCBS Basel III (2017), Standardised approach for credit risk, part B, including para. 98.

[149] BCBS Consol. Basel III (2019), CRE20.7 and 20.10, and BCBS Basel III (2017), Standardised approach for credit risk, para. 7 and 10.

[150] Solvency II Delegated Regulation, art. 180(2)-(3).

[151] BCBS Consol. Basel III (2019), CRE20.40-41, and BCBS Basel III (2017), Standardised approach for credit risk, para. 37 and 38.

[152] BCBS Consol. Basel III (2019), CRE20.40-41, and BCBS Basel III (2017), Standardised approach for credit risk, para. 37 and 38.

[153] BCBS Consol. Basel III (2019), CRE20.40-41, and BCBS Basel III (2017), Standardised approach for credit risk, para. 37 and 38.

[154] BCBS Consol. Basel III (2019), CRE20.17, and BCBS Basel III (2017), Standardised approach for credit risk, para. 17.

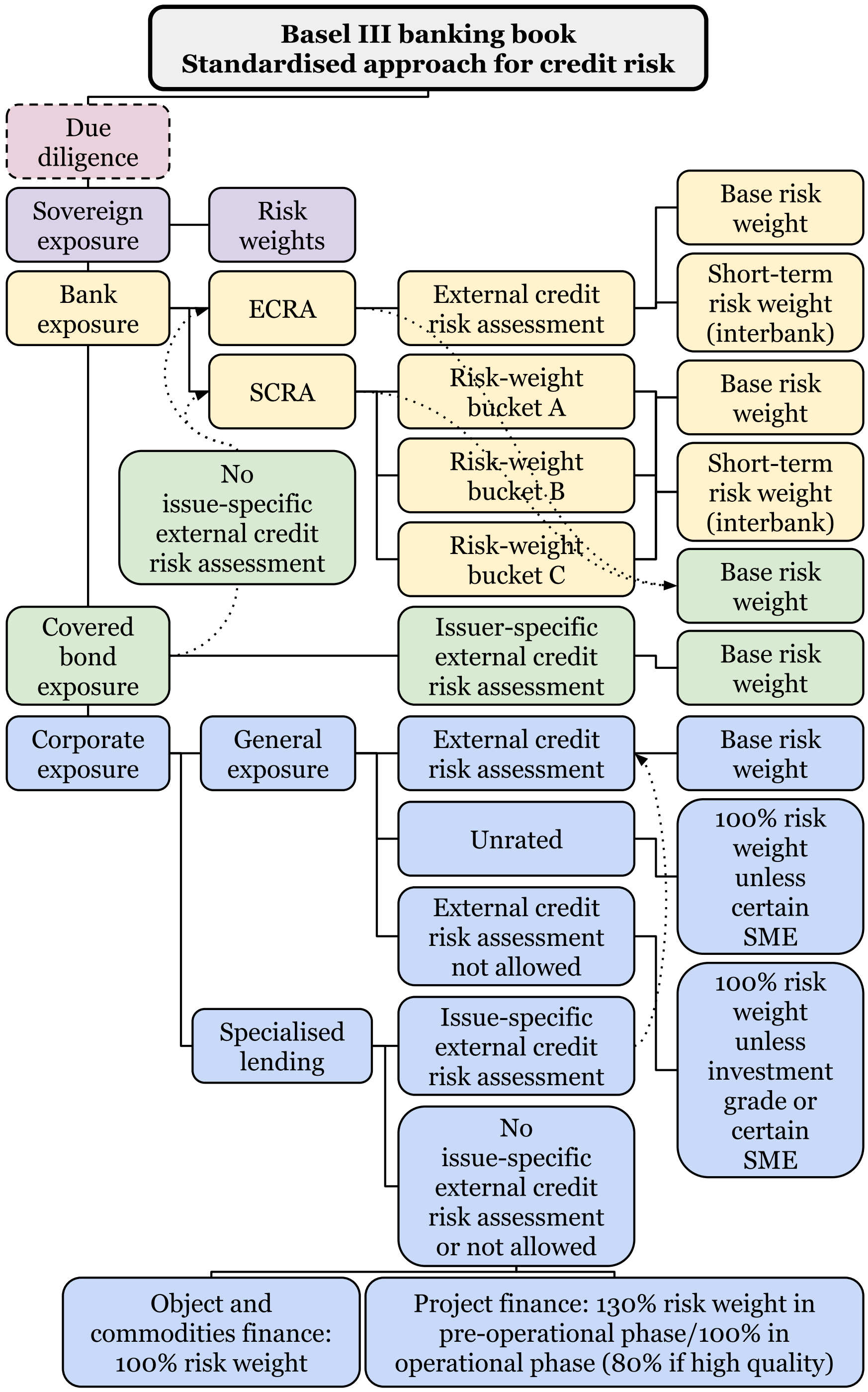

Figure 10.3: Simplified illustration of the finalised Basel III's standardised approach for credit risk.

archy is to ensure that banks cannot "cherry pick" the approaches.[155] Firstly, the external credit risk assessment approach ("ECRA") is to be applied in jurisdictions that allow the use of external credit risk assessments, and it must be applied to all rated exposures to banks.[156] Under the ECRA, the used external credit risk assessments may not incorporate assumptions of implicit government support, unless the external credit risk assessment refers to a public bank owned by its government.[157] The ECRA assigns "base" risk weights - that are based on the external credit risk assessments - to exposures which are then subject to the due diligence that may result in a higher risk weight than the one determined by the external credit credit assessment.[158]

Next in the hierarchy, the standardised credit risk assessment approach ("SCRA") is to be applied (i) in jurisdictions that do not allow the use of external credit risk assessments and (ii) to unrated bank exposures of banks in jurisdictions that allow the use of external credit risk assessments.[159] As illustrated in yellow in figure 10.3 above, the SCRA entails the classification of bank exposures into one of three risk-weight buckets, with assigned "base" risk weights, and these three buckets are in the form of

- grade A (where the counterparty has adequate capacity to meet financial commitments and meets or exceeds published minimum regulatory requirements and buffers, except for bank-specific pillar 2-imposed regulatory requirements or buffers),
- grade B (where the counterparty is subject to substantial credit risk but meets or exceeds published minimum regulatory requirements (excluding buffers) except for bank-specific pillar 2-imposed regulatory requirements), and
- grade C (where the counterparty has material default risks and limited margins of safety and, inter alia, does not meet the criteria for being classified as a grade B exposure in relation to published minimum regulatory requirements).[160]

Under the SCRA, due diligence may result in a higher risk weight via an assignment to a lower bucket.[161] In addition, certain bank exposures are subject

[155] BCBS (2015c), section 1.1.1.
[156] BCBS Consol. Basel III (2019), CRE20.17(1), and BCBS Basel III (2017), Standardised approach for credit risk, para. 17(a) and 18-20.
[157] BCBS Consol. Basel III (2019), CRE20.18, and BCBS Basel III (2017), Standardised approach for credit risk, para. 18.
[158] BCBS Consol. Basel III (2019), CRE20.18-20, and BCBS Basel III (2017), Standardised approach for credit risk, part A, para. 4-6, 18 and 20.
[159] BCBS Consol. Basel III (2019), CRE20.17(2), 20.18 and 20.21, and BCBS Basel III (2017), Standardised approach for credit risk, para. 17(b), 18 and 21-31.
[160] BCBS Consol. Basel III (2019), CRE20.21-30, and BCBS Basel III (2017), Standardised approach for credit risk, para. 21-29.
[161] BCBS Consol. Basel III (2019), CRE20.24 and 20.30, BCBS Basel III (2017), Standardised approach for credit risk, part A, para. 4-6, 24 and 29, and BCBS (2015c), p. 1.

to a risk-weight floor based on the risk weight applicable to exposures to the sovereign of the jurisdiction where the bank/counterparty is incorporated.[162]

The ECRA and SCRA include risk weights that ensure a preferential treatment of bank exposures with an original maturity of three months or less.[163] This preferential treatment is to ensure that the standardised approach does not negatively impact market liquidity in interbank markets and to avoid interference with monetary policy channels, where most short-term exposures are shorter than three months.[164]

Similar to Solvency II's spread risk sub-module, the standardised approach includes a specific treatment of *covered bonds*. The finalised Basel III defines covered bonds as bonds that are issued by a bank or mortgage institution subject - by law - to special public supervision designed to protect bondholders.[165] The proceeds from the issuing of the covered bonds must - in accordance with the law - be invested in assets (i.e. the "cover pool") that (i) are capable of covering claims attached to the covered bonds and (ii) will secure the bondholders' prioritised right to repayment of principal and payment of accrued interest in case of the issuer's failure.[166] In addition, and in order to be subject to the risk weights for covered bonds, (i) the assets must meet eligibility requirements, (ii) the cover pool and covered bonds must meet disclosure requirements, and (iii) the cover pool must exceed the outstanding nominal value by at least 10%.[167] The eligible assets can e.g. be claims on sovereigns or their central banks, claims secured by certain residential real estate with a loan-to-value ratio of 80% or lower, or claims on banks with a 30% risk weight or lower.[168] As illustrated in green in figure 10.3 above, covered bonds, with issue-specific external credit risk assessments, are subject to "base" risk weights assigned to such issue-specific external credit risk assessments.[169] If the covered bonds are unrated then they are subject to "base" risk weights which are linked to the issuer's ECRA-based or SCRA-based risk weights (as described above).[170] As under the other exposure types, the due diligence requirement for external credit risk assessments

[162] BCBS Consol. Basel III (2019), CRE20.32, and BCBS Basel III (2017), Standardised approach for credit risk, para. 31.

[163] BCBS Consol. Basel III (2019), CRE20.19 and 20.31, and BCBS Basel III (2017), Standardised approach for credit risk, para. 19 and 30.

[164] BCBS (2014b), section 2.1(iv), and BCBS (2015c), p. 6

[165] BCBS Consol. Basel III (2019), CRE20.33, and BCBS Basel III (2017), Standardised approach for credit risk, para. 32.

[166] BCBS Consol. Basel III (2019), CRE20.33, and BCBS Basel III (2017), Standardised approach for credit risk, para. 32.

[167] BCBS Consol. Basel III (2019), CRE20.34-37, and BCBS Basel III (2017), Standardised approach for credit risk, para. 33 and 34.

[168] BCBS Consol. Basel III (2019), CRE20.34, and BCBS Basel III (2017), Standardised approach for credit risk, para. 33. In addition to the eligible assets, substitution assets (cash or short-term, liquid and secure assets used for management purposes) and derivatives (used to hedge the risks associated with the covered bond programme) are allowed.

[169] BCBS Consol. Basel III (2019), CRE20.38, and BCBS Basel III (2017), standardised approach for credit risk, para. 35.

[170] BCBS Consol. Basel III (2019), CRE20.38, and BCBS Basel III (2017), Standardised approach for credit risk, para. 35.

may result in a higher risk weight.[171]

In terms of granularity, an obvious difference lies in Solvency II's and the finalised Basel III's categorisation of corporate exposures. As shown in chapter 10.3.2 above, Solvency II's spread risk sub-module initially included a general treatment for "bonds and loans" whereafter specific treatments of e.g. exposures to unrated bonds and loans and qualifying infrastructure were added as a part of the Capital Markets Union Action Plan. An increase in life insurance undertakings' bank-like credit exposures could warrant consistency in asset categories, including corporate exposures.

In relation to exposures to corporates, the finalised Basel III distinguishes between *general corporate exposures* and *specialised lending*.[172] This differentiation is to increase the granularity of the standard approach's treatment of corporate exposures as specialised lending exposures are associated with higher risks and losses than other types of corporate exposures.[173] It is also to enhance consistency and comparability with the IRB approach for credit risk which is described below.[174] As mentioned above, corporate exposures also include insurance undertakings and other financial corporates that do not qualify as exposures to banks.[175]

Figure 10.3 above illustrates the treatment of corporate exposures in blue. In relation to *general corporate exposures* of a bank, which is incorporated in a jurisdiction that allows the use of external credit risk assessments, "base" risk weights are assigned to external credit risk assessments whereafter due diligence must be performed to ensure that the external credit risk assessment appropriately and conservatively reflects the counterparty's creditworthiness.[176] In such a jurisdiction, unrated general corporate exposures of banks receive a 100% risk weight unless they are certain SMEs.[177] In jurisdictions, which do not allow the use of external credit risk assessments, general corporate exposures are assigned a 100% risk weight except for certain exposures to "investment grade"[178] corporates (which receive a 65% risk weight) and exposures to certain SMEs.[179] Under both approaches to general corporate exposures, the "certain" SMEs receive an 85% risk weight (or a 75% risk weight if they are certain

[171] BCBS Consol. Basel III (2019), CRE20.39, and BCBS Basel III (2017), Standardised approach for credit risk, para. 36.

[172] BCBS Consol. Basel III (2019), CRE20.41-52, and BCBS Basel III (2017), Standardised approach for credit risk, para. 38-48.

[173] BCBS (2014b), sections 2.2 and 2.2.2, and BCBS (2015c), section 1.2.

[174] BCBS (2014b), sections 2.2, and BCBS (2015c), section 1.2.

[175] BCBS Consol. Basel III (2019), CRE20.40-41, and BCBS Basel III (2017), Standardised approach for credit risk, para. 16, 37 and 38.

[176] BCBS Consol. Basel III (2019), CRE20.42, and BCBS Basel III (2017), Standardised approach for credit risk, para. 39.

[177] BCBS Consol. Basel III (2019), CRE20.43 and 20.47, and BCBS Basel III (2017), Standardised approach for credit risk, para. 40 and 43.

[178] Defined as, inter alia, a listed corporate entity that has adequate capacity to meet its financial commitments in a timely manner. This ability must be assessed to be robust against adverse changes in the economic cycle and business conditions.

[179] BCBS Consol. Basel III (2019), CRE20.44 and 20.46, and BCBS Basel III (2017), Standardised approach for credit risk, para. 41 and 42.

regulatory retail SME exposures).[180]

A corporate exposure must - either legally or economically - possess some of a number of characteristics in order to constitute the more risky *specialised lending*.[181] Specialised lending includes project finance[182], object finance[183] and commodities finance[184].[185] These categories intentionally match some of the corporate specialised lending categories in the IRB approach for credit risk which is described next.[186] As illustrated in blue in the bottom of figure 10.3 above, any available "issue-specific" external credit risk assessment is used to determine a risk weight, in accordance with the risk weights for general corporate exposures, if the jurisdiction allows the use of external credit risk assessments.[187] If the jurisdiction does not allow the use of external credit risk assessments, or if there is no available issue-specific external credit risk assessment, then (i) object finance and commodities finance exposures are given a 100% risk weight while (ii) project finance exposures are given a 130% risk weight during the pre-operational phase and a 100% risk weight during the operational phase (or 80% if it is characterised as "high quality" in accordance with certain conditions during the operational phase).[188]

As shown above, the finalised Basel III's standardised approach for credit risk captures default risk and is fundamentally different from Solvency II's spread risk sub-module, including asset categories and risk weights. The finalised Basel III subjects corporate exposures to a granular treatment in order to reflect the more risky nature of specialised lending. As mentioned above, the increase in life insurance undertakings' bank-like credit exposures could warrant consistency in asset categories, especially corporate exposures, as such credit investments

[180] BCBS Consol. Basel III (2019), CRE20.43-44 and 20.47, and BCBS Basel III (2017), Standardised approach for credit risk, para. 40, 41 and 43.

[181] These characteristics include (i) not being related to real estate, (ii) being defined as either object finance, project finance or commodities finance, (iii) being an exposure to a special purpose entity ("SPE") created specifically to finance and/or operate physical assets, (iv) the borrower having few or no other material assets or activities which entails that the capacity, to repay the obligation, depends primarily on the income that the borrower generates via the financed assets, and (v) that the terms give the bank/lender a substantial degree of control over the assets and the income that they generate, cf. BCBS Consol. Basel III (2019), CRE20.48-49, and BCBS Basel III (2017), Standardised approach for credit risk, para. 44 and 45.

[182] Defined as a method of funding in which the lender looks primarily to the revenues generated by a single project - both as the source of repayment and as security for the loan.

[183] Defined as a method of funding the acquisition of equipment where the repayment of the loan is dependent on the cash flows generated by the specific assets that have been financed and pledged or assigned to the lender.

[184] Defined as short-term lending to finance reserves, inventories, or receivables of exchange-traded commodities, where the loan will be repaid from the proceeds of the sale of the commodity and the borrower has no independent capacity to repay the loan.

[185] BCBS Consol. Basel III (2019), CRE20.48(1) and 20.49, and BCBS Basel III (2017), Standardised approach for credit risk, para. 44 and 45.

[186] BCBS Consol. Basel III (2019), CRE30.9, 30.11, 30.12, BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 11, 13 and 14, and BCBS (2015c), section 1.2.

[187] BCBS Consol. Basel III (2019), CRE20.50, and BCBS Basel III (2017), Standardised approach for credit risk, para. 46.

[188] BCBS Consol. Basel III (2019), CRE20.51 and 20.52, and BCBS Basel III (2017), Standardised approach for credit risk, para. 47 and 48.

presumably expose life insurance undertakings to the same risks. Although diversification effects prevent "meaningful" comparisons of risk factor-level capital requirements, an alignment of asset categories could allow more granular calibrations of credit risk and ensure additional cross-sectoral consistency.

10.5 The Finalised Basel III's IRB Approach for Credit Risk

The finalised Basel III's IRB approach for credit risk includes prescribed risk-weight functions for asset classes as well as detailed requirements for the risk components PD, LGD and EAD (as defined below). These risk components are used as input, in the risk-weight functions, when calculating capital requirements for credit risk.

As described in chapter 11, the IRB approach was considered in relation to the development of Solvency II's counterparty default risk module. However, it was abandoned as the IRB approach was calibrated to well-diversified banks while the counterparty default risk module's type 1 exposures were assumed not to be diversified.[189] The IRB approach is considerably more complex than the standardised approach for credit risk. In addition, the IRB approach reflects fundamental elements in credit risk (including calibration, portfolio invariance and risk components) that are relevant in relation to Solvency II's treatment of credit risk. The IRB approach's risk-weighting of the EAD is also relevant for the finalised Basel III's risk-weighting of the counterparty credit risk EAD for repos. The above necessitates an overall introduction to the logic behind the IRB approach, and this chapter constitutes a background to the finalised Basel III's treatment of counterparty credit risk in chapter 11 below.

In relation to the IRB approach, BCBS (2005) described how a given year's exact number of defaults and the exact amount outstanding, as well as the actual loss rates on exposures, are random variables.[190] However, banks could estimate the average or expected credit losses it could reasonably expect to experience.[191] Such expected losses were considered a "cost component" of doing lending business which was to be managed by e.g. write-offs, revenues, the pricing of credit exposures, and provisioning.[192]

The *expected loss* on a portfolio was assumed to equal the proportion of obligors that might default within a given time frame (which was one year in Basel II) multiplied by (i) the outstanding exposure at default and (ii) the loss-given-default-rate in the form of the percentage of the exposure that would not be recovered by e.g. the sale of collateral.[193] These three risk components - that reflect the random variables above - were accordingly defined as the

[189] CEIOPS (2009d), para. 3.27-28. See also chapter 10.3.1.
[190] Pp. 2-3.
[191] BCBS (2005), pp. 2-3.
[192] BCBS (2005), pp. 3 and 7.
[193] BCBS (2005), p. 3.

- probability of default ("PD") for a rating grade, which gives the average percentage of obligors that default in a defined rating grade in the course of one year,
- exposure at default ("EAD"), which gives an estimate of the amount outstanding in case the borrower defaults, and
- loss given default ("LGD"), which gives the percentage of the exposure that might in lost in case the borrower defaults, while considering any credit risk mitigation such as collateral.[194]

BCBS (2005) accordingly calculated expected losses ("EL") as as a currency amount via

$$EL = PD * EAD * LGD$$

while expected losses could also be expressed as a percentage amount of the EAD:

$$EL = PD * LGD$$

As described in chapter 4, credit spreads capture the expected loss from default as a part of market risk.[195]

A bank may also suffer seldom and potentially large losses - referred to as *unexpected losses* ("UL") - that exceed expected levels and have to be absorbed via capital requirements.[196] In Basel II's IRB approach for credit credit risk in the banking book, risk-weight functions were designed to provide risk weights for unexpected losses while banks had to demonstrate that they adequately provisioned against expected losses.[197] In relation to exposures to sovereigns, banks and corporates, the finalised Basel III's IRB risk-weight function accordingly produces capital requirements for unexpected losses while expected losses are treated separately.[198]

A risk-weight function transforms risk components into risk-weighted assets.[199] Subject to supervisory approval and minimum requirements, the finalised Basel III's IRB approach allows banks to rely on (some) of their own internal estimates of the risk components PD (in the form of decimals), LGD (in the form of decimals) and effective maturity ("M"), which are used to as input in the prescribed risk-weight function that produces risk-weights to be applied upon the prescribed or estimated EAD (in the form of a currency).[200] Under the

[194] BCBS (2005), pp. 3-4.
[195] I.e. PD*LGD, cf. BCBS (2013a), p. 11.
[196] BCBS (2005), pp. 2 and 7.
[197] Basel II, para. 212, and BCBS (2005), p. 7.
[198] BCBS Consol. Basel III (2019), CRE30.2 and CRE31.1, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 2 and 51.
[199] BCBS Consol. Basel III (2019), CRE30.32(2), and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 32.
[200] BCBS Consol. Basel III (2019), CRE36 (including 36.5-6), CRE30.1 and CRE31.2(1) and (2) and CRE31.4-5, and BCBS Basel III (2017), Internal ratings-based approach for credit

foundation IRB approach, banks generally estimate PD and rely on prescribed estimates for the other risk components.[201] Under the *advanced IRB approach*, and subject to minimum standards, banks generally estimate PD, LGD and EAD as well as calculate M.[202] The foundation IRB approach, advanced IRB approach and the risk components are described next in chapter 10.5.1 in an overall fashion.

Figure 10.4 illustrates how unexpected losses (in red) constitute the gap between expected losses and the IRB approach's 99.9% confidence level. As described in chapter 9.3.2 above, this confidence level reflects a regulatory target wherein the bank will - with the likelihood of 99.9% - remain solvent over a one-year horizon and only suffer losses, above this level, on average once in a thousand years (as shown in green).[203] If expected losses are covered by provisioning and revenues, then unexpected losses must be covered by capital requirements in order to achieve the 99.9% confidence level.[204] In line with the formula above, BCBS (2005) expressed an exposure's expected losses as

$$EL = LGD_{downturn} * PD_{average}$$

where the average PD reflected expected default rates under normal business conditions while the "downturn" LGD was to reflect economic-downturn conditions in circumstances where loss severities were expected to be higher during cyclical downturns than during typical business conditions.[205] This is illustrated in the middle of the distribution in figure 10.4.

The entire amount of capital, which was needed to achieve the one-tailed 99.9% confidence level, could be estimated via a credit portfolio model that estimated the sum of expected losses and unexpected losses for each exposure.[206] This entire amount of capital (the sum of expected losses and unexpected losses) is shown to the right in figure 10.4 as the *conditional expected losses* for an exposure, which is expressed as

$$EL_{conditional} = LGD_{downturn} * PD_{conditional}$$

where the conditional PD is based on the transformation of the average PD into a conditional PD via a supervisory mapping function.[207]

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risk, section H and para. 1 and 52-53. The risk-weight function is $CapitalRequirement = K = \left(LGD * N\left(\frac{G(PD)}{\sqrt{(1-R)}} + \sqrt{\frac{R}{1-R}} * G(0.999)\right) - PD * LGD\right) * \frac{(1+(M-2.5)*b)}{(1-1.5*b)}$.

[201] BCBS Consol. Basel III (2019), CRE30.33, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 33.

[202] BCBS Consol. Basel III (2019), CRE30.33, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 33.

[203] BCBS (2005), pp. 3 and 11. The 99.9% confidence level was also to protect against estimation errors in relation internal estimates of PD, LGD and EAD as well as other model uncertainties.

[204] BCBS (2005), p. 3.

[205] Pp. 5-8.

[206] BCBS (2005), pp. 2-3, 5 and 7.

[207] BCBS (2005), pp. 5-6. In the risk-weight function for exposures to sovereigns, banks and

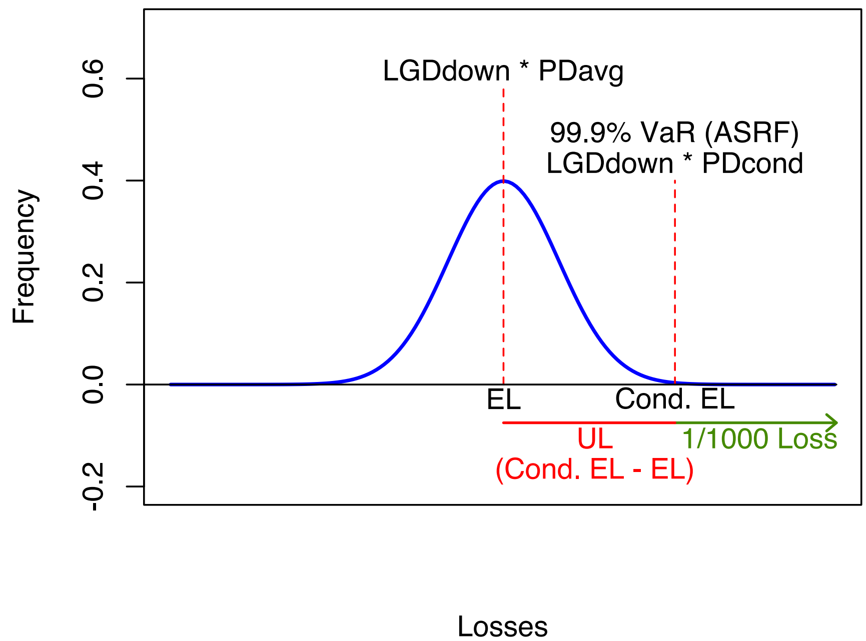

Figure 10.4: Illustration of a 99.9% VaR based on a normal probability density function. As illustrated in red, the IRB approach's risk weight function produces capital requirements for unexpected losses ("UL"), which are placed in the distance between expected losses ("EL") and the 99.9% confidence level. Expected losses are calculated by multiplying the downturn LGD ("LGDdown") with the average PD ("PDavg"). Via the conditional expected loss ("Cond. EL"), the 99.9% VAR ASRF model produces the entire capital amount up to the one-tailed 99.9% confidence level. The conditional expected loss is calculated by multiplying the downturn LGD with a conditional PD ("PDcond"). The capital requirement for only UL is calculated by subtracting the expected loss from the conditional expected loss. Losses above the 99.9% confidence level (in green), which occur on average once in a thousand years, are not covered by the IRB approach.

The conditional PD reflects default rates given an "appropriately conservative" value of a *single systematic risk factor* that is used for all exposures in the portfolio.[208] As described in chapter 9.4.2 above, the IRB approach was calibrated to "well-diversified banks".[209] This calibration was due to the desire for portfolio invariance[210], which was based on the view that an assessment of actual portfolio compositions, when determining the capital requirement for each loan, would have been a too complex task for most banks and supervisors.[211] In addition, under portfolio-invariant capital requirements, the exposure-specific risk components PD, LGD and EAD are viewed as sufficient to determine capital requirements for credit exposures.[212] As described in chapter 9.4, the IRB approach's portfolio invariance prevents "meaningful" comparisons of risk factor-level capital requirements as Solvency II's SCR standard formula includes diversification effects when aggregating the risk factor-level capital requirements.

Only so-called asymptotic single risk factor ("ASRF") credit models were considered portfolio-invariant and these ASRF models were derived from credit portfolio models by the law of large numbers.[213] As in insurance, the law of large numbers entails that idiosyncratic risks, associated with individual exposures, tend to cancel out each other in a portfolio that consists of a large number of relatively small exposures.[214] Accordingly, only non-diversifiable systematic risks, which affect many exposures, remain in the diversified portfolio and may have a material effect on portfolio losses.[215] The ASRF model chosen by the

corporates, the conditional PD reflects default rates given an appropriately conservative value of the systematic risk factor, i.e. $N\left(\frac{G(PD)}{\sqrt{(1-R)}}+\sqrt{\frac{R}{1-R}}*G(0.999)\right)$, cf. BCBS Consol. Basel III (2019), CRE31.5, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 53.

[208] BCBS (2005), pp. 5-6. In the risk-weight function for exposures to sovereigns, banks and corporates, the conditional PD is based on a default threshold that is derived by applying the inverse of the standard normal distribution (i.e. the value of x such that $N(x)=z$, or - in other words - the value of x that amounts to the quantile z (e.g. the 99.9th percentile) of the standard normal distribution) to the PD (i.e. G(PD)) which is then correlation-weighted (i.e. $\frac{G(PD)}{\sqrt{(1-R)}}$); the systematic risk factor is derived by applying the inverse of the standard normal distribution to the given confidence level (i.e. G(0.999)) which is then correlation-weighted, (i.e. $\sqrt{\frac{R}{1-R}}*G(0.999)$); the conditional PD is derived by applying the standard normal distribution (i.e. $P(Z\leq z)$), *N(x)*, to the conditional default threshold (the correlation-weighted sum of the default threshold and the systematic factor), i.e. $N\left(\frac{G(PD)}{\sqrt{(1-R)}}+\sqrt{\frac{R}{1-R}}*G(0.999)\right)$, cf. BCBS Consol. Basel III (2019), CRE31.2(4) and (5) and CRE31.5, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 53, including footnote 12.

[209] BCBS (2005), section 3.

[210] Portfolio invariance entails that the capital requirement, for any given loan, depends only on the risk of that loan and not on the portfolio it is added to, cf. BCBS (2005), p. 4, and BCBS (2012), p. 51.

[211] BCBS (2005), section 3.

[212] BCBS (2005), p. 4.

[213] BCBS (2005), pp. 4-5.

[214] BCBS (2005), pp. 4-5.

[215] BCBS (2005), pp. 4-5.

BCBS modelled all systematic risks via only the single systematic risk factor that is derived from the 99.9% confidence level and which may be viewed as reflecting the state of the global economy.[216]

The degree of a borrower's exposure to the single systematic risk factor is included in the risk-weight formula via asset correlation that is asset class-dependent, as borrowers and/or asset classes have different degrees of dependency on the overall economy.[217] The finalised Basel III introduced an asset value correlation multiplier of 1.25 that is applied upon the correlation parameter for exposures to certain financial institutions in the form of (i) regulated financial institutions[218] whose total assets are greater than or equal to USD 100 bill. and (ii) unregulated financial institutions regardless of their size.[219] It also includes a firm-size adjustment in the form of a reduction of correlation for certain SMEs[220] which stems from Basel II.[221]

As reflected in figure 10.4 above, the ASRF model provides the entire amount of capital (the sum of expected losses and unexpected losses) until the one-tailed 99.9% confidence level VaR, which entails that the conditional expected loss[222] must be reduced by expected losses[223] to provide the risk weight for unexpected losses[224]:

$$UL = EL_{conditional} - EL$$

The IRB risk-weight function includes a maturity adjustment as long-term credit exposures are viewed as riskier than short-term credit exposures.[225] The maturity adjustment accordingly increases the capital requirement for unexpected losses in accordance with maturity and can be viewed as capturing mark-

[216] BCBS (2005), pp. 4-5, 8 and 11-12.

[217] BCBS (2005), pp. 8-9. In the risk-weight function for exposures to sovereigns, banks and corporates, asset correlation (R) is applied in relation to the default threshold and the systematic factor, i.e. $N\left(\frac{G(PD)}{\sqrt{(1-R)}} + \sqrt{\frac{R}{1-R}} * G(0.999)\right)$, cf. BCBS Consol. Basel III (2019), CRE31.5, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 53.

[218] Financial institutions supervised by a regulator that imposes prudential requirements consistent with international norms, including insurance companies.

[219] BCBS Consol. Basel III (2019), CRE31.7, BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 53, and Basel III, para. 102.

[220] I.e. with reported sales - for the consolidated group of the borrower - that are less than EUR 50 million.

[221] Basel II, para. 273, BCBS (2005), pp. 13-14, and BCBS Consol. Basel III (2019), CRE31.8, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 54.

[222] I.e. $LGD * N\left(\frac{G(PD)}{\sqrt{(1-R)}} + \sqrt{\frac{R}{1-R}} * G(0.999)\right)$.

[223] I.e. $PD * LGD$.

[224] BCBS (2005), pp. 7-8. In the risk-weight function for exposures to sovereigns, banks and corporates, the unexpected loss is given by $LGD * N\left(\frac{G(PD)}{\sqrt{(1-R)}} + \sqrt{\frac{R}{1-R}} * G(0.999)\right) - PD * LGD$, cf. BCBS Consol. Basel III (2019), CRE31.5, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 53.

[225] BCBS (2005), pp. 9-10.

to-market losses caused by e.g. risk-adjusted discount factors as well as anticipations of additional capital requirements due to downgrades:

$$CapitalRequirement(K) = (EL_{conditional} - EL) * Maturity_{adjustment}$$

where the capital requirement (K) is expressed as a percentage.[226] Finally, the risk-weighted asset is expressed as:

$$RWA = K * EAD * 12.5$$

where the factor 12.5 is the reciprocal of the minimum capital ratio of 8% that was described in chapter 9.1.[227] When producing capital requirements for counterparty credit risk, a specific counterparty credit risk EAD is used for repos that are subject to master netting agreements. This is described in chapter 11 below.

In short, the IRB approach for credit risk prescribes risk-weight functions that produce portfolio-invariant and maturity-adjusted capital requirements for unexpected losses in the form of a risk-weighted asset for each credit exposure in the banking book. This approach is fundamentally different from Solvency II's spread risk sub-module. As shown next, and similar to the finalised Basel III's standardised approach, the IRB approach entails greater granularity in terms of asset classes than Solvency II's spread risk sub-module.

10.5.1 Asset Classes and Risk Components

This chapter will describe the IRB approach's asset classes and risk components in an overall fashion in order to provide a basic perspective on the minimum requirements in the IRB approach, especially when compared to Solvency II's SCR internal model. In addition, it will present how the risk components reflect counterparty credit risk in a specific fashion.

Under the IRB approach, each exposure must be classified into one of the following asset classes:

- sovereigns - which is aligned with the definition in the standardised approach and includes, inter alia, central banks.[228]

- banks - which is aligned with the definition in the standardised approach and includes securities firms and other financial institutions (such as insur-

[226] BCBS (2005), pp. 9-11. In the risk-weight function for exposures to sovereigns, banks and corporates, the maturity adjustment (b) is multiplied with the unexpected losses, i.e. capital requirement (K) $= \left(LGD * N\left(\frac{G(PD)}{\sqrt{(1-R)}} + \sqrt{\frac{R}{1-R}} * G(0.999)\right) - PD * LGD\right) * \frac{(1+(M-2.5)*b)}{(1-1.5*b)}$, cf. BCBS Consol. Basel III (2019), CRE31.5, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 53.

[227] BCBS (2005), section 4.7, BCBS Consol. Basel III (2019), CRE31.5, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 53.

[228] BCBS Consol. Basel III (2019), CRE30.4 and 30.17 , and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 5 and 19.

ance undertakings) that are subject to prudential standards and supervision equivalent to banks (including capital and liquidity requirements).[229] The bank asset class also includes covered bonds.[230]

- corporates - which includes general corporates and five specialised lending sub-classes (in the form of project finance[231], object finance[232], commodities finance[233], income-producing real estate[234] and high-volatility commercial real estate ("HVCRE")) that legally or economically possess specific characteristics, including being SPEs.[235] The corporate specialised lending sub-classes include exposures, which are similar to specialised lending in the standardised approach for credit risk, but it also includes the exposures to real estate, which is a separate exposure class under the standardised approach.[236] HVCRE, which is subject to specific treatment under specialised lending, is associated with higher loss rate volatility - or higher asset correlation - compared to the other four types of specialised lending.[237]

- retails - which must meet prescribed criteria and include three sub-classes in the form of (i) residential mortgage loans, (ii) qualifying revolving retail exposures, and (iii) all other retail exposures.[238]

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[229] BCBS Consol. Basel III (2019), CRE30.4 and 30.18, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 5 and 20.

[230] BCBS Consol. Basel III (2019), CRE30.18.

[231] Defined as a method of funding in which the lender looks primarily to the revenues generated by a single project as both the source of repayment and as security for the exposure.

[232] Defined as a method of funding the acquisition of physical assets where the repayment of the exposure is dependent on the cash flows generated by the specific assets that have been financed and pledged or assigned to the lender.

[233] Defined as structured short-term lending to finance reserves, inventories, or receivables of exchange-traded commodities, where the exposure will be repaid from the proceeds of the sale of the commodity and the borrower has no independent capacity to repay the exposure.

[234] Defined as a method of providing funding to real estate where the prospects for repayment and recovery on the exposure depend primarily on the cash flows generated by the asset (i.e. lease or rental payments or a sale of the asset).

[235] BCBS Consol. Basel III (2019), CRE30.4 and 30.7-16, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 5 and 9-18. The characteristics are that: (i) the exposure is typically to an SPE created specifically to finance and/or operate physical assets, (ii) the borrower has little or no other material assets or activities, and therefore little or no independent capacity to repay the obligation, apart from the income that it receives from the financed asset(s), (iii) the terms of the obligation give the lender a substantial degree of control over the asset(s) and the income that it generates, and (iv) due to the prior three characteristics, the primary source of repayment of the obligation is the income generated by the asset(s).

[236] BCBS Consol. Basel III (2019), CRE20.48(1) and 20.69, and BCBS Basel III (2017), Standardised approach for credit risk, para. 44 and 59.

[237] BCBS Consol. Basel III (2019), CRE30.15, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 17. HVCRE includes, inter alia, exposures that finance the acquisition, development and construction of properties where the source of repayment, at origination of the exposure, is either the future uncertain sale of the property or cash flows whose source of repayment is substantially uncertain (unless the borrower has substantial equity at risk), cf. BCBS Consol. Basel III (2019), CRE30.15, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 17.

[238] BCBS Consol. Basel III (2019), CRE30.4, 30.19 and 30.23, and BCBS Basel III (2017),

- equity - which is excluded from the IRB approach.[239]

In comparison to Solvency II's spread risk sub-module, the asset classes are more granular and entail specialised treatment of specific exposure types, including the more risky specialised lending. Similar to the comparison with the standardised approach above, the increase in life insurance undertakings' bank-like credit exposures could warrant consistency in asset categories as such credit exposures presumably expose life insurance undertakings to the same risks.

Under both the *foundation* IRB approach and *advanced* IRB approach, the prescribed risk-weight function for exposures to sovereigns, banks and corporates (as described above) must be used to calculate risk-weighted assets and relies on the risk components PD, EAD, LGD and effective maturity ("M").[240] Due to the variability in risk-weighted assets during the financial crisis, the finalised Basel III revised Basel II's IRB approach whereby the risk components were adjusted, as well as subjected to input floors, while certain asset classes were excluded from the advanced IRB approach as they are not perceived as susceptible to robust and prudent modelling.[241] The asset classes, which are excluded from the *advanced* IRB approach, are

- exposures to general corporates, belonging to a group with total consolidated annual revenues greater than EUR 500 mill. (i.e. non-specialised lending to "large and mid-size" corporates), and
- exposures to banks, securities firms and financial institutions, including insurance companies and any other financial institutions in the corporate asset class.[242]

These excluded exposures are accordingly subject to the *foundation* IRB approach if the bank applies the IRB approach. As mentioned in chapter 9.1 above, the risk-weighted assets, used to calculate minimum risk-based capital requirements, have also become subject to the output floor that is based on standardised approaches for calculating risk-weighted assets.[243]

In relation to exposures to sovereigns, banks and corporates, the foundation approach entails that the bank estimates the PD associated with each of their borrower grades and uses supervisory estimates for for LGD, EAD and effective maturity.[244] Under the advanced IRB approach, for non-excluded exposures,

Internal ratings-based approach for credit risk, para. 5, 21 and 23.

[239] BCBS Consol. Basel III (2019), CRE30.4 and 30.26 and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 5 and 26.

[240] BCBS Consol. Basel III (2019), CRE30.33 and CRE31.2(1)-(2) and 31.4-5, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 33 and 52-53.

[241] BCBS (2017), pp. 5-6.

[242] BCBS Consol. Basel III (2019), CRE30.34, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 34.

[243] BCBS Consol. Basel III (2019), RBC20.4 and 20.11, and BCBS Basel III (2017), Output floor.

[244] BCBS Consol. Basel III (2019), CRE30.36, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 35. In relation to the specialised lending categories project finance, object finance, commodities finance and income-producing real estate lend-

the bank estimates PD, LGD and EAD and calculates the effective maturity.[245]

The estimation of risk components requires an internal rating system that must have two separate and distinct dimensions:

- Dimension 1 is oriented to the risk of borrower default and includes borrower grades[246] that provide estimates of PD.[247] There must be a least seven grades for non-defaulted borrowers, and one grade for defaulted borrowers, and exposures must be meaningfully distributed across grades with no excessive concentrations.[248]

ing, banks - that are *not able* to meet the requirements for the estimation of PD under the foundation IRB approach - must use the *supervisory slotting approach* wherein banks map their internal risk grades to five supervisory categories which "broadly" correspond to a range of external credit assessments and provide risk weights for unexpected losses, cf. BCBS Consol. Basel III (2019), CRE30.38-39, CRE31.10(1) and CRE33.1-3, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 37-38 and 56-57. Banks that are able to meet the requirements for the estimation of PD may use the foundation IRB approach for corporates to derive risk weights for all specialised lending classes except for HVCRE, cf. BCBS Consol. Basel III (2019), CRE30.40 and CRE31.10(1), and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 39 and 59. If the jurisdiction has chosen to implement a foundation IRB approach for HVCRE, then such exposures will be subject to a risk-weight function that applies a specific asset correlation formula, cf. BCBS Consol. Basel III (2019), CRE30.40 and CRE31.11, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 39 and 64. Banks - which are *not able* to meet the requirements for the estimation of PD for HVCRE or whose jurisdiction has chosen not to implement the foundation IRB approach for HVCRE - must apply the supervisory slotting approach for HVCRE that provides risk weights for unexpected losses, cf. BCBS Consol. Basel III (2019), CRE33.5-6, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 61-62.

[245] BCBS Consol. Basel III (2019), CRE30.37, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 36. Banks that meet the requirements for the estimation of PD, LGD and EAD are able to use the advanced IRB approach for corporates to derive risk weights for the specialised lending classes except for HVCRE, cf. BCBS Consol. Basel III (2019), CRE30.41 and CRE31.10(2), and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 40 and 60. If the bank is able to meet the requirements for the estimation of PD, LGD and EAD for HVCRE, and if the jurisdiction has chosen to implement an advanced IRB approach for HVCRE, then such exposures will be subject to a risk-weight function that applies a specific asset correlation formula, cf. BCBS Consol. Basel III (2019), CRE30.41 and CRE31.11, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 40 and 64. Banks - which are *not able* to meet the requirements for estimation of the PD or whose jurisdiction has chosen not to implement the advanced IRB approach for HVCRE - must apply the supervisory slotting approach for HVCRE that provides risk weights for unexpected losses, cf. BCBS Consol. Basel III (2019), CRE33.5-6, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 61-62. If the bank is *not able* to meet the requirements for the estimation of LGD or EAD for HVCRE, it must use the prescribed LGD and EAD (for corporate exposures) or use the supervisory slotting approach for specifically HVCRE, cf. BCBS Consol. Basel III (2019), CRE31.12, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 65.

[246] Borrower grades constitute an assessment of borrower risk on the basis of a specified and distinct set of rating criteria for that level of credit risk.

[247] BCBS Consol. Basel III (2019), CRE36.11-12 and 36.20, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 163-164, 172 and 177.

[248] BCBS Consol. Basel III (2019), CRE36.18-19 and 36.21, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 170 and 173. Specific rules apply for grades in relation to the supervisory slotting criteria for specialised lending.

- Dimension 2 captures transaction-specific factors in the form of e.g. collateral, the seniority of the exposure, and product type.[249] Under the foundation IRB approach, this dimension can be a facility dimension that reflects both borrower and transaction-specific factors.[250] Under the advanced IRB approach, where the bank also estimates the LGD and EAD, a facility rating must reflect only LGD and can reflect factors that can influence the LGD including, inter alia, collateral, the product, industry, and purpose.[251] There must also be a sufficient number of facility grades to avoid grouping facilities with widely varying LGDs into a single grade.[252]

The assigning of exposures to rating grades must be done in accordance with specific definitions, processes and criteria.[253] During the loan approval process, each borrower (and e.g. guarantors) must be assigned a rating and each exposure must be associated with a facility rating.[254] As described in the points above, there must - in both dimensions - be a meaningful distribution of exposures across grades with no excessive concentrations.[255]

The estimates of PD for exposures to sovereigns, banks and corporates is the long-run average of one-year default rates for borrowers in the internal borrower grade or "one-year PD" (i.e. over a one-year time horizon).[256] The PD must be estimated for each borrower grade, be based on a historical observation period of at least five years, and is subject to an "input floor" of 0.05%.[257]

Under the foundation IRB approach, the LGD is based on prescribed LGDs that depend on if the exposure is unsecured (or secured by non-recognised collateral) or secured by eligible and recognised collateral.[258] Senior claims on sovereigns, banks, securities firms and other financial institutions (including insurance undertakings), which are not secured by recognised collateral, receive a 45% LGD, while senior claims on other corporates, which are not secured by recognised collateral, receive a 40% LGD.[259] All subordinated claims on corpor-

[249] BCBS Consol. Basel III (2019), CRE36.11 and 36.13, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 163 and 165.

[250] BCBS Consol. Basel III (2019), CRE36.13, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 165.

[251] BCBS Consol. Basel III (2019), CRE36.14, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 166.

[252] BCBS Consol. Basel III (2019), CRE36.18 and 36.22, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 170 and 174.

[253] BCBS Consol. Basel III (2019), CRE36.25, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 177.

[254] BCBS Consol. Basel III (2019), CRE36.38, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 190.

[255] BCBS Consol. Basel III (2019), CRE36.18, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 170.

[256] BCBS Consol. Basel III (2019), CRE32.3 and CRE36.29, 36.62-63, 36.77 and 36.79, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 67, 181 and 214-215, 229 and 234.

[257] BCBS Consol. Basel III (2019), CRE32.2 and 32.4 and CRE36.62 and 36.79, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 68, 214 and 234.

[258] BCBS Consol. Basel III (2019), CRE32.6-14, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 70-83.

[259] BCBS Consol. Basel III (2019), CRE32.6, and BCBS Basel III (2017), Internal ratings-

ates, sovereigns and banks receive a 75% LGD.[260]

Under the advanced IRB approach, banks use their own internal estimates of LGDs for sovereigns and corporates, which are measured as the loss given default as a percentage of the EAD.[261] LGD is the economic loss and must be estimated for each of the bank's facilities based on historical recovery rates (over a period of at least seven years that ideally includes one complete economic cycle) and not solely rely on any estimated market value of any collateral.[262] As described above in relation to the IRB risk-weight function, the LGD must aim to reflect economic downturn conditions as well as any cyclical variability and it must be at least the long-run default-weighted average loss rate based on the average economic loss of all observed defaults within a data source for the specific facility type.[263] The LGD must also consider dependence between the borrower and risks associated with any collateral or collateral provider.[264] Own estimates of LGDs for corporates (but not sovereigns) are subject to prescribed floors, which depend on whether the exposure is secured or unsecured, and unsecured corporate exposures are subject to a 25% floor.[265]

Also under the advanced IRB approach, the long-run default-weighted average EAD must be estimated for each facility based on a period of at least seven years that ideally covers a complete economic cycle.[266] The EAD for an on-balance sheet item is the expected gross exposure of the facility upon default of the obligor while recognising eligible on-balance sheet netting.[267]

As reflected above, LGDs can reflect the risk mitigating effect of collateral. However, LGDs and EADs in relation to repos and financial collateral are described in chapter 11 below regarding counterparty credit risk.[268] As described in that chapter, the applicable LGDs are the foundation IRB approach's LGDs for unsecured exposures as counterparty credit risk, and the effect of master netting agreements, are reflected in a calculated exposure amount after credit risk mitigation - the *counterparty credit risk EAD* - which is used as the EAD in the

based approach for credit risk, para. 70.

[260] BCBS Consol. Basel III (2019), CRE32.7, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 71.

[261] BCBS Consol. Basel III (2019), CRE32.15, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 84.

[262] BCBS Consol. Basel III (2019), CRE32.5 and CRE36.63, 36.76, 36.83, 36.85 and 36.87, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 69, 215, 228, 235, 237 and 239.

[263] BCBS Consol. Basel III (2019), CRE36.83, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 235.

[264] BCBS Consol. Basel III (2019), CRE36.84, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 236.

[265] BCBS Consol. Basel III (2019), CRE32.16, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 85.

[266] BCBS Consol. Basel III (2019), CRE36.63, 36.90 and 36.98, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 215, 242 and 250.

[267] BCBS Consol. Basel III (2019), CRE36.89, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 241.

[268] See e.g. BCBS Consol. Basel III (2019), CRE36.97 and 36.128, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 249 and 280.

IRB approach's calculation of risk-weighted assets.[269] Similarly, the advanced IRB approach uses the counterparty credit risk EAD while own-estimate LGDs may be used for the unsecured equivalent amount.[270]

Under the foundation approach, effective maturity ("M") is 2.5 years except for repo-style transactions where the effective maturity is 0.5 (i.e. 6 months).[271] Under the advanced IRB approach, effective maturity must be measured for each facility while being subject to a floor of one year (except for, inter alia, certain short-term repo-style transactions[272]) and a cap of 5 years.[273] Effective maturity can be the nominal maturity[274] of the exposure or - if the exposure is subject to a determined cash flow schedule - the calculation must be done in accordance with a prescribed formula.[275]

To ensure capital adequacy, the use of the IRB approach is subject to stress testing, including credit risk stress testing that assesses the effect of certain specific conditions on its IRB approach-based capital requirements, e.g. ratings migration and the effects of mild recession scenarios on the PDs, LGDs and EADs.[276] In addition, estimates of PDs, LGDs, and EADs must include a "margin of conservatism" to address unpredictable errors and limited data.[277]

As shown above, the finalised Basel III's IRB approach constitutes an internal modelling approach for credit risk that is subject to detailed minimum requirements. In the light of the financial crisis, the IRB approach limits the modelling of risk components, in relation to certain exposures to financial institutions and corporates, and aims to limit variability between the standardised approach and the IRB approach for credit risk. When compared to Solvency II's SCR standard formula and spread risk sub-module in chapter 10.3.2 above, the IRB approach applies a portfolio-invariant and more granular approach to credit exposures, including the more risky specialised lending. It also relies on risk-weighting via only the risk components PD, LGD, EAD and M without "market consistent" inputs. From a regulatory arbitrage perspective, life insur-

[269] BCBS Consol. Basel III (2019), CRE32.13 and 32.37-43 and CRE51.7 and 51.13, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 77, 106 and 249. Se also Basel II, annex 10, para. 1, 2, 4, 6-8.

[270] BCBS Consol. Basel III (2019), CRE32.20 and 32.37-43 and CRE51.7 and 51.13, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 89, 106 and 249. Se also Basel II, annex 10.

[271] BCBS Consol. Basel III (2019), CRE32.44 and 32.55, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 107 and 114.

[272] Which have an original maturity of less than one year and are subject to daily remargining, daily revaluation and prompt liquidation or setoff of collateral in case of an event of default or failure to remargin.

[273] BCBS Consol. Basel III (2019), CRE32.45-46 and 32.51-53, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 108, 109,110 and 113.

[274] I.e. the remaining time in years that the borrower is permitted to take, under the agreed terms, to fully discharge its contractual obligation.

[275] BCBS Consol. Basel III (2019), CRE32.47-48, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 109.

[276] BCBS Consol. Basel III (2019), CRE36.50-53, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 202-205.

[277] BCBS Consol. Basel III (2019), CRE36.67, 36.78 and 36.90, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 219, 230 and 242.

ance undertakings' internal modelling of credit risk would have to meet similar minimum requirements and quantitative standards in order to not gain a competitive advantage when making credit investments under the SCR internal model. As also described in chapters 9 and 10.1, the SCR internal model must cover all material risk exposures and include *at least* the risks in the general provisions for the SCR, including market risk and credit risk.[278] However, the SCR internal model is to deliver a "true" undertaking-specific VaR and it allows a life insurance undertaking to calculate its own probability distribution for the SCR, which must comply with statistical standards and the general provisions for the SCR.[279] The SCR internal model accordingly seems to apply a primarily approval-based approach to the internal modelling of credit risk exposures that is not comparable to the minimum requirements in the finalised Basel III's IRB approach for credit risk in the banking book.

10.6 The Finalised Basel III's Trading Book and Credit Risk

The finalised Basel III's capital requirements for market risk, in the trading book, includes the standardised approach and internal models approach for market risk.[280] The trading book's overall capital requirement and risk measures, as well as the aggregation of risk factor-level capital requirements and diversification effects, were described in detail in chapter 9 above. Contrary to the banking book's capital requirements for credit risk, the capital requirements for market risk are not portfolio invariant. However, as described in chapter 9.4, the finalised Basel III's aggregation and diversification effects are fundamentally different from the aggregation of the risk modules in Solvency II's SCR standard formula. This chapter will accordingly only apply a risk factor-level approach to how the credit risk components are treated in the finalised Basel III's standardised approach and internal models approach for market risk.

10.6.1 Credit Spread Risk, Migration Risk and Liquidity Horizons

As described in chapters 4 and 9, during the financial crisis - and contrary to the initial perception of the liquidity of trading book exposures - banks' trading books included large (structured) credit exposures that became illiquid as well as subject to idiosyncratic default risk and substantial mark-to-market losses.[281] During the fundamental review of the trading book, the BCBS accordingly considered it important to incorporate the risk of market illiquidity into the

[278] Solvency II, art. 101, 112, and 121(4), and Solvency II Delegated Regulation, art. 233.

[279] Solvency II, art. 100, 101, 121 and 122(2), and e.g. CEIOPS (2005b), para. 10.9.

[280] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR20-23 and MAR30-33.

[281] BCBS (2019b), section 2.3(b) and (c), BCBS (2012), p. 3, sections 2.1 and 3.3, and annex 1, section 2.2.1, BCBS (2013a), section 1.3, BCBS (2009c), para. 1, BCBS (2009d), para. 3, and BCBS (2009b), p. 8, 16 (footnote 28) and 18.

capital requirements for market risk in the trading book.[282] Market liquidity was proposed to be addressed via prescribed and differentiated liquidity horizons for market risk factors.[283] The incorporation of liquidity horizons would rely on the assumption that banks were able to "shed" the market risk at the end of the liquidity horizon and that capital requirements covered the market risk measured over that period.[284]

During the review, the BCBS also agreed to bring the trading book's requirements for credit risk closer to the requirements for credit risk in the banking book.[285] However, and similar to the Solvency II project's considerations regarding credit risk, the BCBS considered it challenging to capture both default risk and migration risk in the trading book, including that it could inhibit consistency in capital requirements for credit risk exposures in the banking book and trading book.[286] In relation to the treatment of credit exposures, under both the internal models approach and standardised approach for market risk in the trading book, the BCBS decided to include migration risk in the capital requirements for credit spread risk while a separate capital requirement would explicitly capture default risk.[287]

The purpose of the capital requirement for credit spread risk was to capture the risk of changes in the market value of credit instruments with respect to the volatility of credit spreads.[288] Similar to Solvency II's spread risk sub-module, it was considered possible to appropriately incorporate migration risk into the measurement of market risk through the volatility of credit spreads, including via increasing time horizons of the market risk measurement.[289] This credit spread risk capital requirement for mark-to-market losses would accordingly capture the risk of changes in credit spreads (including migration risk) but not the risk of loss from jump-to-default risk that was to be captured in the separate default risk capital requirement.[290] The separate default risk capital requirement was initially presented in chapter 9 and will be further discussed in chapter 10.6.2 below in relation to default risk.

As also presented in chapter 9 above, the 97.5% expected shortfall, in the finalised Basel III's internal models approach for market risk, must include, inter alia, credit spread risk.[291] The expected shortfall must also be calibrated to a period of stress.[292] Stress calibration entails that the expected shortfall is based on input from stressed modellable risk factors, with a sufficiently long

[282] BCBS (2012), p. 3 and section 3.3, and BCBS (2013a), section 1.3.
[283] BCBS (2012), p. 3, section 3.3 and annex 4, and BCBS (2013a), section 1.3. A liquidity horizon was finally defined as the time assumed to be required to exit or hedge a risk position without materially affecting market prices in stressed market conditions, cf. BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR10.20.
[284] BCBS (2012), annex 4, section 2, and BCBS (2013a), section 1.3(i).
[285] BCBS (2013a), p. 2 and section 1.2.
[286] BCBS (2012), p. 6 and section 4.5.4, and BCBS (2013a), p. 3 and section 1.2(i).
[287] BCBS (2013a), p. 3, section 1.2(i) and p. 30.
[288] BCBS (2013a), section 1.2(i).
[289] BCBS (2013a), section 1.2(i).
[290] BCBS (2013a), section 1.2(i).
[291] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR31.3 and MAR33.2-3.
[292] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR33.5.

history of observations, and on the most severe 12-month period of stress available, including - as a minimum - the financial crisis of 2007.[293] To address the risk of market illiquidity, the expected shortfall must also reflect liquidity horizons for prescribed risk factors.[294] As described above, the liquidity horizons are considered to incorporate migration risk.[295] The expected shortfall is accordingly scaled from a base liquidity horizon of 10 days and prescribed risk factors are assigned specified liquidity horizons.[296] The granular approach to liquidity horizons was to counteract the former assumptions regarding liquidity in the trading book and - as examples - high-yield corporate credit spread risk exposures receive a liquidity horizon of 60 days while investment grade sovereign credit spread risk receives 20 days.[297] The finalised Basel III's spread risk capital requirements are accordingly not calibrated to a period that matches the calibration of Solvency II's spread risk sub-module, which is based on the one-year 99.5% VaR.

In relation to the standardised approach for market risk, which was also presented in chapter 9 above, BCBS (2019b) describes the sensitivities-based method as similar to a stress test as the capital requirement is based on the loss a bank estimates it would suffer under a defined stress scenario.[298] In the sensitivities-based method, an exposure's calculated delta risk sensitivity[299] to the prescribed credit spread risk factor is allocated to one of 18 buckets.[300] These 18 buckets are linked to "sectors" (including sovereigns and central banks, financials and covered bonds as well as various other sectors, e.g. technology, health care and consumer goods and services) as well as divided into investment grade exposures and high-yield/non-rated exposures.[301] Each bucket has a risk-weight and risk-weighted sensitivities are calculated by applying the specified risk weight to the calculated delta risk sensitivity placed in the bucket.[302] As examples, an investment grade sovereign delta risk sensitivity is subject to a 0.5% risk weight while a high-yield financials delta risk sensitivity receives a 12% risk weight.[303] Similar to the capital requirements for credit risk, the standardised approach for market risk applies an approach that is more granular, i terms of types credit exposures, than Solvency II's spread risk sub-module.

[293] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR33.5-7.

[294] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR33.4 and 33.12.

[295] BCBS (2019b), section 3.2(iv).

[296] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR33.4 and 33.12.

[297] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR33.4 and 33.12. See also BCBS (2013a), section 1.3(i).

[298] Section 1.

[299] Generally defined as the change in the market value of the instrument, as a result of applying a specified shift to each risk factor, assuming all the other relevant risk factors are held at the current level, cf. BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR21.16 and MAR10.13.

[300] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR20.4(1)(a) and (d), MAR21.1(1)(b), 21.4, 21.9(1), 21.20, 21.39-40 and 21.51-21.53.

[301] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR21.51.

[302] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR20.4(1)(a) and (d), and MAR21.1, 21.4, 21.39-40, and 21.51-53.

[303] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR21.51-53.

The subsequent three separate scenario-based aggregations, within buckets and across buckets (to produce the delta credit spread risk capital requirement) was described in detail in chapter 9.4.2.1 above.

In order to ensure consistency with the internal models approach, the risk weights, in the standardised approach, have been calibrated to stressed market conditions and mirror the liquidity horizons in the internal models approach.[304] Risk weights - and correlations used in the aggregation of risk-weighted sensitivities - have accordingly been calibrated to reflect market liquidity-adjusted time horizons for each risk class.[305] As an example, the above risk weights for delta credit spread risk (for non-securitisation exposures) have been modified for delta credit spread risk for securitisations to reflect longer liquidity horizons.[306]

The finalised Basel III accordingly includes explicit and market liquidity risk-adjusted capital requirements for credit spread risk that capture migration risk implicitly. From an overall perspective, the explicit capturing of credit spread risk, and implicit capturing of migration risk, are similar to Solvency II's spread risk sub-module, which is calibrated to implicitly capture migration risk via the one-year 99.5% VaR calibration of the factors of movements in credit spreads.[307] However, chapter 10.3 above showed how the Solvency II project viewed the introduction of the spread risk sub-module and counterparty default risk module as more closely aligned with Basel II's trading book and banking book, as well as that the spread risk sub-module was calibrated to *implicitly* capture default risk on bonds and loans.[308] As shown in the next chapter, this "alignment" may no longer be the case as the finalised Basel III reflects the ambition of bringing the trading book's treatment of default risk closer to the banking book's treatment of default risk.

10.6.2 Explicit Default Risk in the Trading Book

Chapter 4 described how credit spreads capture the expected loss from default (i.e. PD*LGD) and measure the mean of the default loss distribution.[309] A change in a credit spread accordingly represents a shift in the mean of the default loss distribution.[310] The risk of mark-to-market losses - from changes in the credit spread - is therefore the risk of a change in the mean of the default loss distribution.[311]

Due to the losses on credit exposures in the trading book during the financial crisis, the BCBS' fundamental review of the trading book entailed that the trading book's treatment of credit risk exposures was to become closer to the

[304] BCBS (2019b), section 3.3(i), and BCBS (2016), section 3.3.
[305] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR21.40.
[306] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR21.58(2) and 21.59.
[307] EIOPA (2014c), section 2.5. See also CEIOPS (2007a), para. 5.159, CEIOPS (2007d), para. 1.2 and 2.2, CEIOPS QIS3 (2007), para. I.3.89, and European Commission QIS4 (2008), para. TS.IX.F.2.
[308] EIOPA (2014c), section 2.5.
[309] BCBS (2013a), section 1.2(i). See also this dissertation's chapter 10.5.
[310] BCBS (2013a), section 1.2(i).
[311] BCBS (2013a), section 1.2(i).

banking book's treatment of credit risk.[312] The proposed expected shortfall, which captured a change in the mean, would not capture jump-to-default risk that entails a jump in the mean of the default loss distribution to 100%.[313] The purpose of introducing a separate default risk capital requirement, in the capital requirements for market risk, was to capture the incremental loss from defaults in excess of the mark-to-market loss from changes in credit spreads and migration risk.[314] This default risk capital requirement would accordingly capture the risk of defaults falling in the "extreme tail" of the default loss distribution.[315] In order to ensure consistency with the banking book's capital requirements for credit risk, the BCBS found that the trading book's default risk capital requirement was to be based on a *one-year 99.9%* confidence level VAR and apply to all trading book exposures that were subject to default risk.[316]

In line with the fundamental review of the trading book, the purpose of the finalised Basel III's default risk capital requirement (in the standardised approach for market risk) is to capture the jump-to-default risk that may not be captured by the capital requirements for credit spread risk shocks in the sensitivities-based method that was described in chapter 9.4.2.1 above.[317] The default risk capital requirement applies to exposures subject to default risk, including exposures to debt instruments.[318] In order to reduce the potential discrepancy in capital requirements for similar risk exposures, the default risk capital requirement has been calibrated in line with the treatment of credit risk in the banking book.[319]

Before aggregation, as described in chapter 9.4.2.1 above, the default risk capital requirement entails that

1. the gross jump-to-default risk position of each individual exposure is calculated separately, and a long and short exposure to the same counterparty/obligor are treated as two separate exposures.[320] The long or short gross jump-to-default risk position, over the generally applied *one-year capital horizon*, is calculated by multiplying the exposure's notional amount (e.g. a bond's face value) with a prescribed LGD (to reflect the loss of principal at default) whereafter any already incurred cumulative mark-to-market loss/gain (the P&L[321]) is added to ensure that only the net loss is included without double counting already incurred market value losses.[322] As examples, senior debt instruments are assigned an LGD of

[312] BCBS (2013a), p. 2 and section 1.2.
[313] BCBS (2013a), section 1.2(i). See also BCBS Basel III (2016b), para. 141.
[314] BCBS (2013a), section 1.2(i) and p. 30.
[315] BCBS (2013a), section 1.2(i). See also BCBS Basel III (2016b), para. 141.
[316] BCBS (2013a), section 1.2(i) and pp. 29-30.
[317] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR22.1. See also BCBS Basel III (2016b), para. 141.
[318] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR22.2(1).
[319] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR20.4(2).
[320] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR22.3(1) and 22.9-10.
[321] The P&L is equal to the current market value of the exposure minus its notional amount, cf. BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR22.11(2) and 22.14.
[322] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR22.11-22.15, i.e.

75%, while non-senior debt instruments are assigned 100% and covered bonds are assigned 25%.[323]

2. subject to certain conditions, gross jump-to-default risk exposures to the same counterparty are then subject to offsetting[324] that produces net long and/or net short jump-to-default risk exposures to that counterparty.[325]

The calculated net jump-to-default risk exposures for non-securitisations are allocated to buckets for sovereigns, local governments and municipalities, and corporates.[326] Default risk weights - that depend on any external credit assessment of the exposure or if its unrated - are prescribed.[327] A weighted net jump-to-default risk exposure is then calculated by applying the prescribed default risk weight to the net jump-to-default risk exposure.[328] As examples, a AAA-rated exposure receives a 0.5% default risk weight while a CCC-rated exposure receives a 50% default risk weight.[329] However, claims on sovereigns may be allowed to receive a default risk weight of 0% in line with the standardised approach for credit risk in the banking book.[330]

The subsequent aggregation of risk-weighted net jump-to-default risk exposures, in the default risk capital requirement, was described in detail in chapter 9.4.2.1 above. Similar to the aggregation of capital requirements in Solvency II's spread risk sub-module, diversification effects are not allowed when calculating the default risk capital requirement for credit exposures in the form of non-securitisations and securitisations.[331]

As described in chapter 9, the finalised Basel III's internal models approach for market risk also includes a separate default risk capital requirement wherein an internal model measures the default risk of trading book positions.[332] Similar to the standardised approach, default risk is to be assessed in terms of the incremental loss from default for each exposure in excess of the mark-to-market losses already taken into account in the current valuation of the exposure.[333] The default risk capital requirement must be calculated weekly and be based on a one-year 99.9% VaR similar to the banking book.[334] It accordingly entails that

$JumpToDefault_{(long)} = max(LGD * notional + P\&L, 0)$ and $JumpToDefault_{(short)} = max(LGD * notional + P\&L, 0)$.

[323] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR22.12.

[324] I.e. gross long positions are offset against gross short positions.

[325] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR22.1, 22.3(2) and 22.19.

[326] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR22.3(3) and (4), and 22.22.

[327] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR22.24.

[328] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR22.3(4) and 22.24.

[329] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR22.24.

[330] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR22.7.

[331] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR22.4.

[332] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR33.18. The internal models approach defines default risk as the risk of direct loss due to an obligor's default as well as the potential for indirect losses that may arise from a default event, cf. BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR33.19.

[333] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR33.30 and 33.33.

[334] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR33.18-21. See also BCBS (2013a), pp. 11 and 30.

constant positions over a one-year horizon must be assumed.[335] In addition, if PDs or LGDs are estimated by the bank, under the IRB approach for credit risk in the banking book, then these PD's or LGD's data must be used under the internal models approach for market risk.[336] Alternatively, PDs or LGDs must be estimated in a manner that is consistent with the IRB approach while being subject to certain conditions.[337] PDs must, inter alia, be based on historical default frequency data over a one-year period and are subject to a floor of 0.03%.[338] LGDs must, inter alia, be based on an exposures's current market value while subtracting the exposure's expected market value subsequent to default.[339]

In short, in addition to explicit market liquidity-adjusted capital requirements for credit spread risk, which implicitly capture migration risk, the finalised Basel III's trading book captures default risk on credit exposures explicitly via the default risk capital requirement in both the standardised approach and internal models approach for market risk. In order to ensure consistency in the treatment of credit exposures, the default risk capital requirements are banking book-calibrated. As shown in chapter 10.3 above, the Solvency II project looked towards the former Basel II's capital requirements for market risk and credit risk and viewed the spread risk sub-module and counterparty default risk module as more closely aligned with banking regulation where "specific interest rate risk" was treated as a part of the trading book while default risk was a part of the banking book.[340] The finalised Basel III's consistent default risk treatment of credit exposures, in both the banking book and trading book, may entail that Solvency II's treatment of default risk is no longer "aligned" with the treatment of default risk in banking standards.

10.7 Overview of Findings regarding Default Risk, Credit Spread Risk and Migration Risk

Chapter 12 compares Solvency II's and the finalised Basel III's treatment of liquidity risk and this chapter's findings regarding market liquidity risk will be included in that chapter.

In relation to credit risk and market risk, the research question is whether Solvency II subjects life insurance undertakings' credit risk exposures to requirements that are "similar" to the finalised Basel III's requirements for such credit risk exposures. As described in chapter 8, and due to the structural differences illustrated in chapter 9, the comparison is limited to assessing whether credit risk exposures are subject to quantitative pillar 1 requirements. When viewed in the light of the FSB's approach to equivalence in capital requirements, the ques-

[335] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR33.23
[336] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR33.37-38.
[337] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR33.37-38.
[338] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR33.24 and 33.37
[339] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR33.38.
[340] CEIOPS (2007a), para. 5.83. See also CEIOPS (2007d), para. 1.1.

tion can be elevated to an assessment of whether credit risk - as an overall risk type - is subject to quantitative pillar 1 requirements.[341] From this "elevated" perspective, it can be concluded that credit risk is addressed via quantitative pillar 1 requirements in the finalised Basel III's banking book and trading book and in Solvency II's SCR internal model and SCR standard formula. In the SCR standard formula, credit risk exposures are subjected to capital requirements via either the spread risk sub-module or the counterparty default risk module.

However, from a more granular perspective, which looks at default risk, credit spread risk and migration risk, the comparison above showed how the credit risk components are not addressed in similar ways. This is summarised in table 10.2 below. The findings in the table have to viewed in the light of the structural differences between Solvency II's and the finalised Basel III's pillar 1 requirements, including overall capital requirements and calibration as well as aggregation and diversification effects. As described in chapter 9, both the standardised approach and IRB approach for credit risk, in the finalised Basel III's banking book, are portfolio invariant. The standardised approach and internal models approach for market risk, in the finalised Basel III's trading book, allow prescribed diversification effects during aggregation but their aggregation processes are not similar to the prescribed aggregation of risk modules in Solvency II's SCR standard formula.

Solvency II's SCR internal model was generally not included in the comparison as it is regulated in an overall nature that does not allow a comparison with the finalised Basel III, which includes detailed requirements in both the IRB approach for credit risk and the internal models approach for market risk. Solvency II states, inter alia, that the SCR internal model (i) must correspond to the one-year 99.5% VaR of the basic own funds, (ii) must cover, inter alia, market risk and credit risk, and (iii) may, in relation to diversification effects, consider dependencies within and across risk categories provided that the supervisory authority approves the system used for measuring such diversification effects.[342] The adequacy of the SCR internal model and its input seems to generally rely on the approval assessment by the supervisory authority. Solvency II's level 1 and 2 do e.g. not prescribe a particular method for the calculation of the SCR's probability distribution, or provide risk-weight functions or formulas for calculating credit risk capital requirements, or impose quantitative limitations on diversification.[343] As described in chapters 9 and 10.5, the finalised Basel III's IRB approach for credit risk and internal models approach for market risk are subject to detailed regulation that reflects experiences from the financial crisis.

[341]See e.g. FSB (2013c), section 1.1(i) and p. 12 (including footnote 16), and FSB (2015c), p. 4 (footnote 11) and section 3.1.

[342]Solvency II, art. 101(3) and (4)(d) and (e), 121(4) and (5), and 122(2), and Solvency II Delegated Regulation, art. 226(c), 229(c), 233, 234 and 238.

[343]Solvency II, title I, chapter VI, section 4, subsections 1 and 3, including art. 112(3) and (5), 121(4) and 122(2), and Solvency II Delegated Regulation, title I, chapter VI, including art. 228-231, 234 and 238.

			Default risk/jump-to-default risk	**Credit spread risk**	**Migration risk**
Finalised Basel III	**Banking book** (portfolio invariance)	*Standardised approach for credit risk*	Explicit (risk weights)		
		IRB approach for credit risk	Explicit (one-year 99.9% VaR)		
	Trading book (prescribed diversification effects during aggregation (DRC is separate))	*Standardised approach for market risk*	Explicit (DRC calibrated in line with banking book)	Explicit (via sensitivities-based method (calibration aligned with IMA))	Implicit (via risk weights in credit spread risk)
		Internal models approach (IMA) for market risk	Explicit (DRC in line with banking book's one-year 99.9% VaR)	Explicit (97.5% expected shortfall)	Implicit (via credit spread risk and liquidity horizons)
Solvency II	**SCR standard formula** (prescribed diversification effects during aggregation in SCR standard formula)	*Spread risk sub-module*	Implicit (via one-year 99.5% VaR calibration of stress factors)	Explicit (one-year 99.5% VaR)	Implicit (via one-year 99.5% VaR calibration of stress factors)
		Counterparty default risk module	Explicit (15% risk factor applied on LGD for specific retail mortgage loans)		

Table 10.2: Overview of findings in the comparison of pillar 1 requirements for the individual components of credit risk. The default risk capital requirement ("DRC") is a separate capital requirement for default risk under both the standardised approach and internal models approach for market risk in the finalised Basel III.

Solvency II entails a *one-year* 99.5% VaR calibration of capital requirements for credit risk in the spread risk sub-module and the counterparty default risk module. This is different from the finalised Basel III's capital requirement for (modellable) credit spread risk, in the trading book, which is calibrated via the liquidity horizon-scaled 97.5% expected shortfall. However, the trading book also includes the separate default risk capital requirement that is calibrated in line with the banking book or based on a *one-year* 99.9% VaR. This default risk capital requirement is accordingly aligned with - or has been calibrated based on - the treatment of credit risk in the banking book in order to reduce any potential discrepancy in capital requirements for similar risk exposures.[344] The explicit capturing of default risk under all approaches, in both the banking book and trading book, was not present in the former Basel II's trading book. In Solvency II, the spread risk sub-module captures spread risk explicitly while default risk and migration risk are addressed implicitly via the calibration of the stress factors. This approach to credit risk was developed in the light of Basel II and CEIOPS (2007a) viewed the introduction of the spread risk sub-module and counterparty default risk module as more closely aligned with banking regulation where "specific interest rate risk" was treated as a part of the trading book while default risk was a part of the banking book.[345] As shown in table 10.2 above, both Solvency II and the finalised Basel III capture migration risk implicitly via capital requirements for credit spread risk. However, Solvency II's approach to credit spread risk and default risk can - in principle - no longer be viewed as "aligned" with banking standards as the finalised Basel III explicitly captures credit spread risk and the incremental default risk on trading book exposures. In the IAIS' proposed "standard method" for the insurance capital standard, both (non-default) spread risk and credit risk are to be addressed.[346]

Obviously, the question of whether Solvency II's spread risk sub-module sufficiently captures default risk depends on the actual *one-year* 99.5% VaR calibration of the stress factors. At the time of CEIOPS' final level 2 advice for the spread risk sub-module, European insurance undertakings' corporate bond investments were considered of a generally high quality and approximately 87% were in the rating classes AAA, AA, and A (while 37.8% were in the rating class AAA).[347] However, life insurance undertakings' increasing alternative credit investments are - in comparison to traditional investments - characterised by being traded on a shallow, illiquid and non-transparent market as well as being long-term and associated with different risks.[348] As described in chapter 9.1, the longer the exposure horizon, the more non-diversifiable systematic risk and default risk are perceived to increase.[349] The finalised Basel III's default risk capital requirement, in both the standardised approach and internal models

[344] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR20.4(2) and MAR33.18-21.
[345] CEIOPS (2007a), para. 5.83. See also CEIOPS (2007d), para. 1.1.
[346] IAIS (2018c), para. 206 and 359-360.
[347] CEIOPS (2010a), para. 4.121.
[348] Danish FSA (2014b), p. 1, Danish FSA (2016), p. 13, Danish FSA (2017a), p. 9, and Danish FSA (2018b), p. 11.
[349] BCBS (2009b), pp. 2 and 8 and section 4.

approach for market risk, is accordingly to capture the jump-to-default risk (or incremental loss from default) that may not be captured by the capital requirements for credit spread risk.[350]

Solvency II's spread risk sub-module initially included a general treatment for "bonds and loans" whereafter specific treatments of e.g. exposures to unrated bonds and loans and qualifying infrastructure were added as part of the Capital Markets Union Action Plan. From a banking perspective, it seems counterintuitive to subject presumably illiquid and long-term credit exposures, including unrated bonds and loans, to primarily spread risk capital requirements. However, Solvency II's 99.5% VaR calibration of capital requirements for credit spread risk is to capture a one-year exposure period (similar to the one-year period in the finalised Basel III's banking book) and only future experiences can reveal what part of credit losses are actually captured via this calibration. In addition, the possible changes in the credit risk that are associated with life insurance undertakings' alternative credit investments may be transferred to policyholders via non-guaranteed products.

As described in chapters 6.2 and 10.3.2 above, life insurance undertakings' alternative credit investments, including unrated bonds and loans, may become increasingly similar to banks' credit intermediation and occur alongside banks. However, the comparison above also showed that there is no alignment of asset classes for credit exposures in Solvency II and the finalised Basel III. In general, the finalised Basel III applies a more granular approach to exposure types, including the more risky specialised lending, which is subject to specific risk weights in the banking book. In addition, the finalised Basel III's standardised approach for market risk includes more granular sectors with specific risk weights. An increase in life insurance undertakings' bank-like credit exposures, which resemble e.g. specialised lending, could warrant consistency in asset classes for credit risk. Diversification effects may prevent "meaningful" comparisons of risk factor-level capital requirements. However, an alignment of asset classes could enable more granular calibrations of credit risk and ensure additional cross-sectoral consistency in relation to credit exposure types.

[350] BCBS Basel III (2019)/BCBS Consol. Basel III (2019), MAR22.1 and MAR33.19, 33.30 and 33.33.

Chapter 11

Counterparty Credit Risk

Chapter 5.2 presented in detail how repos give rise to bilateral counterparty credit risk. In a repo, the market value of the transaction can be positive or negative to *either* counterparty, and a counterparty could default before the final settlement of the transaction's cash flows.[1] A bank that makes a loan (posts cash financial collateral) to a life insurance undertaking, and receives securities financial collateral, is exposed to the risk of the life insurance undertaking's default and that a sale of the received securities financial collateral is insufficient to cover the loss on the loan; at the same time, the life insurance undertaking is exposed to the risk that the bank defaults and does not return the cash financial collateral.[2] In line with this dissertation's scope, this chapter will only focus on repos. However, securities lending is functionally similar to repos and counterparty credit risk capital requirements apply similarly to securities lending.[3]

As mentioned in chapters 7.1 and 8, in the EU, CCPs are governed by EMIR and CPP-clearing entails that the CPP establishes positions (including the calculation of net obligations) and ensures that financial collateral is available to secure the exposures arising from those positions.[4] Margins are considered a CCP's "primary line of defence" and the CCP's collection of variation margin[5] and initial margin[6], as well as the application of haircuts on accepted collateral, are explicitly regulated in EMIR.[7] The CCP is to mark-to-market received collateral - as well as monitor the credit quality, market liquidity and price volat-

[1]See e.g. BCBS Consol. Basel III (2019), CRE50.1 and CRE51.2.

[2]See e.g. BCBS Consol. Basel III (2019), CRE51.3.

[3]See, inter alia, BCBS Consol. Basel III (2019), CRE50.13 and CRE51.4(4) and 51.7.

[4]EMIR, art. 1 and 2(3).

[5]I.e. margins collected or paid out to reflect current exposures resulting from actual changes in market price.

[6]I.e. margins collected to cover potential future exposure in the interval between the last margin collection and the liquidation of positions following a default.

[7]EMIR, recital 70 and art. 41 and 46, and EMIR Delegated Regulation, art. 1(5) and (6) and chapters VI and X.

ility of the received collateral - on a near to real time basis.[8] The margins must (i) limit the CPP's credit exposures from its clearing members, (ii) be sufficient to cover potential exposures that are estimated to occur until the liquidation of positions, (iii) be sufficient to cover losses that result from at least 99% of the exposure's movements over an appropriate time horizon and (iv) fully collateralise the CPP's exposures with all its clearing members on at least a daily basis.[9] Margins are to be called and collected on an intraday basis and at least when predefined thresholds are exceeded.[10]

CPP-clearing ensures regulatory "equivalence" for both banks and life insurance undertakings as EMIR includes the margin and haircut requirements that address counterparty credit risk. In addition, both the bank's or life insurance undertaking's counterparty credit risk exposure will be to the CCP that is subject to EMIR. As described in chapter 13.2 below, FSB (2015c) includes the numerical haircut floors framework which is to limit the possible build-up of leverage outside the banking system and to reduce the procyclicality of that leverage.[11] In line with the equivalence above, the numerical haircut floors framework only applies to non-banks' SFTs, with non-government financial collateral, that are *not* CCP-cleared.[12] Due to the equivalence, and in line with the FSB's numerical haircut floors framework, this chapter will focus on repos that are *not* cleared by a CCP.[13]

This chapter will firstly present the finalised Basel III's treatment of counterparty credit risk and repos, including the recognition of master netting agreements. When this treatment is subsequently compared to Solvency II's treatment of counterparty default risk, it will be shown that Solvency II does not include a "tailored" treatment of repos and the effect of master netting agreements. As described in detail, this treatment has stayed in place although repos were mentioned during the recent review of the Solvency II Delegated Regulation.

11.1 The Finalised Basel III and Counterparty Credit Risk

As described in chapters 9 and 10 above, the finalised Basel III's total risk-weighted assets include the *risk-weighted assets for credit risk* in the banking book and the *risk-weighted assets for market risk* in the trading book.[14] In relation to on-balance sheet credit exposures, which may constitute financial collateral in a repo, the risk-weighted assets for credit risk and the risk-weighted

[8]EMIR Delegated Regulation, art. 40.
[9]EMIR, art. 41(1), and EMIR Delegated Regulation, chapter VI.
[10]EMIR, art. 41(3).
[11]Sections 1 and 3.
[12]FSB (2015c), section 1(ii) and section 3.
[13]In the finalised Basel III, CCP-cleared repos and other SFTs are subject to a separate counterparty credit risk framework, cf. BCBS Consol. Basel III (2019), CRE51.9 and 51.13 and CRE54, and BCBS Basel III (2014c).
[14]BCBS Consol. Basel III (2019), RBC20.1, 20.4, 20.6(1) and 20.9

assets for market risk capture default risk in both the banking book and trading book. In addition, the risk-weighted assets for market risk capture credit spread risk explicitly and migration risk implicitly in the trading book.

The risk-weighted assets for credit risk also include the *risk-weighted assets for the counterparty credit risk* that is associated with exposures to repos and other SFTs in both the banking book and trading book.[15] Banks are accordingly to identify transactions that constitute exposures to counterparty credit risk and calculate a counterparty credit risk capital requirement.[16] Such exposures include repos and other SFTs that generally exhibit specified characteristics such as short-term financing as well as risk mitigation via marking-to-market, collateral and netting.[17] In the trading book, counterparty credit risk capital requirements for repos must be calculated separately from the capital requirements for market risk.[18]

In addition, the risk-weighted assets for market risk include *risk-weighted assets for credit valuation adjustment ("CVA") risk*[19] in the banking book and trading book.[20] As described in chapters 5.2 and 9.1, the CVA reflects an adjustment of default risk-free prices of repos, due to a potential default of the counterparty, and it constitutes the market value of the credit risk of one repo counterparty or both repo counterparties.[21] Under the finalised Basel III, CVA risk capital requirements only apply to repos and other SFTs that are fair-valued by a bank for accounting purposes.[22] Due to limitation issues, this chapter will only focus on counterparty credit risk capital requirements. However, CVA risk would be equally relevant if life insurance undertakings fair-valued and traded their repos.

[15] BCBS Consol. Basel III (2019), RBC20.1, 20.4, 20.6(2) and 20.7-8, CRE50.13, and CRE51.4(4) and 51.5-7.

[16] BCBS Consol. Basel III (2019), CRE51.1 and 51.7.

[17] The characteristics include (i) the generation of a current exposure or market value, (ii) an associated random future market value based on market variables, (iii) an exchange of payments or an exchange of a financial instrument against payment, (iv) that collateral may be used to mitigate the risk exposure, (v) that short-term financing may be a primary objective via an exchange of one asset for another for a relatively short time period, (vi) that netting is used mitigate risk, (vii) that positions are frequently valued according to market variables, (viii) the use of remargining and (ix) an identified counterparty with a unique probability of default, cf. BCBS Consol. Basel III (2019), CRE50.13, CRE51.4(4), and 51.5-6.

[18] BCBS Consol. Basel III (2019), CRE55.1. See also the replaced BCBS Basel III (2016b), para. 40.

[19] Defined as the risk of losses arising from changing credit valuation adjustment ("CVA") values in response to changes in counterparty credit spreads and market risk factors that drive prices of SFTs, cf. BCBS Consol. Basel III (2019), MAR50.4 and BCBS Basel III (2017), Minimum capital requirements for CVA risk, para. 2.

[20] BCBS Consol. Basel III (2019), RBC20.9(2) and MAR50, and BCBS Basel III (2017), Minimum capital requirements for CVA risk.

[21] BCBS Consol. Basel III (2019), CRE50.32 and MAR50.2, and BCBS Basel III (2017), Minimum capital requirements for CVA risk, para. 1.

[22] BCBS Consol. Basel III (2019), MAR50.5, and BCBS Basel III (2017), Minimum capital requirements for CVA risk, para. 3.

11.1.1 IRB Approach: Collateral, LGD and Counterparty Credit Risk EAD

Chapter 10.5 above described the finalised Basel III's IRB approach for credit risk in the banking book. That chapter accordingly functions as the background for this chapter's presentation of the IRB approach's treatment of collateral and the counterparty credit risk EAD.

Under the *foundation* IRB approach for credit risk, collateral is generally reflected via the risk component LGD.[23] The LGD for a collateralised transaction is produced by firstly dividing the LGD risk component into an LGD for the collateralised part of the exposure and an LGD for the unsecured part of that exposure.[24] The LGD for the unsecured part is the foundation IRB approach's prescribed LGD while specific LGDs are prescribed for the collateralised part depending on the type of collateral, including an LGD of 0% in case of certain eligible financial collateral.[25] The LGD for the collateralised part of the exposure is weighted by a "secured exposure weight" which is calculated by

1. increasing the current value of the credit exposure, if the credit exposure is in the form of lent or posted securities, by applying the *comprehensive approach*'s supervisory haircuts (i.e. the "adjusted credit exposure")[26],

2. subjecting the received collateral's current value to a haircut for the collateral type (and any currency mismatch) based on the comprehensive approach's supervisory haircuts (i.e. the "adjusted collateral value")[27], and finally

3. dividing the adjusted collateral value with the adjusted credit exposure, which gives the secured exposure weight.[28]

The LGD for the unsecured part of the exposure is weighted by the "unsecured exposure weight" which is calculated by (i) subtracting the adjusted collateral value from the adjusted credit exposure and (ii) dividing the result with the adjusted credit exposure.[29] In order to calculate the final LGD for a collateralised transaction, the weighted LGD for the collateralised part of the exposure is added to the weighted LGD for the unsecured part of the exposure.[30]

[23] BCBS Consol. Basel III (2019), CRE32.8, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 72.

[24] BCBS Consol. Basel III (2019), CRE32.10, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 74.

[25] BCBS Consol. Basel III (2019), CRE32.10-11, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 74-75.

[26] I.e. $E * (1 + H_E)$.

[27] I.e. E_s.

[28] I.e. $LGD_S * \frac{E_s}{E*(1+H_E)}$, cf. BCBS Consol. Basel III (2019), CRE32.10-12, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 74-76.

[29] I.e. $LGD_U * \frac{E_U}{E*(1+H_E)}$, cf. BCBS Consol. Basel III (2019), CRE32.10-12, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 74-76.

[30] I.e. $LGD^* = LGD_U * \frac{E_U}{E*(1+H_E)} + LGD_S * \frac{E_s}{E*(1+H_E)}$, cf. BCBS Consol. Basel III (2019), CRE32.10-12, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 74-76.

In relation to eligible financial collateral, the foundation IRB approach relies on haircuts prescribed in the *comprehensive approach*, which is a part of the *credit risk mitigation framework* in the standardised approach for credit risk in the banking book (that is presented in detail below).[31] The credit risk mitigation framework includes the simple approach and comprehensive approach for the recognition of collateral.[32] The simple approach cannot be used by banks that apply the foundation IRB approach, but the recognition of financial collateral - under the foundation IRB approach - is subject to the operational requirements of the credit risk mitigation framework in the standardised approach.[33]

In relation to the *advanced* IRB approach for credit risk in the banking book, own-estimate LGDs for corporate exposures are subject to floors, which apply when the credit exposure is fully secured after haircuts have been applied upon the collateral.[34] A 0% LGD floor applies upon corporate exposures that are fully secured by financial collateral.[35] If the credit exposure is not fully collateralised, then the LGD floor is adjusted based on (i) the weighted LGD floor for the unsecured part and (ii) the weighted LGD floor for the collateralised part (in line with the foundation IRB approach's treatment of LGDs for collateralised exposures described above).[36]

The IRB approach will accordingly reflect the risk mitigating effect of collateral in the LGD.[37] However, as described next in chapter 11.1.2, the risk mitigating effect of master netting agreements, on the counterparty credit risk in repos, is reflected in a calculated exposure amount after credit risk mitigation - the *counterparty credit risk EAD* - which is used as the EAD in the IRB approach's calculation of risk-weighted assets.[38] When recognising the effect of such master netting agreements in the EAD, the foundation IRB approach provides that the prescribed LGDs for *unsecured* exposures are to be used in the IRB risk-weight function.[39] The advanced IRB approach also relies on the counterparty credit risk EAD while own-estimate LGDs may be permitted for the unsecured equivalent amount.[40]

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[31] BCBS Consol. Basel III (2019), CRE32.11, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 75.

[32] BCBS Consol. Basel III (2019), including CRE22.18-19, 22.32 and 22.40, and BCBS Basel III (2017), Standardised approach for credit risk, including para. 133, 146 and 155.

[33] BCBS Consol. Basel III (2019), CRE32.8-9, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 72-73.

[34] BCBS Consol. Basel III (2019), CRE32.16-17, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 85-86.

[35] BCBS Consol. Basel III (2019), CRE32.16-17, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 85-86.

[36] BCBS Consol. Basel III (2019), CRE32.17, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 86.

[37] See also Basel II, annex 10, para. 1.

[38] BCBS Consol. Basel III (2019), CRE32.13, 32.20, and 32.37-43 and CRE51.7-8 and 51.13, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 77, 89, 106 and 249. Se also Basel II, annex 10, para. 1, 2, 4, 6-8.

[39] BCBS Consol. Basel III (2019), CRE32.13, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 77. Se also Basel II, annex 10, para. 2, 4 and 7-8.

[40] BCBS Consol. Basel III (2019), CRE32.20 and 32.37-43, CRE36.97 and CRE51.7 and 51.13, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 89,

Accordingly, the calculation of the IRB approach' s capital requirements for counterparty credit risk, including the risk mitigating effect of master netting agreements, is to be done in accordance with the finalised Basel III's counterparty credit risk framework, which is presented next.

11.1.2 The Approaches for Counterparty Credit Risk

In the finalised Basel III, counterparty credit risk capital requirements, and the recognition of netting in master netting agreements (as described above in chapter 5.1.2), are reflected in counterparty credit risk exposure amounts, under the standardised approach, and counterparty credit risk EADs under the IRB approach.[41]

Figure 11.1 provides an overview of the finalised Basel III's approaches for counterparty credit risk. In relation to repos, a bank can chose not to recognise the effect of master netting agreements, which entails that each repo transaction is subject to a capital requirement that is similar to other collateralised transactions not covered by a master netting agreement.[42] The lower right corner of figure 11.1 shows an overlap between the standardised approach and IRB approach in relation to master netting agreements (in green). The former Basel II explained the logic behind this treatment of repos and master netting agreements.[43] Under Basel II, the standardised approach's credit risk mitigation framework included the simple approach and comprehensive approach that could be used for transactions secured by eligible financial collateral.[44] If a bank wanted to recognise the effects of master netting agreements for repos, the standardised approach's credit risk mitigation framework, including the comprehensive approach, was to be applied regardless of (i) whether the repo was in the banking book or trading book and (ii) whether the standardised approach or IRB approach was applied.[45] For repos that were subject to master netting agreements, the credit risk mitigation framework produced an "unsecured loan equivalent amount" which constituted the standardised approach's exposure amount or IRB approach's EAD.[46]

In the finalised Basel III, as illustrated in figure 11.1, the counterparty credit risk capital requirements for repos and other SFTs in the banking book - that are *not* CCP-cleared - can be calculated via one of the following methods (depending on the use of the standardised approach or IRB approach for credit risk in the banking book):

- the simple approach for the recognition of collateral in the standardised

106 and 249. Se also Basel II, annex 10, para 1, 2 and 7-8.

[41] BCBS Consol. Basel III (2019), CRE51.7-8 and 51.13, CRE20.102, CRE32.13, 32.20, 32.37-43, CRE36.97, and BCBS Basel III (2017), Standardised approach for credit risk, para. 86, and Internal ratings-based approach for credit risk, para. 77, 89, 106 and 249.

[42] BCBS Consol. Basel III (2019), CRE22.44, and Basel II, annex 10, para. 6.

[43] See also BCBS Basel III (2017), Standardised approach for credit risk, footnote 67.

[44] Basel II, part 2.II.D and annex 10, para. 3.

[45] Basel II, para. 137 and 173-181(i), and annex 10, para. 1, 2, 7 and 8.

[46] Basel II, para. 173-181(i) and annex 10, para. 8.

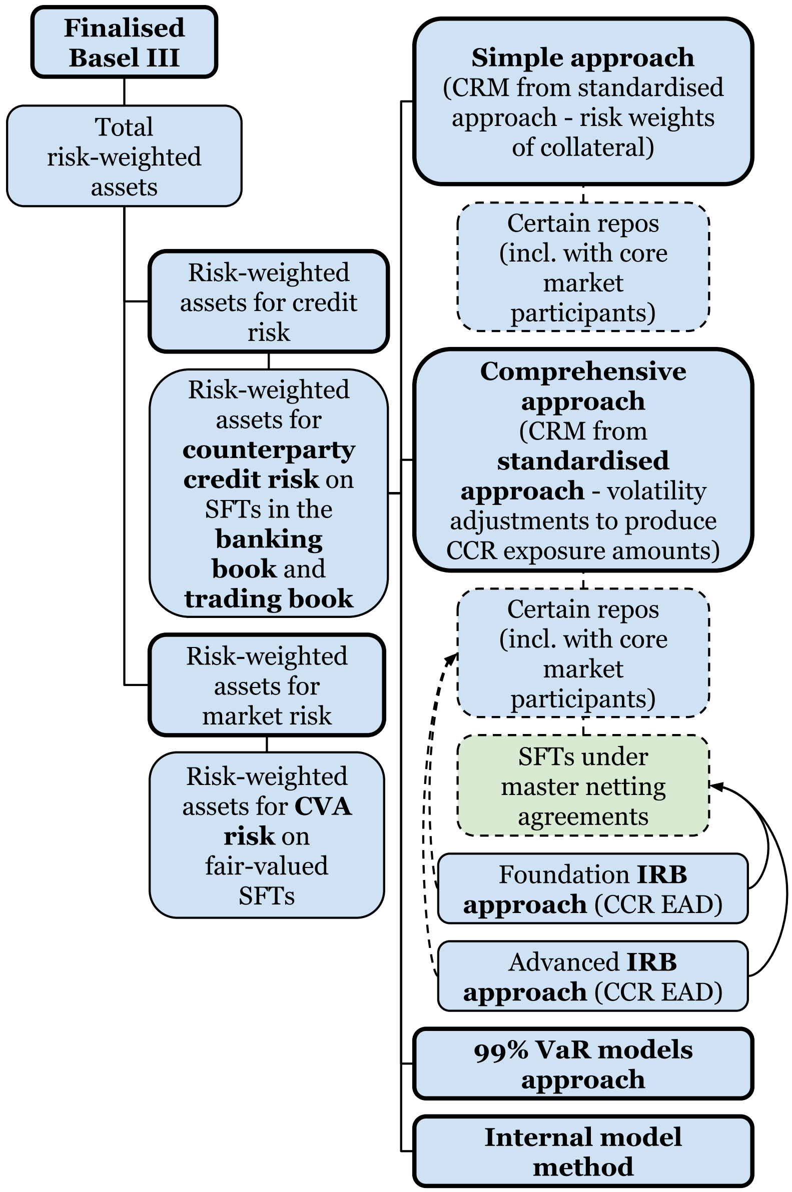

Figure 11.1: Overview of the finalised Basel III's approaches for capital requirements for repos, counterparty credit risk ("CCR") and CVA risk.

approach for credit risk.[47] Under the simple approach, as described below, the collateralised part of the exposure is subject to the risk weight of the collateral while the unsecured part is subject to the risk weight of the counterparty.[48] As described in chapter 11.1.2.1, certain repos - including with certain core market participants - are subject to a specific treatment in order to accommodate banks' short-term wholesale funding to each other.[49]

- the comprehensive approach for the recognition of collateral in the standardised approach for credit risk.[50] Under the comprehensive approach, the volatility-adjusted exposure amount is reduced by the volatility-adjusted value of the collateral to produce a counterparty credit risk exposure amount.[51] Prescribed supervisory haircuts are used to adjust both the exposure amount and the value of received collateral to incorporate possible future fluctuations in the value of both due to market movements.[52] As described in chapter 11.1.2.3 below, the comprehensive approach includes the specific treatment of repos that are subject to master netting agreements and this treatment produces a counterparty credit risk exposure amount (to be used under the standardised approach) and the counterparty credit risk EAD (to be used under the IRB approach).[53]

- the IRB approach's VaR models approach that is based on a 99% VaR (with a holding period of five business days for repos with margin) and to capture the price volatility of the exposure and the financial collateral.[54]

[47] BCBS Consol. Basel III (2019), CRE51.7 and 51.8(2) and CRE22 (including 22.18 and 22.32-39), and BCBS Basel III (2017), Standardised approach for credit risk, part D, including para. 133.

[48] BCBS Consol. Basel III (2019), CRE22.18(1) and 22.32-33, and BCBS Basel III (2017), Standardised approach for credit risk, para. 133(i) and 146-147.

[49] BCBS Consol. Basel III (2019), CRE22.33 and 22.36-39, and BCBS Basel III (2017), Standardised approach for credit risk, para. 147 and 150-154.

[50] BCBS Consol. Basel III (2019), RCB20.6(2) and 20.7(2), CRE51.7 and 51.8(2), CRE20.102 and CRE22 (including 22.18 and 22.40-67), and BCBS Basel III (2017), Standardised approach for credit risk, part D.

[51] BCBS Consol. Basel III (2019), CRE22.18(2) and 22.40, and BCBS Basel III (2017), Standardised approach for credit risk, para. 133(ii) and 155.

[52] BCBS Consol. Basel III (2019), CRE22.40, and BCBS Basel III (2017), Standardised approach for credit risk, para. 155.

[53] BCBS Consol. Basel III (2019), CRE22.44 and 22.62-22.65, CRE32.20 and 32.38 and CRE51.7, 51.8(2) and 51.13, and BCBS Basel III (2017), Standardised approach for credit risk, para. 175-178.

[54] BCBS Consol. Basel III (2019), RCB20.6(2) and 20.7(3), CRE51.7 and 51.8(3), CRE55.2 and CRE32.39-41, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 78-80. The VaR models approach is subject to supervisory approval and applies to a single SFT and SFTs covered by a netting agreement on a counterparty-by-counterparty basis if the financial collateral is revalued on a daily basis, cf. BCBS Consol. Basel III (2019), CRE32.39, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 78. The VaR models approach must meet the minimum requirements for the internal models approach for market risk and can be used by banks, which have received supervisory approval for the internal models approach for market risk, or by banks that have obtained a separate supervisory approval for the VaR models approach, cf. BCBS Consol. Basel III (2019),

The counterparty credit risk EAD for repos that are subject to master netting agreements may be calculated via the VaR models approach.[55]

- the internal models method ("IMM") which is subject to supervisory approval.[56]

If a bank applies the standardised approach for credit risk, either the simple approach or comprehensive approach may be used for repos and other SFTs unless the bank has supervisory approval to use the internal models method.[57] If the IRB approach is applied, banks may use the comprehensive approach but can seek supervisory approval to apply the VAR models approach or the internal models method.[58]

The counterparty credit risk exposure amount (under the standardised approach) or counterparty credit risk EAD (under the IRB approach) for a specific counterparty is equal to the sum of those exposure amounts/EADs calculated for each netting set with a counterparty.[59] Under the standardised approach, the calculated counterparty credit risk exposure amount is risk-weighted in accordance with the prescribed risk weight for the counterparty.[60] Under the IRB approach, the counterparty credit risk EAD is risk-weighted by the risk weight produced by the prescribed IRB risk-weight function.[61]

In the trading book, counterparty credit risk capital requirements for repos must be calculated separately from the capital requirements for market risk.[62] In addition, the calculation is to be done in accordance with the calculation of counterparty credit risk capital requirements for repos in the banking book as described above.[63] The applied risk weights must also be consistent with the use of risk weights in the calculation of counterparty credit risk capital requirements in the banking book.[64]

CRE32.39-40, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 78-79 and 89.

[55] BCBS Consol. Basel III (2019), CRE51.8(3) and CRE32.13, 32.20 and 32.38-39, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 78 and 89.

[56] BCBS Consol. Basel III (2019), RCB20.6(2) and 20.7(4), CRE32.42, CRE51.7 and 51.8(4) and 51.15, and CRE53, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 81.

[57] BCBS Consol. Basel III (2019), CRE51.8(2) and CRE22.17 (footnote 2) and 22.19, and BCBS Basel III (2017), Standardised approach for credit risk, para. 133.

[58] BCBS Consol. Basel III (2019), CRE32.37-42 and CRE51.8(3)-(4), and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 77-81.

[59] BCBS Consol. Basel III (2019), CRE51.11. A netting set is defined as a group of transactions with a single counterparty that are subject to a legally enforceable and recognised bilateral netting arrangement, cf. BCBS Consol. Basel III (2019), CRE50.15.

[60] BCBS Consol. Basel III (2019), CRE51.13, CRE22.48 and 22.65 and CRE20.102.

[61] BCBS Consol. Basel III (2019), CRE51.13 and CRE32.38.

[62] BCBS Consol. Basel III (2019), CRE55.1. See also the replaced BCBS Basel III (2016b), para. 40.

[63] BCBS Consol. Basel III (2019), CRE55.4. See also the replaced BCBS Basel III (2016b), para. 43.

[64] BCBS Consol. Basel III (2019), CRE55.1. See also the replaced BCBS Basel III (2016b), para. 40. Accordingly, if a bank applies the standardised approach for credit risk in the banking book, it must apply the standardised approach's risk weights in the trading book. If

As described above, the IRB approach relies on the comprehensive approach's treatment of repos and master netting agreements. The following chapters will therefore focus on the comprehensive approach and its function in the calculation of counterparty credit risk. The nature of the VaR models approach and the internal models method does not allow for a meaningful comparison with Solvency II's regulation of counterparty default risk. The VaR models approach and internal models method will therefore not be included in the following chapters or the subsequent comparison with Solvency II.

11.1.2.1 Credit Risk Mitigation, Repos and Core Market Participants

The finalised Basel III generally defines a collateralised transaction as where

- a bank has a (potential) credit exposure and
- that credit exposure is hedged in whole - or in part - by collateral that is posted by the counterparty or a third party on behalf of the counterparty.[65]

If such collateral constitutes *eligible* financial collateral, the bank is allowed to reduce its credit risk capital requirements via the prescribed credit risk mitigation framework in the standardised approach for credit risk in the banking book.[66]

In a repo, the repo seller and the repo buyer have the bilateral credit exposure in the form of, inter alia, the repo buyer's transferred cash financial collateral or the repo seller's transferred securities financial collateral.[67] The finalised Basel III therefore requires that both sides of a repo are subject to capital requirements.[68] Under both the standardised approach and IRB approach for credit risk, a bank - that posts financial collateral - must calculate capital requirements for both

- the credit risk or market risk on the posted securities financial collateral (if it remains in the bank's balance sheet) and
- the counterparty credit risk arising from the risk that the counterparty defaults and does not return the securities financial collateral.[69]

the bank applies the IRB approach for credit risk in the banking book, it must apply the risk weights that are produced by the IRB risk-weight function. If a bank applies the VaR models approach in the banking book, it may also apply it in the trading book, cf. BCBS Consol. Basel III (2019), CRE55.2. See also the replaced BCBS Basel III (2016b), para. 41.

[65] BCBS Consol. Basel III (2019), CRE22.16, and BCBS Basel III (2017), Standardised approach for credit risk, para. 132.

[66] BCBS Consol. Basel III (2019), CRE22.17, and BCBS Basel III (2017), Standardised approach for credit risk, para. 132.

[67] See e.g. BCBS Consol. Basel III (2019), CRE22.1 (footnote 1), and BCBS Basel III (2017), Standardised approach for credit risk, para. 117 (footnote 66).

[68] BCBS Consol. Basel III (2019), CRE22.30, and BCBS Basel III (2017), Standardised approach for credit risk, para. 144.

[69] BCBS Consol. Basel III (2019), CRE22.25 and CRE32.13 and 32.20, and BCBS Basel III (2017), Standardised approach for credit risk, para. 139, and Internal ratings-based approach for credit risk, para. 77 and 89.

In Solvency II, the "Solvency II balance sheet" also entails the application of the market risk module upon the posted financial collateral and the application of the counterparty default risk module's treatment of type 1 exposures upon the posted financial collateral, while considering the risk mitigating effect of the received financial collateral.[70] This is described in chapter 11.2.1 below.

In the finalised Basel III's simple approach for the recognition of collateral, the financial collateral must constitute certain *eligible financial collateral*[71] in order for the credit risk mitigation to be recognised.[72] Under the comprehensive approach, eligible financial collateral includes the simple approach's eligible financial collateral as well as certain additional eligible financial collateral.[73] The foundation IRB approach recognises the standardised approach's eligible financial collateral.[74] Similarly, when producing own estimates of LGDs, the advanced IRB approach's LGD floors include floors for specifically financial collateral.[75] In the trading book, all trading book instruments may be used as eligible financial collateral in relation to repos, but they are subject to a prescribed (higher) haircut if they are not recognised as eligible financial collateral in the banking book.[76]

Under the simple approach and comprehensive approach, recognition of credit risk mitigation also requires that prescribed requirements are met.[77]

[70] EIOPA Guidelines (2014d), para. 1.24 and 1.27. See also EIOPA (2014b), SCR.5.2, SCR.5.82 and SCR.6.7.

[71] Such eligible financial collateral includes, inter alia, (1) cash (and certificates of deposit) on deposit with the exposed bank, (2) gold, (3) in jurisdictions, which allow the use of external credit assessments: (a) debt securities, with certain external credit assessments provided by an external credit assessment institution, and (b) certain unrated listed senior debt securities that are issued by banks (with other same-seniority debt issuings with certain ratings) and have sufficient market liquidity, (4) in jurisdictions, which do *not* allow the use of external credit assessments: sufficiently liquid securities in the form of (a) debt securities issued by sovereigns, (b) debt securities issued by banks that are grade A under the SCRA in the standardised approach for credit risk (see chapter 10.4), (c) investment grade debt securities, and (d) securitisation exposures with a risk weight of less than 100% under the separate securitisation framework, (5) equities and convertible bonds that are included in a main index, and (6) UCITS and mutual funds which have daily public price quotes and may only invest in instruments that constitute eligible financial collateral, cf. BCBS Consol. Basel III (2019), CRE22.34-35, and BCBS Basel III (2017), Standardised approach for credit risk, para. 148-149.

[72] BCBS Consol. Basel III (2019), CRE22.34, and BCBS Basel III (2017), Standardised approach for credit risk, para. 148.

[73] BCBS Consol. Basel III (2019), CRE22.45, and BCBS Basel III (2017), Standardised approach for credit risk, para. 159. This additional eligible financial collateral includes listed equities and convertible bonds, which are not included in a main index, as well as UCITS and mutual funds that include such equities and convertible bonds.

[74] BCBS Consol. Basel III (2019), CRE32.8, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 72. The foundation IRB approach also includes additional "IRB collateral", including certain receivables, commercial and residential real estate as well as certain physical collateral.

[75] BCBS Consol. Basel III (2019), CRE32.16-17, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 85-86. The advanced IRB approach also includes receivables, commercial or residential real estate as well as certain physical collateral

[76] BCBS Consol. Basel III (2019), CRE55.2. See also the replaced BCBS Basel III (2016b), para. 41.

[77] BCBS Consol. Basel III (2019), CRE22.3-9 and 22.25, and BCBS Basel III (2017), Stand-

These include that:

- the credit quality of the counterparty must not have a material positive correlation with the applied credit risk mitigation.[78]
- legal requirements must be fulfilled, including the documentation being binding and legally enforceable.[79]
- the pledging or transferring of financial collateral must ensure an enforceable security interest and that the bank has the right to liquidate or take legal possession of the financial collateral, in a timely manner, in case of a defined "credit event" or in the event of a default, insolvency or bankruptcy.[80]
- there must be an orderly operation of margin agreements, including the handling of incoming and outgoing margin calls, as well the handling of the associated risks, e.g. the liquidity and volatility of the financial collateral, concentration risk and liquidity shortfalls.[81]

The standardised approach's minimum requirements and legal certainty standards for the recognition of credit risk mitigation must also be fulfilled in relation to credit risk mitigation under the foundation IRB approach and advanced IRB approach.[82] Next, in chapter 11.1.2.2, it will be shown how the Solvency II project had the intention of addressing regulatory arbitrage in relation to the recognition of risk mitigation and collateral.

As mentioned above, under the finalised Basel III's simple approach, the collateralised part of the credit exposure is subject to the risk weight of the financial collateral while the unsecured part is subject to the risk weight of the counterparty.[83] In order to be recognised, the financial collateral must be pledged for at least the life of the credit exposure and be marked to market and revalued with a minimum frequency of six months.[84] The marked-to-market value of the financial collateral constitutes the collateralised part of the credit exposure that receives the financial collateral's risk weight, which is subject to a 20% floor.[85]

ardised approach for credit risk, para. 119-125 and 139.

[78] BCBS Consol. Basel III (2019), CRE22.7, and BCBS Basel III (2017), Standardised approach for credit risk, para. 122.

[79] BCBS Consol. Basel III (2019), CRE22.9, and BCBS Basel III (2017), Standardised approach for credit risk, para. 125.

[80] BCBS Consol. Basel III (2019), CRE22.26, and BCBS Basel III (2017), Standardised approach for credit risk, para. 140.

[81] BCBS Consol. Basel III (2019), CRE22.28, and BCBS Basel III (2017), Standardised approach for credit risk, para. 142.

[82] BCBS Consol. Basel III (2019), CRE32.1 and CRE36.128, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 3 and 280.

[83] BCBS Consol. Basel III (2019), CRE22.18(1) and 22.32-33, and BCBS Basel III (2017), Standardised approach for credit risk, para. 133(i) and 146-147.

[84] BCBS Consol. Basel III (2019), CRE22.33 and BCBS Basel III (2017), Standardised approach for credit risk, para. 147.

[85] BCBS Consol. Basel III (2019), CRE22.33 and BCBS Basel III (2017), Standardised approach for credit risk, para. 147.

However, certain repos - including repos with "core market participants" - are subject to a special risk-weight treatment as described below.[86]

Under the comprehensive approach, the risk-mitigating effect of financial collateral is taken into account when the volatility-adjusted exposure amount is reduced by the volatility-adjusted value of the financial collateral.[87] Prescribed *supervisory* haircuts are accordingly used to adjust both the exposure amount and the value of the received financial collateral in order to incorporate possible future fluctuations in both values due to market movements.[88] Unless 0% haircuts apply, the adjustments will entail that the credit exposure's volatility-adjusted amount becomes higher than the credit exposure's nominal amount, while the financial collateral's volatility-adjusted value becomes lower than its current value.[89] The volatility-adjusted exposure amount and volatility-adjusted financial collateral accordingly reflect bilateral credit risk, which is the "key concept" in counterparty credit risk.[90]

In line the above, the comprehensive approach includes a formula that subtracts the volatility-adjusted (i.e. decreased) financial collateral value from the volatility-adjusted (i.e. increased) exposure amount to produce the *exposure amount after credit risk mitigation*.[91] As described in chapter 11.1.2 above, counterparty credit risk is reflected in the resulting counterparty credit risk exposure amount, which is then risk-weighted, to produce a risk-weighted asset, in accordance with the prescribed risk weight for the counterparty under the standardised approach for credit risk.[92]

The comprehensive approach's supervisory haircuts for both the exposure amount and financial collateral depend on (i) holding periods (i.e. time peri-

[86] BCBS Consol. Basel III (2019), CRE22.33 and 22.36-22.39, and BCBS Basel III (2017), Standardised approach for credit risk, para. 147 and 150-154.

[87] BCBS Consol. Basel III (2019), CRE22.18(2) and 22.40, and BCBS Basel III (2017), Standardised approach for credit risk, para. 133(ii) and 155.

[88] BCBS Consol. Basel III (2019), CRE22.40 (footnote 7), and BCBS Basel III (2017), Standardised approach for credit risk, para. 155 (footnote 72). If the credit exposure and financial collateral are in different currencies, an additional haircut for currency risk must be applied to the volatility-adjusted financial collateral value, cf. BCBS Consol. Basel III (2019), CRE22.43 and 22.52, and BCBS Basel III (2017), Standardised approach for credit risk, para. 157 and 165. During the Basel III consultation, the BCBS was of the view that Basel II's credit risk mitigation framework had an unnecessarily complex range of available approaches that allowed cherry-picking as well as that the standardised approach should not allow the calculation of capital requirements via internal models; it was accordingly proposed to exclude own-estimate haircuts and the VaR models approach as well as the internal models method from the standardised approach for market risk, while the comprehensive approach was to be revised to take better account for diversification and correlation, cf. BCBS (2014b), section 3, and BCBS (2015c), section 2.

[89] BCBS Consol. Basel III (2019), CRE22.40, and BCBS Basel III (2017), Standardised approach for credit risk, para. 155.

[90] BCBS Consol. Basel III (2019), CRE51.2-3, and BCBS Basel III (2017), Standardised approach for credit risk, para. 3 (footnote 2).

[91] BCBS Consol. Basel III (2019), CRE22.46, and BCBS Basel III (2017), Standardised approach for credit risk, para. 160, i.e. $Expo_{afterCRM} = max\left\{0, Expo_{Cur.Val.} * (1 + Hcut_{Expo}) - Coll_{Cur.Val.} * (1 - Hcut_{Coll.} - Hcut_{FX})\right\}$.

[92] BCBS Consol. Basel III (2019), CRE51.13 and CRE22.48, and BCBS Basel III (2017), Standardised approach for credit risk, para. 162.

ods over which the exposure value and/or financial collateral value are assumed to move before a bank can close out the transaction), (ii) whether the use of external credit assessments is allowed, (iii) the type of transaction, (iv) the transaction's residual maturity, (v) the frequency of marking to market and (vi) the frequency of remargining.[93] As an example, a transaction with a residual maturity of less than one year, a 10-business day holding period, daily marking-to-market and daily remargining, with AAA sovereign financial collateral, receives a default 0.5% haircut to be used in the volatility adjustments.[94] Repos that are subject to daily marking-to-market and daily remargining receive a haircut based on a minimum 5-business day holding period.[95] If the frequency of marking to market or remargining is longer than the provided minimums, the 10-business day supervisory haircut is scaled depending on the actual number of business days between marking to market or remargining.[96]

As mentioned above, certain repos - including with certain *core market participants* - are subject to a specific treatment under both the simple approach and comprehensive approach.[97] In relation to this specific treatment, which stems from Basel II, BCBS (2001) stated that the credit risk could be very small on "well-documented" repos in "liquid securities" that were conducted with "experienced counterparties" and settled quickly across "proven" settlement systems.[98] During the Basel II consultation, it was accordingly proposed that a 0% haircut could be applied in relation to certain repos with a "core market participant".[99] This exemption allowed banks to provide short-term wholesale funding to each other without being subject to capital requirements.[100] In the finalised Basel III, certain repos - that fulfil prescribed conditions[101] - are exempted from the 20% risk-weight floor under the simple approach, where the collateralised part

[93] BCBS Consol. Basel III (2019), CRE22.41-42, 22.49-59, and BCBS Basel III (2017), Standardised approach for credit risk, para. 156, 163-172.

[94] BCBS Consol. Basel III (2019), CRE22.49, and BCBS Basel III (2017), Standardised approach for credit risk, para. 163.

[95] BCBS Consol. Basel III (2019), CRE22.42 and 22.57, and BCBS Basel III (2017), Standardised approach for credit risk, para. 170.

[96] BCBS Consol. Basel III (2019), CRE22.42, 22.53 and 22.56-22.59 and BCBS Basel III (2017), Standardised approach for credit risk, para. 156, 166 and 169-172.

[97] BCBS Consol. Basel III (2019), CRE22.33, 22.36-39 and 22.60, and BCBS Basel III (2017), Standardised approach for credit risk, para. 147, 150-154 and 173.

[98] Para. 160.

[99] BCBS (2001), para. 160.

[100] BCBS (2015c), section 2.3.

[101] These conditions include, inter alia, that (i) both the credit exposure and the financial collateral are cash or a sovereign security (in the same currency) that receives a 0% risk weight under the standardised approach for credit risk, (ii) the repo is overnight or both the credit exposure and the financial collateral are marked to market daily and subject to daily remargining, (iii) the transaction is settled across a "proven" settlement system, (iv) the documentation is standard market documentation and ensures the transaction is immediately terminable in case of an event of default (such as a failure to deliver margin), (v) the bank has an "unfettered" and legally enforceable right to immediately seize and liquidate the financial collateral in case of an event of default and (vi) that no more than four business days pass between the last mark-to-market (before the failure to remargin) and the liquidation of the financial collateral, cf. BCBS Consol. Basel III (2019), CRE22.36, and BCBS Basel III (2017), Standardised approach for credit risk, para. 150.

of the exposure is subject to the risk weight of the financial collateral.[102] A repo accordingly receives a 10% risk weight if it fulfils the conditions.[103] In addition, a repo receives a 0% risk weight if it fulfils the conditions and is with a defined core market participant, which includes central banks, banks and certain insurance undertakings.[104] In the comprehensive approach and IRB approach, a qualifying repo (i.e. a repo that fulfils the conditions) with a core market participant is subject to a 0% haircut in the calculation of the counterparty credit risk exposure amount or counterparty credit risk EAD.[105] This treatment was also reflected in figure 11.1 in the start of chapter 11.1.2.

As described above, the finalised Basel III includes a specific treatment of master netting agreements for repos that must be applied if the bank wants to recognise the netting effect. This treatment will be described before Solvency II's approach to counterparty default risk is presented and compared to the finalised Basel III. However, before doing so, the next chapter will show how the Solvency II project had the intention of addressing regulatory arbitrage in relation to the recognition of risk mitigation and collateral.

11.1.2.2 Solvency II's Risk Mitigation and Cross-Sectoral Consistency

Chapter 10.3 above showed how CEIOPS (2007a) and the third quantitative impact study amended the SCR standard formula and replaced the proposed credit risk module with (i) the spread risk sub-module and (ii) the separate counterparty default risk module, which was to capture the default of a counterparty to risk mitigating contracts like reinsurance and financial derivatives.[106] CEIOPS accordingly also had to assess the recognition of risk mitigation, including "traditional" and "non-traditional risk transfer instruments" in relation to assets (e.g. financial hedging) and liabilities (e.g. hedging instruments and reinsurance) as well as "financial risk mitigation techniques".[107] CEIOPS proposed that the effects of risk mitigation could be recognised by reducing capital requirements for the risk type (e.g. underwriting risk) in proportion to the risk

[102] BCBS Consol. Basel III (2019), CRE22.32-33 and 22.36, and BCBS Basel III (2017), Standardised approach for credit risk, para. 146-147 and 150.

[103] BCBS Consol. Basel III (2019), CRE22.38, and BCBS Basel III (2017), Standardised approach for credit risk, para. 152.

[104] BCBS Consol. Basel III (2019), CRE22.37-38, and BCBS Basel III (2017), Standardised approach for credit risk, para. 151-152. Core market participants can include, inter alia, (i) central banks and sovereigns, (ii) banks and securities firms, (iii) "other financial companies" that receive a 20% risk weight in the standardised approach for credit risk, including insurance undertakings, (iv) regulated pension funds, (v) regulated mutual funds that are subject to capital or leverage requirements, and (vi) qualifying CCPs, cf. BCBS Consol. Basel III (2019), CRE22.37, and BCBS Basel III (2017), Standardised approach for credit risk, para. 151.

[105] BCBS Consol. Basel III (2019), CRE22.60 and CRE32.43, and BCBS Basel III (2017), Standardised approach for credit risk, para. 173, and Internal ratings-based approach for credit risk, para. 82.

[106] CEIOPS (2007a) , para. 2.44, 5.47, 5.48, 5.82, 5.83, 5.91, 5.99, 5.158-5.165, 5.177-5.191, and CEIOPS QIS3 (2007), para. I.3.1, I.3.24, I.3.27-I.3.30, I.3.88-I.3.99, and I.3.114-I.3.126.

[107] CEIOPS (2007a), para. 5.39-46.

transfer, while the acquired and corresponding (counterparty) risk was to be captured in the treatment of credit risk.[108] In addition, CEIOPS looked towards the operational requirements in the former CRD's credit risk mitigation framework that implemented Basel II.[109]

In line with this approach, the fourth quantitative impact study recognised the effect of risk mitigation, in individual risk modules, while placing the acquired counterparty risk in the counterparty default risk module.[110] The fourth quantitative impact study also included requirements regarding the recognition of risk mitigation tools and principles for the treatment of *financial* risk mitigating tools (that did not include reinsurance), which were based on banking regulation, including requirements for both funded credit protection (in the form of collateral) and unfunded credit protection (in the form of guarantees and credit derivatives).[111]

Solvency II's level 1 prescribes that the effect of risk-mitigation techniques may be taken into account provided that the credit risk, and other risks associated with the risk-mitigation techniques, are properly reflected in the SCR.[112] Similarly, the SCR standard formula's counterparty default risk module is to capture the possible losses due to unexpected default - or deterioration in the credit standing - of counterparties over the following 12 months and cover, inter alia, risk-mitigating contracts, such as reinsurance arrangements, securitisations and derivatives.[113] It is also to take account of collateral or other security held by the life insurance undertaking and the associated risks.[114] In addition, the counterparty default risk module must - for each counterparty - take account of the overall counterparty risk exposure irrespective of the legal form of its contractual obligations to that counterparty.[115]

The recognition of risk-mitigation techniques entails the fulfilment of qualitative criteria that were to be developed at level 2 and ensure that the risk is transferred effectively to a third party.[116] During the level 2-development of financial risk mitigation, CEIOPS (2009c) mentioned that the elimination of regulatory arbitrage among financial sectors was highly desirable in order to promote a stable behaviour of all financial participants and to avoid artificial movements of funds and risks from one financial sector to another.[117] CEIOPS

[108] CEIOPS (2007a), para. 5.43. See also CEIOPS (2009c), para. 3.26 and 3.69.

[109] CEIOPS (2007a), para. 5.41-42, and CRD, recital 37 and art. 92. These included, inter alia, (i) that the risk mitigation technique had to be legally effective and enforceable, (iii) the ensuring of effectiveness, (iii) that there was appropriate assurance as to the risk mitigation achieved, and (iv) that the correlation between the value of the risk mitigation instruments and the credit quality of the provider was not undue.

[110] European Commission QIS4 (2008), para. TS.VII.A.4. See also CEIOPS (2009c), para. 3.26.

[111] European Commission QIS4 (2008), para TS.VII.B, including TS.VII.B.3A and TS.VII.C-I, and CRD art. 92 and annex VIII, part 2, including point 6 and 14.

[112] Solvency II, art. 101(5).

[113] Solvency II, art. 105(6).

[114] Solvency II, art. 105(6).

[115] Solvency II, art. 105(6).

[116] Solvency II, art. 111(1)(f).

[117] Para. 3.31.

accordingly found that financial risk mitigation had to fulfil cross-sector consistent requirements and principles and its advice was developed while considering, as much as possible, the existing provisions in other financial sectors to minimise the possibility of regulatory arbitrage.[118] Sectoral divergences were therefore to be limited to features where the nature or the manner of the financial business was "substantially different".[119] However, CEIOPS stated that in order to avoid the possibility of regulatory arbitrage, the treatment of techniques, which were not specifically addressed by CEIOPS, were to be assessed based on the developed principles and - by analogy - the regulation of the same techniques in other financial sectors.[120]

CEOIPS also found that financial risk mitigation techniques and reinsurance had some common features but that they referred to markets and had respective specific characteristics that were sufficiently different to warrant separate treatments.[121] Financial risk mitigation techniques were defined as, inter alia, credit derivatives and collateral, which covered the risk of failure and downgrades, and the proposed treatment was viewed as aligned with banking regulation.[122] Subsequently, the fifth quantitative impact study differentiated between (i) special purpose vehicles and reinsurance that mitigated underwriting risks and (ii) financial risk mitigation techniques that included collateral and the purchase or issuance of financial instruments, including financial derivatives that transferred risk to the financial markets.[123] The use of financial risk mitigation techniques required the fulfilment of recognition principles that were inspired by banking regulation.[124] The Solvency II project accordingly differentiated between insurance risk mitigation and financial risk mitigation. In addition, the Solvency II project's regulation of risk mitigation, including collateral, intended to address regulatory arbitrage.

At level 2, the Solvency II Delegated Regulation regulates risk mitigation and the criteria for recognition, including general qualitative criteria and specific criteria for financial risk mitigation techniques and collateral.[125] The criteria were developed before the finalised Basel III but they share similarities with the finalised Basel III's credit risk mitigation framework as described above.[126]

[118] CEIOPS (2009c), para. 3.30(b), 3.32, 3.40-42, 3.49 and 3.60. The principles where (i) economic effect over legal form, (ii) legal certainty, effectiveness and enforceability, (iii) liquidity and ascertainability of value, (iv) credit quality of the provider of the financial risk mitigation technique and (v) direct, explicit, irrevocable and unconditional features, cf. CEIOPS (2009c), para. 3.40 and 3.71-3.91.

[119] CEIOPS (2009c), para. 3.30(b).

[120] CEIOPS (2009c), para. 3.60.

[121] CEIOPS (2009c), para. 1.3.

[122] CEIOPS (2009c), para. 3.18 and 3.41-42.

[123] European Commission QIS5 (2010), SCR.12.1-3, 12.7 and 12.8.

[124] European Commission QIS5 (2010), SCR.12.2 and 12.6-8 and annex p, and CRD art. 92 and annex VIII, part 2, including point 6, 14 and 20. See also CEIOPS (2009c), para. 3.40-41 and 3.71-98.

[125] Solvency II Delegated Regulation, title I, chapter V, section 10, including art. 209, 210, 212, 214 and 215.

[126] Compare Solvency II Delegated Regulation, art. 209(1), 210, 212, 214, 215 to BCBS Consol. Basel III (2019), CRE22.5-7, 22.9, 22.26-29, 22.34, 22.71, 22.73 and 22.76, and BCBS Basel III (2017), Standardised approach for credit risk, para. 121-123, 125, 140-143, 148 192,

In relation to the recognition of collateral, Solvency II's level 2 defines "collateral arrangements" as

- the transfer of full ownership of the collateral to the collateral taker, for the purposes of securing or otherwise covering the performance of a relevant obligation, or

- the providing of collateral by way of security in favour of - or to - a collateral taker, where the legal ownership of the collateral remains with the collateral provider (or a custodian) when the security right is established.[127]

In line with the intentions regarding regulatory arbitrage, Solvency II's recognition requirements include collateral-specific requirements that share similarities with the finalised Basel III's requirements regarding credit risk mitigation and collateralised transactions.[128] In addition, these two definitions of collateral arrangements are similar to the Financial Collateral Directive's financial collateral arrangements, which include *title transfer* financial collateral arrangements (i.e. repos) and *security* financial collateral arrangements.[129]

Similar to the finalised Basel III's credit risk mitigation framework, Solvency II-recognised collateral arrangements can be used to mitigate spread risk in the spread risk sub-module as well as counterparty default risk in the counterparty default risk module.[130] When unrated bonds and loans in the spread risk sub-module are secured by recognised collateral, the collateral is risk-adjusted via an adjustment for market risk.[131] The spread risk sub-module's applied stress factor is then adjusted depending on whether the risk-adjusted value of the collateral is higher than or equal to (or lower than) the value of the bond or loan.[132]

In the next chapter, the finalised Basel III's "tailored" treatment of repos and master netting agreements is described. In chapter 11.2 below, this treatment will be compared to Solvency II's treatment repos and master netting agreements in the counterparty default risk module.

11.1.2.3 Master Netting Agreements

If a repo fulfils certain requirements for a financial collateral arrangement, then both the repo seller's credit exposure and the repo buyer's credit exposure are

194 and 197.

[127] Solvency II Delegated Regulation, art. 1(26).

[128] Compare Solvency II Delegated Regulation, art. 209, 210 and 214, and BCBS Consol. Basel III (2019), CRE22.5, 22.7, 22.9, 22.26, 22.28, 22.29, 22.34 and 22.71, and BCBS Basel III (2017), Standardised approach for credit risk, para. 121, 123, 125, 140, 142, 143, 148 and 192.

[129] Financial Collateral Directive, art. 2(1)(b) and (c). See chapter 5.1 regarding financial collateral arrangements.

[130] Solvency II, art. 101(5) and 105(6), and Solvency II Delegated Regulation, art. 176(5) and 209, 210 and 214.

[131] Solvency II Delegated Regulation, art. 176(5), 197 and 214.

[132] Solvency II Delegated Regulation, art. 176(5).

collateralised and the parties will have access to the effective realisation of financial collateral as well as risk mitigation via bilateral close-out netting, including the setting off of cash financial collateral against owed financial obligations.[133]

In the finalised Basel III's capital requirements for counterparty credit risk, the comprehensive approach includes the specific treatment of repos that are governed by a master netting agreement.[134] This treatment recognises the effects of bilateral netting, on a counterparty-by-counterparty basis, subject to the bilateral netting agreement meeting certain conditions, including that:

- the non-defaulting party has the right to terminate and close out, in a timely manner, all covered transactions upon an event of default, including in the event of the counterparty's insolvency or bankruptcy,
- the agreement ensures the netting of gains and losses (including the value of financial collateral) on covered transactions that are terminated and closed out, whereby a single net amount is owed by one party to the other,
- the agreement allows for the prompt liquidation or set-off of collateral in case of an event of default, and
- the agreement is legally enforceable upon the occurrence of an event of default, regardless of whether the counterparty is subject to insolvency or bankruptcy.[135]

The conditions above are aligned with the purposes of the EU's Financial Collateral Directive and are reflected in the GMRA.[136] Under the GMRA, a default in the performance of any obligations, in respect of each transaction, constitutes a default in respect of all covered transactions.[137] If an event of default occurs, the sums due from one party are set off against the sums due from the other party and only the balance of the account is payable by the party whose claim is valued at the lower amount.[138]

In order to recognise the effects of bilateral netting in counterparty credit risk capital requirements, the finalised Basel III prescribes a formula for repos that are subject to netting agreements.[139] This formula stems from Basel II and was revised during the Basel III consultation in order to better consider diver-

[133] Financial Collateral Directive, including recitals 3, 5, 13, 14, 17 and 18, and art. 1(1), (2)(c) and (4)(a), 2(1)(a)-(f) and (n), 4 and 7.

[134] BCBS Consol. Basel III (2019), CRE51.7 and 51.8(2) and CRE22.44 and 22.62-65, and BCBS Basel III (2017), Standardised approach for credit risk, para. 158 and 175-178.

[135] BCBS Consol. Basel III (2019), CRE22.62, and BCBS Basel III (2017), Standardised approach for credit risk, para. 175.

[136] Financial Collateral Directive, recitals 5, 10, 13, 14, 17 and 18, and art. 4, 6, 7 and 8, and GMRA, including para. 10 and 13.

[137] GMRA, para. 13.

[138] GMRA, para. 10.

[139] BCBS Consol. Basel III (2019), CRE22.64-65, and BCBS Basel III (2017), Standardised approach for credit risk, para. 177-178.

sification and correlation.[140] The formula[141], which produces the counterparty credit risk exposure amount, includes:

- a net exposure.[142]
- an add-on to reflect potential price changes in the values of securities financial collateral in the netting set.[143]
- an add-on to reflect any currency mismatches.[144]

In a summarised fashion, this exposure value of the netting set, after risk mitigation, is calculated as:

$$Exposure_{NetSetAfterCRM} = Exposure_{Net} + AddOn_{PriceChanges} + AddOn_{FX}$$

Based on the comprehensive approach, the foundation IRB approach and advanced IRB approach also recognise the effect of bilateral netting in master netting agreements when calculating capital requirements for counterparty credit risk.[145] As described in chapter 11.1.1 above, the foundation IRB approach

[140] Basel II, para. 176, and BCBS (2015c), section 2.1.

[141] I.e. $E^* = max\left\{0; \sum_i E_i - \sum_i C_j + 0.4 * (|\sum_s E_s H_s|) + 0.6 * \frac{(\sum_s E_s |H_s|)}{\sqrt{N}} + \sum_{fx}(E_{fx} * H_{fx})\right\}$, cf. BCBS Consol. Basel III (2019), CRE22.65, and BCBS Basel III (2017), Standardised approach for credit risk, para. 178.

[142] I.e. $\sum_i E_i - \sum_i C_j$, where (i) the sum of current values of all cash and securities *posted or sold* (with an agreement to repurchase) to the counterparty under the netting agreement (E_i) is reduced by (ii) the sum of current values of all cash and securities *received or purchased* (with an agreement to resell) by the bank under the netting agreement (C_j).

[143] I.e. $0.4*(|\sum_s E_s H_s|)+0.6*\frac{(\sum_s E_s|H_s|)}{\sqrt{N}}$. First, net current values of each security issuance under the netting set (E_s) (an always positive value) are subjected to the comprehensive approach's supervisory haircuts (H_s) and summed to calculate the "net exposure" (an always positive value) which is then multiplied by 0.4, i.e. $0.4 * (|\sum_s E_s H_s|)$. In order to reflect the netting of longs and shorts in the "net exposure", the applied haircuts are positive (i.e. for a long exposure) if the securities financial collateral is *posted or sold* (with an agreement to repurchase)(i.e. a repo) while haircuts are negative (i.e. for a short exposure) if the securities financial collateral is *received or purchased* (with an agreement to resell)(i.e. a reverse repo); secondly, net current values of each security issuance under the netting set (E_s) (an always positive value) are subjected to the comprehensive approach's (positive) supervisory haircuts (H_s) and summed to produce a "gross exposure" that is divided by the square root of the number (N) of security issues contained in the netting set (to reflect the effect of diversification) whereafter the result is multiplied with 0.6, i.e. $0.6 * \frac{(\sum_s E_s|H_s|)}{\sqrt{N}}$, cf. BCBS (2015c), section 2.1. A netting set is defined as a group of transactions with a single counterparty that are subject to a legally enforceable and recognised bilateral netting arrangement, cf. BCBS Consol. Basel III (2019), CRE50.15.

[144] I.e. $\sum_{fx}(E_{fx} * H_{fx})$.

[145] BCBS Consol. Basel III (2019), CRE32.13, 32.20 and 32.37-38 and 32.43, CRE36.97 and CRE51.7, 51.8(2) and 51.13, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 77, 89, 106 and 249.

entails that the exposure amount after credit risk mitigation is used as the counterparty credit risk EAD, while the LGD is based on the foundation IRB approach's LGD for unsecured exposures.[146] The advanced approach also relies on the counterparty credit risk EAD while own-estimate LGDs may be permitted for the unsecured equivalent amount.[147] The IRB approach also includes specific effective maturities for repos, including for repos subject to master netting agreements, which go into the IRB risk-weight function when calculating the risk weight.[148]

The finalised Basel III's treatment of counterparty credit risk, repos and master netting agreements has now been presented in detail. In the next chapter, this treatment will be compared to Solvency II's treatment of counterparty default risk and repos.

11.2 Solvency II and Counterparty Default Risk

As described above, the finalised Basel III's counterparty credit risk capital requirements explicitly address repos while recognising the effects of master netting agreements and accommodating traditional banking activities, including short-term wholesale repo funding between banks. In blue, figure 11.2 summarises the finalised Basel III's approaches for counterparty credit risk capital requirements, repos and master netting agreements. In this treatment of repos, insurance undertakings can constitute "core market participants" alongside regulated pension funds.[149] However, when compared to the overview of Solvency II (in red), it becomes evident that the finalised Basel III's explicit regulation of repos and master netting agreements is not mirrored in Solvency II.

At level 1, Solvency II's SCR standard formula includes the counterparty default risk module which is to cover, inter alia, *risk-mitigating contracts*, such as reinsurance arrangements, securitisations and derivatives.[150] At level 2, the counterparty default risk module was accordingly structured to include a capital requirement for type 1 exposures in the form of risk-mitigation contracts, including reinsurance arrangements, special purpose vehicles, insurance securitisations and derivatives.[151] In line with the description of risk mitigation in chapter 11.1.2.2, the counterparty default risk module reflects how life insurance undertakings rely on insurance-specific risk mitigation. As described in

[146] BCBS Consol. Basel III (2019), CRE32.13, CRE32.20 and CRE32.37-38 and 32.43, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 77, 82 and 106. Se also Basel II, annex 10.

[147] BCBS Consol. Basel III (2019), CRE32.20 and 32.37-38 and 32.43, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 82, 89, 106 and 249. Se also Basel II, annex 10.

[148] BCBS Consol. Basel III (2019), CRE32.44, 32.51 and 32.54, and BCBS Basel III (2017), Internal ratings-based approach for credit risk, para. 107, 110 and 113.

[149] BCBS Consol. Basel III (2019), CRE22.37 and 22.60, and CRE32.43, and BCBS Basel III (2017), Standardised approach for credit risk, para. 151 and 173, and Internal ratings-based approach for credit risk, para. 82.

[150] Solvency II, art. 105(6).

[151] Solvency II Delegated Regulation, art. 189(1) and (2).

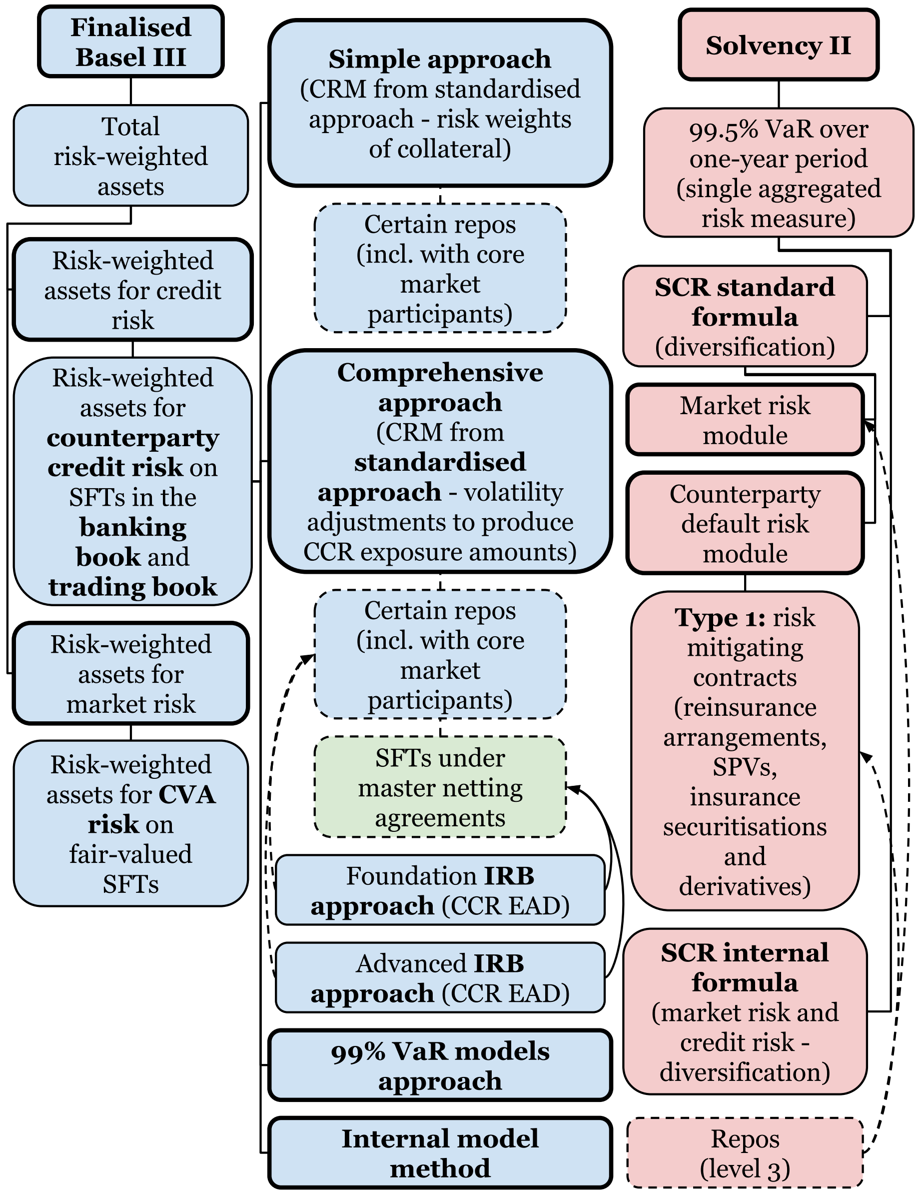

Figure 11.2: Comparison of (i) the finalised Basel III's approaches for capital requirements for counterparty credit risk ("CCR") and CVA risk on repos, and (ii) Solvency II's treatment of repos and financial collateral in the counterparty default risk module and market risk module.

that chapter, life insurance undertakings also rely on more "generally" applied risk mitigation, in the form of financial risk mitigation and financial collateral, and the counterparty default risk module is to take appropriate account of received collateral and the risks associated therewith.[152]

Chapter 10.3.1 presented the logic behind the counterparty default risk module's treatment of type 1 and type 2 exposures. Type 1 exposures are illustrated in the lower right corner in figure 11.2 above. In the next chapter, it will be assessed how Solvency II's counterparty default risk module captures counterparty default risk (i.e. counterparty credit risk) on type 1 exposures while recognising risk mitigation. It will be shown how Solvency II's counterparty default risk module was not explicitly structured to capture repos or other SFTs. Instead, the treatment of repos is provided via level 3 guidelines.

11.2.1 Counterparty Default Risk on Type 1 Exposures and Repos

While the finalised Basel III includes an explicit treatment of repos and master netting agreements, the SCR standard formula's treatment of repos (and securities lending) is provided via level 3 guidelines.[153] Pursuant to these guidelines, life insurance undertakings should follow the recognition of exchanged financial collateral in the "Solvency II balance sheet".[154] As described in chapter 6.3.1.1, Danish law prescribes that a financial asset remains on a life insurance undertaking's balance sheet if it is transferred in a manner whereby the life insurance undertaking retains substantially all the risks and access to cash flows.[155] In such a transfer, a liability, equivalent to the consideration received, must be recognised on the balance sheet.[156] A financial asset, which is transferred under a true sales and repurchase agreement (i.e. a repo), must remain on the balance sheet of the repo seller.[157] Accordingly, when both the received financial collateral and posted financial collateral remain on the Solvency II balance sheet, then a life insurance undertaking must:

1. apply the *market risk module* upon both the posted financial collateral and the received financial collateral (which is described in chapter 10.3 above regarding credit risk and market risk),

2. apply the interest rate risk sub-module on any liabilities associated with the repo, and

3. apply the *counterparty default risk module's* treatment of *type 1* exposures upon the posted financial collateral while considering the *risk mitigating*

[152] Solvency II, art. 105(6).
[153] EIOPA Guidelines (2014d), guideline 8.
[154] EIOPA Guidelines (2014d), para. 1.24.
[155] Danish Executive Order no. 937 of 2015, sec. 44(5).
[156] Danish Executive Order no. 937 of 2015, sec. 44(5).
[157] Danish FSA (2015), pp. 3-4, and Danish Executive Order no. 937 of 2015, sec. 44(5) (comments to sec. 44(5) of 28 March 2011).

effect of the received financial collateral.[158]

This is illustrated in the lower right corner of figure 11.2 above. This treatment seems somewhat similar to the finalised Basel III's risk-weighted assets that include (i) the risk-weighted assets for credit risk on banking book exposures, (ii) risk-weighted assets for market risk on trading book exposures and (iii) risk-weighted assets for the counterparty credit risk that is associated with repos in both the banking book and trading book.[159] As under Solvency II, a bank that posts financial collateral must calculate capital requirements for both

- the credit risk or market risk on the posted securities financial collateral, if it remains on the bank's balance sheet (similar to point 1 above), and
- the counterparty credit risk arising from the risk that the counterparty defaults (similar to point 3 above).[160]

In addition, chapter 11.1.2.2 showed how Solvency II's recognition of risk mitigation effects was intentionally aligned with banking regulation to prevent regulatory arbitrage. However, as shown next, the capital requirements for type 1 exposures are fundamentally different from the finalised Basel III's counterparty credit risk capital requirements.

11.2.1.1 Level 2 Advice and Divergence from Banking Regulation

As already described in chapters 9.2 and 10.3, the Solvency II project amended a proposed SCR standard formula and replaced the proposed credit risk module with (i) a separate counterparty default risk module and (ii) a spread risk sub-module in the market risk module.[161] This approach was viewed as more closely aligned with banking regulation, where "specific interest rate risk" was treated as a part of the trading book while default risk was a part of the banking book.[162] However, such "default risk" was presumably to be understood as both default risk and counterparty default risk as the third quantitative impact study defined the counterparty default risk module as capturing the risk of default of a counterparty to risk mitigating contracts like reinsurance and financial derivatives.[163] Based on the treatment of default risk in the banking sector, the third quantitative impact study's counterparty default risk module relied on external credit assessment-based PDs and the replacement cost of the reinsurance

[158] EIOPA Guidelines (2014d), para. 1.27. See also EIOPA (2014b), SCR.5.2, SCR.5.82 and SCR.6.7.

[159] BCBS Consol. Basel III (2019), RBC20.1, 20.4, 20.6(1) and (2) and 20.7-9, and CRE50.13, and CRE51.4(4) and 51.5-8.

[160] BCBS Consol. Basel III (2019), CRE22.25 and CRE32.13 and 32.20, and BCBS Basel III (2017), Standardised approach for credit risk, para. 139, and Internal ratings-based approach for credit risk, para. 77 and 89.

[161] CEIOPS (2007a) , para. 2.44, 5.47, 5.48, 5.82, 5.83, 5.91, 5.99, 5.158-5.165, 5.177-5.191, CEIOPS (2007d), para. 1.1-1.3 and sections 2 and 3, and CEIOPS QIS3 (2007), para. I.3.1, I.3.24, I.3.27-I.3.30, I.3.88-I.3.99, and I.3.114-I.3.126.

[162] CEIOPS (2007a), para. 5.83 and CEIOPS (2007d), para. 1.1.

[163] CEIOPS QIS3 (2007), para. I.3.114 and I.3.126, CEIOPS (2007d), para. 3.1, and CEIOPS (2007a), para. 5.177.

or financial derivative in case of a default.[164] In Basel II, the replacement cost was used in the calculation of a credit equivalent amount for OTC derivatives, which were subject to master netting agreements, and the replacement cost was comparable to the counterparty credit risk exposure amount (or counterparty credit risk EAD) for repos and other SFTs.[165] In addition, the proposed counterparty default risk capital requirement was based on the loss distribution that forms the foundation of the IRB approach's risk-weight function in Basel II and the finalised Basel III.[166] In the subsequent fourth quantitative impact study, the counterparty default risk module relied on external credit assessment-based PDs, as well as the loss distribution of the IRB approach's risk-weight function, but replaced the replacement cost with a loss-given-default ("LGD") on, inter alia, reinsurance, financial derivatives and other credit exposures.[167]

However, as also described in chapter 10.3.1, CEIOPS (2009d) introduced separate capital requirements for type 1 and type 2 exposures as the use of external credit assessments - and allowing of diversification effects - was seen as appropriate for type 1 exposures that were assumed to *not* be diversified and likely to have a rated counterparty.[168] Type 1 exposures included, inter alia, (i) reinsurance arrangements, securitisations, derivatives and any other risk mitigating contracts, (ii) cash at bank and (iii) deposits with ceding undertakings up to a certain threshold.[169] Chapters 9.4.2 and 10.5 showed how the risk-weight function, in the finalised Basel III's IRB approach, was calibrated to *well-diversified* banks in order to allow portfolio-invariant capital requirements.[170] The IRB approach's loss distribution could therefore not be used in the Solvency II project's treatment of non-diversified type 1 exposures, and CEIOPS developed an alternative reinsurance-based approach that emphasised the heterogeneous nature and the limited number of counterparties under type 1 exposures.[171]

As shown above, the Solvency II project initially looked towards the treatment of derivatives in banking regulation when developing the counterparty default risk module. However, CEIOPS diverged from this approach and looked towards reinsurance models when finalising the counterparty default risk module's

[164] CEIOPS QIS3 (2007), para. I.3.115-117, CEIOPS (2007d), para. 3.2, and CEIOPS (2007a), para. 5.180-181.

[165] Basel II, para. 186-187(i), annex 4, para. 2.E and 92(i), and annex 10, para. 8. Under Basel II, the replacement cost (or current exposure) was used in relation to counterparty credit risk capital requirements for, inter alia, derivatives, and reflected the market value of a transaction (or a portfolio of transactions within a netting set) with a counterparty that would be lost upon the default of the counterparty, while assuming no recovery on the value of the transaction, cf. Basel II, para. 186 and 187(i) and annex 4, para. 2.E.

[166] CEIOPS QIS3 (2007), para. I.3.125, CEIOPS (2007d), para. 3.3, and CEIOPS (2007a), para. 5.186.

[167] European Commission QIS4 (2008), TS.X.A.2, TS.X.A.9 and TS.X.A.16, CEIOPS (2008), section 9.5.2, and CEIOPS (2009d), para. 3.47.

[168] CEIOPS (2009d), para. 3.20-23, 3.128-130, 3.179-181 and 3.235.

[169] CEIOPS (2009d), para. 3.20-23, 3.179-181 and 3.235.

[170] See BCBS (2005), section 3.

[171] CEIOPS (2009d), para. 3.27-28.

capital requirement for type 1 exposures.[172] Under the alternative reinsurance-based approach, the counterparty default risk module's capital requirement for type 1 exposures included two "core" aspects:

- a stress random variable that affected all type 1 exposure counterparties (mainly reinsurers and banks) and lead to an implicit correlation between the default probabilities of the counterparties, and
- each counterparty's vulnerability to the stress random variable expressed in the form of default probabilities.[173]

Based on the LGD and the long-term average probabilities of default ("PD") of the counterparties in a type 1 exposure portfolio, a specific model for reinsurance would provide the portfolio's loss distribution and an estimate of the variance of the loss distribution.[174] The variance could be used to calculate the counterparty default risk capital requirement for type 1 exposures as the loss distribution's standard deviation (the square root of the variance) could be multiplied with a stress quantile factor to achieve Solvency II's 99.5% confidence level.[175] Only the variance would be used to calculate capital requirements for the loss distribution, and a stress quantile factor of 3 was chosen for portfolios that were sufficiently diversified or had a high counterparty credit quality.[176] However, the stress quantile factor was to be increased to 5 if the portfolio was dominated by one or a small number of exposures with a high probability of default (i.e. external credit risk assessments of worse than BBB).[177]

In line with Solvency II's level 1, CEIOPS proposed that the counterparty default risk capital requirement for type 1 exposures was to only cover "unexpected default" explicitly, while the risk of a deterioration in the credit standing was implicitly captured as a default was perceived as the "most severe deterioration" in a credit standing.[178] In addition, the calculation of type 1 exposure capital requirements was to incorporate diversification effects between independent counterparties, while no diversification effects were to be given for entities in the same group or financial conglomerate.[179] The long-term average PDs could be based on external credit risk assessments or solvency ratios.[180] A PD would also be set to a whole set of dependent counterparties (e.g. group companies) in the form of the average probability of the counterparties weighted with the corresponding LGD.[181]

[172] CEIOPS (2009d), para. 3.32.
[173] CEIOPS (2009d), para. 3.29-31.
[174] CEIOPS (2009d), para. 3.33-34, 3.122-123, 3.131, 3.182, 3.215 and 3.227.
[175] CEIOPS (2009d), para. 3.33-34, 3.122-123, 3.182, 3.215 and 3.227. See also CEIOPS (2010c), para. 3.242. Calibrations, confidence levels and quantiles were described in chapter 9.3.
[176] CEIOPS (2009d), para. 3.116, 3.123, 3.182 and 3.232. See also CEIOPS (2010c), para. 3.243.
[177] CEIOPS (2009d), para. 3.124 and 3.232. See also CEIOPS (2010c), para. 3.244
[178] CEIOPS (2009d), para. 3.41 and 3.172, and Solvency II, art. 105(6)
[179] CEIOPS (2009d), para. 3.93-94 and 3.2.6.
[180] CEIOPS (2009d), para. 3.135-141, 3.142, 3-145-3.151 and 3.2.11.
[181] CEIOPS (2009d), para. 3.154 and 3.248.

CEIOPS proposed that the LGD for a type 1 exposure was the loss of basic own funds that would be incurred if the counterparty defaulted.[182] This loss could be measured as the current value of the exposure (i.e. best estimate recoverables in reinsurance or a derivative's market value) in a stressed situation that recognised (i) the risk-mitigating contract's transferred risk and (ii) the associated default risk.[183] CEIOPS also proposed that the LGD for type 1 exposures considered default mitigation techniques such as recognised collateral and the netting of receivables with liabilities.[184] The LGD for type 1 exposures could accordingly be netted with liabilities, towards the same legal entity, provided that they could be set off in case of a default.[185] The counterparty default risk module's recognition of collateral was to entail a market risk adjustment (i.e. reduction) of the collateral's market value.[186] However, this market risk adjustment was not to be based on counterparty default risk-specific haircuts but instead on the SCR standard formula's market risk module, including the allocation of risk factors to the individual sub-modules (e.g. the spread risk sub-module) and the subsequent prescribed aggregation of the sub-modules' capital requirements to produce the market risk module's capital requirement for the collateral.[187]

The LGD for a derivative was accordingly to be calculated by increasing the market value of the derivative by its risk mitigating effect (on market risk) while subtracting the risk-adjusted value of any collateral, posted in relation to the derivative, whereafter the resulting value was multiplied by a recovery rate of the counterparty that recognised that a part of the stressed exposure could still be collected.[188] Due to the financial crisis, including experiences in relation to AIG's derivative exposures and leverage, recovery rates for defaulted derivatives were set at 10%.[189] However, if the contract was not a risk mitigating contract, e.g. cash at bank and deposits with ceding institutions, the LGD for type 1 exposures was proposed to be the current value of the exposure as it was assumed not to vary significantly during the SCR's one-year time horizon.[190]

11.2.1.2 Level 2 Regulation of Type 1 Exposures and a Different Approach to Repos

In accordance with CEIOPS' advice above, the level 2 regulation of Solvency II's SCR standard formula includes a counterparty default risk capital requirement

[182] CEIOPS (2009d), para. 3.48-49.
[183] CEIOPS (2009d), para. 3.48-49.
[184] CEIOPS (2009d), para. 3.100 and 3.219, and Solvency II, art. 105(6). See chapter 11.1.2.2 above regarding the recognition of collateral.
[185] CEIOPS (2009d), para. 3.108.
[186] CEIOPS (2009d), para. 3.100-101 and 3.220, i. e. $Collateral_{adjusted} = 80\% * (MarketValue_{Collateral} - MarketRisk_{Collateral})$, where the 80% factor represented the credit risk of a custodian.
[187] CEIOPS (2009d), para. 3.102-103 and 3.221. See also EIOPA (2018b), 1496-1497.
[188] CEIOPS (2009d), para. 3.49-50, 3.56-57, 3.111, 3.188 and 3.228-229, i.e. $LGD_i = max((1 - Rec.Rate_{fin}) * (MarketValue_i + Effect_{RiskMitigation_i} - Collateral_i); 0)$.
[189] CEIOPS (2009d), para. 3.114 and 3.229.
[190] CEIOPS (2009d), para. 3.89-90 and 3.208.

for type 1 exposures which include, inter alia, (i) risk-mitigation contracts such as reinsurance arrangements, special purpose vehicles, insurance securitisations and derivatives, (ii) cash at bank, and (iii) deposits with ceding undertakings where the number of single name exposures does not exceed 15.[191] The counterparty default risk module does not cover the credit risk transferred by credit derivatives that are covered by the spread risk sub-module.[192]

Pursuant to the underlying assumptions, and in line with CEIOPS' advice, type 1 exposures are assumed not to be diversified but likely to be rated.[193] In addition, the counterparty default risk module prescribes a low diversification effect in the formula for the aggregation of the separate capital requirements for type 1 exposures and type 2 exposures.[194]

Also in line with CEIOPS' advice, the calculation of the variance of the loss distribution of type 1 exposures is done via the reinsurance-based model and relies on inputs in the form of the LGD and PD.[195] In order to meet Solvency II's 99.5% confidence level, the type 1 exposure loss distribution's standard deviation (the square root of the loss distribution's variance) is scaled by the stress quantile factor, which is 3 for a portfolio of counterparties assumed to be sufficiently diversified and with a reasonably high credit quality, or 5 in case of a less diversified portfolio or lower credit quality (i.e. lower than a BBB rating).[196] This portfolio-based approach accordingly differs from the finalised Basel III's portfolio-invariant approach to risk-weighted assets for credit risk and counterparty credit risk.

During the recent review of the counterparty default risk module, EIOPA (2018b) found that there was a great variance in the relative significance of the counterparty default risk of insurance undertakings but that counterparty default risk was not a major risk.[197] However, the lack of an explicit treatment of netting agreements, including the posting of collateral on the net exposure, was recognised and EIOPA accordingly proposed that LGDs should be calculated at a counterparty-level and not for each derivative.[198] EIOPA could not report on

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[191] Solvency II Delegated Regulation, art. 189(1)-(2).

[192] Solvency II Delegated Regulation, art. 189(6)(a), 175 and 179.

[193] EIOPA (2014c), p. 71.

[194] Solvency II Delegated Regulation, art. 189(1), EIOPA (2014c), p. 72, and CEIOPS (2009d), para. 3.23, i.e. $SCR_{default} = \sqrt{SCR^2_{(default,1)} + 1.5 * SCR_{(default,1)} * SCR_{(default,2)} + SCR^2_{(default,2)}}$.

[195] Solvency II Delegated Regulation, art. 201, and EIOPA (2014c), p. 72, where the type 1 loss distribution's variance is the sum of V_{inter} and V_{intra}, that are calculated as $V_{inter} = \sum\limits_{(j,k)} \frac{PD_k*(1-PD_k)*PD_j*(1-PD_j)}{1.25*(PD_k+PD_j)-PD_k*PD_j} * TLGD_j * TLGD_k$ and $V_{intra} = \sum\limits_{j} \frac{1.5*PD_j*(1-PD_j)}{2.5-PD_j} * \sum\limits_{PD_j} LGD_i^2$. See also European Commission QIS5 (2010), para SCR.6.14, and CEIOPS (2009d), para. 3.37-39 and annex A.14.

[196] Solvency II Delegated Regulation, art. 200, and EIOPA (2014c), p. 72, i.e. $SCR_{default,type1} = 3 * \sigma$, or $SCR_{default,type1} = 5 * \sigma$. The determination of the applicable stress quantile factor depends on the size of the standard deviation of the type 1 exposures' loss distribution in proportion to the total losses-given- default on all type 1 exposures.

[197] EIOPA (2018b), para. 1373-1374, 1433, 1435 and 1438.

[198] EIOPA (2018b), para. 1332-1333, 1412-1417, 1421-1422, 1444, 1451-1452 and 1456-1457

insurance undertakings' use of netting agreements but referred to the treatment of netting agreements in banking regulation and assumed that they were used to "some extent" by insurance undertakings.[199]

EIOPA was also requested to provide advice in relation to the treatment of exposures to CCPs, including derivatives, that was to be consistent with banking regulation.[200] In its advice, EIOPA stated that the risks in case of a CCP's default were not different for banks and insurance undertakings, and EIOPA saw difficulties in arguing for a less restrictive approach for insurance undertakings.[201] Changes in the regulation of banks' CCP exposures would accordingly have to be reflected in Solvency II, and EIOPA considered the finalised Basel III's standardised approach for the treatment of counterparty credit risk (which is not applicable to repos).[202] As also described in chapter 9.4 in relation to aggregation and diversification effects, EIOPA found that a stand-alone comparison of the capital requirements for a specific transaction, in banking and insurance regulation, would not be "very meaningful" as the overall design of the regulatory capital requirements was very different, including diversification within risk modules and across risk modules.[203] However, EIOPA proposed that LGDs should incorporate contractual netting agreements and be calculated on a counterparty-level (i.e. on the basis of the combined economic effect of all covered derivatives and not for each covered derivative), and EIOPA proposed an LGD for bilaterally cleared transactions and LGD for derivative transactions that are indirectly cleared by a CCP through clearing members.[204] These proposals were subsequently incorporated into the Solvency II Delegated Regulation in 2019.[205]

At level 2, the counterparty default risk capital requirement must be calculated on the basis of single name exposures (where a corporate group constitutes a single name exposure) and the LGD on a single name exposure is equal to the sum of the LGD for each of the exposures to counterparties belonging to the single name exposure.[206] The prescribed LGD for *derivatives* incorporates:

- netting effects as it must be net of liabilities towards the single name exposure if (i) the liabilities and the exposures are set off in the case of default and (ii) the qualitative criteria, and criteria regarding the effective transfer of risk, (as described in chapter 11.1.2.2 above) are fulfilled in relation to the set-off right.[207] If a contractual netting agreement covers several derivatives that represent a credit exposure to the same counter-

[199] EIOPA (2018b), para. 1416 and 1421.

[200] EIOPA (2018b), section 14.1, including para. 1508, and European Commission (2016), section 3.2.8.

[201] EIOPA (2018b), para. 1476 and 1511.

[202] EIOPA (2018b), para. 1476, 1517-1547 and 1559, BCBS Basel III (2014d), part C, and BCBS Consol. Basel III (2019), CRE51.8(1).

[203] EIOPA (2018b), para. 1513 and 1536.

[204] EIOPA (2018b), para. 1412-1415, 1451-1452, 1456-1457, 1566 and 1582.

[205] Commission Delegated Regulation (EU) 2019/981, art. 1(44) and (45) (art. 192 and 192a of the Solvency II Delegated Regulation).

[206] Solvency II Delegated Regulation, art. 192 and 190.

[207] Solvency II Delegated Regulation, art. 192(1).

party, then the LGD on those derivatives may be calculated on the basis of the combined economic effect of all of those covered derivatives provided that the qualitative criteria, and criteria regarding the effective transfer of risk, are fulfilled relation to the netting.[208]

- the risk mitigating effect of recognised collateral arrangements (as described in chapter 11.1.2.2 above) as the Solvency II-valued derivative exposure is reduced by the risk-adjusted value of collateral.[209] The risk adjustment of collateral entails that the value of collateral, provided by way of a security (financial) collateral arrangement or title transfer (financial) collateral arrangement, must be adjusted by the market risk adjustment.[210] As described in chapter 11.2.1.1 above, this market risk adjustment is not to be based on counterparty default risk-specific haircuts but instead on the SCR standard formula's market risk module.[211]

In line with CEIOPS' advice, the LGD for cash at bank or a deposit with a ceding undertaking - as well as *any other exposure not subject to prescribed LGDs* - is the value as calculated in accordance with Solvency II's "market consistent" valuation.[212]

Finally, and similar to the allocation of stress factors in the spread risk sub-module, the Solvency II Delegated Regulation prescribes 99.5% quantile calibrated PDs for single name exposures that depend on credit quality steps.[213] Unrated exposures to (re-)insurance undertakings are assigned PDs based on the (re-)insurance undertaking's Solvency II-based solvency ratios.[214] In addition, specific PDs are provided for, inter alia, (i) (re-)insurance undertakings that do not meet Solvency II's MCR, (ii) unrated third country (re-)insurance undertakings that comply with Solvency II-equivalent solvency requirements, (iii) unrated exposures to credit institutions and financial institutions that comply with CRD IV and CRR, (iv) the ECB and EU member states' central government and central banks (which have been given a 0% PD similar to the 0% stress factor in the spread risk sub-module and 0% risk weight in the finalised Basel III's standardised approach for credit risk) and (v) exposures to clearing members of CCPs.[215]

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[208] Solvency II Delegated Regulation, art. 192(1).

[209] Solvency II Delegated Regulation, art. 192(3)-(3d), 196, 197 and 214, e.g. $LGD = max(90\%(Derivative_{value} + RMEffect) - F' * Collateral_{adjusted}; 0)$, where 90% reflects a recovery rate of 10% and $RMEffect$ is the risk-mitigating effect of the derivative on market risk (both are described above) and F' is the economic effect of the collateral arrangement, in relation to the derivative, in case of a counterparty's credit event. See also EIOPA (2014c), pp. 70 and 73.

[210] Solvency II Delegated Regulation, art. 197.

[211] Solvency II Delegated Regulation, art. 197. See also EIOPA (2018b), 1496-1497.

[212] Solvency II Delegated Regulation, art. 192(6).

[213] Solvency II Delegated Regulation, art. 199(2), and EIOPA (2014c), pp. 70 and 72. The PD for a single name type 1 exposure equals the average of the PDs, on each of the exposures to counterparties that belong to the single name exposure, weighted by the LGD for those exposures, cf. Solvency II Delegated Regulation, art. 199(1).

[214] Solvency II Delegated Regulation, art. 199(3), and EIOPA (2014c), p. 72.

[215] Solvency II Delegated Regulation, art. 199. See Commission Delegated Regulation (EU) 2019/981, art. 1(48).

As mentioned above, an exposure in the counterparty default risk module, which is not subject to a prescribed LGD, is given an LGD based on the exposure value calculated in accordance with Solvency II's "market consistent" valuation.[216] In relation to repos, EIOPA Guidelines (2014d) state that life insurance undertakings must apply the counterparty default risk module's treatment of type 1 exposures upon the posted financial collateral, while considering the risk-mitigating effect of the received financial collateral.[217] During the Solvency II review, stakeholders emphasised the importance of ensuring consistency with future banking regulation and also mentioned that more and more repo transactions were centrally cleared.[218] Although the proposed treatment of exposures to CCPs could apply to all CCP exposures, EIOPA (2018b) considered whether repo exposures should be covered.[219] However, stakeholders did not seem to consider repos as relevant exposures.[220] The Solvency II review accordingly focused on counterparty default risk in relation to specifically derivatives, as well as netting agreements for derivatives, but it did not lead to an explicit LGD for repos, including repos subject to master netting agreements.

11.3 Overview of Comparison and Findings

In relation to counterparty credit risk, the research question is whether Solvency II subjects life insurance undertakings' counterparty credit risk exposures (in the form of repos) to requirements that are "similar" to the finalised Basel III's requirements for such exposures. As described in chapter 8, the comparison is limited to assessing whether counterparty credit risk is subject to quantitative pillar 1 requirements.

Chapter 11.1 presented the finalised Basel III's treatment of counterparty credit risk and repos. This is illustrated in blue and green in figure 11.3. As a part of risk-weighted assets for credit risk, the finalised Basel III explicitly addresses banking book and trading book exposures to repos via counterparty credit risk exposure amounts (or counterparty credit risk EADs) that recognise the effect of master netting agreements and rely on prescribed haircuts to adjust for volatility.

Chapter 11.2 described Solvency II's counterparty default risk module. An overall view of the details of the counterparty default risk module appear in red in figure 11.3. During its development, the counterparty default risk module initially relied on banking regulation, including the loss distribution of the IRB approach for credit risk. However, it diverged to a reinsurance-based approach for counterparty default risk capital requirements. This approach multiplies the type 1 exposure loss distribution's standard deviation with a stress quantile factor to achieve Solvency II's 99.5% confidence level. The counterparty default

[216] Solvency II Delegated Regulation, art. 192(6).
[217] EIOPA Guidelines (2014d), para. 1.27. See also EIOPA (2014b), SCR.5.82 and SCR.6.7.
[218] EIOPA (2018b), para. 1482 and 1486.
[219] EIOPA (2018b), para. 1506.
[220] EIOPA (2018b), para. 1506.

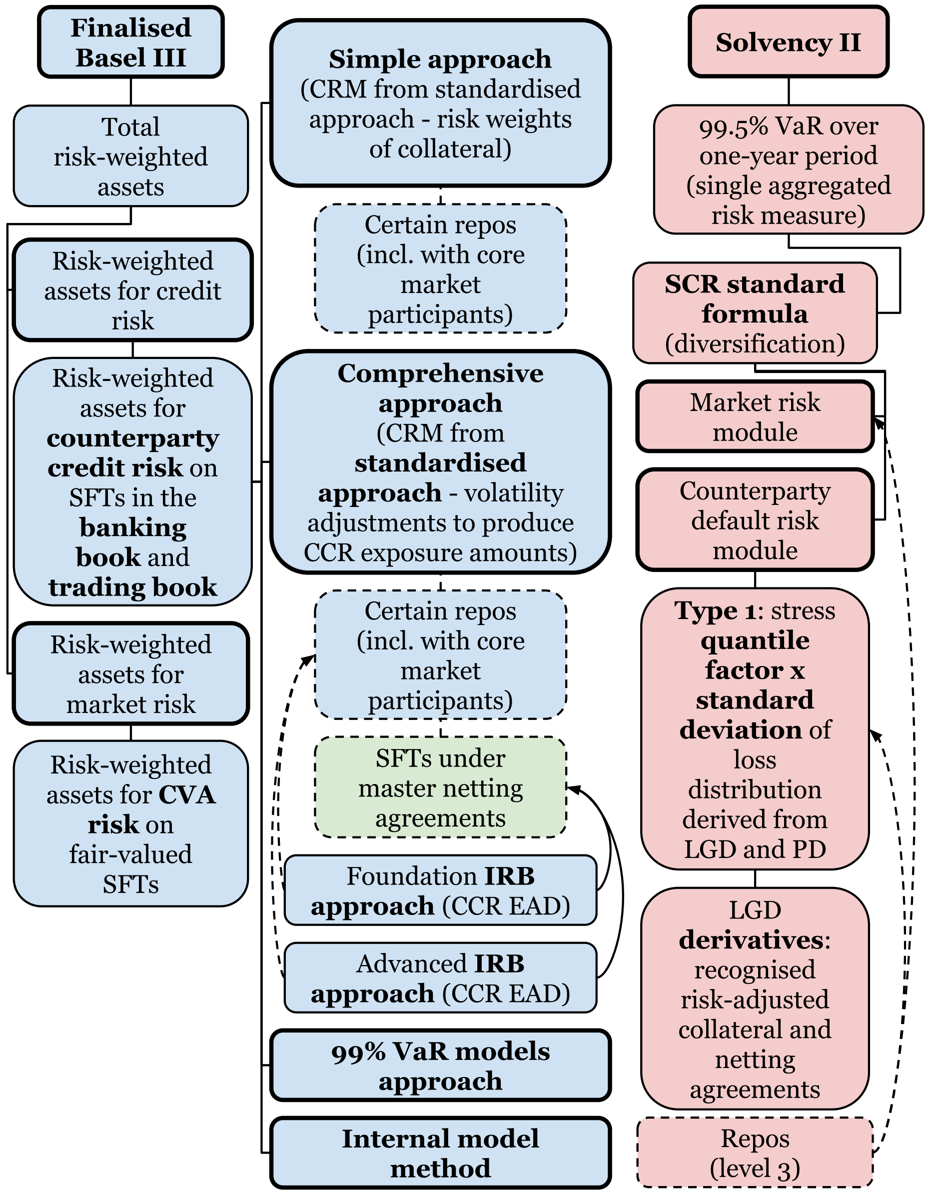

Figure 11.3: A comparison of the finalised Basel III's treatment of repos and counterparty credit risk ("CCR") in comparison to Solvency II's counterparty default risk module.

risk capital requirement for type 1 exposures is accordingly a portfolio-based capital requirement. As described in chapter 11.1.2.2, the Solvency II project aimed for cross-sectoral consistency when developing the criteria for the recognition of risk mitigation effects, including the risk mitigating effect of collateral.[221] Such cross-sectoral consistency was to eliminate regulatory arbitrage and avoid artificial movements of funds and risks from one financial sector to another.[222] Recognised collateral is generally subject to a risk adjustment but that adjustment is not based on banking regulation-inspired haircuts but instead on market risk adjustments via the SCR standard formula's market risk module.[223] In relation to repos, EIOPA Guidelines (2014d) state that life insurance undertakings must apply the counterparty default risk module's treatment of type 1 exposures upon the posted financial collateral, while considering the risk-mitigating effect of the received financial collateral.[224] However, the level 2 regulation of type 1 exposures does not include an explicit LGD for repos that are subject to master netting agreements.

Solvency II's approach for counterparty default risk and repos accordingly differs from the finalised Basel III's portfolio-invariant counterparty credit risk capital requirements for repos. However, despite the different approaches, it is concluded that counterparty credit risk (or counterparty default risk) on repos is addressed in Solvency II via quantitative pillar 1 capital requirements in the counterparty default risk module. Counterparty credit risk on repos is accordingly subject to quantitative pillar 1 capital requirements in both Solvency II and the finalised Basel III.

During the recent Solvency II review, repos were not considered relevant in relation to the counterparty default risk module's treatment of CCP exposures.[225] However, as showed in chapter 6.3.1 above, exposures to repos may be a country-specific characteristic as the top five Danish life insurance undertakings have had significant exposures to repos and the posted financial collateral. This aspect, as well as cross-sectoral consistency, may warrant an explicit treatment of repos that are subject to master netting agreements. The explicit treatment could also ensure cross-sectoral consistency in calibrations of capital requirements, including prescribed haircuts or risk adjustments. While considering Solvency II's diversification effects, such a treatment could rely on the finalised Basel III's comprehensive approach for financial collateral that is tailored specifically for repos and master netting agreements. This could also ensure equivalence in relation to the capital requirements for short-term repos with core market participants.

[221] CEIOPS (2009c), para. 3.31-32.
[222] CEIOPS (2009c), para. 3.31-32.
[223] See also EIOPA (2018b), 1496-1497.
[224] EIOPA Guidelines (2014d), para. 1.27.
[225] EIOPA (2018b), para. 1506.

Part VII

Liquidity Risk

Chapter 12

Liquidity Risk

FSB (2013c) labels the ability of repos to create short-term and money-like liabilities, which facilitate leverage as well as maturity and liquidity transformation outside the reach of capital and liquidity requirements, as a pure shadow banking risk.[1] From the FSB's perspective, shadow banking, in the form of repos, accordingly depends on both capital requirements and liquidity requirements. Part VI above compared the finalised Basel III's and Solvency II's capital requirements for credit risk, market risk and counterparty credit risk. In line with the scope in chapter 8, and the FSB's perspective, this chapter will compare the finalised Basel III's and Solvency II's approaches to liquidity risk.

Chapter 5 provided a detailed description of liquidity risk in relation to repos and financial collateral arrangements, including roll-over risk, margin calls, haircuts and the "run on repo".[2] BCBS (2008b) generally distinguishes between

- funding liquidity risk - the risk that a bank will not be able to meet efficiently both expected and unexpected current and future cash flow needs and collateral needs, without affecting either daily operations or the financial condition of the bank, and
- market liquidity risk - the risk that a bank cannot easily offset or eliminate a position at the market price because of inadequate market depth or market disruption.[3]

In relation to repos, the two types of liquidity risk interact. If short-term financing is obtained through a repo, the repo seller will expose itself to funding liquidity risk as a failure to make a margin transfer constitutes an event of default that entails the repayment of the short-term liability.[4] The margin transfer or repayment may entail that assets have to be "transformed" or "monetised"

[1] Section 1.1.
[2] See, inter alia, Brunnermeier and Pedersen (2009), Gorton and Metrick (2012) and Copeland et al. (2014).
[3] Para 1, footnote 2.
[4] See e.g. GMRA, para. 10, including (a)(iv)(A).

via liquidations in the market, in order to obtain cash or a another specific form of financial collateral, which exposes the repo seller to market liquidity risk. In addition, a margin call may be due to decreases in the value of posted financial collateral. Funding via repos may accordingly be procyclical because of the direct relationship between the access to funding and fluctuating asset values.[5] A comparison of the regulation of leverage and the possible procyclicality is made in part VIII.

Prior to the financial crisis, banks' funding shifted towards a greater reliance on the capital markets, including wholesale funding via repos.[6] These funding sources are considered potentially more volatile than traditional retail deposits and may - similar to repos in shadow banking - lead to increasing liquidity pressures from margin calls, demands for collateral, and roll-over risk during a period of stress.[7] During the "liquidity phase" of the financial crisis, banks experienced difficulties, despite adequate capital levels, because they did not manage their liquidity in a "prudent manner".[8] As a result, the banking system became subject to severe stress that necessitated central bank assistance.[9] In this light, Basel III found that strong capital requirements are a necessary condition for the stability of the banking sector but not sufficient by themselves.[10] Basel III accordingly supplemented the risk-based capital requirements (and the BCBS' principles for sound liquidity risk management) with two minimum quantitative standards for funding and liquidity: the liquidity coverage ratio ("LCR") and net stable funding ratio ("NSFR").[11] The finalised Basel III therefore includes risk-based capital requirements that are supplemented by the quantitative LCR and NSFR.[12]

Solvency II defines liquidity risk as the risk that life insurance undertakings are *"...unable to realise investments and other assets in order to settle their financial obligations when they fall due..."*.[13] This definition seems to reflect both funding liquidity risk and market liquidity risk. However, the SCR standard formula and the general provisions for the SCR do not include liquidity risk as an explicit risk type.[14] In relation to its assessments regarding macroprudential tools to enhance Solvency II, EIOPA (2018e) considers Solvency II to be a capital-based framework that focusses primarily on solvency and not specifically on liquidity.[15] EIOPA does not consider liquidity risk to be a major risk in the traditional insurance business model, and EIOPA states that Solvency II does

[5] FSB (2013c), section 1.2(i).
[6] BCBS (2008a), pp. 2-3 and 4.
[7] BCBS (2008a), pp. 2-3 and 4.
[8] Basel III, para. 35, BCBS Basel III (2013), para. 2, and BCBS Basel III (2014b), para. 3.
[9] Basel III, para. 35, BCBS Basel III (2013), para. 2, and BCBS Basel III (2014b), para. 3.
[10] Basel III, para. 34.
[11] Basel III, para. 36-42, and BCBS (2008b).
[12] BCBS Consol. Basel III (2019), LCR and NSF, BCBS Basel III (2013), para. 4, and BCBS Basel III (2014b), para. 5.
[13] Solvency II, art. 13(34).
[14] Solvency II, art. 101 and 104-105.
[15] Pp. 28 and 33.

not include quantitative requirements for liquidity risk or provide a "harmonised view" of insurance undertakings' liquidity positions.[16] Similarly, the SCR standard formula's underlying assumptions state that the defined liquidity risk is not explicitly covered.[17] In relation to traditional insurance, the SCR standard formula's life underwriting risk module includes the lapse risk sub-module which is to capture *"...the risk of loss, or of adverse change in the value of insurance liabilities, resulting from changes in the level or volatility of the rates of policy lapses, terminations, renewals and surrenders..."*.[18] The lapse risk sub-module does accordingly not capture non-insurance liabilities and shadow banking in the form of repos and other SFTs. In line with the above, EIOPA's insurance stress test framework targets market risks and insurance-specific risk, including (i) an upward shift in the yield curve combined with increases in lapses, (ii) a downward shift in the yield curve combined with a longevity stress, and (iii) a natural catastrophe scenario.[19]

In relation to liquidity risk, the research question is whether Solvency II subjects life insurance undertakings' liquidity risk exposures to requirements that are "similar" to the finalised Basel III's requirements for such exposures. As described in chapter 8, the comparison is limited to assessing whether liquidity risk exposures are subject to quantitative pillar 1 requirements. This is obviously not the case. Solvency II's lack of quantitative requirements regarding liquidity risk entails that this chapter's comparison of Solvency II and the finalised Basel III will be different from the prior comparisons regarding credit risk, market risk and counterparty credit risk. In the next chapter, the logic behind Solvency II's approach to liquidity risk will firstly be described. This logic will reveal whether the Solvency II project focused purely on traditional insurance or actually incorporated non-insurance activities and made informed decisions regarding the chosen approach. Subsequently, the finalised Basel III's LCR and NSFR will be described whereafter adapted versions for life insurance undertakings' non-insurance activities and repos will be proposed.

As described in chapters 1 and 5.1.3, the primary example of shadow banking and non-insurance liquidity risk - in relation to life insurance - is presumably AIG during the financial crisis.[20] In this case, an AIG non-insurance subsidiary lent out securities (provided by AIG life insurance subsidiaries) in return for cash financial collateral which it reinvested in long-term and illiquid investments.[21] This activity exposed AIG to runs by securities borrowers (i.e. the cash lenders) as they could demand their cash financial collateral returned on short notice when they became aware of AIG being subject to, inter alia, margin calls under credit default swaps.[22] As shown below, AIG occurred after CEIOPS provided

[16] EIOPA (2018e), pp. 28 and 33-34 (including box 5).

[17] EIOPA (2014c), p. 11.

[18] Solvency II, art. 105(3)(f).

[19] EIOPA (2018a), para. 17-18 and 24-32.

[20] IAIS (2011), para 18 and appendix A7, FSB (2012c), section 5.6, IAIS (2017), p. 14, EIOPA (2017c), p. 46, and EIOPA (2018f), p. 44.

[21] IAIS (2011), para 18 and appendix A7, IAIS (2017), p. 14, FSB (2012c), section 5.6, EIOPA (2017c), p. 46, EIOPA (2018f), p. 44, and McDonald and Paulson (2015), p. 85.

[22] IAIS (2011), para 18 and appendix A7, IAIS (2017), p. 14, FSB (2012c), section 5.6,

a significant part of its advice in relation to liquidity risk.

Chapters 1 and 6.1.1 presented how the IAIS has assessed the relationship between insurance and systemic risk, including shadow banking and non-insurance activities, as well as produced policy measures for G-SIIs and proposed a holistic framework for systemic risk in insurance.[23] Chapter 14 below will elaborate on the IAIS' approach to G-SIIs, liquidity risk and shadow banking. However, in its holistic framework for systemic risk, IAIS (2018a) defines liquidity risk as *"...the uncertainty, emanating from business, investment or (re-)financing activities, over whether the insurer will have the ability to meet expected and unexpected payment obligations or collateral needs in time and in full as they fall due in both current and stressed environments."*[24] This definition seems able to capture both traditional insurance as well as non-insurance activities, and the IAIS listed securities lending transactions (including reinvestment into illiquid assets and the risk of margin calls) as exposures to liquidity risk.[25] In the light of discussions regarding macroprudential policy for the banking sector, EIOPA also began assessing systemic risk and macroprudential policy in insurance.[26] The perspectives of the IAIS and EIOPA will accordingly be included in this chapter's assessments regarding liquidity risk and the applicability of the finalised Basel III's LCR and NSFR on life insurance undertakings.

12.1 The Solvency II Project and Liquidity Risk

In its framework for consultation on the Solvency II project, the European Commission initially requested that advice should be constructed around a Basel II-similar three pillar structure in the form of (i) quantitative capital requirements, (ii) a supervisory review process and (iii) disclosure requirements.[27] The European Commission also requested that the risks, to be addressed in the capital requirements, should be based on the risk classification by the IAA and include underwriting risk, credit risk, market risk, operational risk and *liquidity risk*.[28]

In an insurance context, International Actuarial Association (2004) defined liquidity risk as the *"...exposure to loss in the event that insufficient liquid assets will be available, from among the assets supporting the policy obligations, to meet the cash flow requirements of the policyholder obligations when they are due or assets may be available, but only at excessive cost."*[29] The IAA's definition accordingly focused on insurance liabilities. The IAA believed that liquidity is-

EIOPA (2017c), p. 46, EIOPA (2018f), p. 44, and McDonald and Paulson (2015), pp. 86-87 and 102.

[23]See, inter alia, IAIS (2010), IAIS (2011), IAIS (2013b), IAIS (2013a), IAIS (2016b), IAIS (2016a), IAIS (2017) and IAIS (2018a)

[24]Para. 29(a).

[25]IAIS (2018a), para. 34.

[26]See e.g. EIOPA (2016), EIOPA (2017c), EIOPA (2018f) and EIOPA (2018e).

[27]European Commission (2004a), p. 2, European Commission (2004b), p. 2, European Commission (2005), para. 2 and European Commission (2006), para. 2.

[28]European Commission (2004a), p. 4, and European Commission (2004b), p. 4, European Commission (2005), para. 20, and European Commission (2006), para. 20.

[29]Para. 5.43 and p. 178.

sues in an insurance undertaking were typically triggered by "difficult-to-predict events", which frequently involved policyholder behaviour because of various operational risk events (e.g. a rating downgrade), and recommended that liquidity risk was subject to pillar 2 requirements instead of pillar 1 requirements.[30]

In its answers to the European Commission's first wave of calls for advice, and from an asset-liability management perspective, CEIOPS (2005a) noted the view of the IAA but still considered whether liquidity risk was to be treated using standardised capital requirements.[31] CEIOPS considered, inter alia, a "worst liability strain" that an insurance undertaking could face and stated that it would not be plausible to imagine that all liabilities would have to be paid immediately but that sufficient liquid assets should be available to cover a "prudent stress".[32] As described below, such a requirement regarding sufficient liquid assets could seem similar to the finalised Basel III's LCR.

CEIOPS also stated that an insurance undertaking's liabilities could not be considered in isolation from its investment activities.[33] The characteristics of liabilities were the driving force in developing investment policies for an insurance undertaking and the nature of insurance business and policies required the establishment of technical provisions as well as investment in assets that were appropriate to the liabilities.[34] An insurance undertaking was accordingly to manage its assets in a "sound and prudent manner" that considered the profile of its liabilities, its solvency position and its complete risk-return profile.[35] It was recommended (i) that the SCR should apply to all assets and liabilities and be sensitive to the combined effects of investment risk and asset-liability matching, (ii) that "some" investment and concentration limits were included in pillar 1 and (iii) that investment and asset-liability management were considered in a coherent manner, including that insurance undertakings should have an investment policy for all their assets that addressed market illiquidity.[36] CEIOPS found that it could - to a certain extent - reduce the need for detailed limits on investment and asset-liability management if the SCR was sensitive to the combined effects of investment risk and asset-liability matching.[37] In addition, CEIOPS considered a capital requirement that would reflect any lack of investment diversification and could be placed in pillar 1 or 2.[38]

Although the first wave of advice constituted initial considerations regarding liquidity risk and asset-liability management, it reflected a total balance sheet

[30] International Actuarial Association (2004), para. 5.50.

[31] Para. 85 and 92.

[32] CEIOPS (2005a), para. 94. CEIOPS also considered (i) a conservative approach for illiquid assets that was based on estimating the value that could be realised by converting illiquid assets into short-term and liquid assets (while not considering the relationship between assets and liabilities), and (ii) a joint stress of assets and liabilities which entailed that liabilities fell due earlier than expected (e.g. where policyholders had significant surrender options) and that assets became more illiquid, cf. CEIOPS (2005a), para. 92-95.

[33] CEIOPS (2005a), para. 100.

[34] CEIOPS (2005a), para. 100.

[35] CEIOPS (2005a), para. 100.

[36] CEIOPS (2005a), para. 97-99, 101-102,104-106 and 109-111.

[37] CEIOPS (2005a), para. 105.

[38] CEIOPS (2005a), para. 107.

approach as well as the "prudent person", investment risk and asset-liability management.[39] However, it also seemed to focus on traditional insurance liabilities in the form of obligations to policyholders.

In its answers to the second wave of calls for advice, CEIOPS (2005b) generally considered quantitative diversification and concentration requirements (that could supplement the SCR and pillar 2), the "prudent person approach", investment policy and asset-liability management, as well as assets that were eligible to cover the SCR, MCR and technical provisions.[40] CEIOPS proposed that the eligibility of assets could be based on eligibility criteria, principles and/or a list of eligible asset classes.[41] In addition, it was suggested that liquidity risk and concentration risk could be addressed via quantitative limits on assets.[42] CEIOPS also noted how liquidity risk was difficult to measure as well as that illiquid assets could take time to be realised and that the obtainable value would usually be uncertain and possibly severely reduced as a result of a forced sale.[43] To address this, CEIOPS considered a requirement wherein insurance undertakings had sufficient liquid assets to cover the expected "outgo" in the form of claims and expenses over the following 12 months.[44] Although such a requirement related to insurance liabilities, its overall principle may have shared similarities with the finalised Basel III's LCR.

CEIOPS perceived the IAA's risk classification above as the starting point and that the SCR standard formula should - at a minimum - address underwriting risk, market risk, credit risk and operational risk.[45] In relation to liquidity risk, CEIOPS noted that asset-liability management coordinated the cash flows and therefore constituted an effective tool for reducing liquidity risk in both life and non-life insurance.[46] In line with "traditional" insurance, CEIOPS argued that cash flows - for a large portfolio of life business - should be reasonably predictable on a one-year time horizon because of the law of large numbers.[47] CEIOPS found that effective liquidity planning, which could be tested under pillar 2, could address most sources of liquidity risk, while other sources of liquidity risk could be considered implicitly under pillar 1.[48] Accordingly, quantifiable aspects of liquidity risks (e.g. an increase in lapse rates) could be a pillar 1 requirement, while the remaining aspects of liquidity risk were to be addressed in pillar 2.[49] In addition, the SCR standard formula was to capture any asset-liability mismatch, if the effect could be quantified, while all other aspects of asset-liability systems - and their role in risk management - would be placed in

[39] CEIOPS (2005a), para. 104-105. See also CEIOPS (2007b), para. 1.1-1.2.
[40] CEIOPS (2005b), para. 9.86-9.111, 9.122-9.160 and 10.30-10.34.
[41] CEIOPS (2005b), para. 9.125-9.133.
[42] CEIOPS (2005b), para. 9.134.
[43] CEIOPS (2005b), para. 9.104, 9.142 and 10.33-10.34.
[44] CEIOPS (2005b), para. 9.105.
[45] CEIOPS (2005b), para. 10.25 and 10.131.
[46] CEIOPS (2005b), para. 10.33
[47] CEIOPS (2005b), para. 10.33
[48] CEIOPS (2005b), para. 10.33-10-34.
[49] CEIOPS (2005b), para. 10.133.

pillar 2.[50]

The answers to the second wave of calls for advice accordingly reflected considerations regarding sufficient liquid assets while moving liquidity risk into pillar 2 and keeping the insurance-specific lapse risk in pillar 1. When doing so, CEIOPS referred to the effect of the law of large numbers on a large portfolio of life insurance business.[51] The second quantitative impact study's SCR standard formula did not include explicit quantitative liquidity risk requirements, except for lapse risk in the life underwriting risk module.[52] In subsequent advice, CEIOPS (2007a) excluded liquidity risk from the SCR, and placed it in pillar 2, while stating that lapse risk would be reflected in the SCR and that credit risk and market risk capital requirements would - to some extent - reflect the liquidity of assets.[53]

In the light of the "prudent person approach", CEIOPS (2007b) discussed the role of quantitative limits in Solvency II.[54] CEIOPS divided insurance products into three types that depended on whether the policyholder or insurance undertaking bore the risk.[55] While recognising that liquidity risk differed between financial sectors, CEIOPS' compared e.g. unit-linked insurance products (where the policyholder bore the risk) to UCITS, while e.g. fixed-yield insurance products (where the insurance undertaking bore the risk) were compared to banking products.[56] However, CEIOPS found that the business models of banks and insurance undertakings differed significantly as banks would use the received money to sell loans, which earned a higher yield than the guarantees given, while insurance undertakings invested premiums on capital markets to receive higher returns than the guarantees given.[57] UCITS were accordingly perceived as sharing more similarities with insurance than the process of producing loans in banking, and CEIOPS directed its focus towards the regulation of concentration risk and liquidity risk in the former UCITS directive.[58] However, in relation to liquidity risk, and contrary to the former UCITS directive's requirements regarding investments, CEIOPS did not propose standardised limits on investments in the risk-based Solvency II system.[59] Liquidity risk was excluded from the SCR standard formula (and placed under pillar 2) and con-

[50] CEIOPS (2005b), para. 10.134.

[51] In line with the approaches above, CEIOPS' answers to the third wave of calls for advice focused on liquidity risk in relation to policyholder behaviour and lapse risk and stated that pillar 2 requirements and reporting could address liquidity risk, cf. CEIOPS (2006a), para 21.31, annex A, item 3.6, and annex B, para. B.33.

[52] CEIOPS QIS2 (2006b), para. 5.31 and 5.78.

[53] Para. 9.15, 9.22 and 9.44-45.

[54] Para. 1.1-1.2.

[55] CEIOPS (2007b), para. 2.3 and 2.8-2.12. The three types were (i) insurance products where the investment risk was held by the policyholder (e.g. unit-linked life insurance), (ii) insurance products where the investment risk was held by the insurance undertaking (e.g. life insurances with a fixed yield) and (iii) insurance products which did not incur investment risk for the policyholder at all.

[56] CEIOPS (2007b), para. 2.4-2.6.

[57] CEIOPS (2007b), para. 2.6.

[58] CEIOPS (2007b), para. 2.6-2.12.

[59] CEIOPS (2007b), para. 4.17-4.19, and Directive 85/611/EEC, section V.

centration risk would be addressed via a proposed concentration risk module, while the *qualitative* requirements for investments, including the investment policy, asset-liability management and prudent approach, would ensure that liquidity risk was considered.[60] CEIOPS recognised that specific risk characteristics of assets and liabilities could not be covered by the SCR standard formula but believed that these characteristics (including complex relationships between different risks) should not be addressed via quantitative limits.[61] If the investment risk was borne by the policyholder, CEIOPS believed that the prudent person principle implied a greater freedom of investment.[62] Those investments were accordingly to be subject to qualitative requirements but no restrictions or limits on the types of investments as they should be in accordance with contractual obligations.[63] If the risk was borne by the insurance undertaking, the associated technical provisions and the SCR were to be subject to additional requirements.[64]

In the subsequent quantitative impact studies, liquidity risk (which was perceived as "quite different" from banking) was discussed, and some participants considered liquidity risk to be a pillar 2 issue, while it was also proposed to address liquidity risk via the holding of liquid assets equal to the best estimate of cash flows.[65] However, in line with its former advice, the final level 2 advice in CEIOPS (2009a) concluded that liquidity risk was to be captured in pillars 2 and 3.[66]

This chapter's detailed examination of the Solvency II project shows that CEIOPS' primary advice, in relation to liquidity risk, did not distinguish between insurance and non-insurance liabilities or explicitly address shadow banking and SFTs. In terms of assets, CEIOPS' comparison of insurance undertakings' investment process with UCITS assumed that insurance undertakings invested premiums on capital markets.[67] It did not reflect life insurance undertakings' alternative credit investments that resemble credit intermediation by banks.[68] In terms of liabilities, CEIOPS' advice regarding liquidity risk seems to have relied on principles in traditional insurance, including the law of large numbers, which are still viable in relation to present traditional insurance liabilities. However, the advice seems to reflect a "pre-financial crisis view" in relation to non-insurance activities and SFTs. As described in chapters 6.1.1 and 14, the IAIS considers repos and securities lending as potentially systemic non-insurance activities, and the IAIS' updated assessment methodology for G-SIIs includes the indicators "non-policyholder liabilities and non-insurance revenues" and "short-term funding" that capture non-insurance activities as well as short-

[60] CEIOPS (2007b), para. 4.4, 4.6, 4.10, 4.17, 4.19, 4.37, 4.43 and 4.44.
[61] CEIOPS (2007b), para. 4.33 and 4.47.
[62] CEIOPS (2007b), para. 3.5 and 4.39.
[63] CEIOPS (2007b), para. 3.5 and 4.39.
[64] CEIOPS (2007b), para. 3.7 and 4.40.
[65] CEIOPS (2007c), pp. 9, 66, 89 and 94, and CEIOPS (2008), p. 186-187 and section 9.10.1.2.
[66] Para. 4.6.
[67] CEIOPS (2007b), para. 2.6.
[68] See chapter 6.

term borrowing, repos, securities lending, maturity transformation and liquidity risk.[69] As mentioned above, IAIS (2018a) lists securities lending transactions (including reinvestment into illiquid assets and the risk of margin calls) as exposures to liquidity risk that may have a systemic impact.[70] As a part of its recent macroprudential assessments, EIOPA (2017c) considers insurance undertakings' bank-like activities as possibly systemic activities and EIOPA (2018e) and EIOPA (2018f) consider repos and securities lending as activities that may have a systemic impact.[71]

In short, the Solvency II project placed liquidity risk in pillars 2 and 3 and did not address shadow banking or repo-based liquidity risk. However, EIOPA and the IAIS recognise the possible systemic risk that life insurance undertakings' non-insurance liabilities and shadow banking may pose. In the next chapter, the application of adopted Solvency II requirements upon repos will be assessed.

12.2 Repos - Prudent Person Principle and Freedom of Investment

Solvency II's recitals state that a life insurance undertaking should have assets of sufficient quality to cover its overall financial requirements.[72] As a matter of principle, the risk-based approach in Solvency II does not include quantitative investment limits or asset eligibility criteria but the recitals state that it should be possible to introduce investment limits and asset eligibility criteria to address risks which are not adequately covered by the SCR standard formula.[73] At the same time, Solvency II provides the freedom of investment and prescribes that EU member states may not require that investments are made in particular asset categories as this would be incompatible with the liberalisation of capital movements.[74]

However, all assets of a life insurance undertaking must be invested in accordance with the prudent person principle.[75] In relation to the entire asset portfolio, the prudent person principle entails that life insurance undertakings may only conduct investments in assets and instruments if they can *properly identify, measure, monitor, manage, control* and *report* the *associated risks* as well as appropriately take those risks into account when assessing overall solvency needs.[76] In addition, all assets must be invested in a manner that ensures the security, quality, *liquidity* and profitability of the portfolio as a whole.[77] At level 3, EIOPA's guidelines regarding the prudent person principle state that

[69] IAIS (2016b), para. 2.1-2-3, IAIS (2016a), para. 25 and p. 14, table 2, and IAIS (2013a), para. 29 and p. 16.

[70] Para. 29 and 34.

[71] EIOPA (2017c), pp. 43-44, EIOPA (2018e), pp. 51-52, and EIOPA (2018f), pp. 43-44.

[72] Solvency II, recital 71.

[73] Solvency II, recital 67.

[74] Solvency II, recital 72 and art. 133.

[75] Solvency II, recital 71 and title I, chapter VI, section 6, including art. 132.

[76] Solvency II, art. 132(2), subpara. 1.

[77] Solvency II, art. 132(2), subpara. 2.

life insurance undertakings should regularly review and monitor the security, quality, *liquidity* and profitability of the portfolio as a whole, including liability constraints, diversification, the characteristics[78] of assets (including liquidity, gearing or encumbrances) and availability (including over-collateralisation and lending).[79] EIOPA's guidelines also state that life insurance undertakings' investment decisions should consider the associated risks without relying only on the risk being adequately captured by capital requirements.[80]

Accordingly, and in line with the Solvency II project, the prudent person principle entails qualitative liquidity requirements that apply upon all assets. In addition, and similar to CEIOPS' advice, qualitative requirements apply upon assets that cover technical provisions. The prudent person principle entails that assets, which cover technical provisions, must be invested in a manner appropriate to the nature and duration of the insurance liabilities.[81] Those assets must be invested in the best interest of all policyholders and beneficiaries while taking into account any disclosed policy objective.[82] In relation to assets, where the investment risk is *not* borne by the policyholder, or assets related to a guarantee of investment performance or other guaranteed benefit (in relation to e.g. unit-linked products), the prudent person principle entails, inter alia, that:

- investment and assets, which are not admitted to trading on a regulated financial market, must be kept to prudent levels.[83] EIOPA's guidelines also provide that assets, which are admitted to trading on a regulated market but not traded (or traded on a non-regular basis), should be treated similarly to assets not admitted to trading on a regulated market.[84]

- assets must be properly diversified to (i) avoid excessive reliance on any particular asset, issuer or group or geographical area and (ii) avoid excessive accumulation of risk in the portfolio as a whole.[85] In addition, excessive risk concentration must not be created via assets issued by the same issuer or by issuers belonging to the same group.[86]

Liquidity risk is therefore addressed via pillar 2 of Solvency II, including the prudent person principle.[87]

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[78] They also include e.g. (i) credit quality of counterparties and (ii) existence and quality of collateral or other assets backing the assets.

[79] EIOPA Guidelines (2014c), para. 1.11 and 1.68. See also guideline 28(d) regarding non-routine investment activities.

[80] EIOPA Guidelines (2014c), para. 1.65.

[81] Solvency II, art. 132(2), subpara. 3.

[82] Solvency II, art. 132(2), subpara. 3.

[83] Solvency II, art. 132(3), subpara. 4, and (4), subpara. 3. The use of derivatives is also allowed if it contributes to a reduction of risks or facilitates efficient portfolio management, cf. Solvency II, art. 132(3), subpara. 4, and (4), subpara. 2. EIOPA (2018e) (p. 53.) stated that it is not clear what the criterion "efficient portfolio management" means and that e.g. the speculative use of derivatives is not explicitly forbidden.

[84] EIOPA Guidelines (2014c), para. 1.74.

[85] Solvency II, art. 132(3), subpara. 4, and (4), subpara. 4.

[86] Solvency II, art. 132(4), subpara. 5.

[87] See e.g. EIOPA (2018e), p. 28.

The prudent person principle is considered capable of regulating shadow banking. In relation to SFTs and the management and valuation of financial collateral, European Commission (2017b) stated that insurance undertakings can only invest in assets and instruments whose risks they can properly identify, measure, monitor and control, and that insurance undertakings can engage in SFTs if the prudent person principle is satisfied.[88] EIOPA (2018e) has subsequently stated that the prudent person principle is to discourage excessive involvement in certain products and activities, including repos and securities lending, that are more risky and could be more prone to systemic risk.[89] However, ESRB (2015) and EIOPA (2018e) consider the prudent person principle to be a replacement of quantitative limits.[90] Contrary to "hard" regulatory limits, EIOPA views the prudent person principle as allowing insurance undertakings flexibility, in relation to investment strategies and asset-liability management, as they are not forced or induced to invest in certain asset classes.[91] At the same time, EIOPA views it as a challenging task to verify compliance with the liquidity aspects of the prudent person principle due to its "principle-based nature" as well as the lack of clear definitions and indicators.[92] The nature of the prudent person principle and the lack of a prolonged experience also makes it difficult for EIOPA to assess the prudent person principle's contribution to mitigating systemic risk.[93]

The prudent person principle is accordingly not a quantitative requirement or "similar" to the finalised Basel III's LCR or NSFR. As described in chapter 12.4 below, the LCR entails that banks must have certain high-quality liquid assets to survive a significant stress scenario lasting 30 calendar days. In addition, the NSFR requires banks to match the liquidity characteristics and residual maturities of various assets with stable funding in the form of capital and liabilities that are expected to be reliable over a one-year time horizon.

In chapter 6.3.1, this dissertation documented Danish life insurance undertakings' non-compliance with the collateral reporting obligation in relation to repos, including after Solvency II entered into force in 2016. If life insurance undertakings are not able to ensure compliance with - or demonstrate sufficient comprehension of - the collateral reporting obligation and repos, it may indicate uncertainty in relation to liquidity risk management and compliance with the prudent person principle for repos.[94]

Part IX compares the finalised Basel III's and Solvency II's approaches to systemic risk. In relation to this risk type, the prudent person principle only targets a life insurance undertaking's own investment strategy and does not target macro-level aspects, e.g. that the life insurance sector may generally

[88] P. 9. When doing so, collateral has to be valued in accordance with Solvency II and the Solvency II Delegated Regulation.

[89] Pp. 52-53.

[90] ESRB (2015), p. 24, and EIOPA (2018e), pp. 51-52. See also EIOPA Guidelines (2014c), para. 1.11.

[91] EIOPA (2018e), p. 52.

[92] EIOPA (2018e), p. 33.

[93] EIOPA (2018e), p. 52.

[94] European Commission (2017b), p. 9.

be concentrated in the same specific exposures and create systemic risk via common exposures and herding behavior.[95] In addition to liquidity risk, the finalised Basel III's LCR and NSFR address systemic risk as they are both to protect against the liquidity shocks that had systemic implications during the financial crisis.[96]

12.3 Overview of Findings in relation to Liquidity Risk

The general provisions for the SCR prescribe that the SCR must be calibrated to ensure that *all quantifiable risk exposures* are taken into account.[97] In the SCR internal model, a life insurance undertaking must ensure that the internal model covers *all material risk exposures* and it must include *at least* the risk types in the general provisions for the SCR, which are non-life, life and health underwriting risks, market risk, credit risk and operational risk.[98] In addition, the SCR internal model must take account of all expected payments to policyholders and beneficiaries regardless of such payments being contractually guaranteed.[99]

From a liquidity risk perspective, the SCR standard formula includes

- the life insurance-specific lapse risk sub-module, in the life underwriting risk module,
- the market risk module that is to properly reflect the structural mismatch between assets and liabilities, and
- the market risk concentrations sub-module that captures additional risks stemming from a lack of diversification in the asset portfolio or from large exposure to default risk by a single issuer of securities or a group of related issuers.[100]

In line with CEIOPS advice described in chapter 12.1, non-insurance-based liquidity risk is not explicitly included in the general provisions for the SCR or as a risk module in the SCR standard formula.[101] The SCR standard formula's underlying assumptions state that a liquidity risk capital requirement would be ineffective and that it was appropriate to cover liquidity risk by an explicit liquidity risk management policy, within the overall risk management system, as well as that insurance undertakings had to disclose qualitative and quantitative information regarding their risk profile.[102] In its macroprudential assessment

[95] EIOPA (2018e), p. 42.
[96] BCBS Basel III (2013), para. 1-4 and 20, BCBS Basel III (2014b), para. 1-5, and Basel III, para. 34-42.
[97] Solvency II, art. 101(3).
[98] Solvency II, art. 101(4) and 121(4).
[99] Solvency II, art. 121(9).
[100] Solvency II, art. 105(3)(f) and (5)(f).
[101] Solvency II, art. 101(4) and 104-105, and EIOPA (2014c), p. 11.
[102] EIOPA (2014c), p. 11.

of Solvency II, EIOPA (2018e) similarly stated that Solvency II's capital-based framework focused on solvency - and not specifically on liquidity - as well as that Solvency II relied upon pillar 2 requirements to address liquidity risk, including the prudent person principle, risk management and the ORSA.[103] Risk management and the ORSA were initially presented in chapter 3.2 above.

The market risk concentrations sub-module may incentivise life insurance undertakings to hold more diversified assets. However, Solvency II, including the prudent person principle, does not subject non-insurance liquidity risk to an explicit quantitative pillar 1 requirement.[104] The finalised Basel III includes the quantitative LCR and NSFR that are presented in chapter 12.4 below. In addition, and as described in chapters 9 and 10.6.1, the finalised Basel III's capital requirements for market risk, in the trading book, address market liquidity risk via the internal models approach's liquidity horizons or the standardised approach's risk weights that mirror the liquidity horizons.

Solvency II's approach to liquidity risk is similar to the IAIS' global approach to supervision and solvency. The IAIS' insurance core principles recognise that liquidity risk may be less quantifiable.[105] In addition, the IAIS' proposed risk-based global insurance capital standard for internationally active insurance groups does not include prescribed quantitative capital requirements for liquidity risk (except for lapse risk under insurance risks) as liquidity risk was considered better captured via supervisory tools and instruments, e.g. stress testing.[106] However, as shown in part IX below, this is not the case in relation to the IAIS' approach to G-SII's liquidity risk and shadow banking.

One could argue that liquidity risk or another non-prescribed risk type can be addressed "quantitatively" via Solvency II's supervisory review, including the capital add-on. Such a capital add-on would entail that the risk type becomes subject to a quantitative capital requirement. However, as shown next, the capital add-on is microprudential and not meant to address systemic risk or shadow banking.

12.3.1 Supervisory Review, Capital Add-On and Macroprudential Purposes?

The recitals of Solvency II state that the SCR standard formula is intended to reflect the risk profile of most insurance undertakings but that there may be cases where the SCR standard formula does not adequately reflect the specific risk profile of an insurance undertaking.[107] An SCR internal model may also be "hit" by significant deficiencies.[108]

Solvency II accordingly provides that if the risk profile of a life insurance undertaking deviates "significantly" from the assumptions underlying the SCR

[103] Pp. 28, 30 and 33.
[104] See also EIOPA (2018e), p. 28.
[105] IAIS (2018b), para. 17.7.5-17.7.6.
[106] IAIS (2018c), para. 204-206, 386 and 390.
[107] Solvency II, recital 26.
[108] Solvency II, recital 28.

standard formula, which makes it inappropriate to calculate the SCR in accordance with the SCR standard formula, the supervisory authority may require the life insurance undertaking to use an SCR internal model to calculate the SCR or the relevant risk modules.[109] In addition, and subject to the supervisory review process, supervisory authorities may set a capital add-on for a life insurance undertaking whereby the SCR plus the capital add-on replaces the inadequate SCR.[110] However, the capital add-on is only to be used in *"exceptional circumstances"* and in specific cases, including when the risk profile of the life insurance undertaking deviates significantly from the assumptions underlying the SCR as calculated via the SCR standard formula or SCR internal model.[111] "Exceptional" means that the capital add-on should be used only as a *"measure of last resort"* when other supervisory measures are ineffective or inappropriate.[112] In addition, "exceptional" should be understood in the context of the specific situation of each life insurance undertaking rather than in relation to the number of capital add-ons imposed in a specific market.[113] In its level 2 advice, CEIOPS (2009b) stated that the expression "last resort measure" entails that other potential management actions of the life insurance undertaking and/or alternative measures applied by the supervisory authority to remedy the deviation have failed, are unlikely to succeed or are not feasible.[114]

[109]Solvency II, art. 119.

[110]Solvency II, recitals 26-27 and art. 37, and Solvency II Delegated Regulation, title I, chapter X.

[111]Solvency II, recitals 26-27 and art. 37, and Solvency II Delegated Regulation, title I, chapter X. The capital add-on can only be imposed in the following cases: ***(I)*** The risk profile deviates significantly from the assumptions underlying the SCR standard formula and, inter alia, a requirement to use an SCR internal model is inappropriate or has been ineffective, cf. Solvency II, art. 37(1)(a), and Solvency II Delegated Regulation, art. 276, 279, 280 and 282-283. In this case, the capital add-on is to ensure that the SCR captures all quantifiable risk exposures, cf. Solvency II, art. 37(2), subpara. 1, and 101(3), and Solvency II Delegated Regulation, art 282-283. ***(II)*** The risk profile deviates significantly from the assumptions underlying an SCR internal model (or partial internal model) because certain quantifiable risks are captured insufficiently and a necessary adaptation of the SCR internal model has failed within an appropriate timeframe, cf. Solvency II, art. 37(1)(b), and Solvency II Delegated Regulation, art. 276, 279, 281 and 282-283. This capital add-on is also to ensure that the SCR captures, inter alia, all quantifiable risk exposures, cf. Solvency II, art. 37(2), subpara. 1, and 101(3), and Solvency II Delegated Regulation, art 282-283. ***(III)*** The system of governance deviates significantly from the Solvency II standards and those deviations prevent the life insurance undertaking from being able to properly identify, measure, monitor, manage and report the risks, which the life insurance undertaking is - or could be - exposed to, and the application of other measures is in itself unlikely to improve the deficiencies sufficiently within an appropriate timeframe, cf. Solvency II, art. 37(1)(c), and Solvency II Delegated Regulation, art. 277, 281 and 286. In this case, the capital add-on is to be proportionate to the material risks arising from the deficiencies, cf. Solvency II, art. 37(2), subpara. 2. ***(IV)*** The life insurance undertaking applies long-term guarantee measures (including the matching adjustment and the volatility adjustment described in chapter 13.1 below) and the risk profile deviates significantly from the assumptions underlying those measures, cf. Solvency II, art. 37(1)(d), and Solvency II Delegated Regulation, art. 278 and 284-285. In this case, the capital add-on is to be proportionate to the material risks arising from the deviation, cf. Solvency II, art. 37(2), subpara. 3.

[112]Solvency II, recitals 26 and 27.

[113]Solvency II, recitals 26 and 27.

[114]Para. 3.7.

Solvency II's capital add-on is fundamentally different from the supervisory review process in the finalised Basel III. Principle 3 of the finalised Basel III states that pillar 1 requirements embody minimum goals for soundness and include a buffer for uncertainties surrounding pillar 1 that affect the banking population as a whole.[115] Principle 3 also states that bank-specific uncertainties must be treated under pillar 2 and that supervisors "will typically require (or encourage)" banks to operate with a buffer above pillar 1 capital requirements.[116] The additional buffer can consider, inter alia, bank-specific risks, or risks associated with the economy at large, that are not included in pillar 1.[117] In order to ensure that individual banks have adequate levels of capital, supervisory authorities can set trigger and target capital ratios or define categories above minimum ratios to identify the capitalisation level of the bank.[118] Supervisory authorities are also free to require additional levels of liquidity if they assess that the LCR does not adequately reflect the liquidity risks of a bank.[119]

The finalised Basel III's bank-specific capital requirements are accordingly to be set as a typical part of the supervisory review, while Solvency II's capital add-on is a "measure of last resort". In Denmark, and in line with this point, Danish FSA (2018a) stated that no Danish insurance undertaking had so far been imposed a capital add-on.[120] The repos documented in chapter 6.3.1 have accordingly not led to capital add-ons that reflect the liquidity risks associated with repos or a lack of compliance with the collateral reporting obligation.

The capital add-on reflects the initial purpose of Solvency II, which states that the main objective of insurance regulation and supervision is the adequate protection of policyholders and beneficiaries.[121] The recitals also state that financial stability and fair and stable markets are other objectives of insurance regulation and supervision, which should also be taken into account but should not undermine the main objective.[122] However, without "prejudice" to the main objective, supervisory authorities must consider the potential impact of their decisions on financial stability as well as the potential procyclical effects of their actions in times of exceptional movements in the financial markets.[123] In its level 2 advice, CEIOPS (2009b) stated that procyclicality considerations should not prevent the supervisory authority from setting a capital add-on where this is necessary to reflect the true risk profile of insurance undertakings.[124] However, if a number of insurance undertakings breached the SCR, as a consequence of the setting of a capital add-on, the supervisory authority was to exercise its

[115] BCBS Consol. Basel III (2019), SRP20.42.
[116] BCBS Consol. Basel III (2019), SRP20.42.
[117] BCBS Consol. Basel III (2019), SRP20.42.
[118] BCBS Consol. Basel III (2019), SRP20.43.
[119] BCBS Basel III (2013), para. 6.
[120] Danish FSA (2018a), p. 12. In 2019, a Danish *non-life* insurance undertaking was imposed a capital add-on, cf. Danish FSA (2019a).
[121] Solvency II, recital 16 and art. 27.
[122] Solvency II, recital 16.
[123] Solvency II, art. 28.
[124] Para. 3.13.

powers with due regard to the procyclical effects.[125] Solvency II's supervision does accordingly not have financial stability as its main objective but it does - to a certain extent - consider the procyclical effects of supervision.

Similar to Solvency II's main objective, EIOPA (2018e) states that the capital add-on allows supervisors to increase capital requirements on a case-by-case basis in order to protect policyholders while also seeking to preserve a level playing field.[126] However, ESRB (2015) and EIOPA (2018e) describe how the capital add-on is *micro*prudential and not meant to address systemic risk or to be used for purely macroprudential reasons in relation to certain activities, including non-insurance activities such as repos.[127] Solvency II's capital add-on can therefore not be perceived as equivalent to the setting of bank-specific capital requirements under the finalised Basel III's supervisory review.

By nature, pillar 2 requirements and risk management depend on qualitative aspects, individual assessments and discretion. The history of the Basel framework has showed that the regulation of liquidity risk, via only pillar 2, can entail a lack of proper handling of the actually incurred liquidity risk. Prior to the financial crisis and the introduction of the LCR and NSFR, Basel II's principle 1 (in the supervisory review) prescribed an obligation for banks to establish a process for assessing their overall capital adequacy, in relation to their risk profiles, and a strategy for maintaining the capital level.[128] The capital assessment process, which was to capture all material risk exposures, considered liquidity as "crucial to the ongoing viability of any banking organisation".[129] It included stress tests and market liquidity risk (under market risk) and an obligation for each bank to have adequate systems for measuring, monitoring and controlling liquidity risk and to evaluate the adequacy of capital based on its own liquidity profile and the liquidity of the markets in which it operated.[130] In addition, the supervisory review's principle 2 prescribed that supervisory authorities were to regularly review a bank's process for assessing its capital adequacy, risk position, resulting capital levels and the quality of its capital.[131] As described above, and despite Basel II's supervisory review process, the "liquidity phase" of the financial crisis entailed that banks experienced difficulties - despite adequate capital levels - because they did not manage their liquidity in a "prudent manner".[132]

If this can occur in relation to banks, where liquidity risk is a part of the fundamental nature of banking, then it seems possible that the same may occur if life insurance undertakings expose themselves to the same form of liquidity risk via repos and other SFTs. In relation to the documentation of the five Danish life insurance undertakings' repos, chapter 6.3.1 identified the lack of compliance with the collateral reporting obligation. Chapter 6.3.1.8 then reviewed those life

[125] CEIOPS (2009b), para. 3.13.
[126] P. 23.
[127] ESRB (2015), pp. 24-26, and EIOPA (2018e), p. 23.
[128] Basel II, para. 725, 727, and 731.
[129] Basel II, para. 727, 732 and 741.
[130] Basel II, para. 727, 738, 738(ii) and 741.
[131] Basel II, para. 746.
[132] Basel III, para. 35, BCBS Basel III (2013), para. 2, and BCBS Basel III (2014b), para. 3.

insurance undertakings' solvency and financial condition reports and none of them specifically addressed repos in relation to liquidity risk. The next chapter will accordingly discuss how the finalised Basel III's LCR and NSFR can be adapted to address repos and non-insurance liquidity risk in life insurance.

12.4 LCR, NSFR and Life Insurance Undertakings' Shadow Banking

The previous chapter concluded that Solvency II does not include an explicit quantitative requirement for non-insurance liquidity risk. The finalised Basel III includes the LCR and NSFR, which are two minimum quantitative standards for funding and liquidity that became fully effective global standards as of 1 January, 2019.[133] This chapter will therefore firstly describe the LCR and NSFR, in an overall fashion, and then discuss how these two standards can be adapted to address liquidity risk in relation to life insurance undertakings' non-insurance activities, including repos and other SFTs. When doing so, it is essential to distinguish between:

- traditional life insurance obligations/liabilities, which Solvency II prescribes must be met with technical provisions and which are generally long-term and subject to the law of large numbers, and
- non-insurance liabilities/activities in the form of e.g. repos and other SFTs.[134]

Due to Solvency II's requirement regarding technical provisions, as well as the nature of life insurance liabilities, this chapter will only focus on non-insurance liabilities and activities, including repos, that presumably expose life insurance undertakings and banks to the same liquidity risks, including roll-over risk, margin calls, haircuts and the "run on repo".[135]

12.4.1 LCR

The LCR is to promote the short-term resilience of the liquidity risk profile of banks, and it aims to ensure that banks have a stock of unencumbered high-quality liquid assets ("HQLA") that consists of cash or assets that can "easily and immediately" be converted into cash in private markets, at little or no loss of value, to meet the banks' liquidity needs for a 30 calendar day liquidity stress scenario.[136] During periods without stress, the LCR's ratio can be no lower than 100%, but banks can use their HQLA during periods of both idiosyncratic and

[133] Basel III, para. 37-38, BCBS Consol. Basel III (2019), LCR (including LCR90.1) and NSF, BCBS Basel III (2013) and BCBS Basel III (2014b).
[134] Solvency II, art. 76, and CEIOPS (2005b), para. 10.33.
[135] See, inter alia, Brunnermeier and Pedersen (2009), Gorton and Metrick (2012) and Copeland et al. (2014).
[136] BCBS Consol. Basel III (2019), LCR20.1, and BCBS Basel III (2013), para. 1, 4, 14 and 16. See also Basel III, para. 38 and 40-41.

systemic stress and fall below the 100% LCR.[137] The LCR should accordingly enable a bank to survive during the 30-day period, and ensure enough time for corrective actions by the management and supervisory authority and allow central banks to take any "necessary and appropriate" measures.[138]

The LCR is to be viewed via a financial crisis-inspired idiosyncratic and market-wide shock scenario that includes, inter alia, (i) the run-off of a proportion of retail deposits, (ii) a partial loss of unsecured wholesale funding, (iii) a partial loss of secured short-term financing with certain collateral and counterparties, e.g. repos, (iv) additional contractual outflows, including collateral posting requirements, due to a downgrade in the bank's external credit assessment by up to and including three notches, and (v) increases in market volatilities, which impact the quality of collateral or derivatives' potential future exposure, that require larger haircuts or additional collateral or lead to other liquidity needs.[139]

In the EU, only banks (i.e. credit institutions) may take deposits or other repayable funds from the public.[140] Life insurance undertakings can accordingly not be affected by a run on deposits in the LCR's scenario above. Deposits will therefore generally not be included in the following. However, as experienced in relation to AIG, the other elements in the scenario are equally relevant for life insurance undertakings that engage in SFTs and derivatives.[141]

The LCR was inspired by internal coverage ratios in banking and relies on two components in the form of

- the value of the stock of unencumbered and "monetisable" HQLA in stressed conditions, and
- total net cash outflows over the next 30 calendar days calculated via prescribed parameters for the specified stress scenario.[142]

"Unencumbered" entails that the asset cannot be pledged and must be free of legal, regulatory, contractual or other restrictions on the bank's ability to liquidate, sell, transfer or assign the asset.[143] However, in relation to financial collateral in repos and other SFTs, received and non-re-used (i.e. non-rehypothecated) assets, which are held at the bank and legally and contractually available for the bank's use, can be considered as HQLA.[144]

The LCR can be summarised as

[137] BCBS Consol. Basel III (2019), LCR20.5 and 20.6(4), and BCBS Basel III (2013), para. 11, 17 and 18(d).
[138] BCBS Basel III (2013), para. 16.
[139] BCBS Consol. Basel III (2019), LCR20.2, and BCBS Basel III (2013), para. 19-20.
[140] CRD IV, art. 9(1).
[141] See e.g. IAIS (2011), para 18 and appendix A7, IAIS (2017), p. 14, FSB (2012c), section 5.6, EIOPA (2017c), p. 46, EIOPA (2018f), p. 44, and McDonald and Paulson (2015), pp. 86-87 and 102.
[142] BCBS Consol. Basel III (2019), LCR20.4-5, LCR30 and LCR40, and BCBS Basel III (2013), para. 17 and 22-23. See also the LCR's operational requirements in BCBS Consol. Basel III (2019), LCR30.13, and BCBS Basel III (2013), para. 28.
[143] BCBS Consol. Basel III (2019), LCR30.16, and BCBS Basel III (2013), para. 31.
[144] BCBS Consol. Basel III (2019), LCR30.16, and BCBS Basel III (2013), para. 31.

$$\frac{HQLA_{Stock}}{TotalNetCashOutFlows_{30days}} \geq 100\%$$

HQLA must be liquid during stress periods and "ideally" be eligible at central banks for intraday liquidity needs and overnight liquidity facilities.[145] In order to be eligible as HQLA, assets must be able to "easily and immediately" be converted into cash, at little or no loss of value, and the LCR assumes that some assets can be "monetised" via a sale - or as collateral in repos - without incurring large "fire-sale" discounts or haircuts during periods of severe idiosyncratic and market stress.[146] The LCR is accordingly also to ensure that banks do not trigger the liquidity spiral (that is incorporated into this dissertation's scope) by trying to obtain liquidity from non-HQLA assets and thereby cause fire sales and mark-to-market losses for other banks and undertakings that are exposed to those assets.[147]

In accordance with the above, HQLA are defined via characteristics that are associated with higher liquidity, including fundamental[148] and market[149] characteristics.[150] Based on these characteristics, the LCR includes two categories of assets that can be included in the HQLA:

- *level 1 assets* that are *not* subject to limits or haircuts and include, inter alia, (i) certain central bank reserves, such as overnight deposits and term deposits, (ii) 0% risk-weighted[151] marketable claims on sovereigns, central banks, the ECB, the European Stability Mechanism and the European Financial Stability Facility that are traded in large, deep, active and low-level-concentrated repo or cash markets, and (iii) certain non-0% risk-weighted sovereign or central bank debt securities.[152]

- *level 2 assets* that are subject to haircuts and can only amount to 40% of the HQLA, after the haircuts, and which may - if allowed by the supervisory authority - include level 2b assets that can amount to no more than 15% of the total HQLA.[153]

The current market values of level 2a assets (in case level 2b assets are allowed) are subject to haircuts of 15%, and level 2a assets include, inter alia, (i) certain

[145] BCBS Consol. Basel III (2019), LCR30.1 and 30.4, and BCBS Basel III (2013), para. 23 and 26.

[146] BCBS Consol. Basel III (2019), LCR30.2-3, and BCBS Basel III (2013), para. 24.

[147] BCBS Consol. Basel III (2019), LCR30.3, and BCBS Basel III (2013), para. 25.

[148] I.e. low risk, the ease and certainty of market valuation, low correlation with assets that are risky during stress, and being listed on exchanges.

[149] I.e. an active and sizeable market for the asset, low volatility prices and haircuts over time, and the asset being a "flight to quality" asset.

[150] BCBS Consol. Basel III (2019), LCR30.2 and 30.6-30.12, and BCBS Basel III (2013), para. 24.

[151] Under the standardised approach for credit risk.

[152] BCBS Consol. Basel III (2019), LCR30.31, 30.40-41 and LCR99.1, and BCBS Basel III (2013), para. 46 and 49-50.

[153] BCBS Consol. Basel III (2019), LCR30.31, 30.33-39, 30.42-46, and LCR99.1, and BCBS Basel III (2013), para. 48 and 51-54.

20% risk-weighted[154] marketable claims on sovereigns and central banks and (ii) certain non-financial and non-affiliated corporate debt securities and commercial paper, as well as certain non-affiliated covered bonds, all with an external or internal rating of AA- or higher.[155] Level 2a assets must be traded in large, deep, active and low-level-concentrated repo or cash markets, and be a proven reliable source of liquidity during stressed market conditions, which is determined via recorded declines in prices or increases in haircuts.[156]

The current market values of level 2b assets are subject to larger haircuts than level 2a assets, and level 2b assets include, inter alia, (i) certain non-originated, non-affiliated, AA-rated and "full recourse" residential mortgage-backed securities subject to a haircut of 25%, (ii) certain non-affiliated and non-financial corporate debt securities and commercial paper, with external or internal ratings of at least BBB-, which are subject to a haircut of 50%, (iii) certain listed, centrally-cleared, non-financial and non-affiliated common equity shares, which are constituents in major stock indices, that are subject to a haircut of 50%.[157] Level 2b assets must also be traded in large, deep, active and low-level-concentrated repo or cash markets, and be a proven reliable source of liquidity during stressed market conditions, as determined via recorded declines in prices or increases in haircuts.[158]

The stock of HQLA is to be well-diversified except for certain sovereign debt, central bank reserves, central bank debt securities and cash.[159] As described above, the LCR entails that banks are required to obtain specific and sufficient HQLA to at least match the defined net cash outflows over the next 30 calendar days. However, some jurisdictions do not have a sufficient amount of level 1 and/or level 2 assets to fulfil the LCR (when the required level 1 or level 2 asset may have to be in the currency of the bank's home country or the specific liquidity risk's currency), and the finalised Basel III accordingly includes a specific treatment for jurisdictions with insufficient HQLA, which is expected to apply to a limited number of currencies and jurisdictions.[160]

None of the HQLA assets above appear to be bank-specific and can presumably also be found in the balance sheets of life insurance undertakings. Some of the HQLA assets are even subject to specific treatment in the SCR standard formula's spread risk sub-module.[161] However, the introduction of an LCR for life insurance undertakings would obviously entail quantitative limits on investments and put additional pressure upon any HQLA shortages.

The second component in the LCR is the *total net cash outflows,* which

[154] Under the standardised approach for credit risk.
[155] BCBS Consol. Basel III (2019), LCR30.42-43 and LCR99.1, and BCBS Basel III (2013), para. 51-52.
[156] BCBS Consol. Basel III (2019), LCR30.43, and BCBS Basel III (2013), para. 52.
[157] BCBS Consol. Basel III (2019), LCR30.44-46 and LCR99.1, and BCBS Basel III (2013), para. 53-54.
[158] BCBS Consol. Basel III (2019), LCR30.45, and BCBS Basel III (2013), para. 54.
[159] BCBS Consol. Basel III (2019), LCR30.29, and BCBS Basel III (2013), para. 44.
[160] BCBS Consol. Basel III (2019), LCR30.32, 30.41(4)-(5), 30.45(3)(d) and LCR31, and BCBS Basel III (2013), para. 50(d)-(e), 54(c) and 55.
[161] See chapter 10.3.2.

- under the specified stress scenario for the subsequent 30 calendar days - is defined as the

- *total expected cash outflows* (that are calculated by multiplying the outstanding balances of liabilities and off-balance sheet commitments by prescribed run-off rates that reflect the expected run-offs or draw-downs) *minus*

- *total expected cash inflows* (that are subject to a cap of 75% of total expected cash outflows and calculated by multiplying the outstanding balances of contractual receivables by prescribed inflow rates that reflect how inflows are expected to flow under the scenario).[162]

The LCR can accordingly also be summarised as:

$$\frac{HQLA_{Stock}}{TotalExpCashOutflows_{30days} - TotalExpCashInflows_{30days,75\%cap}} \geq 100\%$$

where the component total expected cash inflows is subject to the cap of 75% of total expected cash outflows. The 75% cap is to ensure that banks have a minimum level of HQLA, and do not rely solely on anticipated inflows to meet the LCR, and it entails that 25% of the total expected cash outflows must be covered by HQLA.[163] Cash inflows, which are associated with an HQLA asset, cannot be included in the total expected cash inflows.[164]

Total expected cash outflows over the 30-day horizon include, inter alia, the following items and run-off rates:

- Retail deposits, including demand deposits and term deposits, which are categorised as either (i) "stable" and subject to a minimum run-off rate of 3%, if they are, inter alia, in transactional accounts that are fully insured by an "effective"[165] deposit insurance scheme, or equivalent protection, and a part of an established relationship between the depositor and the bank, or (ii) "less stable" and subject to a minimum run-off rate of 10%.[166] Term deposits are excluded if they have a residual maturity or withdrawal notice period of more than 30 days (and the depositor has no legal right to withdraw deposits within the 30-day horizon or is subject to a significant penalty in case of an early withdrawal), and individual jurisdictions are expected to determine higher run-off rates that reflect the depositor behaviour in a period of stress in each jurisdiction.[167]

[162] BCBS Consol. Basel III (2019), LCR40.1 and 40.77, and BCBS Basel III (2013), para. 69 and 144.

[163] BCBS Consol. Basel III (2019), LCR40.77, and BCBS Basel III (2013), para. 144.

[164] BCBS Consol. Basel III (2019), LCR40.4, and BCBS Basel III (2013), para. 72.

[165] The deposit insurance scheme has to meet defined criteria in order to, inter alia, be an "effective" deposit insurance scheme, cf. BCBS Consol. Basel III (2019), LCR40.8 and 40.11, and BCBS Basel III (2013), para. 76 and 78.

[166] BCBS Consol. Basel III (2019), LCR40.5-18 and LCR99.1, and BCBS Basel III (2013), para. 73-84.

[167] BCBS Consol. Basel III (2019), LCR40.6, 40.13, 40.15-16, 40.18 and LCR99.1, and BCBS Basel III (2013), para. 74 and 79 and 81-82 and 84.

- Various types of unsecured wholesale funding from non-natural persons (e.g. unsecured debt securities as well as operational deposits generated by clearing, custody and cash management activities) is included if it has an undetermined maturity or is callable - or has its earliest possible contractual maturity date - within the 30-day horizon.[168] Under this type of unsecured wholesale funding, deposits and other funding (including via bonds and other debt securities) from banks, securities firms and insurance undertakings (that are not related to clearing, custody and cash management activities) receives a run-off rate of 100%.[169]

- In relation to secured funding, it is assumed that only repos and other SFTs that are backed by HQLA, or entered into with the bank's domestic sovereign or central bank, can be transacted by the bank.[170] Accordingly, the amount of funding raised via *outstanding* repos, which have maturities within the 30-day horizon, are subject to run-off rates that depend on the type of financial collateral and/or counterparty.[171] A bank's repos with its domestic central bank, as well as level 1 asset-backed repos, are not subject to a reduction in funding availability (similar to the haircuts used in the determination of HQLA).[172] In addition, a bank's domestic sovereign is considered unlikely to withdraw secured funding during a market-wide stress, and a 25% run-off rate is applied upon outstanding repos, which are not backed by level 1 or level 2a assets, with that domestic sovereign.[173] In line with the haircut percentages prescribed for level 2 assets in the HQLA, run-off rates are applied to repos backed by level 2 assets, while all other non-specified secured funding transactions are subject to a run-off rate of 100%.[174] A level 2a asset-backed repo is accordingly subject to a 15% run-off rate while a level 2b asset-backed repo is subject to a 50% run-off rate (except for a 25% run-off rate for level 2b residential mortgage-backed securities).[175]

- A run-off rate of 100% applies to collateral or cash outflows that must be posted due to any downgrade up to and including a 3-notch downgrade.[176]

[168] BCBS Consol. Basel III (2019), LCR40.19-21, 40.26-36 and LCR99.1, and BCBS Basel III (2013), para. 85-88 and 93-104.
[169] BCBS Consol. Basel III (2019), LCR40.42-43 and LCR99.1, and BCBS Basel III (2013), para. 109-110.
[170] BCBS Consol. Basel III (2019), LCR40.45-46, and BCBS Basel III (2013), para. 112-13.
[171] BCBS Consol. Basel III (2019), LCR40.46-48, and BCBS Basel III (2013), para. 113-15.
[172] BCBS Consol. Basel III (2019), LCR40.47 and LCR99.1, and BCBS Basel III (2013), para. 114 and 115.
[173] BCBS Consol. Basel III (2019), LCR40.47-48 and LCR99.1, and BCBS Basel III (2013), para. 114-15.
[174] BCBS Consol. Basel III (2019), LCR40.47-48 and LCR99.1, and BCBS Basel III (2013), para. 114-15.
[175] BCBS Consol. Basel III (2019), LCR40.47-48 and LCR99.1, and BCBS Basel III (2013), para. 114-15.
[176] BCBS Consol. Basel III (2019), LCR40.51 and LCR99.1, and BCBS Basel III (2013), para. 118.

- The increased liquidity needs, due to mark-to-market valuation changes on posted collateral, must be included in the form of 20% of the notional value of non-level 1 posted collateral after the application of any haircuts.[177]

- Increased liquidity needs, due to mark-to-market valuation changes on derivatives or other transactions, must also be included.[178]

As stated above, deposit cash outflows are not relevant in relation to life insurance undertakings' possible shadow banking as the EU only allows banks (i.e. credit institutions) to take deposits or other repayable funds from the public.[179] However, the remaining expected cash outflow rates above can be relevant, especially secured funding outflow rates that would address deposit-like outflows due to life insurance undertakings' repos and other SFTs. In addition, other forms of cash outflows may become relevant if life insurance undertakings' alternative credit investments assume the characteristics of committed credit facilities or if they offer committed liquidity facilities.[180]

The second component in the calculation of the LCR's total net cash outflows is the total *expected cash inflows*, over the 30 calendar days, which are subtracted from the described total expected cash outflows and subject to the cap of 75% of total expected cash outflows.[181] Total expected cash inflows include non-contingent contractual inflows (e.g. interest payments) from outstanding exposures that are fully performing and not expected to a default within the 30-day horizon.[182] Total expected cash inflows are subject to the following examples of inflow rates:

- Reverse repos, which are secured by non-HQLA assets, are assumed to not be rolled-over and are accordingly subject to a 100% inflow rate on the cash financial collateral on those transactions.[183] Reverse repos, which are secured by level 1 assets, are assumed to be rolled-over and receive a 0% inflow rate, while reverse repos, secured by level 2 assets, are assumed to lead to a cash inflow rate similar to the haircuts on level 2 assets in the HQLA.[184] Financial collateral, in the form of level 2a assets, accordingly leads to a 15% inflow rate while level 2b assets lead to a 50% inflow rate (except for a 25% inflow rate when level 2b residential mortgage-backed securities are used).[185] If the received financial collateral is re-used and

[177]BCBS Consol. Basel III (2019), LCR40.52 and LCR99.1, and BCBS Basel III (2013), para. 119.
[178]BCBS Consol. Basel III (2019), LCR40.56 and LCR99.1, and BCBS Basel III (2013), para. 123.
[179]CRD IV, art. 9(1).
[180]BCBS Consol. Basel III (2019), LCR40.59-64, and BCBS Basel III (2013), para. 126-131.
[181]BCBS Consol. Basel III (2019), LCR40.1, and BCBS Basel III (2013), para. 69.
[182]BCBS Consol. Basel III (2019), LCR40.75, and BCBS Basel III (2013), para. 142.
[183]BCBS Consol. Basel III (2019), LCR40.78-79 and LCR99.1, and BCBS Basel III (2013), para. 145-146.
[184]BCBS Consol. Basel III (2019), LCR40.78-79 and LCR99.1, and BCBS Basel III (2013), para. 145-146.
[185]BCBS Consol. Basel III (2019), LCR40.78-79 and LCR99.1, and BCBS Basel III (2013), para. 145-146.

covers short positions that can extend beyond the 30-day horizon, then the reverse repo is assumed to be rolled-over and receives a 0% inflow rate as the short position must be covered or repurchased.[186]

- In order to limit contagion risk, the bank's committed credit facilities, liquidity facilities and other contingent funding facilities, provided by other institutions, are assumed not to be drawable and receive a 0% inflow rate.[187]

- Inflows (including interest payments and instalments) from fully performing secured or unsecured loans, which are assumed to be received on the latest possible contractual date, are given inflow rates of (i) 50% for retail and small business customers, as banks are assumed to continue extending loans to such customers, (ii) 50% for non-financial wholesale counterparties, as banks are also assumed to continue extending loans to such customers, and (iii) 100% for financial institutions and central banks.[188]

- Inflows from non-HQLA securities that mature within 30 days are given a 100% inflow rate.[189]

- The sum of all net cash inflows on derivatives receive a 100% inflow rate.[190] If a derivative is collateralised by HQLA, then cash inflows must be netted against outflows of cash and collateral (that reduces the stock of HQLA collateral) and receive a 100% inflow rate.[191]

All the expected cash inflow items above may be relevant for a life insurance undertaking that engages in derivatives and non-insurance activities, including repos and other SFTs. None of them are exclusive to banks.

In line with the purpose of the LCR, the combined effect of the total expected cash outflows and total expected cash inflows "simulate" a financial crisis-inspired shock scenario where liquidity strains manifest themselves in "runs" and margin calls (on certain forms of liabilities and financial collateral) and a "liquidity crunch" where a bank's cash inflows, via e.g. credit or liquidity facilities, may be inhibited.[192] The LCR scenario, except for runs on deposits, can occur in relation to life insurance undertakings that engage in repos and other SFTs. It accordingly seems possible to apply the two components of the total net cash outflows (except for deposit outflows) as well as the HQLA in relation to life insurance undertakings non-insurance activities.

[186] BCBS Consol. Basel III (2019), LCR40.79, and BCBS Basel III (2013), para. 146.
[187] BCBS Consol. Basel III (2019), LCR40.82, and BCBS Basel III (2013), para. 149.
[188] BCBS Consol. Basel III (2019), LCR40.83-87 and LCR99.1, and BCBS Basel III (2013), para. 150-154.
[189] BCBS Consol. Basel III (2019), LCR40.88, and BCBS Basel III (2013), para. 155.
[190] BCBS Consol. Basel III (2019), LCR40.91 and LCR99.1, and BCBS Basel III (2013), para. 158.
[191] BCBS Consol. Basel III (2019), LCR40.92 and LCR99.1, and BCBS Basel III (2013), para. 159.
[192] BCBS Consol. Basel III (2019), LCR20.2, and BCBS Basel III (2013), para. 19-20.

As initially emphasised, it is fundamental to distinguish between (i) traditional life insurance obligations/liabilities, which Solvency II prescribes must be met with technical provisions and which are generally long-term and subject to the law of large numbers, and (ii) non-insurance liabilities/activities in the form of e.g. repos and other SFTs.[193] Any application of an adapted version of the LCR will accordingly have to be limited to non-insurance liabilities/activities and not capture traditional insurance or long-term insurance liabilities. The component total expected cash outflows must therefore only reflect non-insurance outflows.

The next chapter will describe the NSFR, which complements the LCR by ensuring stable funding over a longer time horizon, whereafter chapter 12.4.3 proposes adapted versions of the LCR and NSFR that may possibly be applied upon life insurance undertakings' non-insurance activities.

12.4.2 NSFR

While the LCR above is to ensure that banks have enough HQLA to endure a 30-day stress scenario, the NSFR is to limit overreliance on short-term wholesale funding and promote resilience over a longer time horizon by creating incentives for a bank to fund its activities with more stable sources of funding.[194] The NSFR accordingly requires banks to maintain a stable funding profile in relation to the composition of their assets and off-balance sheet activities.[195]

The NSFR is defined as the ratio of *available stable funding* to the amount of *required stable funding*, which must be at least 100% on an ongoing basis.[196] It can be summarised as:

$$\frac{Available_{StableFunding}}{Required_{StableFunding}} \geq 100\%$$

Due to the financial crisis, the NSFR addresses maturity and liquidity transformation, including the vulnerabilities associated with the funding of illiquid assets via short-term wholesale funding.[197] Both components in the NSFR are calibrated to reflect presumptions regarding funding behaviour and the stability of liabilities, as well as the liquidity of assets, including that:

- longer-term liabilities are assumed to be more stable than short-term liabilities,
- short-term (i.e. less than one year) retail deposits and funding provided by small business customers is considered behaviourally more stable than short-term wholesale funding from other counterparties,

[193] Solvency II, art. 76, and e.g. CEIOPS (2005b), para. 10.33.
[194] BCBS Consol. Basel III (2019), NSF20.1, BCBS Basel III (2014b), para. 1-2 and 6, and Basel III, para. 38 and 42.
[195] BCBS Consol. Basel III (2019), NSF20.1, and BCBS Basel III (2014b), para. 1.
[196] BCBS Consol. Basel III (2019), NSF20.2, and BCBS Basel III (2014b), para. 9 and 49.
[197] BCBS Basel III (2014b), para. 2-3.

- stable funding for some proportion of lending to the real economy is required in order to ensure the continuity of credit intermediation,
- banks may seek to roll over a significant proportion of maturing loans to preserve customer relationships,
- some short-dated assets (i.e. less than one year) require a smaller proportion of stable funding as some proportion of those assets can mature instead of being rolled over, and
- unencumbered and high-quality assets, which can be readily used as collateral to secure additional funding or be sold in the market, do not need to be wholly financed with stable funding.[198]

The component *available stable funding* is defined as the portion of capital and liabilities that is expected to be reliable over the NSFR's one-year time horizon.[199] It is based on the stability of the bank's funding sources, including the contractual maturity of its liabilities and differences in the various types of funding providers' tendency to withdraw funding.[200] Available stable funding is calculated by (i) assigning the value of a bank's capital and liabilities to one of five categories, (ii) multiplying each category's assigned amount by a prescribed "ASF factor" to produce weighted amounts and (iii) summing the weighted amounts to produce the total available stable funding.[201] The ASF factor is provided for various types of liabilities and capital, including 100% for (i) regulatory capital with a residual maturity of more than one year, (ii) secured and unsecured borrowings and liabilities (including term deposits), with effective residual maturities of one year or more, and (iii) retail term deposits that are maturing over one year and cannot be withdrawn early without a significant penalty.[202] A 50% ASF factor is provided for (i) secured and unsecured funding, with a residual maturity of less than one year, from non-financial corporate customers, and (ii) secured and unsecured funding, with a residual maturity between six months to less than one year, from central banks and financial institutions.[203] In addition, a 0% ASF factor is provided for funding, with a residual maturity of less than six months, from central banks and financial institutions.[204]

Similar to the LCR, not all of the NSFR's presumptions and ASF factors are relevant in relation to life insurance undertakings' non-insurance activities and repos. As mentioned above, only banks (i.e. credit institutions) are allowed

[198] BCBS Consol. Basel III (2019), NSF30.1-3, and BCBS Basel III (2014b), para. 12-14.
[199] BCBS Consol. Basel III (2019), NSF20.2, and BCBS Basel III (2014b), para. 9.
[200] BCBS Consol. Basel III (2019), NSF30.5, and BCBS Basel III (2014b), para. 17.
[201] BCBS Consol. Basel III (2019), NSF30.6, and BCBS Basel III (2014b), para. 17.
[202] BCBS Consol. Basel III (2019), NSF30.10 and NSF99.1, and BCBS Basel III (2014b), para. 21 and 26.
[203] BCBS Consol. Basel III (2019), NSF30.13 and NSF99.1, and BCBS Basel III (2014b), para. 24 and 26.
[204] BCBS Consol. Basel III (2019), NSF30.14 and NSF99.1, and BCBS Basel III (2014b), para. 25 and 26.

to take deposits or other repayable funds from the public.[205] The following will therefore not focus on deposits. However, secured and unsecured short-term funding from financial institutions (which may be deposit-like) is awarded the 50% or 0% ASF factor when calculating the available stable funding. These ASF factors accordingly "reduce" the value of that type of funding to a presumed "availability percentage".

The NSFR's second component, *required stable funding*, is based on the liquidity characteristics and residual maturities of the bank's various assets and off-balance sheet exposures.[206] It is calculated by (i) assigning the values of a bank's assets to prescribed categories, (ii) multiplying each category's assigned amount by its prescribed "RSF factor" to produce weighted amounts and (iii) summing the weighted amounts (while adding a weighted amount for off-balance sheet exposures) to produce the total required stable funding amount.[207] The prescribed RSF factors reflect the approximate amount of an asset, which would have to be funded by stable funding, due to the asset being rolled over or because the asset cannot be "monetised" via a sale or as collateral (in e.g. a repo) over the course of one year without significant expenses.[208] Assets are accordingly allocated to RSF factors based on their residual maturity or liquidity value.[209] RSF factors are provided for various types of assets including the LCR's level 1, 2a and 2b assets.[210] The RSF factor is e.g.

- 0% for all claims on central banks, with residual maturities of less than six months,
- 5% for unencumbered level 1 assets, including (i) certain marketable securities representing claims on, inter alia, sovereigns, central banks, the ECB, the European Community, or multilateral development banks that are 0% risk-weighted[211] and (ii) certain non-0% risk-weighted sovereign or central bank debt securities,
- 10% for unencumbered loans to financial institutions, with residual maturities of less than six months, that are collateralised by level 1 assets and where the received collateral can be freely reused for the life of the loan,
- 15% for (i) unencumbered level 2a assets including (a) certain marketable securities representing claims on, inter alia, sovereigns, central banks or multilateral development banks that are 20% risk-weighted[212] and (b)

[205] CRD IV, art. 9(1).

[206] BCBS Consol. Basel III (2019), NSF20.2, 30.15 and 30.33-, and BCBS Basel III (2014b), para. 9, 27 and 46-47. Off-balance sheet exposures include e.g. contingent funding obligations.

[207] BCBS Consol. Basel III (2019), NSF30.15 and 30.33, and BCBS Basel III (2014b), para. 27 and 46-47.

[208] BCBS Consol. Basel III (2019), NSF30.16, and BCBS Basel III (2014b), para. 28.

[209] BCBS Consol. Basel III (2019), NSF30.16-17, and BCBS Basel III (2014b), para. 29.

[210] BCBS Consol. Basel III (2019), NSF30.25-32 and NSF99.2, and BCBS Basel III (2014b), para. 36-44.

[211] Under the standardised approach for credit risk.

[212] Under the standardised approach for credit risk.

corporate debt securities (including commercial paper) and covered bonds both with external credit assessments equal (or equivalent) to at least AA–, and (ii) unencumbered loans to financial institutions, with residual maturities of less than six months, that are not collateralised by reusable level 1 assets,

- 50% for (i) unencumbered level 2b assets, including certain (a) residential mortgage-backed securities, with an external credit assessment of at least AA, (b) corporate debt securities and commercial paper, with an external credit assessment between A+ and BBB–, and (c) non-affiliated, non-financial and listed common equity shares, and (ii) loans to financial institutions and central banks, with a residual maturity of between six months and less than one year, and

- 100% for loans to financial institutions with a residual maturity of one year or more.[213]

In addition, assets that are encumbered for one year or more are given a 100% RSF factor, as they have to be funded throughout that period, while assets that are encumbered, for a period of between six months and less than one year, receive a 50% RSF factor (if they, as unencumbered assets, would receive an RSF factor lower than or equal to 50%).[214] Assets with a remaining "encumbrance period" of less than six months are given the RSF factor for an equivalent unencumbered asset.[215] Assets that are encumbered under exceptional central bank liquidity operations receive a reduced RSF factor that is decided by the supervisory authority and cannot be less than for an equivalent unencumbered asset.[216]

As shown above, longer maturities and less liquidity as well as encumbrances increase the RSF factor that is applied upon the bank's assets to determine the required stable funding. If the bank has entered into secured funding arrangements (e.g. repos and other SFTs), the bank is to

- exclude received securities financial collateral from its assets, if the bank does not have beneficial ownership, and

- include posted securities financial collateral, in the RSF category, if the bank retains beneficial ownership and the assets remain on the bank's balance sheet.[217]

Under such SFTs, the gross amount of receivables and payables are to be placed in the required stable funding or available stable funding.[218] However, if the

[213] BCBS Consol. Basel III (2019), NSF30.25-32 and NSF99.2, and BCBS Basel III (2014b), para. 36-44.
[214] BCBS Consol. Basel III (2019), NSF30.20 and NSF99.2 , and BCBS Basel III (2014b), para. 31 and 44.
[215] BCBS Consol. Basel III (2019), NSF30.20 , and BCBS Basel III (2014b), para. 31.
[216] BCBS Consol. Basel III (2019), NSF30.20 , and BCBS Basel III (2014b), para. 31.
[217] BCBS Consol. Basel III (2019), NSF30.21 , and BCBS Basel III (2014b), para. 32.
[218] BCBS Consol. Basel III (2019), NSF30.22 , and BCBS Basel III (2014b), para. 33

SFTs are with a single counterparty, they may be measured on a net basis if the criteria for the leverage ratio's recognition of netting are fulfilled.[219] The leverage ratio is described below in part VIII.

In short, while the previously described LCR is to address a financial crisis-inspired shock scenario, the NSFR captures a longer time horizon and incentivises banks to fund their activities with more stable sources of funding.[220] The applied RSF factor depends on the funding, which is assumed to be required to fund an asset over the course of one year, and it is lower for short-term and/or liquid assets (e.g. short-term claims on central banks) and higher for encumbered, long-term and/or illiquid assets (e.g. loans to financial institutions, with a residual maturity of one year or more, or level 2b assets).[221] At the same time, the described ASF factors "reduce" the value of various types of funding to a presumed "availability value", e.g. the 50% or 0% ASF factor for secured and unsecured short-term funding from financial institutions. The NSFR accordingly addresses maturity and liquidity transformation as it e.g. applies a high required "funding percentage" on illiquid assets and a low "availability percentage" on short-term secured funding. Except for deposits, which the EU only allows banks to take, the other elements of the NSFR - as well as the other elements of the LCR - can apply to life insurance undertakings' financing via non-insurance liabilities, including repos and other SFTs. In the next chapter, this dissertation will propose adapted versions of the LCR and NSFR that may possibly address any maturity or liquidity transformation conducted via life insurance undertakings' repos and other SFTs.

12.4.3 Adapted Versions of the LCR and NSFR

In its macroprudential assessments of Solvency II, EIOPA (2018e) did not consider liquidity risk to be a material risk in traditional insurance, which typically entailed that long-term and less liquid liabilities were transformed into more short-term and liquid assets.[222] However, EIOPA recognised the risks associated with margin calls on derivatives, the monetisation of assets, collective behaviour and fire sales.[223]

EIOPA suggested that the EU's definition of HQLA could be used when monitoring the evolution of unencumbered high-quality liquid assets in insurance undertakings' balance sheets.[224] In relation to actual liquidity requirements, EIOPA considered the LCR and NSFR but rejected the adoption of liquidity requirements before the introduction of additional reporting requirements and a liquidity risk assessment framework.[225] When doing so, EIOPA noted that

[219] BCBS Consol. Basel III (2019), NSF30.22 , and BCBS Basel III (2014b), para. 33
[220] Basel III, para. 38 and 42, BCBS Consol. Basel III (2019), NSF20.1, and BCBS Basel III (2014b), para. 1-2 and 6.
[221] BCBS Consol. Basel III (2019), NSF30.16, and BCBS Basel III (2014b), para. 28.
[222] Pp. 27 and 33.
[223] EIOPA (2018e), pp. 27-29 and 31.
[224] EIOPA (2018e), p. 29 (note 15).
[225] EIOPA (2018e), pp. 35-36. In the assessment, EIOPA discussed (i) information gaps in relation to insurance undertakings' liquidity risk, (ii) the challenge of supervising liquidity

- liquidity requirements could affect the long-term investment strategies of insurance undertakings and possibly compel them to invest in lower yielding liquid assets, instead of less liquid and higher yielding assets,
- liquidity requirements could increase exposures to high-quality liquid assets and lead to excessive concentration on certain asset classes or geographical regions, and that
- there was no evidence of material liquidity risk at the "macro level" that would justify the development and implementation of binding liquidity requirements.[226]

At the global level, and instead of binding requirements, the IAIS' proposed holistic framework for systemic risk also intends to develop liquidity risk metrics (including liquidity ratios that capture short-term debt and SFTs) to monitor individual insurance undertakings and the insurance sector.[227] In relation to liquidity sources, the IAIS considered using adapted versions of the BCBS' liquidity categories.[228]

Despite EIOPA's assessment and the IAIS' approach, this chapter will propose adapted versions of the LCR and NSFR that can presumably apply to life insurance undertakings' shadow banking. The application of quantitative liquidity risk requirements is motivated by the five Danish life insurance undertakings' repos that were documented in chapter 6.3.1. Such repos, which may be a country-specific trait, are presumably deposit-like non-insurance liabilities that expose banks and life insurance undertakings to the same liquidity risks.[229] In support of this quantitative approach, chapter 12.1 above reflected how CEIOPS actually considered requirements regarding sufficient liquid assets during the Solvency II project. In relation to liquidity risk management, IAIS (2018a) also discussed a "liquidity asset buffer" which consisted of certain unencumbered assets that could easily and immediately be converted into cash, through a repo or sale, at little or no loss in value.[230]

As initially emphasised, it is fundamental to distinguish between (i) traditional life insurance obligations/liabilities, which Solvency II prescribes must be met with technical provisions and which are generally long-term and subject to the law of large numbers, and (ii) non-insurance liabilities/activities in the form of e.g. repos and other SFTs.[231] The adapted versions of the LCR and NSFR are accordingly limited to addressing non-insurance liabilities and non-insurance assets and should therefore not capture traditional life insurance or long-term insurance liabilities.

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risk via pillar 2 and the prudent person principle, (iii) the extension of the reporting and monitoring of liquidity profiles/risk (in order to identify activities or products associated with liquidity risk and collective behaviour) as well as (iv) the development of a liquidity risk assessment framework including liquidity risk ratios, cf. EIOPA (2018e), pp. 28-34 and 67.

[226] EIOPA (2018e), pp. 35-36.

[227] IAIS (2018a), para. 160-162 and annex 2.

[228] IAIS (2018a), para. 162.

[229] See chapter 5, and e.g. FSB (2013c), sections 1.1 and 1.2, and BCBS (2008a).

[230] IAIS (2018a), para. 162 and annex 2.6.

[231] Solvency II, art. 76, and e.g. CEIOPS (2005b), para. 10.33.

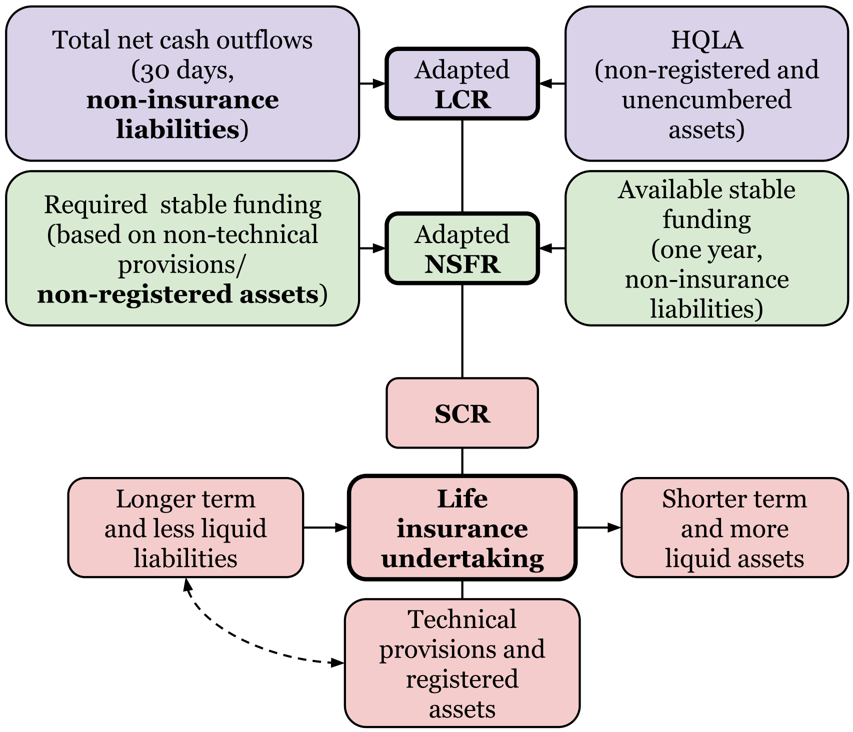

Figure 12.1: Illustration of "traditional" life insurance (in red) and the proposed adapted version of the LCR (in purple) and NSFR (in green).

Traditional life insurance liabilities are accordingly to be excluded from the adapted LCR's total expected cash outflows that go into the total net cash outflows. Chapters 6.3.1.1 and 6.3.2 described how registered assets are used to cover technical provisions in life insurance. As registered assets constitute life insurance assets, they should not be used as input in the adapted NSFR's required stable funding component. Registered assets can also not constitute HQLA as HQLA have to be unencumbered.

As illustrated in figure 12.1, the adapted versions of the LCR (in purple) and NSFR (in green), which are separate from the risk-based SCR, can be summarised as:

$$LCR_{adapted}=\frac{HQLA_{Non-Reg.Assets/Unencumbered}}{TotalNetCashOutFlows_{30days,Non-Ins.Liab.}} \geq 100\%$$

and

$$NSFR_{adapted} = \frac{AvailableStableFunding_{Non-Ins.Liab.}}{RequiredStableFunding_{Non-Reg.Assets}} \geq 100\%$$

This approach will also accommodate EIOPA's concerns regarding possible effects on life insurance undertakings' investment strategies and the concentration into specific high-quality liquid assets. Life insurance liabilities could continue as a funding source for long-term and less liquid assets as both the adapted LCR and adapted NSFR would be based on a closed "shadow banking circuit" where the only input would be non-insurance assets and non-insurance liabilities. This closed circuit would accordingly constitute an "internal shadow bank" with its own assets and liabilities. In the adapted LCR, short-term non-insurance liabilities would have to be met with HQLA. In the adapted NSFR (with a Solvency II-similar one-year horizon), maturity and liquidity transformation would be addressed by determining the required funding based on the maturity and liquidity of non-registered assets, including assets used as financial collateral.

As the EU only allows banks to take deposits or other repayable funds from the public, the LCR's and NSFR's deposit-related factors and rates would not be applicable.[232] However, as mentioned in the chapters above, the other rates and factors in the LCR (i.e. haircuts on HQLA, run-off rates and in-flow rates) and NSFR (i.e. ASF factors and RSF factors) are not necessarily bank-specific and may be relevant for life insurance undertakings that conduct credit intermediation and engage in repos and other SFTs. The use of equivalent factors and rates would ensure consistency but they could be adjusted to reflect the life insurance-specific context. The limiting of the adapted LCR to non-insurance liabilities also entails that only shadow banking activities would lead to additional demands for HQLA and put pressure on any existing demands for HQLA in banking.

[232]CRD IV, art. 9(1).

Part VIII

Leverage and Procyclicality

Chapter 13

Leverage and Procyclicality

Chapter 5.1.1.1 presented how repos are associated with liquidity risk due to margin calls, the "run on repo" via haircuts, and roll-over risk. In addition, chapter 5.1.1.2 presented how repos are associated with leverage and procyclicality. As described those chapters, assets are used as financial collateral in repos and allow entities to obtain funding and leverage. Variations in the value of assets will occur with the cycles, and repo-based leverage entails a direct procyclical relationship between those fluctuating asset values and the access to leverage.[1] The procyclical nature of leverage and margin requirements lies in how increasing asset values and lower margin requirements - during upswings - increase a repo seller's access to leverage via financial collateral based on those asset values.[2] When asset values subsequently decrease and margin requirements increase - in accordance with the cycle - the access to leverage, via the financial collateral, is accordingly decreased.[3] A decrease in the access to leverage may force the repo seller to "delever" via fire sales which may put a downward pressure on asset values and cause (i) losses on such assets held on the balance sheet of the repo seller as well as other undertakings exposed to the assets and (ii) an increase in margin requirements, in relation to the use of those assets as financial collateral, which further reduces the access to secured funding.[4]

In its considerations regarding repos and financial stability, the FSB referred to the liquidity spiral in Brunnermeier and Pedersen (2009).[5] Subsequently, FSB (2013c) labeled

- the direct relationship between fluctuating values of financial collateral and the access to leverage, and

[1] FSB (2012c), section 5.2, and FSB (2013c), sections 1.1 and 1.2.

[2] See e.g. ESRB (2016a), p 10, and ESMA (2016), para. 43 and 45, and ESRB (2017a), section 3.2.

[3] See e.g. ESRB (2016a), p. 10, ESMA (2016), para. 32, 39 and 44-45, and ESRB (2017a), para. 74-75 and 80.

[4] ESRB (2017a), para. 80.

[5] FSB (2012c), annex 3.2.

- the risk of fire sales, which lead to price falls that create mark-to-market losses for all undertakings exposed to the assets,

as risks that span *both* banking and shadow banking.[6] Similar to the liquidity risk associated with repos, the procyclical nature of repo-based leverage is a risk that both banks and life insurance undertakings can be exposed to. As described in chapters 1 and 6.1.1, both the IAIS and EIOPA associate life insurance undertakings' repos with possible systemic risk, including the risk of collective behaviour, fire sales and liquidity spirals.

Up to and during the financial crisis, banks are considered to have built up excessive leverage while maintaining "strong" risk-based capital ratios.[7] The financial crisis forced banks to reduce their leverage in manner that amplified downward pressures on asset prices and exacerbated the feedback loop between losses, falling bank capital and shrinking credit availability.[8] The finalised Basel III's *leverage ratio* was accordingly introduced to constrain leverage in the banking sector and thereby mitigate the risk of such destabilising deleveraging and price spirals.[9] Similar to the LCR and NSFR, the leverage ratio is to supplement risk-based capital requirements with a non-risk-based, simple and transparent "backstop" measure and constitute a safeguard against model risk and measurement errors.[10] The leverage ratio is presented in chapter 13.3 below.

Under the finalised Basel III, banks may also be subject to a countercyclical buffer that varies between 0% and 2.5% of risk-weighted assets and is made up of common equity tier 1.[11] The countercyclical buffer is to reduce procyclical behaviour (including the release of leverage), dampen the cyclicality of the risk-based requirements, and enable the absorption of shocks.[12] In addition, G-SIBs will be subject to a leverage ratio buffer requirement that must be met with tier 1 capital.[13] The leverage ratio buffer is set at 50% of the G-SIB's higher-loss absorbency requirement that is described in chapter 14 below.[14] The finalised Basel III's leverage ratio is accordingly supplemented by buffers that address

[6] Section. 1.2.

[7] Basel III, para. 151, BCBS Basel III (2014a), para. 1, and BCBS Basel III (2017), Leverage ratio, para. 1.

[8] Basel III, para. 16, BCBS Basel III (2014a), para. 1, and BCBS Basel III (2017), Leverage ratio, para. 1.

[9] BCBS Consol. Basel III (2019), LEV, including LEV20.1, and BCBS Basel III (2017), Leverage ratio, including para. 2. See also Basel III, para. 7 and 16, and BCBS Basel III (2014a), para. 1 and 2.

[10] BCBS Consol. Basel III (2019), LEV20.1-5, and BCBS Basel III (2017), Leverage ratio, para. 2-5. See also Basel III, para. 7, 16 and 152, and BCBS Basel III (2014a), para. 1 and 2.

[11] BCBS Consol. Basel III (2019), RBC30.6-23, and Basel III, A.4 and Part I.IV, including para. 142.

[12] Basel III, para. 18-19.

[13] BCBS Consol. Basel III (2019), LEV40.1 and LEV90.1, and BCBS Basel III (2017), Leverage ratio, para. 8 and 14.

[14] BCBS Consol. Basel III (2019), LEV40.2, and BCBS Basel III (2017), Leverage ratio, para. 9. G-SIBs are subject to a higher loss absorbency requirement of 1-3.5% of risk weighted-assets, which is to be met with common equity tier 1, cf. BCBS Consol. Basel III (2019), RBC40 (including 40.1 and 40.4), Basel III, A.5, and BCBS (2018), including para. 46. See also FSB (2010b), section II.

leverage, procyclicality and systemic risk.

In its macroprudential assessments of Solvency II, EIOPA (2018e) assessed the introduction of a countercyclical capital buffer in the form of a time-varying buffer that is built up during the upswings of the credit cycle and runs down during periods of financial market stress.[15] In the assessment, EIOPA looked to the countercyclical buffer in Basel III.[16] However, EIOPA found that the insurance sector was not exposed to the credit cycle in the same way as banks, and that insurance undertakings' vulnerability to shocks depended on their assets (which varied substantially across the EU) and their insurance liabilities, which could entail fixed or variable returns.[17] A broad-based countercyclical buffer was accordingly not considered an adequate tool but EIOPA considered additional capital tools to address the procyclicality that is not covered by Solvency II's long-term guarantee measures, which are described next in chapter 13.1.[18]

In addition no countercyclical buffer, chapter 13.1 will show how Solvency II does not address repo-/non-insurance-based leverage or procyclicality via other quantitative requirements. Chapter 13.2 will then describe global initiatives to limit leverage, via haircut floors on certain financial collateral in certain SFTs, which have not been implemented by the EU. Finally, chapter 13.3 will describe the finalised Basel III's leverage ratio and propose an adapted version for life insurance's undertakings' possible shadow banking.

13.1 Solvency II's Approach to Procyclicality and Leverage

During the Solvency II project, CEIOPS (2006a) was aware of how insurance undertakings were major users of corporate bonds and that a "massive" selling of corporate bonds, during an economic downturn that affected the ratings of bond issuers, could put additional pressure on the perceived creditworthiness of the issuers.[19] However, CEIOPS considered a "straight re-across" of procyclicality in banking to insurance as "inappropriate".[20]

In 2014, Solvency II was amended by Omnibus II's long-term guarantee measures to accommodate the environment of low interest rates and low asset values that developed "largely" after the adoption of Solvency II and was viewed as challenging to life insurance undertakings that offered long-term guarantees.[21] As described in CEIOPS QIS2 (2006a), interest rate risk exists for all assets and liabilities whose value is sensitive to changes in the term structure of interest rates or interest rate volatility, e.g. fixed-income instruments, insurance liabil-

[15] Section 2.3 and p. 68.
[16] EIOPA (2018e), p. 19.
[17] EIOPA (2018e), pp. 19 and 22.
[18] EIOPA (2018e), pp. 20 and 22 and 68.
[19] Annex B.21. See also answers to call for advice no. 22.
[20] CEIOPS (2006a), para. 22.13 and 22.42.
[21] European Commission (2013a), Quick Fix 2 Proposal, section 1.1, and Omnibus II, art. 2(23) and (36), and Solvency II, art. 77a-f and 138(4).

ities/obligations, debt financing and interest rate derivatives.[22] A life insurance undertaking is accordingly exposed to interest rate risk (via e.g. issued guarantees) if the risk is not allocated to policies where the policyholders bear the investment risk.[23]

In a low interest rate environment, the challenge for life insurance undertakings lies in, inter alia, the requirement to establish technical provisions in order to ensure that they are able to meet their commitments towards policyholders and beneficiaries.[24] When discounting, a low or zero discount factor will increase the expected present value of future cash-flows and thereby force life insurance undertakings to increase their technical provisions as they cannot - to the same extent as under higher rates - benefit from the time value of money.[25] In the "double hit scenario", low interest rates have an adverse impact on returns while the simultaneous low discount factor will increase the expected present value of future cash-flows and thereby force life insurance undertakings to increase their technical provisions.[26] Conversely, an increase in interest rates will decrease technical provisions but also decrease the value of fixed-income exposures and increase lapse risk and liquidity risk due to possible surrenders.[27]

To accommodate the low interest rates and low asset value environment, Omnibus II's long-term guarantee measures included:

- the extrapolation of the relevant risk-free interest rate term structure in order to avoid "artificial volatility" of technical provisions and eligible own funds.[28]

- the matching adjustment to the relevant risk-free interest rate term structure which usually lowers technical provisions and protects against spread shocks.[29] It entails that bonds (or other assets with similar cash-flow characteristics) are assigned to cover - as well as cash flow-match - the best estimate in technical provisions, and it relies on life insurance undertakings not being exposed to spread risk and interest rate risk when the bonds are held to maturity.[30] The matching adjustment is perceived to address procyclicality and collective behaviour, which may exacerbate market price movements, as cash flow-matching and the holding of assets

[22] Para. 5.41.

[23] CEIOPS QIS2 (2006a), para. 5.41 and Solvency II, art. 105(5)(a).

[24] Solvency II, recital 53 and art. 76(1). See chapter 6.3.1.1.

[25] See e.g. EIOPA (2017c), pp. 34-35 (box 4), and EIOPA (2018c), p. 5 and 50.

[26] Solvency II, recital 58 and art. 77(1)-(2), Solvency II Delegated Regulation, title I, chapter III, section 4, as well as EIOPA (2013), pp. 20-22, EIOPA (2016), para. 43, and EIOPA (2017c), pp. 34-35 and 55.

[27] See e.g. EIOPA (2018c), pp. 13-14 and 26.

[28] Omnibus II, recital 30 and art. 2(23), Solvency II, art. 77a, and Solvency II Delegated Regulation, art. 46-48.

[29] Omnibus II, recital 31 and art. 2(23), Solvency II, art. 77b and 77c, Solvency II Delegated Regulation, recitals 22 and 26 and title I, chapter III, section 4, subsection 4, EIOPA (2013), pp. 76-77, and EIOPA (2018f), pp. 23 and 26.

[30] Omnibus II, recital 31 and art. 2(23), Solvency II, art. 77b(1), EIOPA (2013), p. 75, EIOPA (2016), para. 97, and EIOPA (2018f), p. 23.

to maturity removes market risk and the risk of fire sales.[31]

- the volatility adjustment to the relevant risk-free interest rate term structure which is to prevent procyclical investment behaviour by allowing life insurance undertakings to adjust the relevant risk-free interest rate term structure in order to mitigate the effect of exaggerations of bond spreads.[32] In case of large increases in bond spreads, which reduce the value of the related credit assets, the volatility adjustment allows a raise in the risk-free interest rate term structure that results in a decrease in the expected present value of insurance liabilities (i.e. the best estimate in the technical provisions).[33] Pursuant to EIOPA, the volatility adjustment avoids, inter alia, fire sales in stressed market conditions as the volatility adjustment is assumed to limit the fluctuation of technical provisions and keep the balance sheet more stable.[34] Similar to the matching adjustment, EIOPA finds that the volatility adjustment addresses procyclicality and collective behaviour that may exacerbate market price movements.[35]

- the extension of the recovery period, in the event of exceptional adverse situations, in case of non-compliance with the SCR.[36] Similar to the matching adjustment and volatility adjustment, EIOPA finds that the possibility of extensions addresses procyclicality and collective behaviour.[37]

The long-term guarantee measures may accordingly address procyclicality but they are limited to traditional insurance, via technical provisions and the SCR, and do not address procyclicality due to non-insurance liabilities or shadow banking.[38]

In a very non-detailed fashion, the European Commission, EIOPA and ESMA have stated that life insurance undertakings' shadow banking, SFTs and leverage are subject to Solvency II's

- economic risk-based solvency requirements,
- total balance sheet approach,
- risk management,
- reporting requirements[39],

[31] EIOPA (2018f), pp. 23-25.

[32] Omnibus II, recital 32 and art. 2(23), Solvency II, art. 77d, and Solvency II Delegated Regulation, recital 22 and title I, chapter III, section 4, subsection 3.

[33] EIOPA (2018f), pp. 15, footnote 12, and 20.

[34] EIOPA (2016), para. 95.

[35] EIOPA (2018f), p. 17.

[36] Omnibus II, art. 2(36), Solvency II, art. 138(4) and Solvency II Delegated Regulation, art. 288-289.

[37] EIOPA (2018f), p. 32.

[38] ESRB (2015), pp. 24-26. See also ESRB (2016a), p. 13, EIOPA (2016), para. 34, 53, 56 and 67, EIOPA (2017c), pp. 14 and 66, and EIOPA (2018f), p. 3.

[39] The Solvency II Delegated Regulation includes reporting obligations regarding, inter alia, (i) the risk profile, including liquidity risk, (ii) the value of sold or re-pledged collateral, (iii)

- minimum regulatory standards for collateral valuation and management,
- "some requirements with regards to SFTs, or collateral, and their use" or "certain measures and requirements", and the
- prudent person principle.[40]

It seems difficult to derive any specific pillar 1 treatment of non-insurance-based leverage from the points above. This dissertation's part VI showed that Solvency II captures credit risk, market risk and counterparty credit risk via quantitative pillar 1 requirements. However, part VII concluded that non-insurance liquidity risk was not addressed via quantitative requirements.[41] As described in chapter 12.2 above, the prudent person principle is considered capable of regulating SFTs and to discourage excessive involvement in certain products and activities (including repos) that could be more prone to systemic risk.[42] However, it is not a quantitative requirement and EIOPA (2018e) viewed it as a challenging task to verify compliance with the liquidity aspects of the prudent person principle due to its "principle-based nature" as well as the lack of clear definitions and indicators.[43] The nature of the prudent person principle and the lack of a prolonged experience also made it difficult to assess its contribution to mitigating systemic risk.[44]

In relation to leverage and procyclicality, the research question is whether Solvency II subjects life insurance undertakings' leverage to requirements that are "similar" to the finalised Basel III's requirements for leverage. As described in chapter 8, the comparison is limited to assessing whether leverage is subject to quantitative pillar 1 requirements. Solvency II does not include quantitative requirements that limit leverage or the possible procyclicality associated with repo-based leverage. Due to the interaction between liquidity risk and leverage, Solvency II's lack of quantitative regulation of leverage must be viewed in the light of the lack of quantitative regulation of non-insurance-based liquidity risk.

In short, Solvency II does not include a quantitative limit on leverage while the finalised Basel III includes the quantitative leverage ratio that is presented in chapter 13.3 below. However, when assessing life insurance undertakings' actual

posted collateral (including the material terms and conditions, the nature of the collateral, the nature and value of the assets provided as collateral, and the actual and contingent liabilities created under the collateral agreement), (iv) the volume and characteristics of any securities lending and repos, (v) risk concentrations and (vi) the value and material terms and conditions regarding received collateral, cf. Solvency II Delegated Regulation, art. 309(1)(d), (2)(b)-(d) and (f), (4) and (5)(b).

[40] European Commission (2012), p. 10, EIOPA (2012), p. 2, ESMA (2016), section 4.2 and para. 180, European Commission (2017b), pp. 6 and 9, EIOPA (2018e), p. 52.

[41] See also IAIS (2018a), section 2.2.1.

[42] European Commission (2017b), p. 9, and EIOPA (2018e), pp. 52-53. European Commission (2017b) stated that the prudent person principle entailed that *"...insurance undertakings only invest in assets and instruments whose risks they can properly identify, measure, monitor and control..."* as well as that *"Insurers can engage in SFTs if the prudent person principle is satisfied. In this case, collateral must be valued in accordance with the Solvency II Directive and its delegated act."*

[43] P. 33.

[44] EIOPA (2018e), p. 52.

access to leverage via repos and other SFTs, it must be kept in mind that their access to such secured funding is limited to non-registered assets.[45] Chapter 6.3.1 showed how a large majority of the five Danish life insurance undertakings' assets were registered assets which may only be used for the satisfaction of policyholders and beneficiaries. Life insurance undertakings' ability to obtain leverage, via repos and other SFTs, is accordingly limited to the non-registered assets.[46] As discussed above, chapter 6.3.1 also showed a lack of compliance with the collateral reporting obligation which leads to uncertainty regarding compliance with the prudent person principle as well as uncertainty regarding which assets are repo collateral.

In addition to the existence of registered assets, haircuts on financial collateral in repos are perceived to have a leverage-limiting capacity that is generally compared to fractional reserve banking.[47] Similar to capital requirements, haircut percentages "force" the cash borrower (i.e. repo seller) to retain an amount of non-leveraged assets.[48] Chapter 13.2 will present the FSB's numerical haircut floors framework for non-centrally cleared SFTs by non-banks as well as the EU's current arguments for not implementing that framework. Subsequently, chapter 13.3 will describe the finalised Basel IIIs leverage ratio and propose an adapted leverage ratio for life insurance undertakings.

13.2 The FSB's and Finalised Basel III's Numerical Haircut Floors

FSB (2014a) examined whether haircuts are procyclical and concluded that haircuts increased significantly during the financial crisis, especially for loans to non-banks where the financial collateral was non-government securities or non-government-sponsored securitisations.[49] The FSB also found that the reduction in total repo funding was significant in both absolute terms and as a percentage of bank's lending to non-banks.[50] FSB (2015c) accordingly includes a numerical haircut floors framework for non-centrally cleared SFTs where financing is provided to non-banks against non-government financial collateral.[51] Financial collateral, in the form of government securities, is excluded from the framework as the associated price movements are perceived to generally be non-procyclical.[52] In order to avoid duplication of regulation, the numerical haircut

[45] See chapter 6.3.1.1 regarding technical provisions and registered assets.
[46] See also EIOPA (2018e), section 2.1.
[47] Brunnermeier and Pedersen (2009), p. 2203, Gorton and Metrick (2012), p. 427, and ESRB (2017a), para. 59.
[48] FSB (2014c), section 1, and FSB (2015c), section 1, Gorton and Metrick (2012), p. 427, and ESRB (2017a), para. 59.
[49] Pp. 1 and 3-4. The focus was on non-centrally cleared lending of cash against collateral (i.e. reverse repos) in 2006, 2008 and 2012.
[50] FSB (2014a), pp. 1 and 4.
[51] P. 4 and section 3.
[52] FSB (2015c), p. 8.

floors framework does not apply to banks.[53]

The numerical haircut floors framework is intended to limit the build-up of excessive leverage outside the banking system and to reduce that leverage's procyclicality.[54] It does so by prescribing numerical haircut floors that set upper limits on the amount that non-banks can borrow against different categories of non-government financial collateral.[55] These numerical haircuts are comparable to the haircuts used to produce volatility-adjusted values of financial collateral under the finalised Basel III's capital requirements for counterparty credit risk.[56]

The numerical haircut floors framework is intended to apply to transactions where the primary motive is to provide financing (i.e. cash-driven SFTs) rather than to borrow or lend specific securities.[57] In order to reduce the risk of regulatory arbitrage, and to maintain a level playing field, the FSB has extended the scope of the numerical haircut floors framework to "non-bank-to-non-bank transactions".[58] When recommending how to implement the numerical haircut floors framework, the FSB was accordingly faced with the issue that it covers both "bank-to-non-bank transactions" and "non-bank-to-non-bank transactions".[59] At the global level, the FSB recommended that the numerical haircut floors framework was incorporated into the entity-based Basel III framework to cover bank-to-non-bank transactions.[60] Jurisdictions, which implemented the finalised Basel III, would accordingly implement the numerical haircut floors in relation to bank-to-non-bank transactions. For non-bank-to-non-bank transactions, the FSB recommended that the numerical haircut floors framework could be regulated via both market regulation and entity-based regulation.[61] The implementation and the possible regulation of life insurance undertakings' SFT-based financing are illustrated in figure 13.1.

In order to implement the FSB's numerical haircut floors framework, the finalised Basel III's counterparty credit risk capital requirements include minimum haircut floors for certain non-centrally cleared SFTs with certain counterparties.[62] Financial collateral in those SFTs is e.g. subject to a

- 0.5% haircut on debt securities issued by corporates and other issuers - and 1% on securitisations - with a residual maturity of less than or equal to one year,

- 3% haircut on debt securities issued by corporates and other issuers - and

[53] FSB (2013c), p. 26, and FSB (2015c). pp. 4 (footnote 11) and 7.
[54] FSB (2014c), section 1, and FSB (2015c), section 1.
[55] FSB (2014c), p. 1 and section 3.2, and FSB (2015c), p. 1 and section 3.2.
[56] See chapter 11.1 as well as FSB (2015c), p. 9, and ESRB (2016a), p. 13.
[57] FSB (2015c), p. 9.
[58] FSB (2015c), p. 2 and section 3.5, including recommendation 15.
[59] FSB (2015c), section 3.5.
[60] FSB (2015c), section 3.5.
[61] FSB (2015c), section 3.5.
[62] BCBS Consol. Basel III (2019), CRE51.17 and CRE56 (including 56.2 and 56.6), and BCBS Basel III (2017), Standardised approach for credit risk, D.3(iv), including para. 179-188. See also FSB (2015c), sections 3.1, 3.2 and 3.5, including recommendation 13, BCBS (2015a) and BCBS (2014b), section 3.5.

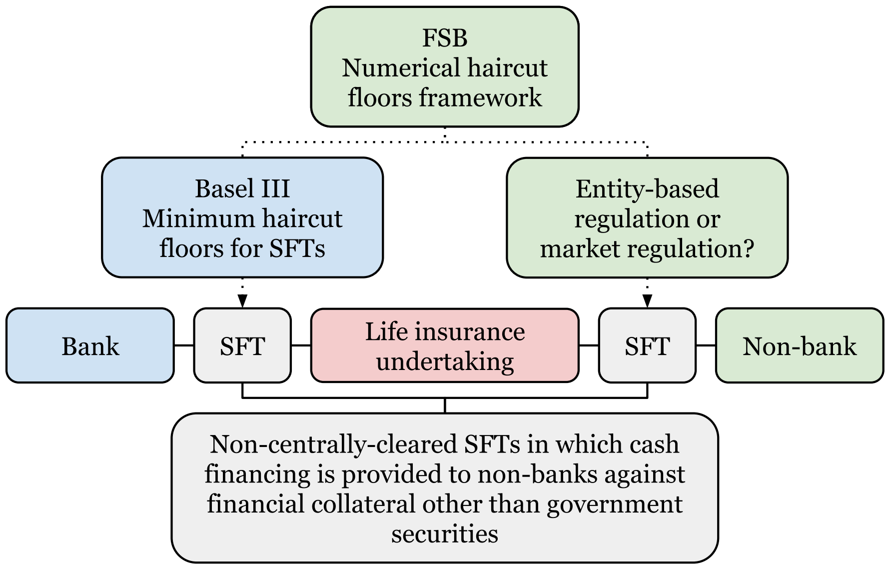

Figure 13.1: Overview of the implementation of the FSB's numerical haircut floors framework and the possible application upon life insurance undertakings' financing via bank-to-non-bank and non-bank-to-non-bank SFTs.

6% on securitisations - with a residual maturity of more than five years and less than or equal to 10 years, and a

- 4% haircut on debt securities issued by corporates and other issuers - and 7% on securitisations - with a residual maturity of more than 10 years.[63]

If the covered cash-driven SFTs do not meet the minimum haircut floors (i.e. the actual financial collateral to lent cash ratio does not exceed the minimum haircut floor), then the SFTs must be treated as unsecured loans and accordingly not benefit from the credit risk mitigation effects of financial collateral that were described in relation to counterparty credit risk in chapter 11.1 above.[64]

The finalised Basel III's minimum haircut floors apply to non-centrally cleared SFTs where cash is provided (against non-government financial collateral) to counterparties who are *not* supervised by a regulator that imposes prudential requirements consistent with "international norms".[65] This requirement may

[63] BCBS Consol. Basel III (2019), CRE56.6, and BCBS Basel III (2017), Standardised approach for credit risk, para. 184.

[64] BCBS Consol. Basel III (2019), CRE56.7-13, and BCBS Basel III (2017), Standardised approach for credit risk, para. 185-188, which also provides a treatment for netting sets.

[65] BCBS Consol. Basel III (2019), CRE56.2(1), and BCBS Basel III (2017), Standardised approach for credit risk, para. 180. The minimum haircut floors also apply to the transfer of lower-quality financial collateral against higher quality financial collateral (i.e. collateral upgrade transactions) with those counterparties unless the bank cannot reuse the received financial collateral, cf. BCBS Consol. Basel III (2019), CRE56.2(2) and 56.5, and BCBS

have to be seen in relation to the FSB's numerical haircut floors framework which states that insurance companies - that are subject to regulatory capital and liquidity requirements and have access to central bank facilities "as appropriate" - may be excluded on an "exceptional basis".[66] As concluded in part VII, Solvency II does not include quantitative requirements for non-insurance-based liquidity risk. Solvency II-governed life insurance undertakings may therefore possibly not meet the conditions for being exempted from the FSB's numerical haircut floors framework. However, the finalised Basel III seems to apply a less specific definition of the exemption and may consider Solvency II to be consistent with "international norms". As mentioned in chapter 12.3, IAIS (2018c) does e.g. not include prescribed quantitative capital requirements for liquidity risk (except for lapse risk under insurance risks) as liquidity risk was considered better captured via supervisory tools and instruments including stress testing.[67]

The finalised Basel III's minimum haircut floors do also not apply upon SFTs with central banks.[68] In addition, as the minimum haircut floors are to prevent maturity and liquidity transformation, they do not apply to

- cash-collateralised securities lending if the securities financial collateral is lent to the bank at long maturities and the securities lender (non-bank) reinvests the cash financial collateral at the same or shorter maturities, or
- short-term cash-collateralised securities lending where the securities lender (non-bank) reinvests the cash financial collateral in accordance with the minimum standards for cash collateral reinvestment by securities lenders in FSB (2013c).[69]

As illustrated in figure 13.1 above, the finalised Basel III's implementation of the FSB's numerical haircut floors framework entails that non-bank's access to leverage via banks (in the form of cash-financing against non-government financial collateral via non-centrally cleared SFTs) is globally regulated in banking regulation. Similar non-bank-to-non-bank transactions are to be governed by market or entity-based regulation.

In the EU, the SFT Regulation governs SFTs which include, inter alia, repos subject to repo agreements, securities or commodities lending transactions, buy-sell back transactions and sell-buy back transactions, and margin lending transactions.[70] The SFT Regulation constitutes pure market regulation that implements the FSB's transparency requirements regarding SFTs.[71] The SFT Regulation states that non-centrally cleared SFTs may raise major risks if they are not properly collateralised.[72] It also states that the EU would initially

Basel III (2017), Standardised approach for credit risk, para. 180 and 183.

[66] FSB (2015c), section 1(ii), footnote 11.

[67] Para. 204-206, 386 and 390.

[68] BCBS Consol. Basel III (2019), CRE56.3, and BCBS Basel III (2017), Standardised approach for credit risk, para. 181.

[69] BCBS Consol. Basel III (2019), CRE56.2(2), and BCBS Basel III (2017), Standardised approach for credit risk, para. 182. See also FSB (2013c), section 3.1.

[70] SFT Regulation, art. 1 and 3(11).

[71] SFT Regulation, recitals 2, 7 21-25 and art. 4, and FSB (2013c), section 2.

[72] SFT Regulation, recital 3.

await the FSB's work on the numerical haircut floors framework and that the European Commission was to submit a report regarding the progress of the international efforts and the appropriateness of the FSB's recommendations.[73] The EBA, ESMA and ESRB were to provide input to the report.[74]

As input to the report, ESRB (2016a) stated that a majority of its members supported the EU's implementation of the FSB's numerical haircut floors framework via market regulation.[75] However, ESMA (2016) considered it too early to draw definitive conclusions as to the impact of the numerical haircut floors on the resilience of the financial system and on the build-up of leverage.[76] ESMA recommended that the EU's regulatory authorities remained cautious when considering the introduction of new quantitative requirements and proposed to submit a report when sufficient SFT data became available via the SFT Regulation's reporting obligation.[77] However, ESMA believed that regulation of non-bank-to-non-bank transactions should be identical to the regulation of bank-to-non-bank transactions in order to prevent regulatory arbitrage and limit the build-up of leverage outside the banking sector.[78] In line with ESMA, European Commission (2017b) suspended the assessment of the EU's possible introduction of numerical haircut floors until the reporting obligations under the SFT Regulation become effective, which is not expected until 2020.[79] The European Commission based this on, inter alia, (i) actual market haircuts tending to be higher than the numerical haircut floors framework, (ii) a lack of understanding of the relationship between haircuts and procyclicality, (iii) the need for a level playing field and not being a "first-moving" jurisdiction and (iv) the in-scope SFTs constituting a limited share of the overall market.[80] Subsequently, in its response regarding implementation of the finalised Basel III's minimum haircut floors for bank-to-non-bank transactions, EBA (2019c) shared the stance of ESMA and the European Commission and recommended withholding the implementation.[81]

In short, non-banks' providing of repo-based leverage to life insurance undertakings is not currently subject to EU-wide and cross-sectoral leverage regulation, or minimum haircut floors, and haircuts are therefore left to the discretion of the non-bank parties.[82] In the next chapter, this dissertation will accordingly propose an adapted leverage ratio for life insurance undertakings' possible shadow banking.

[73]SFT Regulation, recital 3 and art. 29(3), subpara. 1.
[74]SFT Regulation, 29(3), subpara. 2.
[75]Pp. 17-18.
[76]ESMA (2016), para. 179 and 181.
[77]ESMA (2016), para. 181, 186 and 187.
[78]ESMA (2016), para. 185.
[79]pp. 11-12.
[80]European Commission (2017b), pp. 11-12.
[81]EBA (2019c), para. 86. See also EBA (2019a), p. 26 EBA (2019b), p. 57, and European Commission (2018a), section 3.3 and 3.4.
[82]ESRB (2016a), pp. 12-13 and 17, ESMA (2016), para. 8 and 159, ESRB (2017a), para. 129-130, and European Commission (2017b), pp. 6 and 11.

13.3 Adapted Leverage Ratio for Life Insurance

The finalised Basel III's leverage ratio is to be implemented as a pillar 1 requirement in 2022.[83] The leverage ratio is defined as the ratio between a specified *capital measure* and a specified *exposure measure,* which must be a minimum of 3% at all times.[84] It can be summarised as:

$$3\% \leq \frac{Capital_{measure}}{Exposure_{measure}}$$

The *capital measure* is simply the bank's risk-based tier 1 capital requirement, in the form of common equity tier 1 and/or additional tier 1 instruments, as described in chapter 9.1 above.[85]

The leverage ratio is to capture both on- and off-balance sheet sources of leverage.[86] The *exposure measure* is accordingly the sum of

- on-balance sheet exposures in the form of on-balance sheet assets and on-balance sheet financial collateral from SFTs and derivatives (while excluding on-balance sheet derivative and SFT exposures in the following points).[87]

- derivative exposures measured by multiplying an "alpha scalar" with the sum of a specified replacement cost and specified potential future exposure for each separate transaction or at the netting set in case of eligible bilateral netting agreements.[88] In order to capture a non-cleared and written credit derivative's credit exposure to the underlying reference entity, the exposure measure must also generally include the effective notional amount referenced by the written credit derivative.[89]

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[83] BCBS Consol. Basel III (2019), LEV20, and BCBS Basel III (2017), Introduction, para. 9, and Leverage ratio, para. 13.

[84] BCBS Consol. Basel III (2019), LEV20.3 and 20.7, and BCBS Basel III (2017), Leverage ratio, para. 4 and 7.

[85] BCBS Consol. Basel III (2019), LEV20.4, and BCBS Basel III (2017), Leverage ratio, para. 5.

[86] BCBS Consol. Basel III (2019), LEV20.2, and BCBS Basel III (2017), Leverage ratio, para. 3. See also BCBS Basel III (2014a), para. 3.

[87] BCBS Consol. Basel III (2019), LEV20.5 and LEV30.8, and BCBS Basel III (2017), Leverage ratio, para. 27-28.

[88] BCBS Consol. Basel III (2019), LEV20.5 and LEV30.13-15 and 30.22-25, and BCBS Basel III (2017), Leverage ratio, para. 27, 32-35, 37-40 and annex, para. 1-5. In the finalised Basel III's treatment of counterparty credit risk on derivatives (i.e. BCBS Consol. Basel III (2019), CRE52.2-4, and BCBS Basel III (2014d), part III, para. 129-131), the replacement cost for unmargined transactions intends to capture the loss that would occur if a counterparty were to default and be closed out of its transactions immediately. The replacement cost for margined transactions intends to capture the loss that would occur if a counterparty were to default at the present - or at a future time - while assuming that the close-out and replacement of transactions occur instantaneously. In such margined transactions, a change in the value of the transactions (i.e. the potential future exposure) may occur between the last exchange of financial collateral (before default) and the replacement of the transactions in the market.

[89] BCBS Consol. Basel III (2019), LEV30.30-34, and BCBS Basel III (2017), Leverage ratio, para. 45-49.

- SFT exposures (as described below).
- off-balance sheet items, including commitments, that are converted into credit exposures by applying prescribed credit conversion factor percentages on the notional amounts.[90]

In exceptional macroeconomic circumstances, jurisdictions may decide to temporarily exempt central bank reserves from the exposure measure to facilitate the implementation of monetary policies.[91]

While received financial collateral may decrease counterparty credit risk, it may also increase a bank's ability to obtain leverage as the received financial collateral increases the economic resources of the bank.[92] The exposure measure can therefore generally not be reduced by received financial collateral, netting or other credit risk mitigation techniques.[93] However, the leverage ratio recognises that SFT-based secured lending and borrowing is an important source of leverage.[94] In the exposure measure, the above item "SFT exposures" is measured via the sum of

- gross SFT assets that (i) exclude the value of any received financial collateral, which is recognised on the bank's balance sheet, and (ii) measure cash payables and cash receivables, with the same counterparty, on a net basis subject to certain conditions, including the same explicit final settlement date, a legally enforceable right to set off, and a single net amount settlement,
- a measure of counterparty credit risk in the form of (i) the current exposure[95] for SFTs that are subject to an eligible master netting agreement, which is calculated as the total fair value of securities and cash (i.e. financial collateral) lent to a counterparty minus the total fair value of securities and cash (i.e. financial collateral) received from the counterparty and/or (ii) a current exposure[96] on a transaction-by-transaction basis if the SFTs are not covered by a master netting agreement.[97]

[90] BCBS Consol. Basel III (2019), LEV20.5 and LEV30.44-55, and BCBS Basel III (2017), Leverage ratio, para. 27 and 57-59 and annex, para. 8-16. Such commitments are generally defined as any contractual arrangement that has been offered by the bank - and accepted by the client - to extend credit, purchase assets or issue credit substitutes, cf. BCBS Consol. Basel III (2019), LEV30.46, and BCBS Basel III (2017), Leverage ratio, annex, para. 8.

[91] BCBS Consol. Basel III (2019), LEV30.7, and BCBS Basel III (2017), Leverage ratio, para. 26.

[92] BCBS Consol. Basel III (2019), LEV30.21, and BCBS Basel III (2017), Leverage ratio, para. 36. See also Adrian and Shin (2010).

[93] BCBS Consol. Basel III (2019), LEV30.2 and 30.21-25, and BCBS Basel III (2017), Leverage ratio, para. 21 and 36-40.

[94] BCBS Consol. Basel III (2019), LEV30.35, and BCBS Basel III (2017), Leverage ratio, para. 50.

[95] I.e. $E^* = max(0, (\sum Exposure_i - \sum Collateral_i))$.

[96] I.e. $E_i^* = max(0, (Exposure_i - Collateral_i))$.

[97] BCBS Consol. Basel III (2019), LEV20.5 and LEV30.35-38, and BCBS Basel III (2017), Leverage ratio, para. 27 and 50-51 and annex, para. 6-7.

In relation to SFT exposures, banks and supervisory authorities are to be "particularly vigilant" in the pillar 2-assessments of transactions and structures that lead to an inadequate capturing of leverage, e.g. when the exposure increases due to a decrease in the counterparty's credit quality or if the credit quality of the counterparty is positively correlated with the value of the received financial collateral.[98]

In short, the finalised Basel III's leverage ratio can be summarised as:

$$3\% \leq \frac{Capital_{measure}}{(OnBalance_{Expo.} + Derivatives_{Expo.} + SFT_{Expo.} + OffBalance_{Items})}$$

None of the components in the leverage ratio are exclusive to banking. The leverage ratio can accordingly be applied upon non-banks, including life insurance undertakings. However, EIOPA (2018e) considered it "inappropriate" to adopt a banking-based minimum leverage ratio requirement for insurance undertakings due to the insurance business model, including the "quasi-absence" of leverage.[99] EIOPA stated that excessive levels of non-insurance liabilities might increase the build-up of systemic risk and EIOPA considered the introduction of leverage ratios for only monitoring purposes, including (i) own funds to total assets and (ii) non-insurance liabilities to own funds.[100] The "non-insurance liabilities to own funds" ratio was perceived as capable of indicating a high level of interconnectedness across markets and sectors that may entail liquidity risk and the risk of fire sales.[101]

Despite EIOPA's approach, this dissertation proposes a quantitative leverage ratio for life insurance undertakings that is based on the finalised Basel III's leverage ratio. However, it is adapted in order to not capture traditional life insurance business. As reflected in the data collected in chapter 6.3.1, life insurance undertakings will appear significantly leveraged if a "traditional" equity-to-assets ratio is applied upon their balance sheets.[102] This is due to their traditional life insurance business where assets are generally financed with long-term life insurance liabilities and not equity.[103] As described in relation to liquidity risk in part VII above, life insurance undertakings are exposed to mass surrenders and lapse risk but liquidity risk is generally not considered a material risk in traditional insurance.[104] An equity-to-assets assessment of leverage in life insurance is therefore generally not comparable to an equity-to-assets assessment of leverage in banking.

In relation to the leverage ratio's *capital measure*, it can be adapted to include life insurance undertaking's total equity. However, when discussing leverage ratios, EIOPA (2018e) proposed that "own funds" should include assets over

[98] BCBS Consol. Basel III (2019), LEV30.6, and BCBS Basel III (2017), Leverage ratio, para. 25.
[99] P. 11.
[100] EIOPA (2018e), pp. 13 and 67.
[101] EIOPA (2018e), pp. 13.
[102] See e.g. FSB (2013d), annex 1, economic function #2.
[103] See e.g. EIOPA (2018e), p. 11.
[104] See e.g. EIOPA (2018e), pp. 27 and 33.

liabilities (i.e. equity) as well as subordinated liabilities.[105] This approach can be applied provided that such subordinated liabilities are subject to terms that are similar to the finalised Basel III's eligibility criteria for additional tier 1 capital.[106]

Similar to the adapted NSFR that was presented in chapter 12.4.3 above, the leverage ratio's *exposure measure* must be adapted in order to not capture assets that are financed with traditional long-term life insurance liabilities. Chapter 6.3.1 showed how a large majority of the five Danish life insurance undertakings' assets were registered assets which may only be used for the satisfaction of policyholders and beneficiaries.[107] This requirement entails that life insurance undertakings' ability to obtain SFT-based leverage is limited to non-registered assets.[108] In addition, the value of registered assets may be used to reduce the exposure measure's on-balance sheet exposures to *non-registered assets* which indicate assets that are *not* financed by life insurance liabilities. In the leverage ratio, the component "on-balance sheet exposures" can be replaced by non-registered assets which are calculated by subtracting registered assets from total assets. The adapted leverage ratio can accordingly be summarised as:

$$\frac{(Equity + Sub.Liabilities_{Add.Tier1-like})}{((Assets_{Total} - Assets_{Reg.}) + Deriv._{Expo.} + SFT_{Expo.} + OffBalance_{Items})}$$

In relation to AIG and the financial crisis, chapters 1, 5.1.3 and 12 described how an AIG non-insurance subsidiary lent out securities (provided by AIG life insurance subsidiaries) in return for cash financial collateral which it reinvested in long-term and illiquid investments.[109] This activity made AIG subject to runs by securities borrowers as they could demand their cash financial collateral returned on short notice when they became aware of AIG being subject to, inter alia, margin calls under credit default swaps.[110] In the light of AIG, the exposure measure's other items can be relevant for life insurance undertakings that engage in SFTs and write credit default swaps. However, the inclusion of the entire amount of derivative exposures may not be suitable as traditional life insurance entails the use of derivatives to hedge, match and manage assets and liabilities.[111] In line with the FSB's five economic functions for classifying other shadow banking entities, the item "derivative exposures" can be limited to derivatives that facilitate credit creation, e.g. written credit default swaps

[105] P. 11.

[106] BCBS Consol. Basel III (2019), CAP10.9 and 10.11, and Basel III, para. 55. Additional tier 1 capital includes instruments that are, inter alia, (i) paid-in, (ii) subordinated to depositors, general creditors and subordinated debt of the bank, (iii) unsecured, (iv) perpetual, (v) callable at the initiative of the bank only after a minimum of five years, and (vi) provide the bank with full discretion to - at all times - cancel distributions/payments.

[107] See chapter 6.3.1.1 regarding technical provisions and registered assets.

[108] See also EIOPA (2018e), section 2.1.

[109] IAIS (2011), para 18 and appendix A7, IAIS (2017), p. 14, FSB (2012c), section 5.6, EIOPA (2017c), p. 46, EIOPA (2018f), p. 44, and McDonald and Paulson (2015), p. 85.

[110] IAIS (2011), para 18 and appendix A7, IAIS (2017), p. 14, FSB (2012c), section 5.6, EIOPA (2017c), p. 46, EIOPA (2018f), p. 44, and McDonald and Paulson (2015), pp. 86-87 and 102.

[111] See e.g. EIOPA (2018c), pp. 66-69.

and their effective notional amount.[112] Leverage can of course also be obtained via other forms of derivatives but this form of leverage may not relate to credit intermediation or shadow banking. Off-balance sheet items should be equivalent to the off-balance sheet items in the finalised Basel III's leverage ratio as these exposures are banking-like commitments. The adapted leverage ratio can finally be summarised as:

$$3\% \leq \frac{(Equity + Sub.Liabilities_{Add.Tier1-like})}{(Assets_{Non-reg.} + Deriv._{Cred.Fac.} + SFT_{Expo.} + OffBalance_{Items})}$$

where the item "SFT exposure" should be consistent with the finalised Basel III as repos and other SFTs are non-insurance activities and liabilities.

Similar to the adapted LCR and NSFR that were presented in chapter 12.4.3 above, this dissertation's adapted leverage ratio is to reflect the exposure measure of an "internal shadow bank". The adapted leverage ratio's exposure measure is accordingly limited to shadow banking activities and should presumably not capture exposures that are financed with long-term life insurance liabilities.

[112] See chapter 6.1 and FSB (2013d), section 2.4 and annex 1, economic function #4

Part IX

Systemic Risk

Chapter 14

G-SIBs and G-SIIs

The FSB defines SIFIs as financial institutions whose distress or disorderly failure causes significant disruption to the wider financial system and economic activity.[1] Pursuant to the FSB and BCBS, this significant disruption is due to the size, complexity, lack of substitutability, and systemic interconnectedness of SIFIs.[2]

The purpose of global SIFI regulation is (i) to address the "too-big-to-fail" problem that led to public solvency support during the financial crisis, (ii) to force SIFIs to internalise the costs of the (cross-border) negative externalities associated with a SIFI's failure, and (iii) to reduce the moral hazard costs associated with expectations regarding public support.[3] This chapter will only focus on quantitative "going concern" requirements and not include the FSB's resolution framework or key attributes for effective resolution.

In the light of the financial crisis, the G20's systemic risk initiatives resulted in, inter alia, the

- FSB's recommendations regarding SIFIs, including a higher loss-absorbency capacity for G-SIBs that went beyond the minimum levels in the initial Basel III.[4]

- FSB's policy measures to address SIFIs, including the additional loss absorption capacity for G-SIBs.[5]

- FSB's policy measures for G-SIIs, including higher loss absorbency requirements for non-traditional and non-insurance activities.[6]

[1] FSB (2010b), p. 1, and FSB (2011a), para. 3.

[2] FSB (2010b), p. 1, FSB (2011a), para. 3, BCBS Consol. Basel III (2019), SCO40.1, and BCBS (2018), para. 3.

[3] FSB (2010b), p. 1, and FSB (2011a), para. 3 and 4, BCBS Consol. Basel III (2019), SCO40.1 and 40.5, BCBS (2018), para. 1, 2 and 3, IAIS (2013b), para. 7 and 8.

[4] FSB (2010b), pp. 1-2 and section II.

[5] FSB (2011a), para. 4(iii).

[6] FSB (2013b), para. 4(iii). See also FSB (2011a), para. 12.

When applying the global SIFI requirements and designating global SIFIs, the FSB relies on the BCBS' assessment methodologies for designating G-SIBs and the IAIS' assessment methodologies for designating G-SIIs.[7] Accordingly, BCBS (2018) includes an assessment methodology for G-SIBs while IAIS (2016a) includes an assessment methodology for G-SIIs.

When assessing the systemic importance of a bank, the BCBS' assessment methodology for G-SIBs relies on the following equally-weighted categories that include individual indicators:

- size,
- interconnectedness,
- the lack of readily available substitutes or financial institution infrastructure,
- cross-jurisdictional activity, and
- complexity.[8]

A G-SIB designation entails the application of the higher loss absorbency requirement which is to increase the "going concern" loss absorbency of G-SIBs.[9] The finalised Basel III accordingly subjects G-SIBs to the higher loss absorbency requirement, which is based on buckets that go from 1% to 3.5% of risk-weighted assets and is to be met with common equity tier 1.[10] As mentioned in chapter 13 above, G-SIBs are also subject to the leverage ratio buffer requirement that must be met with tier 1 capital.[11] The leverage ratio buffer is set at 50% of the G-SIB's higher loss absorbency requirement.[12]

In insurance, the IAIS' assessment methodology for G-SIIs relies on the following categories:

- size,
- interconnectedness,
- substitutability,
- global activity, and
- asset liquidation, which captures shadow banking as described below.[13]

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[7] FSB (2011a), para. 5 and 12, and IAIS (2015), para. 5. See also e.g. FSB (2017a) and FSB (2017c).

[8] BCBS Consol. Basel III (2019), SCO40.7, and BCBS (2018), para. 14-16 and table 1.

[9] BCBS Consol. Basel III (2019), SCO40.1, and BCBS (2018), para. 5 and 6.

[10] BCBS Consol. Basel III (2019), RBC40 (including 40.1 and 40.4), Basel III, A.5, and BCBS (2018), including para. 46.

[11] BCBS Consol. Basel III (2019), LEV40.1 and LEV90.1, and BCBS Basel III (2017), Leverage ratio, para. 8 and 14.

[12] BCBS Consol. Basel III (2019), LEV40.2, and BCBS Basel III (2017), Leverage ratio, para. 9.

[13] IAIS (2016a), p. 14 (table 2).

The higher loss absorbency requirement for G-SIIs is also a "going concern" capital requirement.[14] It was initially based on, inter alia, G-SII's non-traditional insurance and non-insurance activities ("NTNI") which included shadow banking and SFTs.[15] The NTNI approach was a result of, inter alia, AIG's securities lending and reinvestment of cash financial collateral, which exposed AIG to liquidity risk and made AIG vulnerable to runs.[16] The NTNI category was subsequently discontinued in the IAIS' updated assessment methodology due to uncertainties regarding "non-traditional insurance".[17] However, the IAIS' updated assessment methodology continued to capture shadow banking as the *asset liquidation* category (in the last point above) includes the indicators "non-policyholder liabilities and non-insurance revenues" and "short-term funding" that capture non-insurance activities as well as short-term borrowing, repos, securities lending, maturity transformation, liquidity risk and fire sales.[18]

The IAIS' higher loss absorbency requirement accordingly captures shadow banking by G-SIIs. However, the implementation of the higher loss absorbency requirement for G-SIIs was presumably challenged by the fact that global insurance standards are of a recent nature and that there was no global standard for insurance that was applied in a global fashion like the Basel framework for banks.[19] The higher loss absorbency requirement was to be based on the IAIS' global risk-based insurance capital standard ("ICS") for internationally active insurance groups and G-SIIs, which the FSB requested the IAIS to develop in order to support financial stability.[20] The ICS is expected to be completed in late-2019 whereafter monitoring is to begin in 2020 and implementation is to occur in 2024.[21]

As described in chapters 1 and 6.1.1, IAIS (2018a) has subsequently proposed a holistic framework for systemic risk in the insurance sector (to be adopted in November 2019) which is based on the view that systemic risk can arise from insurance undertakings' collective activities and exposures at a sector-wide level and from the distress or disorderly failure of individual insurance undertakings.[22] The proposed holistic framework accordingly integrates the entity-based approach for G-SIIs[23] and an activities-based approach[24] to systemic risk as

[14]IAIS (2015), para. 2.

[15]IAIS (2013b), para. 9, 14, 18 and 52, and IAIS (2015), para. 5.

[16]IAIS (2011), para. 18 and 31 and appendix A.7, and IAIS (2017), p. 14. See chapters 5.1.3 and 12.

[17]IAIS (2016a), para. 25, and IAIS (2016b), section 2.

[18]IAIS (2016a), para. 25 and p. 14 (table 2), IAIS (2016b), section 2, including para. 2.3, and IAIS (2013a), para. 29 and p. 16.

[19]IAIS (2015), para. 3, 5, 9 and 10. See also IAIS (2014), para. 2.

[20]FSB (2013b), para. 8, and IAIS (2015), para. 9 and 10, and IAIS (2018c), para. 11 and 13.

[21]IAIS (2018c), para. 1 and 10.

[22]Para. 1, 15 and 23-24.

[23]I.e. where the focus is on the systemic risk impact caused by the default of an individual institution, cf. IAIS (2018a), para. 1 and 23-24.

[24]I.e. where the focus is on collective actions, common risk exposures, common responses, or the distress of institutions, which operate in the same markets or are active in the same financial instruments, that could collectively result in systemic risk propagation but where the failure of an individual institution is not a prerequisite for systemic risk propagation, cf.

well as cross-sectoral aspects including banking.[25] It aims to move away from the activities-based approach vs. entity-based/G-SII approach and discusses a removal of the annual identification of G-SIIs.[26] The holistic framework accordingly proposes the "proportionate" application of various enhanced policy measures, including the current G-SII policy measures, to a broader portion of the insurance sector.[27] The holistic framework assumes that systemic risk may arise from both entity-based sources as well as collective activities and exposures.[28] It identifies liquidity risk (including SFTs and liquidity transformation) as a microprudential concern that may become a macroprudential concern due to fire sales that trigger a decrease in asset prices and significantly disrupt trading or funding in key financial markets or cause significant losses or funding problems for other undertakings with similar exposures.[29]

Shadow banking by life insurance undertakings has accordingly been addressed at the global level via the higher loss absorbency requirement for G-SIIs. In addition, shadow banking activities would be addressed via the IAIS' proposed holistic framework for systemic risk.[30]

When assessing the higher loss absorbency requirement in the EU, EIOPA (2016) found it "very important" that it was transposed into EU law in order to increase the resilience of G-SIIs.[31] In addition, the higher loss absorbency requirement was to primarily target non-traditional and non-insurance activities.[32] However, Solvency II is currently not a macroprudential framework that is calibrated to address system-wide risks, designed to limit non-insurance activities, or structured to impose additional capital requirements for macroprudential purposes.[33]

In relation to systemic risk, the research question is whether Solvency II subjects shadow banking-based systemic risk to requirements that are "similar" to the finalised Basel III's requirements for banking-based systemic risk. As

IAIS (2018a), para. 1 and 23-24. IAIS (2017) (para. 27 and section V, including para. 33, 34, 41-45 and 50-52) initially proposed an activities-based approach which identified activities - in terms of the created risk exposures - that insurance undertakings engage in and that could threaten global financial stability. The targeted risk exposures included liquidity risk (including securities lending, termination of short-term funding, changes in the value and liquidity of collateral, margin calls as well as cash collateral reinvestment) that causes a - possibly collective - forced liquidation of illiquid assets in a stressed environment that may impact market prices of assets and the orderly functioning of certain markets. Non-insurance risks were considered difficult to diversify and could trigger correlated losses and downward price spirals if many insurance undertakings were pursuing similar strategies and were forced to sell assets and delever.

[25] IAIS (2018a), para. 1, 12 and 24.

[26] IAIS (2018a), para. 1, 4, 5, 12, 24, 67, 140, 155 and 172-175.

[27] IAIS (2018a), para. 67 and 173-174.

[28] IAIS (2018a), para. 1 and 23-24.

[29] IAIS (2018a), para. 33-37, 49-52 and 58 and p. 21 (figure 1). See also IAIS (2017), para. 33-34, 41-44, and p. 14 (regarding AIG).

[30] IAIS (2018a), section 2.2, including 2.2.1.

[31] Para. 77.

[32] EIOPA (2016), para. 75. See also ESRB (2015), section 3.1 and p. 25.

[33] ESRB (2015), section 6, ESRB (2016a), p. 13, EIOPA (2016), para. 34, 53, 56 and 67, EIOPA (2017c), pp. 14 and 66, EIOPA (2018f), p. 3.

described in chapter 8, the comparison is limited to assessing whether such systemic risk is subject to quantitative pillar 1 requirements. This chapter showed how the finalised Basel III subjects banks to the macroprudential higher loss absorbency requirement in case they are designated as G-SIBs. As shown in parts VII and VIII, the finalised Basel III also subjects banks to the LCR, NSFR and leverage ratio which have macroprudential effects as they address deleveraging and fire sales that may spread to the balance sheets and funding of other exposed parties. In the EU, life insurance undertakings are not subject to quantitative requirements for non-insurance liquidity risk or leverage, and EU G-SIIs are currently not subject to quantitative macroprudential requirements that address shadow banking-based systemic risk.

As also described in chapter 13.1 above, Solvency II is viewed as including elements that may limit procyclicality and have macroprudential as well as financial stability implications.[34] In addition to the long-term guarantee measures, one of Solvency II's possible macroprudential elements could be the supervisory review and capital add-on.[35] The supervisory review and capital add-on, as well as the non-macroprudential purpose, were described in relation to liquidity risk in chapter 12.3.1 above. The capital add-on is not meant to address systemic risk or to be used for purely macroprudential reasons in relation to certain activities, including non-insurance activities such as repos.[36]

As a part of the Capital Markets Union Action Plan, the European Commission undertook a review of the EU's macroprudential framework.[37] EIOPA's recent macroprudential assessments of Solvency II may accordingly transform Solvency II into a macroprudential framework in line with the FSB's and IAIS' initiatives. EIOPA (2018e) considered a separate capital requirement for systemic risk that could be

- an entity-based pillar 1 capital requirement that is aligned with the IAIS' initial higher loss absorbency requirement and addresses the risks associated with national and global SIFIs,
- an activities-based pillar 2 capital requirement that addresses systemically risky activities, common exposures and regulatory arbitrage (e.g. bank-like activities), as well as
- a behavioural-based pillar 2 capital requirement which addresses collective behaviour that affects the financial market and the rest of the economy via market prices and capital flows.[38]

EIOPA also found that Solvency II's capital add-on could be extended to include capital requirements for systemic risk.[39] In a parallel assessment, EIOPA (2018f)

[34] ESRB (2015), section 6, EIOPA (2016), para. 34, 53, 56 and 67, EIOPA (2017c), pp. 14 and 66, EIOPA (2018f), p. 3.
[35] EIOPA (2016), para. 67, and EIOPA (2018f), p. 3.
[36] ESRB (2015), pp. 24-26, and EIOPA (2018e), p. 23.
[37] Capital Markets Union Action Plan, section 6.3 and annex 1.
[38] Section 2.4 and p. 68.
[39] EIOPA (2018e), p. 24.

discussed the power to prohibit or restrict certain types of financial activities, including financial activities that entail leverage and SFTs.[40]

This dissertation's conclusion regarding Solvency II's treatment of shadow banking-based systemic risk may accordingly have to be revised if e.g. the IAIS' higher loss absorbency requirement is implemented into EU law. It may also have to be revised if the IAIS' holistic framework for systemic risk leads to capital requirements for (collective) shadow banking activities by EU life insurance undertakings that may - or may not - be viewed as G-SIIs. However, as described in parts VII and VIII, the EU does not seem inclined to supplement any macroprudential capital requirements with quantitative requirements regarding non-insurance liquidity risk or leverage.

[40]Section 7.1.

Part X

Conclusions

Chapter 15

Conclusions

Chapters 1 and 6 described how banking and shadow banking are associated with credit intermediation as well as maturity transformation, liquidity transformation and leverage. In traditional banking, banks transform short-term and liquid liabilities, including deposits, into long-term and illiquid credit assets. This transformation exposes banks to liquidity risk, including the risk of a "run" on the bank, where depositors rush to withdraw deposits due to the fear of a bank failure. The run forces the bank to liquidate assets at a loss via fire sales and to possibly fail. In general, the need to obtain liquidity via fire sales of assets may entail systemic risk as fire sales may lead to price falls and create mark-to-market losses and funding problems for all undertakings exposed to the assets.

Chapter 1 also described how traditional life insurance has generally not been associated with credit intermediation, maturity transformation, liquidity transformation, leverage or the risk of runs and fire sales. In addition, insurance underwriting risks are generally not correlated with the economic business cycle or financial market risks. Instead, traditional life insurance has generally been associated with long-term and less liquid life insurance liabilities being transformed into shorter-term and liquid assets. Contrary to liquidity risk in banking, the cash flows for a large portfolio of life insurance obligations are perceived as reasonably predictable because of the law of large numbers. In addition, chapter 6.3.1.1 described how life insurance undertakings must establish technical provisions with respect to all of their insurance obligations towards policyholders and beneficiaries of insurance contracts. Such technical provisions are to ensure that life insurance undertakings are able to meet their commitments towards the policyholders and beneficiaries. Chapter 6.3.1.1 also described how life insurance undertakings are obliged to keep a register of "registered assets" that must be used to cover the technical provisions. Contrary to liquidity risk in banking, technical provisions and registered assets entail that life insurance undertakings generally have a large amount of assets on hand relative to liabilities.

As described in chapter 6.1, FSB (2011c) defines shadow banking as "the system of credit intermediation that involves entities and activities outside the regular banking system" and the FSB identifies shadow banking via a two-step approach.

In line with the FSB's step 1, and contrary to traditional life insurance, chapter 6.2 documented the alternative credit investments of Danish life insurance undertakings. When compared to traditional life insurance assets, alternative investments are characterised by being traded on a shallow, illiquid and non-transparent market as well as being long-term and associated with different risks. Danish life insurance undertakings are accordingly conducting credit intermediation by granting bank-like long-term and illiquid credits.

However, step 2 of the FSB's approach for identifying shadow banking entails the identification of non-bank credit intermediation where there are (i) developments that increase systemic risk and/or (ii) indications of regulatory arbitrage that is undermining the benefits of financial regulation. The definition of shadow banking accordingly provides that Danish life insurance undertakings' documented alternative credit investments must be accompanied by systemic risk developments and/or indications of regulatory arbitrage. Similar to regular banking, the FSB states that such systemic risk developments include, inter alia, maturity transformation, liquidity transformation and/or leverage. This approach presumably reflects how credit intermediation - that does not involve maturity transformation, liquidity transformation or leverage - is not exposed to liquidity risk via runs or able to pose a systemic risk due to deleveraging and fire sales. Life insurance undertakings can conduct credit intermediation without significant maturity or liquidity transformation as long-term and less liquid life insurance liabilities can be used to finance long-term and illiquid credit assets.

Runs are generally associated with deposits and EU law ensures that only banks can receive deposits. However, the financial crisis revealed that repos and other SFTs can be used to create short-term and deposit-like liabilities that facilitate credit intermediation, maturity transformation, liquidity transformation and leverage. Chapter 5.1.1.1 described how repos are associated with liquidity risk due to roll-over risk, margin calls and the "run on repo" via haircuts. In addition, chapter 5.1.1.2 described how repos are associated with leverage and procyclicality. Assets are used as financial collateral in repos and allow the repo seller to obtain secured funding and leverage. Variations in the value of assets will occur with the cycles and repo-based leverage entails a direct procyclical relationship between those fluctuating asset values and the access to leverage.

Repos and other SFTs accordingly enable life insurance undertakings and other non-banks to issue "deposit-like" liabilities that expose them to liquidity risk and procyclicality. The primary example of a run in life insurance is presumably the case of AIG, where an AIG non-insurance subsidiary lent out securities (provided by AIG life insurance subsidiaries) in return for cash financial collateral which it reinvested in long-term and illiquid investments.[1] This activity made AIG subject to runs by securities borrowers as they could demand their cash financial collateral returned on short notice when they became aware

[1] IAIS (2011), para 18 and appendix A7, FSB (2012c), section 5.6, IAIS (2017), p. 14, EIOPA (2017c), p. 46, EIOPA (2018f), p. 44, and McDonald and Paulson (2015), p. 85-87.

of AIG being subject to, inter alia, margin calls under credit default swaps. As reflected in chapters 6.1.1 and 14, the IAIS has continuously recognised that life insurance undertakings' SFTs are associated with shadow banking and systemic risk.[2] The IAIS identifies liquidity risk (including SFTs and liquidity transformation) as a microprudential concern that may become a macroprudential concern due to fire sales that trigger a decrease in asset prices and significantly disrupt trading or funding in key financial markets or cause significant losses or funding problems for other undertakings with similar exposures.[3] In its recent macroprudential assessments of Solvency II, EIOPA has also recognised that SFTs are a potential systemic risk driver.[4]

In line with step 2 of the FSB's approach for identifying shadow banking, chapter 6.3 documented significant increases in the repo activities of the "top 5" Danish life insurance undertakings. The repo activities of an individual Danish life insurance undertaking may possibly not constitute a systemic risk development, however, the IAIS' holistic framework for systemic risk assumes that systemic risk may arise from both entity-based sources as well as collective activities and exposures.[5] The repo activities of Danish life insurance undertakings were accordingly documented from both an entity-based and aggregated perspective. As shown in chapter 6.3.1.2, the aggregated values of the five Danish life insurance undertakings' repo indicators increased by approx. DKK 100 bill. (approx. EUR 13.4 bill.) until 2016, and the increase occurred alongside an increase in the alternative credit investments. After 2016, the aggregated repo indicators decreased significantly.

In relation to liquidity risk and runs, chapter 1 described how life insurance undertakings are generally assumed to have a large amount of assets on hand relative to liabilities. However, as described in chapters 6.3.1.1 and 6.3.2, non-compliance with the collateral reporting obligation in relation to repos, and/or a lack of reporting of repos and their associated risks, will lead to a lack of transparency regarding life insurance undertakings' non-insurance activities, liquidity risk profiles and available unencumbered assets. If assets are not correctly reported as financial collateral in repos, then the amount of available non-registered assets will appear more capable of meeting liquidity outflows than is actually the case. Chapter 6.3.1 documented non-compliance with the collateral reporting obligation and chapter 6.3.1.8 showed how none of the "top five" Danish life insurance undertakings' solvency and financial condition reports addressed the liquidity risk associated with repos. This may indicate a lack of compliance with Solvency II's prudent person principle, which states that a life insurance undertaking may only invest in assets and instruments whose risks it can properly

[2] IAIS (2018a), section 2.2, including 2.2.1, IAIS (2017), para. 33-34, 42-45 and pp. 14-15, IAIS (2016a), para. 25 and p. 14 (table 2), IAIS (2016b), section 2, including para. 2.3, IAIS (2015), para. 5, IAIS (2013a), para. 29 and p. 16, IAIS (2013b), para. 9, 14, 18 and 52 andIAIS (2011), para. 18 and 31 and appendix A.7.

[3] IAIS (2018a), para. 33-37, 49-52 and 58 and p. 21 (figure 1). See also IAIS (2017), para. 33-34, 41-44, and p. 14 (regarding AIG).

[4] EIOPA (2017c), p. 28 and 30 (table 6), and EIOPA (2018e), pp. 31 and 52. See also ESRB (2018), pp. 4, 8, 11-14 and section 3.2.

[5] IAIS (2018a), para. 1 and 23-24.

identify, measure, monitor, manage, control and report.[6]

In line with the FSB's two-step approach for identifying shadow banking, chapter 6.2 accordingly documented non-bank credit intermediation, in the form of the total alternative credit investments, while chapter 6.3 documented the aggregated and individual values of the "top five" Danish life insurance undertakings' repo indicators that may indicate entity-based and activities-/behaviour-based sources of systemic risk.

However, as described in chapters 1 and 6, the alternative credit investments and repo activities do not amount to shadow banking if these bank-like activities are subject to prudential regulatory standards that are similar to the prudential regulatory standards that apply upon banks that conduct similar activities. It was accordingly decided to compare (i) the EU's regulation of life insurance in Solvency II and (ii) the global banking standards in the recently finalised Basel III. The comparison of EU law with global banking standards was made as EU banking law would not implement the entire finalised Basel III during the writing of this dissertation. In addition, essential parts of the FSB's shadow banking initiatives and the BCBS' responses to the financial crisis are placed in the finalised Basel III. Although parts of the finalised Basel III may not become EU law, they may still be relevant when assessing Solvency II as they reflect a coordinated effort by the FSB and BCBS to address shadow banking.

While being fully aware of the legal fact that the finalised Basel III only amounts to global standards as well as that the BCBS does not possess any formal supranational authority, this dissertation's overall research question was formulated as follows:

> *Does Solvency II subject life insurance undertakings' bank-like risk exposures to requirements that are similar to the finalised Basel III's requirements for banks that are exposed to similar risks?*

Chapter 8 presented the scope and method for comparing Solvency II and the finalised Basel III. Based on, inter alia, Brunnermeier and Pedersen (2009), Adrian and Shin (2010) and Gorton and Metrick (2012), chapter 8 derived a scenario that enabled a risk-based approach which focused on the assumed risk exposures regardless of the legal or institutional form of the activities or the entity that performed those activities. The overall research question was accordingly answered by comparing how Solvency II and the finalised Basel III address:

- credit risk (in the form of default risk, credit spread risk and migration risk) and counterparty credit risk,
- liquidity risk,
- leverage and the associated procyclicality, and
- systemic risk.

[6] Solvency II, art. 132(2).

Due to the structural differences in pillar 1 requirements, which were described in chapter 9, the comparison was limited to assessing whether the individual risk types and leverage are *subject* to *quantitative pillar 1 requirements*. If a quantitative pillar 1 requirement exists for the risk type in both Solvency II and the finalised Basel III, then the requirement was regarded as "similar" and the risk type was not viewed as being addressed to a materially lesser or different degree.

Table 15.1 provides an overview of the findings in relation to credit risk (in the form of default risk, credit spread risk and migration risk) and counterparty credit risk. Table 15.2 provides an overview of the findings in relation to liquidity risk, leverage and the associated procyclicality, and systemic risk. These findings have to be viewed in the light of the structural differences that were described in chapter 9, including (i) differences between the risk-weighted assets in the finalised Basel III's total capital ratio and Solvency II's 99.5% VaR-based SCR, (ii) differences in risk measures and calibration, and (iii) differences in diversification effects during the aggregation of risk-based capital requirements.

Table 15.1 shows how both the finalised Basel III and Solvency II's SCR standard formula explicitly capture (credit) spread risk but that the finalised Basel III's trading book applies a liquidity horizon-adjusted 97.5% expected shortfall calibration while Solvency II applies a one-year 99.5% VaR calibration. In addition, both the finalised Basel III and Solvency II implicitly capture migration risk via (credit) spread risk. During the Solvency II project, as described in chapter 10.3, CEIOPS viewed the introduction of the spread risk sub-module and the counterparty default risk module as more closely aligned with banking regulation, where "specific interest rate risk" was treated as a part of the trading book while default risk was a part of the banking book.[7] Based on this approach, Solvency II's SCR standard formula captures default risk *implicitly* via the *one-year 99.5% VaR* calibration of the spread risk sub-module's stress factors. The Solvency II project's approach for default risk may have been aligned with Basel II's treatment of default risk in the banking book and market risk in the trading book. However, due to the interaction between credit risk and market risk during the financial crisis, the finalised Basel III *explicitly* captures (jump-to-) default risk at a *one-year 99.9% VaR* regardless of whether the credit exposure is in the banking book or trading book and regardless of the applied approach. Despite these differences, it was concluded that default risk, credit spread risk and migration risk are addressed via quantitative pillar 1 capital requirements in both Solvency II and the finalised Basel III. The question of whether Solvency II's spread risk sub-module sufficiently captures default risk in comparison to the finalised Basel III will depend on the actual one-year 99.5% VaR calibration of the stress factors and the applied diversification effects.

As described in chapter 6.2 and 10.3.2, life insurance undertakings' alternative credit investments, including unrated bonds and loans, may become increasingly similar to banks' credit intermediation and occur alongside banks. However, the comparison showed that there is no alignment of asset classes for

[7] CEIOPS (2007a), para. 5.83. See also CEIOPS (2007d), para. 1.1.

<table>
<tr><th colspan="3"></th><th>Default risk/jump-to-default risk</th><th>Credit spread risk</th><th>Migration risk</th><th>CCR (repos)</th></tr>
<tr><td rowspan="4">Finalised Basel III</td><td rowspan="2">Banking book (portfolio invariance)</td><td>Standardised approach</td><td>Explicit (risk weights)</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="4">CCR exposure amounts/ EADs (prescribed haircuts produce volatility-adjusted exposure amounts/ financial collateral values). Qualifying repos, core market participants, master netting agreements.</td></tr>
<tr><td>IRB approach</td><td>Explicit (99.9% one-year VaR)</td></tr>
<tr><td rowspan="2">Trading book (prescribed diversification effects during aggregation (DRC is separate))</td><td>Standardised approach</td><td>Explicit (DRC calibrated in line with banking book)</td><td>Explicit (via sensitivities-based method - calibration aligned with IMA)</td><td>Implicit (via risk weights in credit spread risk)</td></tr>
<tr><td>Internal models approach (IMA)</td><td>Explicit (DRC in line with banking book's one-year 99.9% VaR)</td><td>Explicit (97.5% expected shortfall)</td><td>Implicit (via credit spread risk and liquidity horizons)</td></tr>
<tr><td rowspan="2">Solvency II</td><td rowspan="2">SCR standard formula (diversification effects during aggregation in SCR standard formula)</td><td>Spread risk sub-module</td><td>Implicit (via one-year 99.5% VaR calibration of stress factors)</td><td>Explicit (one-year 99.5% VaR)</td><td>Implicit (via one-year 99.5% VaR calibration of stress factors)</td><td></td></tr>
<tr><td>Counterparty default risk module</td><td>Explicit (15% risk factor applied on LGD for specific retail mortgage loans)</td><td></td><td></td><td>Type 1 exposure loss distribution's standard deviation x 99.5% VAR stress quantile factor</td></tr>
</table>

Table 15.1: Overview of findings in the comparison of quantitative pillar 1 requirements for (i) the individual components of credit risk and (ii) counterparty credit risk ("CCR"). The default risk capital requirement ("DRC") is a separate capital requirement for default risk under both the standardised approach and internal models approach for market risk in the finalised Basel III.

credit exposures in Solvency II and the finalised Basel III. In general, the finalised Basel III applies a more granular approach and a specialised treatment of specific exposure types, including the more risky specialised lending which is subject to specific risk weights in the banking book. In addition, the finalised Basel III's standardised approach for market risk includes more granular sectors with specific risk weights. The increase in life insurance undertakings' bank-like credit exposures, which may resemble e.g. specialised lending, could warrant consistency in asset classes for credit risk. Diversification effects may prevent "meaningful" comparisons of risk factor-level capital requirements. However, an alignment of asset classes could enable more granular calibrations of credit risk and ensure additional cross-sectoral consistency in relation to the same credit exposure types.

Table 15.1 also shows the findings regarding counterparty credit risk ("CCR") on repos. The finalised Basel III includes an explicit treatment of repos that are subject to master netting agreements. This treatment is provided via counterparty credit risk exposure amounts (or counterparty credit risk EADs) that recognise master netting agreements and rely on prescribed haircuts to produce volatility-adjusted values. Table 15.1 also shows how the finalised Basel III includes a specific treatment of qualifying repos and core market participants in order to accommodate interbank short-term wholesale funding. Under Solvency II, repos are regulated at level 3 as EIOPA Guidelines (2014d) state that life insurance undertakings must apply the counterparty default risk module's treatment of type 1 exposures upon the posted financial collateral while considering the risk mitigating effect of the received financial collateral.[8] Chapter 11.1.2.2 described how Solvency II's regulation of risk mitigation, including collateral, was based on an intention to ensure cross-sectoral consistency in order to address regulatory arbitrage. In addition, chapter 11.2.1 showed how Solvency II's counterparty default risk module initially relied on banking regulation but diverged to a reinsurance-based approach for counterparty default risk capital requirements for type 1 exposures. The counterparty default risk module accordingly multiplies the type 1 exposure loss distribution's standard deviation with a stress quantile factor to achieve Solvency II's 99.5% VaR. Solvency II's level 2 regulation of type 1 exposures does not include an explicit LGD for repos that are subject to master netting agreements. In addition, the counterparty default risk module generally subjects recognised collateral to risk adjustments. However, these risk adjustments are not based on banking regulation-inspired haircuts but instead on market risk adjustments via the SCR standard formula's market risk module. Despite these differences, it was concluded that counterparty credit risk is addressed via quantitative pillar 1 requirements in both Solvency II and the finalised Basel III.

During the recent Solvency II review, stakeholders emphasised the importance of ensuring consistency with future banking regulation and also mentioned that more and more repo transactions were centrally cleared.[9] In relation to

[8] EIOPA Guidelines (2014d), para. 127. See also EIOPA (2014b), SCR.5.82 and SCR.6.7.
[9] EIOPA (2018b), para. 1482 and 1486.

the counterparty default risk module's treatment of CCP exposures, EIOPA (2018b) considered whether repo exposures should be covered but stakeholders did not seem to consider repos as relevant exposures.[10] However, as showed in chapter 6.3.1, exposures to repos may be a country-specific characteristic as the "top five" Danish life insurance undertakings have had significant exposures to repos and the posted financial collateral. This aspect, as well as cross-sectoral consistency, may warrant an explicit treatment of repos that are subject to master netting agreements. The explicit treatment could also ensure cross-sectoral consistency in calibrations of capital requirements, including prescribed haircuts or risk adjustments. While considering Solvency II's diversification effects, such a treatment could rely on the finalised Basel III's comprehensive approach for financial collateral that is tailored specifically for repos and master netting agreements. This could also ensure equivalence in relation to the capital requirements for short-term repos with core market participants.

Due to the financial crisis, the finalised Basel III's risk-based capital requirements are supplemented with the LCR and NSFR, which are two minimum quantitative standards for funding and liquidity. As described in chapter 12.4, the introduction of the LCR and NSFR was based on the view that strong capital requirements are a necessary condition for the stability of the banking sector but not sufficient by themselves. In addition, chapter 10.6.1 described how market liquidity risk is addressed in the finalised Basel III's trading book via liquidity horizons and stressed risk weights and calibrations. In relation to leverage and procyclicality, chapter 13 described how the finalised Basel III's leverage ratio is to supplement risk-based capital requirements with a quantitative non-risk-based, simple and transparent "backstop" measure. Chapter 13 also described how the risk-based capital requirements are supplemented with a countercyclical buffer as well as that G-SIBs will be subject to a leverage ratio buffer requirement. Finally, chapter 14 described how the finalised Basel III includes the higher loss absorbency requirement for G-SIBs to address systemic risk.

A fundamental difference between Solvency II and the finalised Basel III lies in the fact that the finalised Basel III supplemented its revised risk-based capital requirements with, inter alia, the LCR, NSFR, leverage ratio and capital requirements for systemic risk. This is reflected in table 15.2. Solvency II does not subject non-insurance liquidity risk to an explicit quantitative requirement under the SCR standard formula or SCR internal model. Solvency II does also not subject non-insurance-/repo-based leverage and procyclicality to quantitative requirements. The EU has not (yet) implemented the FSB's numerical haircut floors framework, which could address procyclical leverage via "non-bank-to-non-bank" SFTs that are not CCP-cleared. Solvency II has also not (yet) implemented the higher loss absorbency requirement for the systemic risk that G-SIIs' shadow banking may pose.

From an overall perspective, table 15.1 reflects how the components of credit risk as well as counterparty credit risk are subject to quantitative pillar 1 re-

[10]Para. 1506.

<table>
<tr><th colspan="3"></th><th>Market liquidity risk</th><th>Liquidity risk (for non-insurance in Solvency II)</th><th>Leverage and procyclicality (for non-insurance in Solvency II)</th><th>Systemic risk (for non-insurance in Solvency II)</th></tr>
<tr><td rowspan="4">Finalised Basel III</td><td rowspan="2">Banking book (portfolio invariance)</td><td>Standardised approach</td><td rowspan="2"></td><td rowspan="4">LCR and NSFR</td><td rowspan="4">Leverage ratio, Countercyclical buffer, G-SIB leverage ratio buffer</td><td rowspan="4">G-SIB higher loss absorbency requirement.</td></tr>
<tr><td>IRB approach</td></tr>
<tr><td rowspan="2">Trading book (prescribed diversification effects during aggregation)</td><td>Standardised approach</td><td>Risk weights (calibrated to stressed market conditions and mirror liquidity horizons in IMA)</td></tr>
<tr><td>Internal models approach (IMA)</td><td>97.5% expected shortfall (stressed and liquidity horizons for prescribed risk factors)</td></tr>
<tr><td colspan="3">Solvency II</td><td>None</td><td>None</td><td>None</td><td>None</td></tr>
</table>

Table 15.2: Overview of findings in the comparison of quantitative pillar 1 requirements for liquidity risk, leverage and procyclicality, and systemic risk.

quirements in both Solvency II and the finalised Basel III. However, table 15.2 clearly reflects how Solvency II is currently a non-macroprudential framework. Solvency II does not impose quantitative pillar 1 requirements on non-insurance liquidity risk, leverage and the associated procyclicality, or shadow banking-based systemic risk. This is also illustrated in figure 15.1, which constitutes the scenario that was used to identify the relevant risks and delimit this dissertation's risk-based comparison of Solvency II and the finalised Basel III. The "green risks" are subject to quantitative pillar 1 requirements in Solvency II while the "red risks" are *not* subject to quantitative pillar 1 requirements in Solvency II.

The answer to the overall research question is accordingly that Solvency II does *not* subject life insurance undertakings'

- bank-like exposures to *liquidity risk* or
- bank-like *leverage and its possible procyclicality*

to quantitative pillar 1 requirements, while liquidity risk, leverage and procyclicality are addressed via quantitative pillar 1 requirements in the finalised Basel III. In addition, the finalised Basel III addresses *systemic risk* as it imposes the higher loss absorbency requirement upon G-SIBs. Solvency II does not impose a higher loss absorbency requirement upon the systemic risk that G-SIIs' shadow banking may pose. These differences regarding liquidity risk, leverage and systemic risk presumably entail regulatory arbitrage possibilities - and the possibility of systemic risk - as life insurance undertakings can obtain leverage, via repos and other SFTs, without being subject to quantitative pillar 1 requirements for such non-insurance liabilities.

This dissertation has not proposed any buffers for systemic risk as the IAIS has developed the higher loss absorbency requirement for G-SIIs' shadow banking. In its macroprudential assessments of Solvency II, EIOPA (2018e) similarly considered the development of a separate capital requirement for systemic risk that could be entity-based, activities-based or behavioural-based.[11]

EIOPA also considered the LCR and NSFR but rejected the adoption of liquidity requirements.[12] In addition, EIOPA considered it "inappropriate" to adopt a banking-based minimum leverage ratio requirement for insurance undertakings due to the business model in insurance, including the "quasi-absence" of leverage.[13] However, in order to ensure that Solvency II addresses life insurance undertakings' possible repo-based shadow banking, this dissertation proposed adapted versions of the LCR, NSFR and leverage ratio in chapters 12.4.3 and 13.3. These adapted versions are presumably structured to only capture shadow banking as they exclude, inter alia, traditional life insurance liabilities and assets.

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[11] Section 2.4 and p. 68.
[12] EIOPA (2018e), pp. 35-36.
[13] EIOPA (2018e), p. 11.

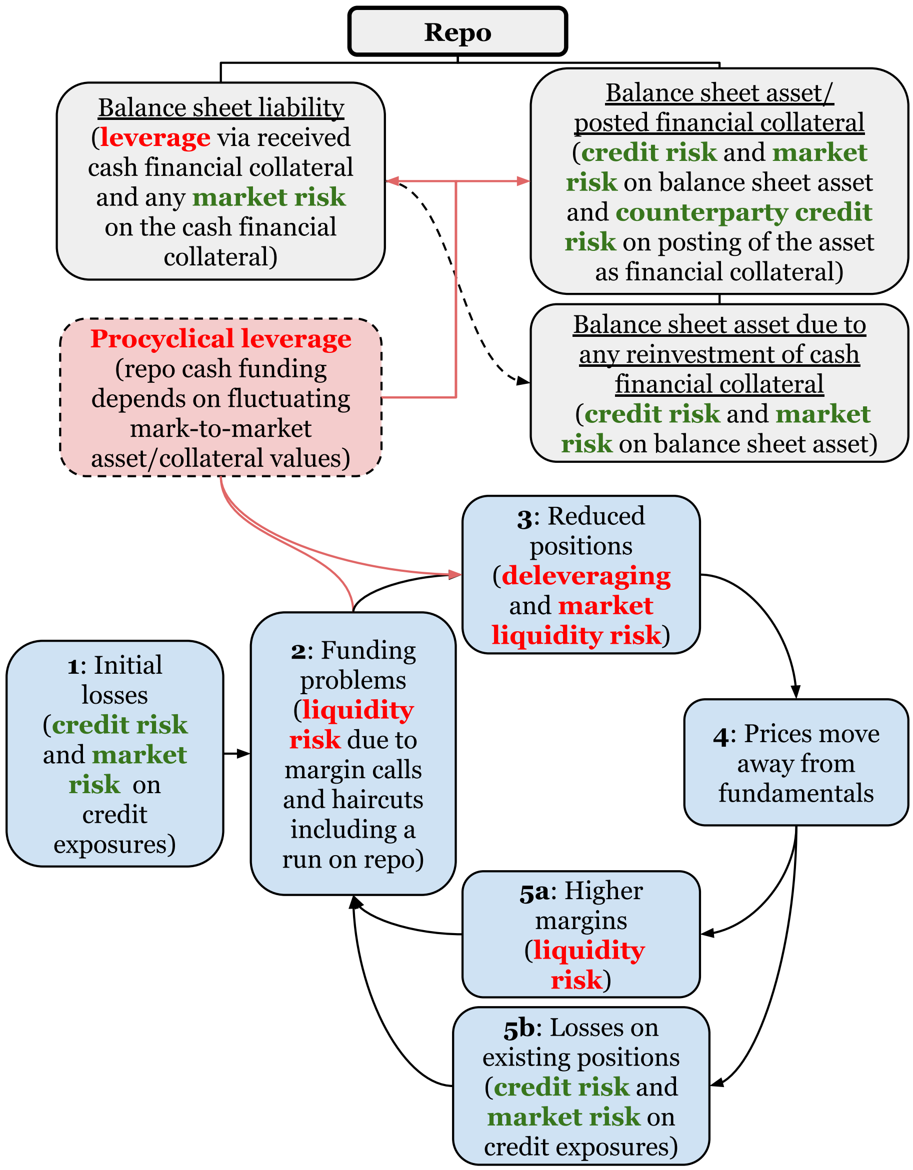

Figure 15.1: Illustration of how Solvency II is currently a non-macroprudential framework that does not address shadow banking via quantitative pillar 1 requirements regarding liquidity risk or procyclical leverage.

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