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# Bank capital requirements and credit risk management

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**Čestné prohlášení**

Prohlašuji, že diplomovou práci na téma *"Bank capital requirements and credit risk management"* jsem vypracovala samostatně a veškerou použitou literaturu a další prameny jsem řádně označila a uvedla v přiloženém seznamu.

V Praze dne 1. září 2015 …….

*podpis*

**Poděkování**

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## Abstrakt

Cílem této diplomové práce je analýza kapitálových požadavků v rámci Basel III a jejich dopady pro řízení úvěrového rizika. Teoretická část práce je rozdělena do dvou kapitol. První kapitola, popisuje kápitalové požadavky v rámci reforem Basel III. Druhá část se zaměřuje na úvěrových derivátech jako jeden z hlavních nástrojů pro řízení úvěrového rizika. Poslední část poskytuje ilustrativní příklad řízení úvěrového rizika pomocí logistické funkce. Na závěr jsou shrnuté hlavní výsledky této diplomové práce.



**Klíčová slova:** finanční krize, Basel III, řízení úvěrového rizika, úvěrové deriváty

## Abstract

The aim of this master thesis is to analyze bank capital requirements under Basel III and its implications for credit risk management. The theoretical part of the thesis is divided into two chapters. The first chapter assesses bank capital requirements under Basel III reforms. The second chapter focuses on credit derivative instruments as a major tool for credit risk management. The last part provides an illustrative example of credit risk management, by developing a logistic scoring function. The results of the paper are summarized in the conclusion.

**Keywords:** financial crisis, Basel III, credit risk management, credit derivatives

# Contents

## Introduction

The 2007-2008 financial crisis represented a major challenge for the financial stability of economies worldwide. Even though it initiated in the USA, the financial contagion effect transformed it in the most severe crisis since 1930s. The outbreak of the crisis was mainly a result of inadequate risk management at macro and micro level. On one hand, the capital adequacy rules had significant drawbacks that enabled banks to take on too much risk, and on the other hand, banks lacked understanding of the risks they were exposed to and proved to be ineffective in their management. Although the crisis revealed new risks for the financial system, credit risk represented the root cause of risk build-up.

Broadly speaking, credit risk is the risk that a counterparty will fail to fulfill its financial obligations. It includes the risk of default on a loan or bond, as well as the risk of a guarantor or derivative counterparty not meeting its commitment. Among common sources of credit risk are *concentrations* of credits to single borrowers or group of connected counterparties, the *credit process* mainly due to the lack of qualitative due diligence, inappropriate testing and validation techniques, failure to perform periodic monitoring, and inadequate pricing methodology. *Contingent market- and liquidity-sensitive exposures* may serve as an additional cause of credit risk.

In general terms, all the above mentioned causes stand behind the recent crisis. In a response to it, Basel III was issued. Basel capital accords set the regulatory framework for bank capital requirements. From its first release in 1988, it has been amended on several times to include besides capital requirements for credit risk, also capital demands for market and operational risk. On this occasion, Basel III aims to enhance risk management and governance, strengthen banks' ability to absorb shocks and sets higher standards for transparency and disclosure.

The objective of this master thesis is to assess bank capital requirements under Basel III, referring to its implications for credit risk management. The analysis of the new liquidity requirements and issues not directly related to credit risk are out of the scope of this paper. The paper is divided into 3 chapters. The first chapter, discusses Basel III credit risk requirements. It addresses the necessity to implement new capital adequacy standards, by explaining major causes of the financial crisis and continues by defining the new reforms. Next, we analyze the consistency of Basel III implementation across different economies, to get a broader picture of bank capital regulatory. The last section, provides a synthesis of the main findings.

The second chapter focuses on describing the credit derivatives market and basic credit instruments. It continues by referring to Basel III implications for credit derivatives, namely the regulatory capital relief and Credit Valuation Adjustment matters. We proceed by quoting related literature that discusses the development in the credit derivatives market.

In the last chapter, we develop a logistic scoring function that presents a more practical approach on credit risk measuring. We begin by making a brief theoretical introduction, and continue with presenting the methodology and summarizing the main results. Besides short comments at the end of each chapter, the main conclusion summarizes the overall results of this paper.

# I. Basel Credit Risk Requirements

## 1.1 The rationale behind Basel III

The first Basel Capital Accord was agreed on in 1988. Its main goal was to ensure sound banking practices, financial stability and equitable competition between banks. In 1996 the accord was amended to include capital requirements for market risk. As a consequence of its shortcomings in relationship to large institutions, concentration process and increased complexity of risk mitigation methodologies, a new Basel II consultative paper was released in 1999. In contrast with its former version Basel II Accord - effective starting with 2008 - granted three options for measuring credit and operational risk, without changes on measuring market risk1. Basel III requirements were approved by 27 member jurisdictions and 44 central banks and supervisory authorities on September 12, 2010. Full scale implementation deadline is set for 2019.

This chapter aims to make a reasoning behind the new Basel III requirements by going through the main causes of the recent financial crisis and the reforms imposed by the regulatory authorities to mitigate them. The focus is mainly on matters associated with credit risk.

### 1.1.1 Causes of the financial crisis

There are many explanations for the 2007 financial crisis. Generally speaking, banks had too low capital ratios to absorb the concentration of losses. The low capital ratios resulted from an inappropriate measurement of risk in certain asset classes and from a lack of high quality regulatory capital. Many claim that the root cause of the crisis was the Bush Administration 'American Dream' with zero equity mortgages that allowed low-income families to get a mortgage. The approach was combined with FED's inappropriate monetary policy that cut the interest rates stimulating massive refinancing opportunities complemented by waves of immigration and stagnant wages[2]. The situation was further worsened by financial imbalances as the capital was flowing into western countries putting pressure on lower interest rates while taking on more risk in a 'search for yield'. Financial disruptions were fuelled by the process of deregulation. Alan Greenspan, ex-chairman of FED, states: '*The market-stabilizing private regulatory forces should gradually displace many cumbersome, increasingly ineffective government structures'*. In December 2000 the Commodity Futures Modernization Act was passed deregulating the OTC derivatives market and reducing to a minimum the oversight of CFTC and the SEC. As a consequence, the OTC derivatives' gross market value grew from USD 3.2 trillion to USD 20.3 trillion in less than 8 years. In USA, the five largest institutions in 2008 held 97% of the notional amount of OTC derivatives, being among the world's largest OTC derivatives dealers. Another issue is the excessive leverage positions taken on by banks. Interestingly, financial regulators in the USA allowed investment banks to decide whether they agree to be regulated by SEC. Should they do so, the leverage level of 15:1 applicable in 2004 was raised to as much as 40:1. Haldane (2010) further notes: "*The decision by many banks to increase leverage ap-*

[1] FEDERAL RESERVE: *Capital Standards for Banks: The Evolving Basel Accord*, Bulletin, available on: <http://www.federalreserve.gov/pubs/bulletin/2003/0903lead.pdf>.

[2] WIGNALL, A.; ATKINSON, P.; LEE, H.: *The Current Financial Crisis: Causes and Policy Issues*, Working Paper, available on: <http://www.oecd.org/finance/financial-markets/41942872.pdf>.

*pears to have been driven in part by a desire to maintain ROE, relative to competitors, even as return on assets fell*"[3]. What concerns the situation of Fannie Mae and Freddie Mac, both government sponsored entities, regulatory arbitrage was in place. Not surprisingly, at the very point that OFHEO imposed them to hold greater capital base and balance sheet controls, the banks that used to sell them mortgages started on creating the SIVs and CDOs - own style Mac and Mae vehicles. Further implications uphold to the switch to the 'Originate and Distribute' business model. This type of business model provides the advantage to collect earnings without the need of raising capital. Thus creating a new opportunity for Basel gambling. Now, the so called equity culture implied more income from trading and fees earned from securitisation. Banks in the run for fee-earnings from securitisation engaged more and more into sub-prime mortgages. The paradox is that precisely Basel II made mortgages more tempting. In contrast to Basel **I** that stipulated a 50% RW for mortgages, it proposed a 35% RW; 15-20% for subjects using IRB models. The mortgage crisis that followed was primarily about complex securitised products. Rating agencies played a major role in the growth of this market assigning credit ratings to ABS even though lacking the necessary experience to make reliable risk assessments. In October 2010 the FSB released the 'Principles for Reducing Reliance on CRA Ratings' that aims to reduce the use of external ratings in market standards, laws and regulation.[4] What went wrong besides that? … the massive shadow banking industry[5] - particularly market on commercial paper and repos, money market mutual funds - , systemic risk and interconnectivity - too big to fail and too important to fail syndrome - , corporate governance lapses, unjust management bonuses, etc.[6]

In a first response to the mentioned failures, national and international regulators raised the risk weights for selected asset classes. These measures are known as Basel 2.5 and include among other things the introduction of stressed Value-at-Risk and higher capital charges for credit positions, including resecuritisation in both the banking and trading books[7]. More importantly, it tries to push the derivatives market into regulated exchanges.

The main goal of Basel III is to foster a more resilient banking system, specifically, to strengthen its ability to absorb shocks in situations of stress and to minimize the negative impact on the real economy. Moreover, the reforms are meant to reinforce banks' transparency and disclosure, as well as improve the resolution mechanism for systemically important cross-border banks. The lesson learned from the financial crisis is that excessive on- and off- balance sheet leverage in combination with a lack of liquidity might result in severe stress scenarios. Basel III requirements aim to directly address the root cause of market failures by applying a micro and macro approach. Table 1 presents the implementation timeframe for the new requirements, shared areas indicating transition periods.

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[3]MERROUCHE, O.; NIER, E.*:'What Caused the Global Financial Crisis? – Evidence on the Drivers of Financial Imbalances 1999-2007',* IMF, Working Paper, 2010, available on: <https://www.imf.org/external/pubs/ft/wp/2010/wp10265.pdf>.
[4]FINANCIAL STABILITY BOARD*: Principles for Reducing Reliance on CRA Ratings*, Working Paper, 2010, available on: <http://www.financialstabilityboard.org/wp-content/uploads/r_101027.pdf?page_moved=1>.
[5] Involves funding through: commercial papers, repo, net securities loaned, liabilities of ABS issuers, money market mutual fund assets.
[6]SCHECHTER, D.: *The Financial Crisis Inquiry Report*: *The Final Report of the National Commission on the Causes of the Financial and Economic Crisis in the United States, Including Dissenting Views*, ISBN: 978-1-61640-541-0, 2011.
[7] KUGLER, P.; JUNGE, G.*: Quantifying the impact of higher capital requirements on Swiss economy, Working Paper, 2012, available on:*
<https://wwz.unibas.ch/fileadmin/wwz/redaktion/makro/Papers/G_Junge_P_Kugler_July_02_2012_V3_fina.pdf>.

**Table 1: Basel III phase-in arrangements**

| | 2014 | 2015 | 2016 | 2017 | 2018 | From 2019 |
|---|---|---|---|---|---|---|
| Minimum CET1 ratio | 4.0% | 4.5% | 4.5% | 4.5% | 4.5% | 4.5% |
| Capital conservation buffer | | | 0.625 % | 1.25% | 1.875% | 2.5% |
| G-SIB surcharge | | | Phase in | | | 1% - 2.5% |
| Minimum common equity + capital surcharge | 4.0% | 4.5% | 5.125 % | 5.75% | 6.375% | 7.0% |
| Phase in of deductions from CET1 | 20% | 40% | 60% | 80% | 100% | 100% |
| Minimum Tier 1 capital | 5.5% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% |
| Minimum total capital | 8% | 8% | 8% | 8% | 8% | 8% |
| Minimum total capital + capital conservation buffer | 8% | 8% | 8.625 % | 9.25% | 9.875% | 10.5% |
| Capital instruments that no longer qualify as Tier1 or Tier2 capital | Phase-out in period of 10 years beginning with 2013 | | | | | |
| Leverage ratio | Parallel run[8] | | | | Final adjustments | Mandatory |

Source: Bank for International Settlements

## 1.1.2 Reforms on strengthening the capital base

This section will present major changes made under Basel III in comparison with the stipulations set by previous requirements. It will refer merely on amendments that are relevant for credit risk management: capital requirements, capital buffers, counterparty credit risk, leverage ratio. The primer of this section presents more details on contingent convertible capital that is a novelty within the capital base.

*Requirements on qualitative, solid and transparent capital*

The core form of capital is made of common shares or its equivalent for non-joint stock companies and retained earnings. The following amendments are in place:

a. The minimum in common equity will be raised to from 2% to 4.5% of RWA, after deductions;
b. Innovative hybrid capital instruments that were set to be less than 15% of Tier 1 will be eliminated. Tier 2 capital instruments will be harmonized.

*Improving the risk coverage*

[8]BIS: The transitions period is set of a supervisory monitoring period and the parallel run period, in which the leverage ratio is reported and tracked, however, public disclosure requirements will begin in January, 2015. Relying on the outcome of the parallel run and the made adjustments calibration of the ratio is scheduled in the first months of 2017.

a. The counterparty credit risk capital requirement will be set based on stress conditions in order to tackle pro-cyclicality. It will incorporate at the same time market risk for a more effective counterparty risk assessment;
b. New capital charges will be implemented for market-to-market losses depending on the decreasing credit worthiness of the counterparty. Justification: the credit valuation adjustment caused significantly higher losses during the 2007 crisis than direct defaults;
c. Enhanced collateral and initial margin diligence is required. Establishing a longer margining period for large and illiquid derivatives exposure;
d. Emphasis on lowering the reliance on external ratings for securitisation exposures. Furthermore, including the IOSCO 'Code of Conduct Fundamentals for Credit Rating Agency' into the eligibility criteria for the application of external ratings;
e. Lower risk weights for the banks' collateral and market-to-market exposures to a CCP.

*Supplementing the risk-based requirement*

During the financial crisis the reduction of excessive leverage triggered a loss spiral defined by sharp drop in asset prices, decrease in bank capital and the depletion of credit lines. The new leverage ratio:

$$\text{LR} = \frac{Tier1\ Capital}{Total\ exposure\ (on + off\ balance\ sheet)} > 3\%$$

Main goals:

a. Limit the drastic deleveraging process as a result of unreasonable on- and off- balance leverage expansion during good times;
b. Supplemental hedging of potential errors in risk modelling and measurement. Provides a simpler measure that is based on gross exposures.[9]

*Decrease pro-cyclicality and creation of countercyclical buffers*

Amplifier of pro-cyclic behaviour was caused by inadequate accounting standards for mark-to-market assets and held-to-maturity instruments, margining practices, and as stated above by unreasonable leveraging. To tackle pro-cyclicality the following actions have been implemented:

a. ***Cyclicality of minimum capital requirements in time*** – application of long term data to calculate PD, use of downturn LGD and the calibration of the risk functions;
b. ***Stronger provisioning practices*** – forward looking provisioning: shift from 'incurred losses' provisioning to 'expected losses' provisioning. The main goal is to promote higher transparency in reporting and more accurate accounting standards;
c. ***Capital conservation*** – equal to 2.5% in common equity of RWA, bringing the total level of common equity to 7%. Constrains on distributions such as dividends, share buy backs and bonus payments are imposed if banks fall below the buffer range;
d. ***Limit on unreasonable credit extension*** – due to the mutual influence between the real economy and the banking system, a period of irrational credit granting may exacerbate the crisis in the real economy. A new countercyclical buffer is imposed within a range of 0 –

[9] ACHARYA, V.: *The Dodd-Frank Act and Basel III: Intentions, Unintended Consequences, Transition Risks, and Lessons for India*, Working Paper, 2011, available on: <http://www.theigc.org/wp-content/uploads/2014/09/Acharya-2011-Working-Paper.pdf>.

2.5% in common equity, being enforced at the discretion of the authorities if the credit expansion is resulting in an unacceptable build-up of systematic risk. International banks will pay a weighted average buffer based on their credit exposures to each country.[10]

*Systemic risk and interconnectedness*

The recent financial crisis also showed that financial stability is at the edge of the financial health of systemically important financial institutions (SIFIs). The collapse of a SIFI can have devastating consequences due to the 'vacuuming' counterparty risk, liquidity/fire-sale risks in asset markets causing credit crunches, contagion risks and panic caused by the failure of such an institution.[11]

To manage the exposure of the financial system to a SIFI a combination of capital incentives /surcharges, bail-in debt and contingent capital is applied.

a. *Capital incentives / surcharges* – capital incentives will be implemented when engaging with CCPs for OTC derivatives. For the remaining derivatives operations, trading, off-balance sheet and complex securitisation activities additional capital surcharges apply. Depending on the bank's systemic importance the surcharge ranges between 1-2.5% of progressive CET1 capital. Banks assigned as having the highest level of systemic risk will have to pay an extra 1% in capital as a measure to disincentive their global systematic importance in future[12];
b. *Bail-in debt* - statutory mechanism to restructure the liabilities of a distressed SIFI by converting and/or writing down unsecured debt on a "going concern'' basis. Two new resolution regimes have been adopted. Their main goal is to safeguard the taxpayers and provide an alternative solution to the government's rescue net for stressed SIFIs.

   Resolution mechanisms:
   1. Gone concern basis – the entity might not legally exist anymore. Usually it is shut down whilst sold by parts. Parts of its business, however, could be supplied by another entities such as purchasing institutions or bridge banks;
   2. Going concern basis – the entity is recapitalized. First measure would be to move away the senior management. Secondly, the shareholders would be subject to massive dilution or entirely removed.

a. *Contingent convertibles (CoCos)* - to diminish the banks' risk of default, Raviv (2004) suggests to transform the debt into equity every time the bank's regulatory capital falls below a certain threshold. Contingent convertible capital instruments are hybrid subordinated bonds that share the features of both equity and bonds and are recognized as regulatory capital.[13] CoCos coupons are tax-deductible and the costs are lower than those incurred when issuing share capital.

[10] WITZANY, J.: *Financial Derivatives: Valuation, Hedging and Risk Management*, ISBN 978-80-245-1980-7, Prague, 2013.
[11] ZHOU, J.; et al.: *From bail-out to bail-in: Mandatory debt restructuring of systemic Financial Institutions*, Working Paper, 2012, available on: <http://www.imf.org/external/pubs/ft/sdn/2012/sdn1203.pdf>.
[12] BANK FOR INTERNATIONAL SETTLEMENTS: *Basel III: A global regulatory framework for resilient banks and banking systems*, Working Paper, 2011, available on: < http://www.bis.org/publ/bcbs189.pdf>.
[13] AVDJIEV, S.; KARTASHEVA, A.; BOGDANOVA, B.: *CoCos: a primer*, BIS Quarterly Review, 2013, available on: <http://www.bis.org/publ/qtrpdf/r_qt1309f.pdf>.

See Table 2 for a more detailed overview of the loss profile in case of bail-in and contingent capital.

**Table 2: Principal Loss Profile of Bail-in Debt and Contingent Capital**

| ***Going-concern trigger*** | | ***Gone concern/PONV[14] trigger*** | |
|---|---|---|---|
| **Viable** | | **Nonviable** | **Insolvent** |
| Monitoring | Early supervision intervention | Resolution | Liquidation |
| New regime | Contingent capital (+Tier1hybrids) | Future bail-in debt (Tier2+senior) | |
| ***Loss profile*** | | | |
| Non-bail in bonds | Probability of default in liquidation *Loss given default in liquidation | | |
| Bail-in bonds | Probability of default in liquidation*Loss given default in liquidation + (*probability of loss in resolution*loss given resolution management*) | | |
| Contingent capital bonds | *Probability of contractually triggered loss*loss given contractual trigger* + (probability of loss in resolution*loss given resolution management)+(probability of default in liquidation*loss given default in liquidation) | | |
| Coupon cancellation risk | AT1 hybrids have discretionary coupons. The regulators impose restrictions on distributions to hybrid holders, besides restrictions on dividends and conditional management compensation. The risk of coupon cancellation is reflected into bond valuation. | | |

Source: Credit Suisse

The bail-in process represents an insurance against bank runs. On the other hand, statutory bail-in is not equal to contractual contingent capital instruments even though both options underline recapitalization financed by the creditors. The so called CoCos represent private financial contracts with defined parameters such as principal and regular coupon payments that might be automatically converted into equity or written down when a triggering event happens. The bail-in approach represents, however, a tool of the resolution authority to write down or convert any contingent instrument that has not yet been changed into equity, subordinated debt or secured senior debt. The two approaches can be used in the same time. While the contingent capital can be viewed as a primary line of protection, the bail-in would be applied to SIFIs that continue to be distressed.

## PRIMER: Contingent Convertibles

CoCos are bonds with a fixed coupon. The instruments are mainly characterized by the loss absorption mechanism and the trigger that initiates the conversion. The absorption mechanism can develop into two scenarios: a. losses are converted into common equity, b. losses are written down. In the first scenario the conversion ratio can be an ex-ante defined stock price or market stock price when the trigger is activated. If we apply the market price ratio most probably that the shareholders will be diluted as stock prices are usually very low at the time of the conversion. The ex-ante defined ratio, however, is likely to decrease shareholders' motivation to avoid a triggering event. The principal amount can be written down fully or partially. The triggers can be mechanical or discretionary. In case of mechanical triggers, the resolution process is initiated when the bank's capital drops under a certain level of its RWA. If the trigger is a book-value one then it is based on the book value of CET1 to RWA. Market value triggers refer to the minimum level of stock market capitalization. The trigger can be activated also by the regulator that considers that the bank is at risk, e.g. has

[14] PONV (Point of Non-Viability) - is considered the point immediately before the event of default. The bank's capital ratio is at a critically low level.

sufficient capital but has problems with the liquidity. Table 3 summarizes the discussed resolution approaches.

**Table 3: Mechanics of CoCos**

| **Capital structure** | **Trigger** | **Loss absorption** | |
|---|---|---|---|
| Senior | Total capital ratio | Conversion into shares | Variable No. of shares |
| | Tier 1 ratio | | Variable No. of shares with a floor |
| Tier 2 | Core Tier 1 ratio | | Fixed No. of shares |
| | Regulator's discretion | Principle write-down | Temporary write-down |
| Tier 1 | Issuer's discretion | | Partial write-down |
| | Share price | | Permanent write-down |

Source: Credit Suisse

The resolution mechanisms, however, have a few limitations. First, regulatory capital is calculated every quarter, thus it cannot cope with unexpected significant drops in capital levels. Moreover, the regulators itself can create unpredictable regulatory risk after inappropriately triggering the conversion. Past event show that regulators do make mistakes and the bankruptcy of Lehman Brothers was a very costly on for the entire financial system. Last, market-value triggers may be prone to stock price manipulation.[15] Lately there has been evidence that major banks engaged in practices that have resulted in distortional stock prices and instability within the market.

Since Lloyds Banking Group plc issued the first CoCo bond, the issuance is believed to have increased to USD 288 bn in 2015. The issuance is concentrated within large banks in Europe and Asia, 10 banks accounting for 41% of all CoCo bonds. Based on Moody's Quarterly Report from May 26, 2015 banks will further increase the issuance of CoCos in reaction to tougher bank capital requirements. Quoting Mrs. Havlicek – Moody's Senior Vice President – '*We expect a pick-up in the second half as banks fulfil their regulatory capital requirements. […] We also expect that issuance will remain concentrated among the top 10 issuers, even though the issuance base is broadening. As the largest, globally active institutions, they have to meet significantly higher capital requirements and buffers under Basel III and national regulatory frameworks*'.[16]

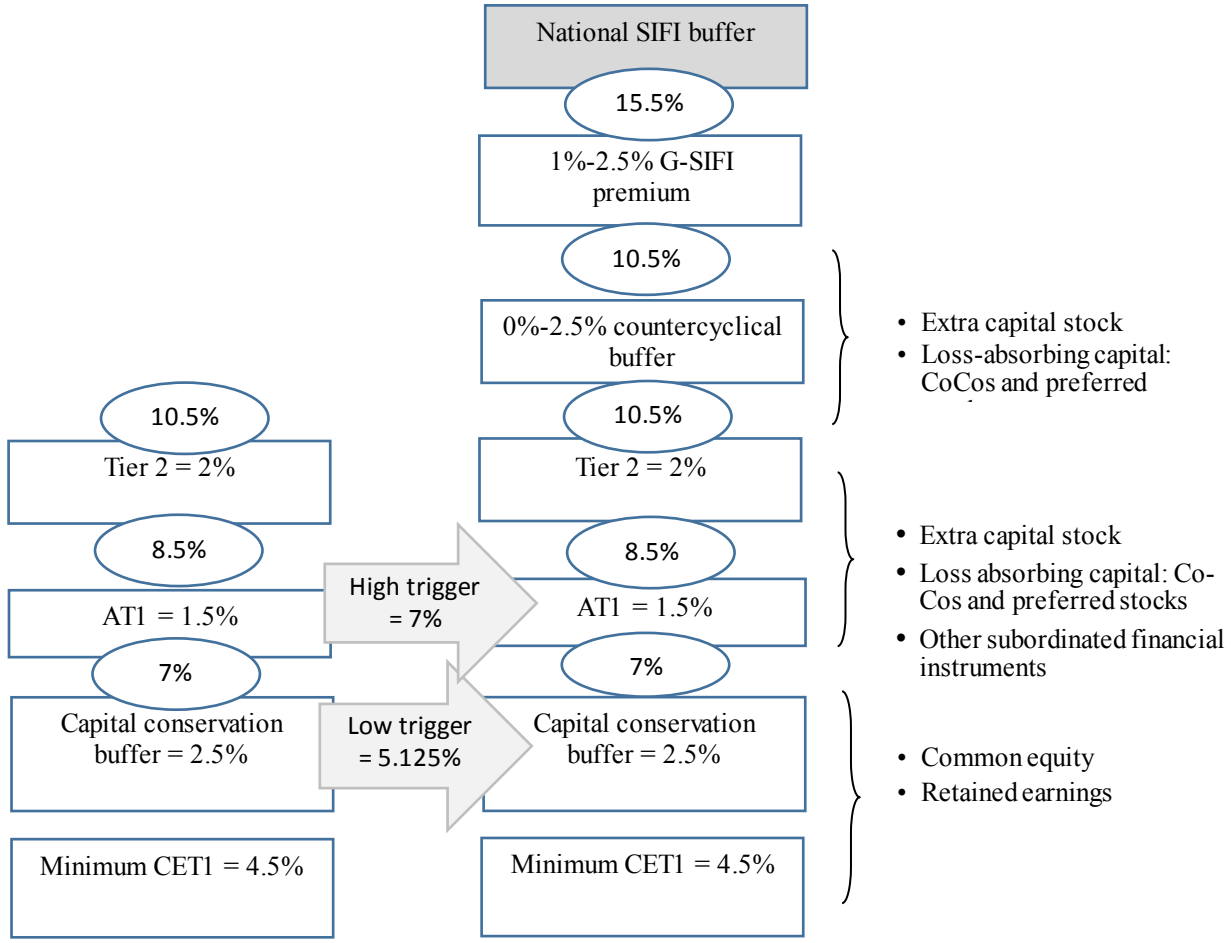
Under Basel III, for CoCos to be classified as AT1, they should have a minimum trigger (CET1/RWA) of 5.125%. Additionally, the instrument has to be perpetual, otherwise will fall under T2 capital. In case of AT1 CoCos coupon payments can be interrupted even though the capital ratio is above the triggering level. Also, the bond has no maturity, however, the issuer holds a call option. Consequently, more than 1/3 of new issues have no maturity. On the other hand T2 CoCos are issued with a certain maturity, disregarding the fact that they embed or not a call option. Moreover, coupon payments can't be interrupted.

[15] PENNACCHI, G.; VERMAELEN, T.; WOLF, C.: *Contingent Capital: The Case for COERCs*, Working Paper, 2011, available on: <http://www.insead.edu/facultyresearch/research/doc.cfm?did=47730>.

[16] Press Release of Moody's Investors Service: *CoCo issuance to rise as banks seek to meet capital requirements*. Release date: May 26, 2015, available on: <https://www.moodys.com/research/Moodys-CoCo-issuance-to-rise-as-banks-seek-to-meet--PR_326041>.

Figure 1 illustrates a comprehensive overview of the new capital regulatory, by comparing the capital requirements imposed to 'common banks' and SIFIs, plus the eligibility of CoCos for regulatory capital.

**Figure 1: CoCos under Basel III**

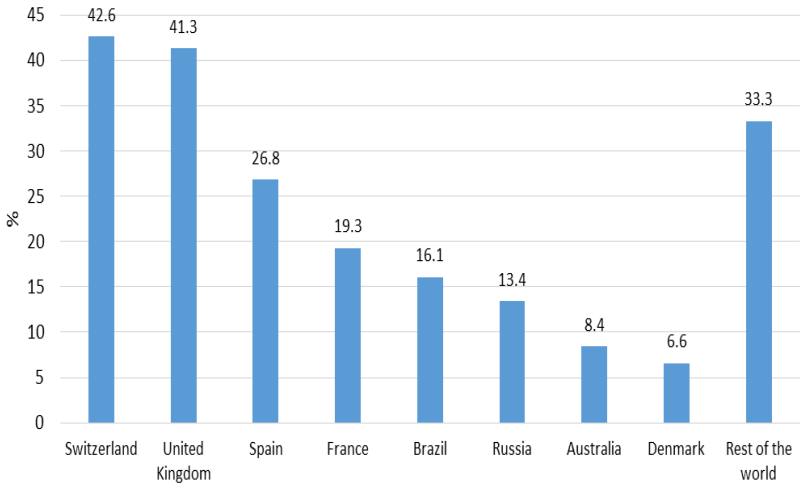



Source: Credit Suisse

Since February 2015, Canadian and Nordic banks, Indian public sector have sharply increased the issuance of CoCo bonds. With Standard Chartered PLC, ING Groep N.V. issuing high trigger AT1 CoCos for the first time. The issuance is concentrated in AT1 CoCos, accounting with 90 % for all new bonds. A major increase has been registered for the issuance of equity loss absorption mechanism rising with 28 % in contrast with 2014. As stated by BIS staff this trend is due to the increased demand from fixed income investors which can't invest in Common Equity CoCos. The enhanced issuance of CoCos is further driven by specific local regulatory. If we look at the nationality of the issuers (Chart 1) we can see that UK and Switzerland account for the biggest stakes. For instance, Swiss regulatory regime demands banks to retain not less than 9% RWA in CoCo instruments.

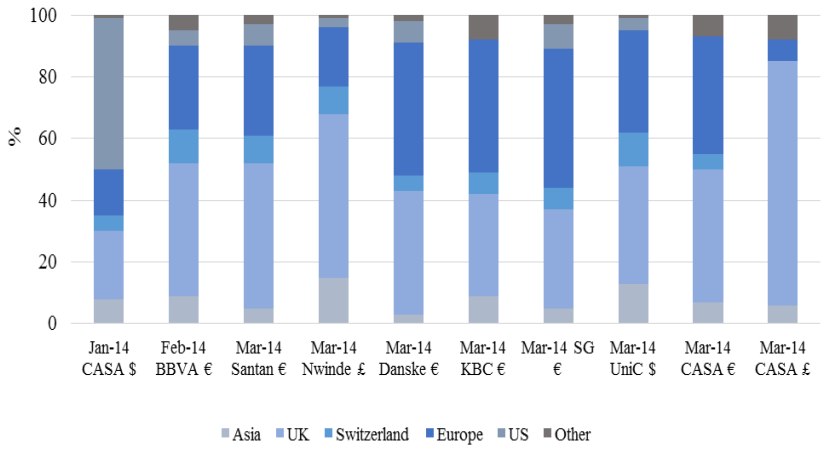
Main categories of CoCo investors for individual issuances are presented in Chart 2 and 3. As we can observe UK remains a leader also on the investor side. With the major group of investors being represented by asset managers. As we will see later, this is mainly due to the so called 'run for yields' tendency which can easily be observed worldwide. Hedge funds also struggle to stay profitable as brokers started to exit a big number of them due to low returns on equity

## Chart 1: CoCo issuers by nationality



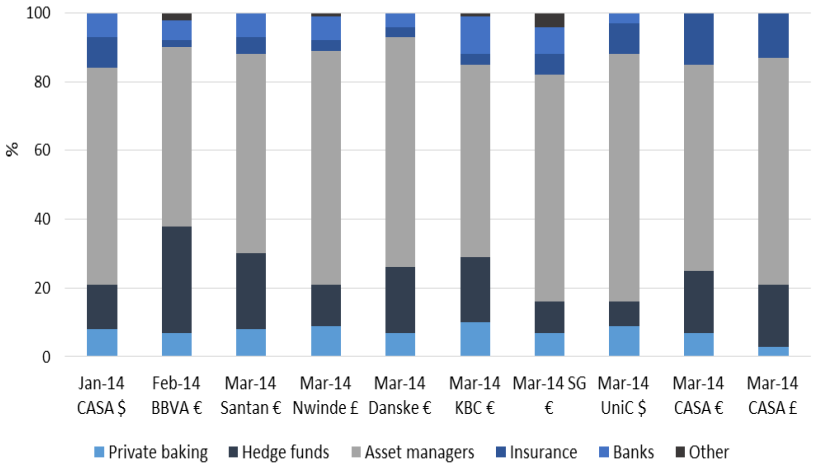

Source: Bank for International Settlements

## Chart 2: CoCo investors by region




Source: Bank for International Settlements

## Chart 3: CoCo investors by type




Source: Bank for International Settlements

In relationship to this, Mrs. Havlicek states that: '"*The market's growing familiarity with CoCos will help boost demand, as will these securities' relatively high yields, which are attractive to investors, particularly in light of persistently low interest rates around the globe. Notwithstanding these benefits, CoCos are not without their risks for investors*'[17].

As with every innovative instrument, there a couple of challenges within the CoCo market, namely:

- *Ratings* – not all CoCos have been assigned a rating, thus making it impossible to be bought by specific institutional investors. Based on Moody's approach AT1 CoCos would get the rating Ba1 and Tier2 CoCos Baa;
- *Regulation* – regulators have not developed a homogenous approach in treating CoCo instruments. The regulator on the buyer side wants to lower the potential losses and grant them a reduced loss absorption capacity. The regulator on the issuer side, wants to ensure high-quality capital in times of stress;
- *Systematic risk* – CoCos are able to diminish systemic risk only if the buyer is not a systemically important entity. The regulators may try to set restrictions on banks to buy these instruments, but its influence on other institutional investors is limited. Thus, there it is likely that opposite to reducing systemic risk, CoCos will only shift it among different sectors.

In the following we can analyse two examples of CoCos (Table 4). First, we can easily observe that they do have a quite high interest rate, uncommon for a period with main policy rates in several countries at 0 %. Moreover, the second bond will pay interests at 'banks discretion'. This issue, however, is worrisome as the shareholders gain a great advantage only for 0.650% in interest in comparison with the first bond where interests are mandatory. There is huge diversity among CoCo products, thus each of them needs to be thoroughly evaluated in order to be fairly priced, a matter which will be analysed below.

**Table 4: Examples of CoCos**

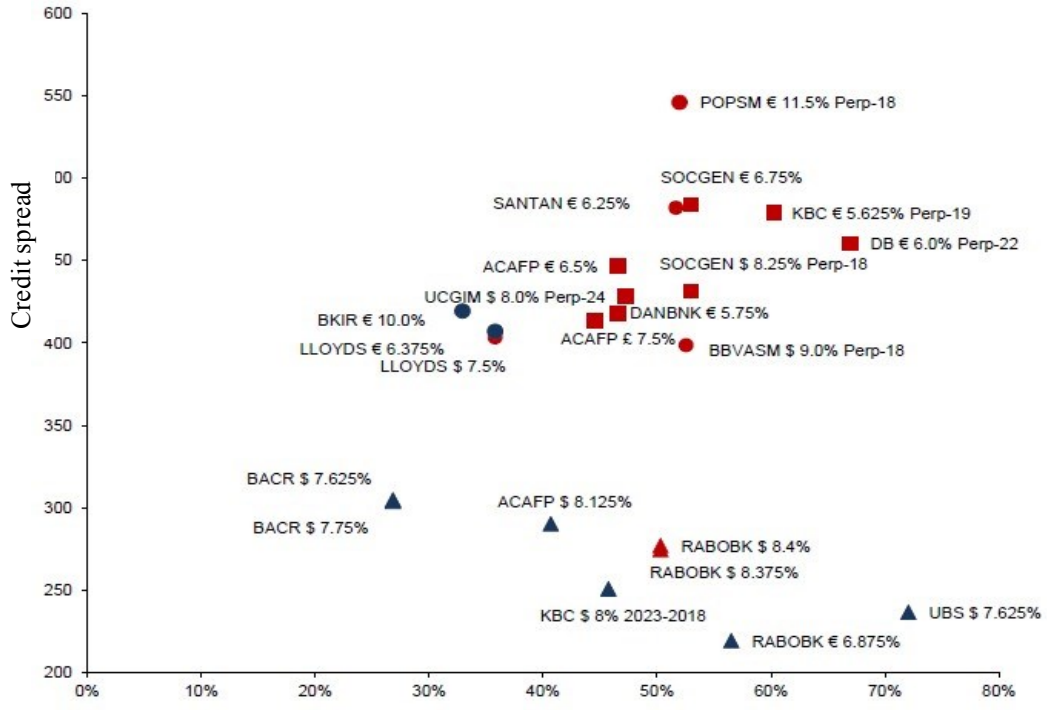
| | Credit Suisse | Societe Generale |
|---|---|---|
| Bond | CS 7.125 22.03.2022 | SOCGEN 7.875% perp. |
| ISIN | CH0181115681 | USF8586CRW49 |
| Issuance date | 22.03.2012 | 11.12.2013 |
| Issue volume | CHF 750 mil | USD 1.75bn |
| Regulatory treatment | Tier 2 | AT1 |
| Interest rate | 7.125% | 7.875% |
| Yield (at next call) | 3.47% | 7.06% |
| Maturity, next call | 22.03.2022; 22.03.2017 | Perpetual term; 18.12.2023 |
| Type of interest offered | Mandatory | At the bank's discretion |
| Trigger amount | 7% | 5.125% |
| Conversion/write-down | Conversion to equity | Temporary write-down |
| Rating (Moody's/S&P/Fitch) | -/-/BBB- | Ba3/BB+/BB |

Source: Credit Suisse

[17] Press Release of Moody's Investors Service: *CoCo issuance will remain strong in 2015*. Release date: Feb 10, 2015, available on: <https://www.moodys.com/research/Moodys-Bank-CoCo-issuance-will-remain-strong-in-2015--PR_318290>.

In the primary market pricing of CoCos depends on the type of triggering event, loss absorption mechanism, and bank capital structure. In 2013 Bank of America Merrill Lynch has released a new Index that assess the performance of contingent convertibles. The index in comprised of 48 bonds with a face value estimated to USD 58 bn. According to it the yield ranges between 6.11% - 6.77%. If we compare it the yield on CoCos with that for other debt instruments, then it is around 2.8 % higher than for non-CoCo subordinated debt and 4.7% higher than for senior unsecured debt. The argument behind it is that CoCos are the first within subordinated debt instruments to absorb potential losses. For the Principal Write Down mechanism yields are higher than for the Common Equity CoCos. The yield is around 3.9% higher than for non-CoCo subordinated debt, opposite to the Common Equity CoCos which is 2.5% higher. The difference in pricing also depends as mentioned before on whether the instrument has a low-level trigger or high level trigger. Low-level trigger CoCos are much cheaper than high-level trigger CoCos, as it is less probable to be breached. Thus, for low-level trigger the yield to maturity is higher than for other subordinated debt with 2.5%, for the high-level trigger around 3.6%. Conclusively, a 'cheap' CoCo is issued under the conditions of low-level trigger and a Common Equity loss absorption mechanism[18]. For the secondary market there is evidence of correlation between CoCo spreads and CDS spreads. Moreover, the CoCo spread is above the CDS spread with approximately 400 to 600bp. An important role in valuating CoCos is played by capital buffers, underlying how close is the capital ratio to the triggering level. A short analysis for major banks is provided in Chart 4.

**Chart 4: CoCos credit spread vs capital buffer**




***Note:*** *Conversion to equity* ● *Complete write-off* ▲ *Temporary write-off* ■

*Red: coupon at the bank's discretion* *Blue: mandatory coupon*

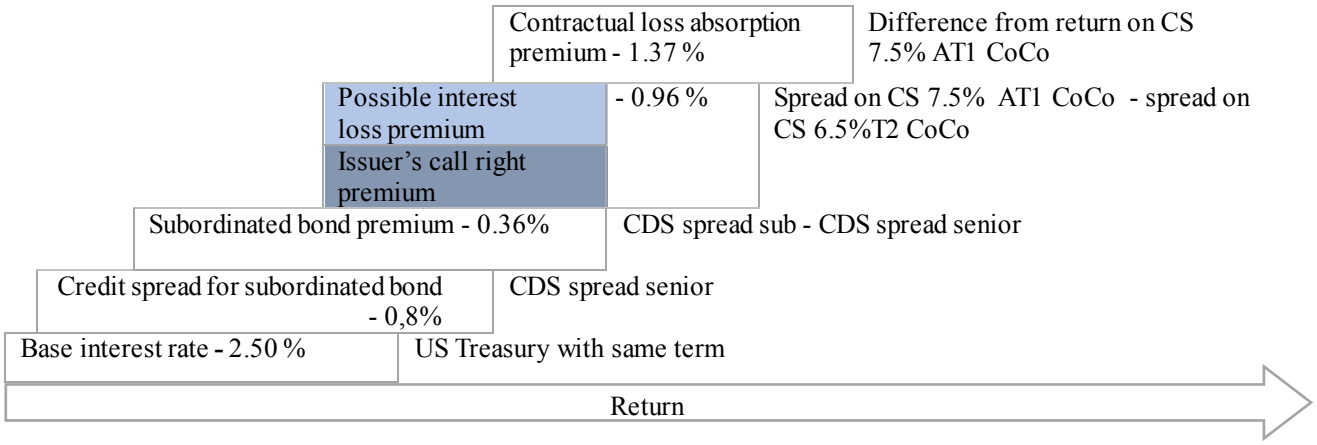
*As of Jul, 2014*

Source: Adopted from Credit Suisse

[18] PAZARBASIOGLU, et al.: Contingent Capital: Economic Rationale and Design Features, Working Paper, 2011, available on: <https://www.imf.org/external/pubs/ft/sdn/2011/sdn1101.pdf>.

One thing is however certain, CoCos ensure a highly attractive return that offsets the relatively higher risk. A set of factors can be identified that define the potential total return on a CoCo. Below we can assess individual components based on Credit Suisse AT1 bond: CS 7.5 %, ISIN: XS0989394589.

**Figure 2: Example of factor-based return**




Legend:
applicable to all CoCos
applicable just for AT1 and some T2
applicable just for AT1 CoCo bonds

Source: Credit Suisse

The loose monetary environment persistent within the Eurozone has some similarities with the before financial crisis conditions in the USA with low interest rates and a booming market of CDS - which will be discussed later. Alike Cocos, CDS were also innovative products which had a favourable treatment within regulatory requirements serving as risk mitigation tools. At the same time, they played a major role in the outbreak of the financial crisis with institutions as AIG which were at the edge of bankruptcy and massive government funds were injected into bail-outs. The paradox of Basel is that on one hand it requires less reliance on external ratings, and on the other CoCos are made part of the regulatory capital being assigned ratings by the same rating agencies. This was the case of structured products during the financial crisis, when rating agencies rated these products even though they did not have any experience with them. However, now it became more dangerous as it is about eligible regulatory capital. Up-to-date, no CoCo has yet suffered a conversion of write-down event, the first is to take place in 2016. The question is what will happen when the first CoCo will be triggered? What will be the reaction of market participants and in particular of the investors when a Credit Suisse CoCo of 6.4bn will be completely wiped-out or when a bulk of CoCos will suffer a triggering event more or less at the same time. Taking into account that these instruments are highly correlated and a conversion is a signal of bad quality of the assets, wouldn't it enhance the probability of bank run? Concerns are also raised due to the fact that a big amount of them are bought by regulated entities such as banks or insurance companies. Even if regulatory authorities forbidden to these institutions to buy them, in order to tackle systemic risk and contagion, there is still the problem of non-regulated institutions. In the latter case, how do we withstand the build-up of systemic risk in these institutions when we are unable to somehow track this risk? In the end, be it in the regulated or non-regulated sector a potential crisis will impact the real economy. Another thing is why the regulators are 'pitting' the shareholders? The rapid growth of the CoCo market is

quite contradictory, even though understandable. Financial institutions promote a conservative business culture, but in the same time buy increasingly risky CoCo instruments. This is a consequence of low rate environment and higher capital requirements that push banks to engage in more risky transactions to meet their commitments. These constrains implicitly oblige them also to agree to tough conditions set by shareholders. For e.g. after 2016 the issuers will have the right to temporarily stop paying coupons while continuing to pay dividends. One questions is, what will make the issuers to keep the capital level above the trigger? They can suffer a dilution, but this is only in case of market triggers and in comparison to the situation of the investors that can remain with nothing this is a quite soft measure. Let's assume that the shareholders did suffer a conversion, what will make them afterwards to provide capital in times of stress? Another issue are the regulators, on what will their decision to trigger the conversion be based on? And what if the conversion is appropriate at micro-level but at macro-level it might have significant repercussions? Wouldn't it mean that the too-big-to-fail, too-important-to-fail, too-interconnected-to-fail problem has not been mitigated? Conclusively, how do we incorporate the possibility of the regulator triggering the conversion within the CoCo pricing as the regulator makes its decision on a case by case basis? Below are summarized main benefits and risks entailed by CoCos.

***Benefits***

- In comparison to bank senior bonds pay higher yields as a compensation for the severe loss absorption regimes in which the nominal is converted or written-off;
- Implicitly better the balance sheet and lower the probability of a triggering event;
- Opposite to common bonds, CoCos show lower sensitivity towards interest movements;
- Fast growing market with innovative investment instruments;
- Regulators stimulate the issuing of CoCos by allowing tax deductions of coupon payments, other dispensations;
- Portfolio diversification.

***Risks***

- The loss absorption mechanisms underlines that investors might partially or entirely lose their money;
- Coupons under AT1 CoCos are paid at the consideration of the issuer. Thus, the coupons might be partially or entirely postponed;
- In contrast to senior bonds, CoCos embed relatively higher default risk;
- High correlation among CoCo bonds.

## 1.2 Consistency of Basel implementation

The implementation of Basel standards differs across regions, taking into account specific local conditions. Globally it is seen a tendency to harmonise bank capital requirements in order to ensure an equally competitive banking environment. In the following chapter we will analyse the implementation of Basel III in several countries addressing major deviations with a focus on minimum bank capital requirements, credit risk assessment methods, securitisation and counterparty credit risk. The analysed countries were chosen based on regional heterogeneity in order to build a broader image of Basel III implementation in different parts of the world. The sample countries are: USA,

Switzerland, Hong Kong SAR, Australia and India. The analysis mentions major deviations from Basel requirements that have material implications for the banking system in case. By no means does it claim to present a detailed overview of all possible inconsistencies, as countries are still in the process of rectification, but to provide a general comparison of country specific regulatory framework.

### 1.2.1 USA

In July 2013, the Federal Reserve and the Office of the Comptroller of the Currency released its final version of the locally adjusted Basel III rules. A comprehensive rule following the changes made from the Federal Deposit Insurance Corporation entered into force on April 2014. The Basel principles are implemented only if they do not contravene with the minimum requirements stipulated in the Collins Amendment section of the Dodd-Frank Act. The Collins requirements exceed the demands set by Basel III, creating competitive advantages for non-US financial entities. An important change was introduced by section 939A of the Act which requires US regulatory agencies not to rely on credit ratings from national agencies when advancing new financial regulations, setting aside any use of external ratings for credit risk management[19].

US adopted the advanced approaches of the Basel rules to the so called 'core' banks, 8 of which are global systemically important banks[20].These banks hold more than 75% of the total assets of the US banking sector. Table 5 provides more detailed data on the banking sector.

**Table 5: Banking sector characteristics - USA**

| **Characteristics** | **USD, bn** |
|---|---|
| Total assets of all banks | 21,523 |
| Total assets of locally incorporated internationally active banks | 14,999 |
| | |
| No. of banks operating in USA | 1,162 |
| No. of internationally active banks | 15 |
| No. of banks required to implement Basel standards | 15 |
| No. of global systemically important banks | 8 |
| | |
| **CA for major locally incorporated banks** | **USD, bn** |
| Total capital | 1,107 |
| Total RWA assets | 7,762 |
| Total off-balance sheet bank assets | 2,769 |
| | |
| RWAs for credit risk (% of total RWAs) | 65.76 |
| CAR* (%) | 14.26 |
| Tier 1 ratio* (%) | 12.02 |
| CET1* (%) | 11.22 |
| **weighted average* | |

***Note**: As of Mar 2014*

Source: Bank for International Settlements

[19]Press Release*: Basel III v Dodd-Frank: What does it mean for US banks*. Release date: Jan 2011, available on: <http://whoswholegal.com/news/features/article/28829/basel-iii-v-dodd-frank-does-mean-us-banks>.

[20] Core banks are: 1. depository institutions (DI) that on a consolidated basis have total assets equal or higher than USD 250bn or on-balance sheet foreign exposure equal or higher than USD 250bn, 2. bank holding companies for which applies the two conditions mentioned above plus a third one: the bank has a subsidiary DI that is a core bank or a bank that opts to voluntarily follow rules.

### A. Capital requirements

FED states that: ''*In establishing capital regulations…, the Board shall seek to make such requirements countercyclical, so that the amount of capital required to be maintained by company increases in times of economic expansion and decreases in times of economic contraction, consistent with the safety and soundness of the company*."[21]

The following deviations in relationship to Basel requirements apply:

i. Basel rules provide us with concrete specification of which instruments are allowed to be included in the capital base. On the contrary, the US regulatory agency can allow at the bank's request the inclusion of additional instruments in its capital, although these were not before officially recognized as eligible;
ii. Differently from Basel the US standardised approach enables the incorporation of allowances for loans and lease losses in Tier 2 capital. Hence, the US regulatory allows to incorporate general provisions used to cover already existing deterioration in certain assets and liabilities in Tier 2 capital;
iii. Even though the statutory approach is applied within the loss absorbency mechanism, it has no concrete stipulations on dealing with capital instruments if their issuance was under foreign law;
iv. Benefit pension fund assets are not deducted from CET1 if the bank is insured by FDIC and it has 'unrestricted and unfettered access' to them during the resolution process;
v. The countercyclical buffer is seen in US as an extension of the conservation buffer and it is included in the surplus CET1, Tier2, total capital of the subsidiary when calculating the minority interests;
vi. For treatment of significant investments into unconsolidated insurance subsidiaries similar to Basel it is required to deduct them from the capital base. However, for consolidated insurance subsidiaries it is necessary to risk-weight the liabilities and assets of the entity and only after make the deductions, thus setting a less conservative approach than in Basel.

### B. Credit Risk

*Standardized approach*

All banking organizations should apply the Standardized Approach in calculating minimum capital ratios as from January 1, 2015.

i. Implementation of the advanced approaches is subject to regulatory approval. According to it, core banks that have exited parallel run[22] should hold a permanent capital floor by using 100% of RWA[23] opposite to that of 80 % set by Basel;

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[21] ACHARYA, V.: *The Dodd Frank-Act and Basel, Intentions, Unintended Consequences, Transition Risks, and Lessons from India*, Working Paper, 2011, available on :< http://www.theigc.org/wp-content/uploads/2014/09/Acharya-2011-Working-Paper.pdf>.

[22] Parallel run implies that Basel I and new US standardized approach run in the same time until full implementation of the later is achieved.

[23] The US Standardized Approach is comparable with the Basel Standardized approach, although it eliminates the capital charge for operational risk and Credit Valuation Adjustment.

ii. For claims on sovereigns, public sector entities, eligible OECD banks: credit exposures are not assessed by external credit ratings but are assigned fixed risk weights[24]. For foreign public sector entities, risk weights are based on the OECD Country Risk Classification score which are given to the home country of the entity (for general and revenue obligations). Countries that are not assigned a rating anymore will apply risk weights of 20% for general obligations, 50% for revenue obligations;

iii. To risk weight claims on banks Basel may use the home sovereign credit rating and adjust it or simply use the external credit rating of the bank, for non-rated banks assigning a 100% risk weight. US, however, applies a fixed rate of 20% for claims on US banks and for claims to foreign banks based on the OECD scoring, with 20% risk weight if the country is not rated anymore but is still an OECD member;

iv. For retail exposures US banks apply a risk weight equal to 100%, Basel requires the 75% risk weight;

v. Basel states that risky corporate exposures rated BB- or worse would get risk weight of 150% or even higher. US regulatory applies a fixed 100% for all corporate exposures, including those that are not rated. However, it has clearly specified that US banks may only invest in instruments that are assessed as 'investment grade';[25]

vi. The eligible financial collateral is defined as 'investment grade' securities. This assessment, however, is not provided by external credit ratings. Consequently, US banks may accept financial collateral that does not comply with Basel rules;

vii. Claims secured by residential property get a risk weight of 35% in Basel. Opposite to that, US imposes a risk weight of 50% or 100% for these exposures. Highly volatile commercial real estate exposures (HVCRE[26]) get a RW equal to 150% in contrast to the 100% RW as for Basel rules;

viii. Equity exposures similar to HVCRE are not directly addressed in Basel getting a risk weight equal to 100% for non-rated exposures. Equity exposures in US can be assigned risk weights between 100% and 600%, when the exposure is towards an investment fund the risk weight might be as high as 1250%;

ix. Supervisory haircuts for collateral are imposed relying on the OECD's Country Risk scoring opposite to using external ratings as applied by Basel[27].

*Internal Rating Based approach*

[24] E.g.: GSE – 20 % for non-equity exposures, general obligation – 20%, revenue obligation – 50%.

[25] *BIS definition*: investment grade securities – securities that have adequate capacity to meet financial commitments for the projected life of the asset or exposure and have adequate capacity to meet financial commitments if the risk of its default is low and the full and timely repayment of principal and interest is expected.

[26] *American Bankers Association definition*: HVCRE is all acquisition, development and construction (ADC) for commercial real estate loans except: a.) one to four family residential ADC loans, b.) Commercial real estate ADC that meets regulatory Loan-to-Value requirements and the borrower has contributed cash to the project of at least 15 % of the real estate's 'appraised as completed' value prior to the advancement of funds by bank and the borrower contributed capital is contractually required to remain in the project until the credit facility is converted to permanent financing, sold or p aid in full.

[27] For sovereign issuers classified as high income OECD countries and other high income Eurozone countries that are not anymore assigned a Country Risk Classification scores , get RW=0 disregarding their actual external credit rating as far as they are not in default.

i. Reliance on accounting valuation typical in US may result in lower capital requirements for expected and unexpected credit risk losses, as well as much lower deductions from CET1;
ii. Application of a broader definition for equity exposures. Under US regulatory 100% risk weight is applicable on positions that are perfectly matched, in contrast to Basel that applies a 0% risk weight to perfectly matched hedged equity exposures;
iii. Slotting is not applied;
iv. In contrast with Basel, the capital requirement for defaulted exposures is not set as the difference between the loss-given-default and the calculated expected loss but simply as exposure-at-default*8%.

**C. Securitisation**

Overall, Bank for International Settlement finds the approach on securitisation in the US non-compliant with that imposed by Basel. The deviations are mostly due to the fact that external ratings are not used. Even though the US requirements tend to be more conservative in terms of risk weight assessment, the exception is set for senior residential mortgage-backed securities. US agencies claim that the divergence has arose mainly due to the rating downgrades of AAA securities after the financial crisis. This issue may imply serious problems as major US banks have large exposures in residential mortgage-backed securities.

**D. Counterparty credit risk**

As US has banned the use of external credit ratings, the determination of counterparty weights within the Standardized approach for Credit Valuation Adjustments differs from Basel. External credit ratings are substituted by probabilities of default of the counterparty.

### 1.2.2 Switzerland

Basel III rules were adopted in Switzerland through the Capital Adequacy Ordinance from January, 2013. The set of rules under Basel are complemented by additional requirements forwarded by the Swiss Financial Market Supervisory Authority (FINMA) known as „Swiss Finish". In accordance to this, FINMA states that: *"The prudential basic philosophy that the Swiss capital adequacy regulations are to go beyond the international minimum Standards is therefore maintained and strengthened further."*

Switzerland's banking system makes for 6% of the Swiss GDP as for 2015 data. The two SIFIs hold around 65% of the banking sector's total assets. Other typical groups of banks are private banks engaging in asset management, saving banks, cooperatives, and specialized banks. See the Table 6 for more information.

**Table 6: Banking sector characteristics – Switzerland**

| Characteristics | CHF, bn |
|---|---|
| Total assets of all banks | 3,845 |
| Total assets of locally incorporated internationally active banks | 3,182 |
| | |
| No. of banks operating in CH | 322 |
| No. of internationally active banks | 98 |

| | |
|---|---|
| No. of banks required to implement Basel standards | 322 |
| No. of global systemically important banks | 2 |
| | |
| **CA for major locally incorporated banks** | **CHF, bn** |
| Total RWA assets | 826 |
| Total off-balance sheet bank assets | 651 |
| | |
| RWAs for credit risk (% of total RWAs) | 62.00 |
| CAR* (%) | 17.40 |
| Tier 1 ratio* (%) | 15.30 |
| CET1* (%) | 14.60 |
| **weighted average* | |

***Note:*** *As for Jan 2013*
Source: Bank for International Settlements

### A. Capital requirements

Under Swiss rules, banks are split into five categories. In order to meet the requirements for a category, at least three criteria must be fulfilled[28]:

**Table 7: Classification of Swiss banks**

| ***Criteria*** | | ***Category 1 (SIFIs)*** | ***Category 2*** | ***Category 3*** | ***Category 4*** | | ***Category 5*** |
|---|---|---|---|---|---|---|---|
| Total assets | ≥ | 250 | 100 | 15 | 1 | < | 1 |
| Assets under management | | 1,000 | 500 | 20 | 2 | | 2 |
| Privileged deposits | | 30 | 20 | 0.5 | 0.1 | | 0.1 |
| Required equity | | 20 | 2 | 0.25 | 0.05 | | 0.05 |

***Note:*** *in bn CHF*
Source: KPMG Audit Financial Services

The following deviations in relationship to Basel requirements apply:

i. In dependence of the assigned category each bank must comply with specific capital requirements as specified below. Should the CET1 capital get under 5.125 % of the total capital, the supervisory authority is eligible to trigger the loss absorption process[29]. Below we can track detailed breakdown of capital requirements.

**Table 8: Swiss regulatory capital by category of banks**

| **Classification** | **Capital adequacy ratio** | **CET1** | **AT1** | **T2** | **Regulatory interference threshold** |
|---|---|---|---|---|---|
| Category 2 | 13.6% - 14.4% | 8.7% - 9.2% | 2.1% - 2.2% | 2.8% - 3% | 11.5% |

[28] KPMG AUDIT FINACIAL SERVICES: *Capital buffer and capital planning – Banks*, Circular 2011/2, available on: <https://www.kpmg.com/CH/en/Library/Legislative-Texts/Documents/pub-20121116-circular-20112-capitalplanning-en.pdf>.
[29] ISLER, P.; PULVER, U.; PEYER, R.: *New Swiss rules to enhance Financial Stability of Banks – Capital Requirements; Recovery and Resolution Regime*, Vol.4, No.4, 2012.

| | | | | | |
|---|---|---|---|---|---|
| Category 3 | 12 % | 7.8% | 1.8% | 2.4% | 11% |
| Category 4 | 11.2 % | 7.4% | 1.6% | 2.2% | 10.5 % |
| Category 5 | 10.5 % | 7% | 1.5% | 2% | 10.5 % |

***Note:*** *Category 1 is discussed in the Primer*
Source: KPMG Audit Financial Services

ii. The point of non-viability characteristics are applicable for all Swiss banks in contrast with Basel that reaches only globally active banks;
iii. On a case by case basis FINMA has the right to impose higher quality requirements for additional capital;
iv. Subject to approval, minority interest can be included in the regulatory capital;
v. Unrealized gains are deducted from CET1 and 45% of the positive difference is added to Tier 2;
vi. Stock surplus on share capital can fall under CET1 irrespective of its origin if it is assessed as disclosed reserves;
vii. The limitation of making dividend payments, share buybacks and discretionary bonus payments is not automatically switched on when failing to maintain an adequate level of capital, but FINMA triggers the restrictions;
viii. No implementation of the unweighted leverage ratio. Reasons to set a higher level of leverage ratio: a. Swiss banks are still undercapitalized, b. risk weights have repeatedly underestimated the risk, c. Swiss banks are 'too big to save' for the size of the Swiss economy[30].

**B. Credit risk**

*Standardized Approach*

i. For unrated bank exposures no sovereign floor is applicable that will risk weight these exposures lower than the risk weight applied to claims on the sovereign of incorporation;
ii. A granularity threshold of 1% instead of 0.2% is imposed for the retail portfolio of small businesses;
iii. If the currency of the repurchase agreement for repo-style transactions is Swiss Francs a zero haircut is applicable should the transactions be performed through the Swiss Value Chain[31];
iv. Commercial real estate loans and agricultural loans have risk weights below 100%. Specific treatment is applicable for the Swiss Lombard Lending business, instruments like life insurance contracts are seen as eligible financial collateral;
v. The credit conversion factor is not set based on the original maturity of the contingent liability but in relationship to its residual maturity. The same practice is applicable for short-term bank claims when risk-weighted.

*Internal Rating Approach*

i. The minimum IRB coverage under Swiss rules is 90% of the credit exposure. After the implementation of the IRB this threshold should be, as stated by the Swiss regulatory, 'in prin-

[30]ROCHET, C.: *The extra cost of Swiss Banking Regulation*, White Paper, 2014, available on: <http://www.swissfinanceinstitute.ch/the_extra_cost_cost_of__swiss_banking_regulation.pdf>.
[31] Swiss Value Chain ensures post-trading services such as clearing and settlement of securities transactions, custody of securities, etc.

ciple' maintained. Basel requires that once a bank implemented the IRB for an asset class, it should implement it for all the exposures within that particular asset class;

ii. For the two G-SIBs (Credit Suisse and UBS) FINMA permitted the use of the standardized approach to unencumbered assets[32] that are meant to ensure liquidity for the Too-Big-Too-Fail. The exemption from IRB is applicable only for liquid high-quality assets;

iii. For defaulted exposures 100% risk weight of Exposure-at-default is applied, accounting with deduction of individual value adjustments or any partial write-offs. Basel, however, demands to assess on and off balance sheet exposures on a gross basis.

### C. Securitisation

Fully compliant with Basel III requirements

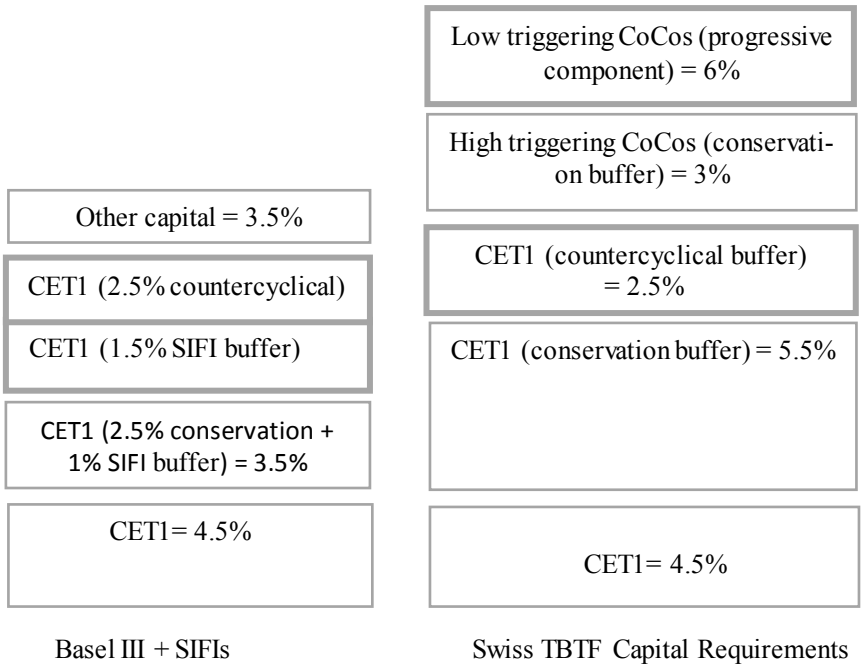
### D. Counterparty credit risk

In general terms, Swiss requirements are compliant with the Basel framework. It additionally allows an alternative simplified Credit Valuation Adjustment charge.

## PRIMER: Swiss Finish cost-benefit analysis

For the two Swiss SIFIs special regulatory requirements are applied. As showed below total capital may rise to 19% of risk weighted assets, implying a variable progressive buffer of up to 6 % of risk weighted assets.

**Figure 3: Comparison of capital requirements for SIFIs**




Source: Bank for International Settlements

[32] Asset or property that is free from debt or any other legal obligation and can be sold or provided as collateral for a mortgage.

Based on the cost-benefit analysis performed by Junge and Kugler (2012) we get to the conclusion that imposing significantly higher capital requirements for Swiss banks will not result in long-term negative impact on its GDP. The authors rely on historical data that refers to periods when Swiss banks had to comply with much higher capital levels with no repercussions on the lending spreads and growth. Moreover, the observed results following the econometric analysis denote a major Miller-Modigliani effect. Thus, the increase in capital requirements will result in lower required ROE and minimal rise in the bank's cost of capital. Furthermore, Junge and Kugler state that there is no material evidence that the special regime for the two SIFIs would cause additional capital costs for the rest of the economy. For the case of Switzerland, higher capital requirements lower the probability of banking crisis that may cause significantly higher GDP losses[33]. For instance, a raise in CET1 of 50% will result in a GDP decrease of 0.7%. On the other hand, it will lower the probability of crisis spearing a 10.2% potential loss in GDP. Table 9 presents the outcome of the cost-benefit analysis performed by the authors.

**Table 9: Swiss Finish Cost-Benefit analysis**

| Δ in CET1 capital ratio | Social Costs | Social benefits | |
|---|---|---|---|
| | GDP effect | Drop in annual Probability of crisis | Expected benefits |
| 50% | -0.7% | 2.9% | 10.2% |
| 100% | -1.2% | 3.6% | 12.7% |
| 150% | -1.7% | 3.8% | 13.6% |

Source: UNIBAS

### 1.2.3 Hong Kong SAR

The Banking Capital Rules (BCR) that were primarily issued to implement Basel into the local law has been amended in 2012 to include the first phase of Basel III that started on January 1, 2013. In October 2014, the BCR was further amended to include the requirements on buffers. Starting with January 1, 2016 Hong Kong Monetary Authority (HKMA) will assign enhanced requirements for Domestic Systemically Important Banks (D-SIBs).

57% of the banking sector assets in Hong Kong are owned by 7 large banking groups. The largest bank accounting with 29% of the total assets. Moreover, around half of the assets are under foreign ownership, 29 of 30 G-SIBs having their presence in Hong Kong (see Table 10 for further details).

BCR is implemented by all locally incorporated Authorised Institutions (AI)[34]. Under BCR holding companies that are not AIs do not have to comply with the capital adequacy standards. However, should these be unregulated holding companies, HKMA reserves the right to regulate them.

[33] JUNGE, G.; KUGLER, P.: *Quantifying the impact of higher capital requirements on the Swiss economy*, Working Paper, 2012,available:<https://wwz.unibas.ch/fileadmin/wwz/redaktion/makro/Papers/G_Junge_P_Kugler_July_02_2012_V3_fina.pdf >.

[34] There are 3 types of AIs: a.) licenced banks that can activate in full range, b.) banks with restricted licence that can receive deposits higher than 500000 HKD, c) deposit-taking entities that can receive deposits of 100000 HKD on tenors of more than three months.

**Table 10: Banking sector characteristics - Hong Kong SAR**

| **Size of the banking sector** | **HKD, mil** |
|---|---|
| Total assets of AIs | 17,397,412 |
| Total assets of all major locally incorporated banks | 9,694,509 |
| | |
| No. of AIs operating | 202 |
| No. of major locally incorporated banks | 10 |
| No. of AIs required to implement Basel standards | 57 |
| | |
| **CA for major locally incorporated banks** | **HKD, mil** |
| Total RWA assets | 5,080,382 |
| Total off-balance sheet bank assets | 1,507,903 |
| | |
| RWAs for credit risk (% of total RWAs) | 86.6 |
| CAR* (%) | 15.4 |
| Tier 1 ratio* (%) | 12.8 |
| CET1* (%) | 12.7 |
| **weighted average* | |

***Note:*** *As for Mar 2014*
Source: Bank for International Settlements

### A. Capital requirements

The following deviations in relationship to Basel requirements apply:

i. Less conservative approach to minority interests that allows at consolidated level to obtain a higher capital ratio;
ii. Certain instruments cannot be included in CET1 but count for Tier 2. E.g.: unrealised gains on property revaluation suffering 55% haircut;
iii. Deferred tax assets, mortgage servicing rights, credit exposures to connected parties - that do not fall under ordinary business activities - are in full deducted from CET1 and not subject to a threshold as in Basel;
iv. Retained earnings from revaluating land and buildings get a 55% haircut and fall under Tier 2 capital. Same practice applies to new shares counting for capitalizing reserves, retained earnings for reserves for expected losses.

The amendment of the BCR to include conservation and countercyclical buffer, as well as Higher Loss Absorbption buffer for SIBs was implemented in January 1, 2015. The amendments fully adhere to the requirements specified by BCBS.

### B. Credit risk

*Standardized approach*

i. Granularity requirement is not applicable in Hong Kong. Meaning that banks do not necessarily have to prove that they hold a well diversified portfolio, being entitled to more favourable risk weights;
ii. Exposures secured by commercial real estate are comprised under existing categories such as corporate exposures and are not assigned a separate category. Consequently, having a lower risk weight;
iii. HKMA requires to apply the same risk weightening approach for claims on securities firms as for claims on banks;

iv. Not allowed to make own-estimation of haircut within the comprehensive approach on credit risk mitigation;
v. Claims on multilateral development banks are risk-weighted as claims on coporates not as claims on banks according to Basel demands.

*Internal Rating approach*

i. Under retail residential mortgages are also included property-holding shell companies;
ii. Residential mortgages secured on Hong Kong properties and provided by an IRB AI are assigned a 15 % risk weight floor;
iii. HVCRE does not fall under the category of specialized lending;
iv. Banned the use of 're-ageing' for defining default.

**C. Securitisation**

The securitisation exposure of the banks is surprisingly low, being somewhere between 0-0.4% of RWA. Even though two issues with future implications need to be addressed: 1. interest rate derivatives and currency swaps are not risk-weighted in concordance with the securitisation framework, and 2.ban on the use of 'eligible IRB collateral', such as financial receivables, real estate, physical assets that are used within the Foundation Internal Rating Based Approach.

**D. Counterparty credit risk**

As stated by the Bank for International Settlements, counterparty credit risk makes for approximately 2% of the total risk weight assets. The use of the standardized method for assessing counterparty credit risk is not allowed. Minimal deviation is also attributed to the fact that banks are not demanded to hold capital for exchange rate exposures with a maturity of less than 14 days.

### 1.2.4 Australia

In January 2013, the Australian Prudential Regulation Authority (APRA) released the new capital rules aligning with Basel III requirements. The new reforms are mandatory for all Authorised Deposit taking institutions (ADIs[35]), accounting with domestic small and medium-sized commercial banking institutions, foreign branches that do not comply with Basel in their home country.

In Australia, four main ADIs make for 80 % of the total assets in the banking sector receiving the status of domestically important banks. SNL Financial states that these institutions, namely: National Australia Bank Ltd., Commonwealth Bank of Australia, Westpac Banking Corp. and Australia & New Zealand Banking Group Ltd. had their equity Tier 1 ratio between 8.33 % - 8.82 %, August 2014. This ratio level might seem surprisingly low, however Australia implements stricter capital requirements and the ratio level would rise significantly should it have been calculated under the Basel framework[3637]. As for the other countries a characteristic of the Australian banking sector data is presented below.

[35] Authorised deposit taking Institutions (ADIs) - all locally incorporated banks, branches of overseas banks, credit unions, building societies, providers of purchased payment facilities and specialist credit card providers.
[36]RESERVE BANK OF AUTRALIA: *The Basel III Capital Reforms in Australia*, Publication, 2013, available on: <http://www.rba.gov.au/publications/fsr/boxes/2013/sep/b.pdf>.

**Table 11: Banking sector characteristics - Australia**

| **Size of the banking sector** | **AUD, bn** |
|---|---|
| Total assets of ADIs | 4,225 |
| Total assets of all locally incorporated internationally active ADIs | 3,564 |
| Total assets of locally incorporated ADIs which adhere to Basel | 3,958 |
| | |
| No. of banks operating in Australia | 165 |
| No. of internationally active ADIs | 5 |
| No. of ADIs required to implement Basel standards | 125 |
| | |
| **CA for internationally active ADIs** | **AUD, bn** |
| Total RWA assets | 1,357 |
| Total off-balance sheet bank assets | 769 |
| | |
| RWAs for credit risk (% of total RWAs) | 95.2 |
| CAR* (%) | 11.9 |
| Tier 1 ratio* (%) | 10.2 |
| CET1* (%) | 8.3 |
| **weighted average* | |

***Note:*** *As for Mar 2013*
Source: Bank for International Settlements

### A. Capital requirements

The following deviations in relationship to Basel requirements apply:

i. Under Basel common shares that were directly/indirectly funded by the bank are excluded from the regulatory capital. APRA states that if these instruments are bought by a borrower that has a diversified /highly collateralized portfolio and are used as collateral for a full re-course loan than it can be added as regulatory capital;
ii. If an entity directly holds capital instruments of an ADI and both are part of the same consolidated group, then these instruments can be categorized as regulatory capital if:
    a. A third party funded the purchase of these instruments
    b. The risks and benefits are directly bared by the third party
    c. The third party is able to independently decide whether to buy or sell such capital;
iii. If the entity that invests in shares is funded under a share-based employee remuneration scheme, then it is approved as CET1. The following restrictions, however, apply:
    a. The shares should be ordinary
    b. The amount contained in CET1 should be in line with a profit loss charge
    c. It is impossible to transform the shares in another type of payment;
iv. Basel specifies that dividends should not be included in CET1 capital. APRA requires to extract dividends which were declared but still not paid. The deduction amount can be lowered by the expected proceeds of a Dividend Reinvestment Plan, if dividends serve to buy new shares of the ADI;

[37] APRA: *Implementing Basel III capital reforms in Australia*, Policy Document, 2012, available on : < http://www.apra.gov.au/Policy/Documents/September-2012-Basel-III-capital-regulation-impact-statement.pdf>.

v. According to Basel intangible assets are also extracted from CET1. APRA demands that comparable instruments such as capitalised expenses, capitalized transaction costs, mortgage servicing rights also to be deducted. For deferred tax assets for temporary differences, important investments in unconsolidated financial entities and mortgage servicing rights full deduction is applicable;
vi. APRA claims that call options and the condition to be transformed into ordinary shares does not represent a stimulus to redeem if there are more than two years from the date when the ADI has the option to call the instrument to the earliest date when the conversion can be made. This requirement is in contradiction with the principles set by Basel that demands only perpetual instruments;
vii. APRA may increase the minimum capital requirement for an ADI. Consequently, it may decide to impose a lower capital conservation buffer than 2.5%. This approach results in much stricter conditions for distributions, which are provided conditional on a much higher minimum CET1.

**B. Credit risk**

96% of all locally incorporated ADIs use the Standardised approach. Only 5 ADIs are active internationally and use both the internal rating based approach and Standardised approach.

*Standardised approach*

i. Claims on public sector entities, including claims on foreign local governments and non-commercial publics sector entities receive preferential risk weights;
ii. In contrast to Basel it does not apply the sovereign floor in relationship to unrated banks or corporate claims;
iii. Banks rely on recognized External Credit Assessment Institution in measuring credit risk. However, their individual assessment is only available to wholesale clients and foreign entities and not publicly available as required by Basel;
iv. Retail exposures have 100% risk weight opposite to 75% RW set in Basel;
v. APRA applies a residential mortgage risk-weighted matrix that ranges between 35% - 100%. Basel risk weight for residential property is 75%

*Internal Rating Approach*

i. Under Basel residential mortgages receive retail treatment only if the mortgage is given to the owner-occupier. APRA applies retail treatment to all residential mortgages regardless of their status, if owner-occupier or non-owner occupier;
ii. LGD are usually set to express economic downturn. The 10% LGD floor for exposures backed by residential mortgages must be imposed at the sub-segment of exposures to which the RWA formula is used. Given the use of granular segmentation approaches in the banks' rating system APRA sets an even more conservative 20% floor that is imposed at portfolio level;

iii. HVCRE[38] is excluded from the IRB approach. As a consequence, the exposures that should be assessed as HVCRE go in the category of income-producing real estate and are likely to receive lower RWA.
iv. Margin lending exposures are not included in IRB portfolios under Australian rules, creating higher capital requirements than those set by Basel;
v. Retail exposures that have business purposes are recorded in the 'other' portfolio or corporate portfolio, setting stricter capital treatment;
vi. Collateral that does not fall under the following categories: eligible financial collateral, financial receivables, residential or real estate is assessed as unsecure and identified with a higher LGD in the foundation IRB approach;
vii. The credit conversion factor for commitments, note issuance facilities, revolving facilities is 100% in comparison with Basel 75%;
viii. Basel sets that if eligible provisions are higher than the expected loss, then the surplus is added to Tier 2. APRA does not allow such an approach.

**C. Securitisation**

APRA develops a different approach when addressing the originating banks under the standardised method. Basel standardised approach says that all retained securitisation exposures that have a rating lower than 'investment grade' should get 1250% risk weight. APRA assigns a risk weight of 350% for all exposures rated BB+ to BB-.

**D. Counterparty credit risk**

For mark-to-market risk losses Australian banks apply the Standardised Credit valuation Adjustment as in Basel. The only difference is set for ADIs that do not have a direct exposure within the OTC derivatives market. Subject to APRA's approval these entities can use a more simple credit valuation adjustment approach. However, this approach cannot be implemented by ADIs that have default fund contributions to a central counterparty and internationally active ADIs.

### 1.2.5 India

The final version of the Indian Basel III guidelines was adopted by the Reserve Bank of India (RBI) in May, 2012, becoming effective from January 2013 with a phase in period similar to Basel that ends in 2018.

The new capital requirements apply to all commercial banks except some regional rural banks. More than 70% of the banks in India are state owned entities. With 85% of the banking assets being hold by commercial banks. The sector has an impressive number of branches accounting with some 90 000 entities, for a more detailed overview see Table 12. Currently, among major problems of the banking system are related to low Tier 1 ratio, decreasing profitability, worsening asset quality, increasing provisioning requirements.

[38] Basel par. 215/227 requires banks that adopted IRB approach for credit risk to classify 5 specialised lending sub-asset categories for the corporate asset class: project finance, object finance, commodities finance, income-producing real estate, high-volatility commercial real estate.

**Table 12: Banking sector characteristics – India**

| **Size of the banking sector** | **INR, bn** |
|---|---|
| Total assets of all banks | 117,621 |
| Total assets of all locally incorporated internationally active banks | 34,905 |
| | |
| No. of banks operating in India | 90 |
| No. of internationally active banks | 4 |
| No. of banks required to implement Basel standards | 90 |
| | |
| **CA for internationally active banks** | **INR, bn** |
| Total RWA assets | 23,470 |
| Total off-balance sheet bank assets | 6,094 |
| | |
| RWAs for credit risk (% of total RWAs) | 86.2 |
| CAR* (%) | 13 |
| Tier 1 ratio* (%) | 9.7 |
| CET1* (%) | 9.3 |
| **weighted average* | |

***Note:*** *As of Sept 2014*
Source: Bank for International Settlements

### A. Capital requirements

The following deviations in relationship to Basel requirements apply:

i. RBI sets minimum capital requirements at: 5.5 % - CET1, 7% - Tier1, total capital – 9%, thus imposing higher requirements than those in Basel. Banks achieve higher capital ratios mostly due to the minority interest and third-party investments in capital instruments of the subsidiaries that is evaluated as part of the regulatory capital;
ii. Indian banks are not allowed to directly invest in their own shares or hold contracts that would obligate them to buy back their own shares;
iii. In the AT1 capital RBI includes besides perpetual shares and debt instruments also an extra clause that enables 'any other type of instruments generally notified by the RBI from time to time for inclusion in AT1'.

### B. Credit Risk

*Standardised approach*

i. Lower risk weights for commercial real estate-residential housing, residential housing/loans/advances to a bank's own staff covered by superannuation benefits[39] and /or mortgage of flat/house. Under Basel they would get a 75% RWA. Indian Basel 20% RWA;
ii. Higher risk weights: consumer credits, claims secured by residential proprieties, venture capital fund, capital market, AA and BB rated corporates. E.g: a) consumer credit loans: 125% RWA under RBI requirements, 75% Basel requirements; b) venture capital funds: 150 % RWA under RBI requirements, 100% Basel requirements; c) individual housing loans secured by residential property: 50% - 75% RBI requirements, 35% Basel requirements;
iii. Life insurance policies with a 0% haircut are assigned as eligible financial collateral[40];

[39] Superannuation is a special type of retirement savings scheme that is linked to the employment of the individual. The contributions go to special funds. If these funds meet certain government requirements then a lower tax is paid on them.

iv. Public state entities receive a risk weight comparable to those imposed for corporates.

*Internal Rating Approach*
Currently, no bank in India is applying the IRB approach, even though 7 have been granted the right to use the Foundation IRB.

i. The credit default event that implies 90 days payment past due is replaced with crop seasons;
ii. Some small exposures as claims on venture capital funds that can be assessed under IRB are exempted from it;
iii. Authorization to defer the use of IRB for sovereign exposures, if banks encounter difficulties to set rating systems due to unavailable data.

**C. Securitisation**

Securitisation is not very popular among Indian banks, with only 2 out of 8 largest banks having any securitisation exposure. Furthermore, the securitisation RWA accounts for less than 1.5% of total RWA. In comparison with USA and European markets the products have a rather simple structure. As a consequence of RBI tougher regulation, banks are not allowed to engage in synthetic securitisation, re-securitisation or revolving structures. Moreover, if in case of Basel III the underlying assets might be sold to a SPV/SPE for cash or assets funded by the entity's debt, under Indian rules the assets can only be sold for cash.

**D. Counterparty credit risk**

For the counterparty credit risk, RBI does not set any capital requirements for foreign exchange contracts with maturity equal or less than 14 days. The only exception is for gold contracts. While Basel requires a potential exposure factor of 1% for counterparty risk for all foreign exchange contracts with residual maturity of less than one year. The advanced approach for credit valuation adjustment charge is not applicable in India.

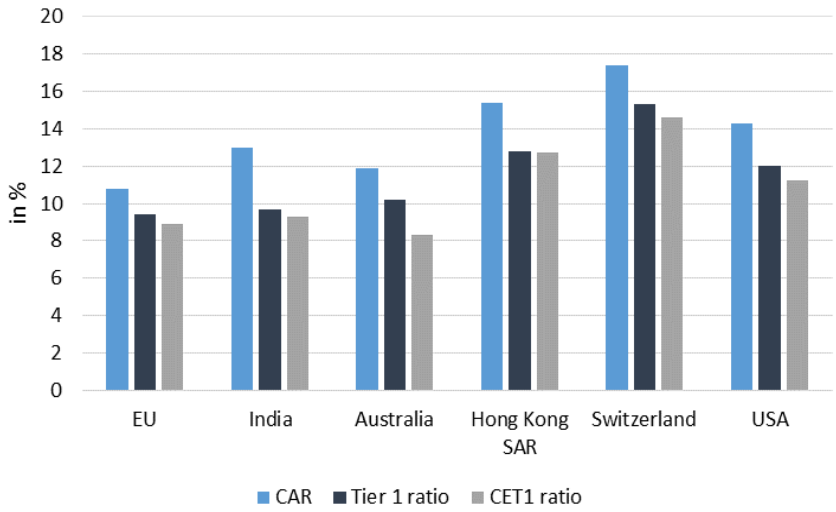
### 1.2.6 Synthesis

The performed analysis aimed to present an overview of bank capital adequacy rules set in several countries and their consistency with Basel III requirements. The analysis was structured in several points such as minimum capital requirements, credit risk measurement methods, securitisation and counterparty risk in order to be able to make a thorough assessment for each country. Overall, countries are largely compliant with Basel a majority of them imposing significantly higher capital demands. According to it the capital standards in Hong Kong SAR are the closest to Basel with minor deviations in the process of risk weighting by setting a less conservative approach. For Switzerland, USA and India a major role is played by the regulatory authority that is able to set enhanced capital requirements, change the structure of the eligible capital, trigger the loss absorption process, etc. A distinctive feature for Switzerland is its highly restrictive capital treatment of SIFIs. However, due to the importance of the banking system for the Swiss economy, we found that these restrictions are reasonable. In case of USA, besides higher capital requirements than in Basel, a distinguishing

[40] RBI claims that life insurance policies are highly liquid and reliable instruments in comprison with equity that is not considered by RBI but permitted by Basel as eligible collateral.

characteristic is its non-reliance on external credit ratings and their full replacement with risk weights. Higher risk weights result in a more conservative approach, the only exception is applicable to mortgage backed securities that were the root cause of the recent financial crisis. As in the past, Australia has higher capital standards than its European peers. Interestingly, similar to banks in India, the vast majority use the Standardized Approach in measuring credit risk. Conclusively, a preview of capital ratios is provided below.

**Chart 5: Synthesis of capital ratios across countries**




***Note:*** *Rough estimations as for 2014*
Source: Bank for International Settlements

## 1.3 The macro-economic impact of Basel III

### 1.3.1 Transitional impact

The task of assessing the costs of new capital requirements during the transition phase has been undertaken by the Macroeconomic Assessment Group (MAG)[41]. According to its analysis, should a temporary crisis occur, its costs will be equal to 19 % of the before-crisis GDP while the average probability of systemic banking crisis is 4.5% per year. They claim that the new capital requirements are likely to lower the probability of crisis by 0.45 % - 1.05 % yearly. Under the assumption that the banking crisis will not have permanent effects, Financial Stability Board (FSB) calculates that 1% reduction in the probability of banking crisis is equal to a 0.2% GDP benefit per year. The International Monetary Fund (IMF) claims that additionally it will result in a major decrease of the spillover effect. The largest effect from increased capital requirements will be achieved in the 35$^{th}$ quarter after its initial implementation. MAG assumes that the annual growth will drop by 3 bp yearly in the first 8 ¾ years, consequently switching to run above its baseline forecast[42].

[41] Established by the Financial Stability Board and the Basel Committee on Banking Supervision.
[42] BANK FOR INTERNATIONAL SETTLEMENTS: *Assessment of the macroeconomic impact of higher loss absorbency for global systemically important banks*, Report, 2011, available on: <http://www.financialstabilityboard.org/wp-content/uploads/r_111010.pdf?page_moved=1>.

In order to assess the medium-term macro impact of Basel III, the department of Economics of OECD employs the adjusted semi-elasticities of the OECD New Global Model. It calibrates the short-term interest rate semi-elasticities to their long term equivalents, taking into account the share of banks in the overall credit intermediation process. By multiplying the estimated semi-elasticities with the banks' lending spreads the authors evaluate the total impact of enhanced regulatory capital. Table 13 and 14 present the findings.

**Table 13: Macroeconomic impact of Basel III in 2015**

| | GDP level % | | | | | GDP growth % |
|---|---|---|---|---|---|---|
| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Annual |
| **US** | -0.01 | -0.04 | -0.07 | -0.10 | -0.11 | -0.02 |
| **Eurozone** | 0.00 | -0.04 | -0.17 | -0.26 | -0.39 | -0.08 |
| **Japan** | 0.00 | -0.05 | -0.07 | -0.17 | -0.19 | -0.04 |
| **Average (simple)** | 0.00 | -0.04 | -0.10 | -0.17 | -0.23 | -0.05 |
| **Average (GDP weighted)** | 0.00 | -0.04 | -0.11 | -0.17 | -0.23 | -0.05 |

Source: OECD

**Table 14: Macroeconomic impact of Basel III in 2019**

| | GDP level % | | | | | GDP growth % |
|---|---|---|---|---|---|---|
| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Annual |
| **US** | -0.05 | -0.20 | -0.34 | -0.49 | -0.59 | -0.12 |
| **Eurozone** | 0.00 | -0.13 | -0.51 | -0.76 | -1.14 | -0.23 |
| **Japan** | 0.00 | -0.12 | -0.18 | -0.41 | -0.47 | -0.09 |
| **Average (simple)** | - 0.02 | -0.15 | -0.34 | -0.56 | -0.73 | -0.15 |
| **Average (GDP weighted)** | - 0.02 | -0.16 | -0.38 | -0.58 | -0.79 | -0.16 |

Source: OECD

The resulting impact of tighter capital requirements on GDP across studies, however, differ significantly as shown below.

**Table 15: Literature preview on Basel III impact**

| Analyzed countries | Authors | Year | Impact of 1% increase in capital requirements on GDP during Basel III implementation period |
|---|---|---|---|
| US, Eurozone, Japan | Slovnik, Cournede | 2011 | ↓ 0.20 % |
| Italy | Locarno | 2011 | ↓ 0.33 % |
| US | Angelini et al. | 2011 | ↓ 0.09 % |
| US, Eurozone, Japan, UK, Switzerland | Institute of International Finance | 2011 | ↓ 3.20 % |
| France | Sy | 2011 | ↓ 0.30 % |
| Emerging Economies | Abdel-Baki | 2012 | ↓ 3.00 % |

Source: Financial Stability Board

*Short-term costs for G-SIBs*

According to the FSB (2011) in the long-run the costs of higher capital for G-SIBs should be weak or non-existent. Relying on Kashyap et al. (2010) or Admati et al. (2011) we claim that the banks' liability side should only affect the value of the entity mostly by tax advantages of debt relative to equity, the explicit or implicit government subsidies directed to certain categories of bank debt, and the deadweight costs of bankruptcy. Short-term costs, on the other hand, relate only to the needed adjustment investments to fulfil the new capital rules. In doing so, banks can opt for external or internal raise of capital. In practice, banks use a combination of strategies like reducing dividend payouts and increase in lending spreads or deleveraging. At the point that higher credit spreads and lower lending may affect the real economy by increasing the funding costs, regulatory authorities tend to loosen the monetary policy. Nevertheless, this measure might be limited under current conditions when many countries have a zero policy rate.

The approach adopted by the FSB while computing the costs for G-SIBs implies multiplying the estimated GDP impact by lending shares or asset shares. It is claimed that the impact of capital surcharge for G-SIBs is a linear function of the amount of these surcharges, and surcharges on G-SIBs have the same impact per percentage point of capital as do increased capital ratios on the banking system as a whole. Conclusively, it is estimated that surcharges on G-SIBs will have a quite modest impact on the lending spreads and volumes. The maximum decline in lending volumes is forecasted at 0.005% relative to the baseline assumptions. The lending spreads increase is estimated at 5-6 bp. For the impact on GDP, a 1% increase in capital within an 8 year transition period for top 30 G-SIBs results in a decrease of 0.04% below the forecasted baseline. For a 4 year transition period the highest impact on GDP will be in the $5^{-th}$ quarter after full implementation.

If we assume that all countries implement the new capital requirements almost simultaneously, we have to account in the analysis with the spillover effect. The domestic demand will follow a decrease not only due to tightening country specific conditions but also due to the aggregate capital enforcement process. By using a structural macroeconomic model of the world economy in its analysis, FSB concludes that 1% increase in capital for top G-SIBs will produce a 0.14% decline in global GDP under the baseline. Bank of Canada suggests that if the monetary authority intervenes the highest GDP loss will be of 0.04% under the baseline, assuming no spillover effect. The spillover effect implies an additional 0.04% drop in GDP. The outcomes of the analyses are highly dependable on the used methodology; if the models consider rationing or lending standard effects, endogenous / exogenous monetary policy as shown in Table 16.

**Table 16: The highest GDP effect of 1% increase in capital**

| | **20 G-SIBs** | **30 G-SIBs** | **40 G-SIBs** | **Implementation horizon** |
|---|---|---|---|---|
| *Using lending shares* | | | | 8 years |
| All models | - 0.05 % | - 0.06 % | - 0.08 % | |
| Exogenous monetary policy | - 0.07 % | - 0.10 % | - 0.11 % | |
| Endogenous monetary policy | - 0.03 % | - 0.03 % | - 0.05 % | |
| *Using asset shares* | - 0.05 % | - 0.07 % | - 0.09 % | |

| | | | | |
|---|---|---|---|---|
| *Using lending shares* | | | | 4 years |
| All models | - 0.05 % | - 0.06 % | - 0.08 % | |
| Exogenous monetary policy | - 0.06 % | - 0.10 % | - 0.11 % | |
| Endogenous monetary policy | - 0.02 % | - 0.03 % | - 0.05 % | |
| *Using asset shares* | - 0.05 % | - 0.07 % | - 0.08 % | |

***Note:*** *Accounting with the international spillover impact*
Source: Financial Stability Board

### 1.3.2 Long – term impact

While the work of Macroeconomic Assessment Group focused on the transitional impact Long-term Economic Impact group (LEI) assesses the capital impact once banks have completed the transition to the new requirements. On the long term benefit side, LEI assumes that it will decrease the probability of banking crisis and lower output fluctuation. Historical data state that banking crisis take place every 20 – 25 years. Reinhart and Rogoff (2008) claim that the frequency of banking crises is between 3.6% - 5.2% per year. The estimated costs of systemic banking crisis – even though dependable on the methodology used – are around 60% of pre-crisis GDP. The expected costs from a banking crisis can be calculated as *annual probability of crisis*output costs.* The expected annual benefits as *decrease in the annual probability of crises*discounted cumulative GDP losses* in case of banking crisis. A summary on annual benefits according to BCBS is provided below.

**Table 17: Annual benefits from reduced probability of crises**

| **Decrease in the probability of crises** | **Crises have no permanent impact on GDP** | **Crises have a small permanent effect on GDP** | **Crises have significant permanent impact on GDP** |
|---|---|---|---|
| 1 % | 0.19 % | 0.63 % | 1.58 % |
| 2 % | 0.38 % | 1.26 % | 3.16 % |
| 3 % | 0.57 % | 1.89 % | 4.74 % |
| | | | |
| **Cumulative GDP losses** | 19% | 63% | 158 % |

Source: Basel for International Settlements

The potential loss of output related to higher capital requirements should be assessed hand in hand with a potential loss in welfare. An insignificant decrease in the steady state output, could result in a drop in consumption. FED expresses the welfare loss as the fraction of consumption that consumers would agree to permanently sacrifice to avoid constraint[43].

LEI report states that there is an almost linear positive dependence between costs and capital, each increase in the capital ratio results in a loan spread increase of 13 bp and a contraction in GDP of

[43]ANGELINI, P., et al.: *Basel III: Long-term Impact on Economic Performance and Fluctuations*, FED, Staff Report, 2011, available on: < http://www.ny.frb.org/research/staff_reports/sr485.pdf>.

0.09% relative to its baseline forecast. Slovik and Cournède (2011)[44] further analyse the impact of Basel III on lending spreads as: regulatory capital impact = lending spreads sensitivity*remaining bank capital increase. Table 18 presents the results of the calculations.

**Table 18: The impact of Basel III on bank lending spreads**

| | Remaining Capital increase (%) | Increase in Bank Lending Spreads ( bp) |
|---|---|---|
| | Till 2019 | |
| US | 3.1 | 63.6 |
| Eurozone | 3.8 | 54.3 |
| Japan | 4.2 | 35.3 |
| Average (simple) | | 51.1 |
| Average (GDP weighted) | | 52.9 |

Source: OECD

*Long-term benefits for G-SIBs*

To assess the overall benefits it is important to understand that the advantages from reducing crisis probability differ depending on the initial level of the probability being decreased. If we assume that the probability of the crisis is equal to 3.3%, then 1% higher bank equity will lower the crisis probability only by 1%. Should we consider an initial crisis probability of 4.8%, then a similar rise of bank equity will result in 1.5% decline in crisis probability. In our analysis we have to consider the particular economic situation in each country. For instance, The UK Financial Services Authority claims that a negative fluctuation in the current account/GDP ratio of 2% will enhance the probability of crisis from 4.5% to 7%.

The FSB assumes that if we merge the effect of the Basel capital demands and the special approach to G-SIBs, then we will be able to decrease the probability of crisis. However, the overall impact is not accurate enough as it doesn't capture the entire banking system but only those that are subject to Basel. If the crisis is only temporal then it would result in a 0.77 % GDP benefit, otherwise with permanent effects it will foster a 6.40% GDP benefit.

## 1.4 Conclusion

The first half of the theoretical part of this paper focused on defining the rationale behind Basel III, its implementation consistency across economies and assessing the potential macroeconomic impact. We find, that the new regulatory imposes stricter rules that aim to raise the quality and transparency of the capital base, enhance the risk coverage, tackle pro-cyclicality, systemic risk and interconnectivity. The requirements are, however, contradictory. Due to the current low yields market environment banks might take on excessive risks in order to meet enhanced demands. Alternatively, the conservation and countercyclical buffers might be sufficient measures to restore discipline without putting excessive pressure on banks. Regulators also aim to enhance transparency, but at the

[44]SLOVNIK, P., COURNEDE, B.: *Macroeconomic Impact of Basel III,* OECD Economics Department Working Paper, No. 844, ISSN: 1815-1973, 2011, available on: <http://www.oecdilibrary.org/docserver/download/5kghwnhkkjs8.pdf?expires=1434441456&id=id&accname=guest&checksum= 7EF06CBA54FC130E121EEC8FE823B8A1>.

same time include in the capital structure innovative instruments as CoCo bonds that market participants are unable to fairly price and assess their underlying risks. The same instruments are rated by rating agencies, even though Basel argues the necessity to lower reliance on rating agencies due to their role in the financial crisis. The hazard is even higher now as CoCos, in contrast with structured finance, are directly included in the capital base. Moreover, we are unable to quantify the consequences of massive CoCo conversions and write-offs on the real economy, as these instruments seem to be highly correlated. In the particular case of SIFIs, we claims that even though at micro level a bank would not be entitled to regulatory assistance, the regulator will still safeguard the SIFI if at macro level it may have significant repercussions. We suppose that the Too-big-too-fail problem will not be overcome by the new capital regulation. Overall, the analysed countries implemented stricter rules than in Basel, denoting an aggregate concern in respect to financial stability and contagion effects. Several studies attempt to quantify the positive impact of Basel III in the long-run. According to them, it will lower the probability of banking crisis and significantly decrease the losses on GDP. There is no doubt that the absence of a banking crisis will have a positive impact by preventing GDP losses. However, in the short-run with implementation deadlines approaching, banks will be challenged to deliver. Enhanced worries are directed towards European banks that are still undercapitalized and weak.

# II Credit Derivatives

Most commonly used methods to mitigate credit risk are: collateral, guarantees, with a great emphasis on entering into credit derivative positions. The transfer to a more systematic approach and the progress made in sophisticated internal models in terms of credit risk management has resulted in the development of an outstanding market for credit derivatives.

As for other derivatives, the value of a credit derivative depends on the credit performance of its credit sensitive asset. The performance is most commonly assessed by yields, price spread in comparison to a benchmark, credit ratings and default events. Currently, most common are credit derivatives on sovereigns, individual corporations, corporate baskets and indices. Credit derivatives are a perfect tool to manage credit risk in particular due to the fact that: 1. the reference entity, its risk is transferred does not have to be a party or know about the derivative transaction, securing a high level of confidentiality and highly customized products, 2. the ability to short sale, which is not possible for bank loans, indexes, or similar products, 3. represent off-balance sheet instruments that ensure significant flexibility with respect to leverage.

In this chapter we will analyse the approach to credit risk management by using credit derivatives. First, we will briefly analyse the credit derivatives market. Continue with basic derivative structures, namely: credit default swaps, total return swaps, credit options, and make a short introduction to hybrid instruments. Next, we will mention the implications for credit derivatives under Basel III. In addition, we will make reference to literature on credit derivatives related topics. The last sections will summarize the findings.

## 2.1 Credit derivatives markets

The market on credit derivatives started to grow at fast pace particularly after the Russian crisis in 1998. Primarily a hedging instrument, later on it became an important instrument for trading credit risk. According to Kothari (2009) the following factors influenced the rapid growth of the market: a.) a flat equity market after the technology bubble, b.) globalization of banking, c.) growth of the securitization instruments[45].

It is difficult to make a precise delimitation on the development of the credit derivatives market. Generally, we can make source of four main stages. The period before 1997 can be said to be the first one. During it market players were only experimenting with credit derivatives products, using them in relationship to loan syndication or as a hedging tool. Between 1997 -1999, credit default swaps (CDS) entered the market as a standardized instrument. In light of the Asian, Russian and Mexican crisis emerged the need to off-load balance sheet risks. Thus, the market starts to be populated by portfolio default swaps and Collaterized Debt Obligations (CDO). The third period is set between 1999 and 2003. This stage is defined by a large and liquid CDS market and the beginning of CDO structuring. With the fourth phase started the large speculative activity of the hedge funds. Even though after the 2007 financial crisis trading in credit derivatives slowed down, it is unlikely that this trend will hold for a long period. Table 19 provides us with a general sequence in the development of credit derivatives products according to Kothari.

**Table 19: Development of the credit derivative**

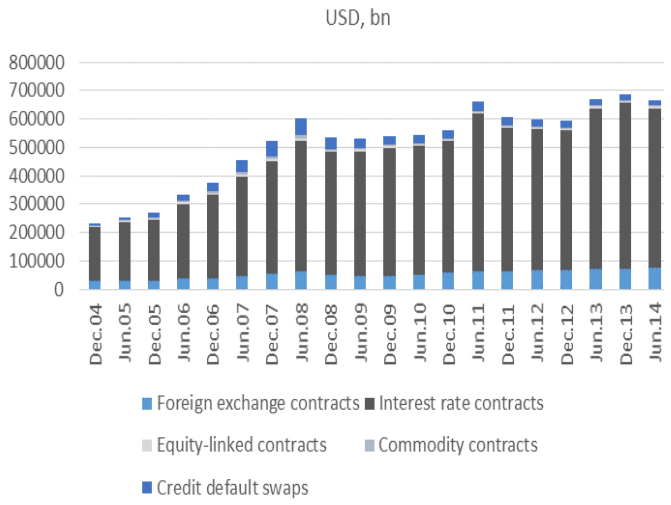
| **Credit event** ⟹ | **Options** ⟹ | **Forwards** ⟹ | **Swaps** ⟹ | **Structured notes** |
|---|---|---|---|---|
| Changes in Credit Spread | Credit Spread Option | Credit Spread Forward | Credit Spread Swap /Total Return Swap | Collaterized Debt Obligation/Alternative instruments |
| Default | Credit Default Option | | Credit Default Swap | |

Source: Adopted from Kothari

It would be useful to analyse the current credit derivatives market in comparison with the development in other OTC instruments. Chart 6 and 7 illustrates the development in OTC derivatives based on notional amounts and gross market value for a 10 year period starting with 2004. The interest contracts continue to lead the market in both cases. Credit default swaps make for more than 97% of the credit derivatives market. By gross market value, it be seen a significant increase in 2008 estimated at USD 5116,235 bn. in comparison to 2004 when it was USD 133,483 bn. Its market value was comparable to that of foreign exchange instruments that have also seen a hike in 2008. In 2014 credit default swaps accounted only for 28,6% by notional outstanding and 11,6 % by gross market value of its level in 2008.

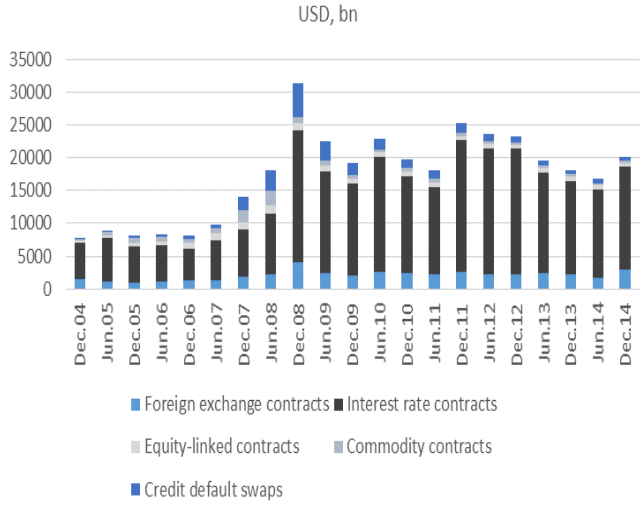
[45]KOTHARI, V.: *Credit Derivatives and Structured Credit Trading*, 2009, ISBN 978-0-470-82292-0.

**Chart 6: OTC derivatives – Notional outstanding**




Source: Bank for International Settlements

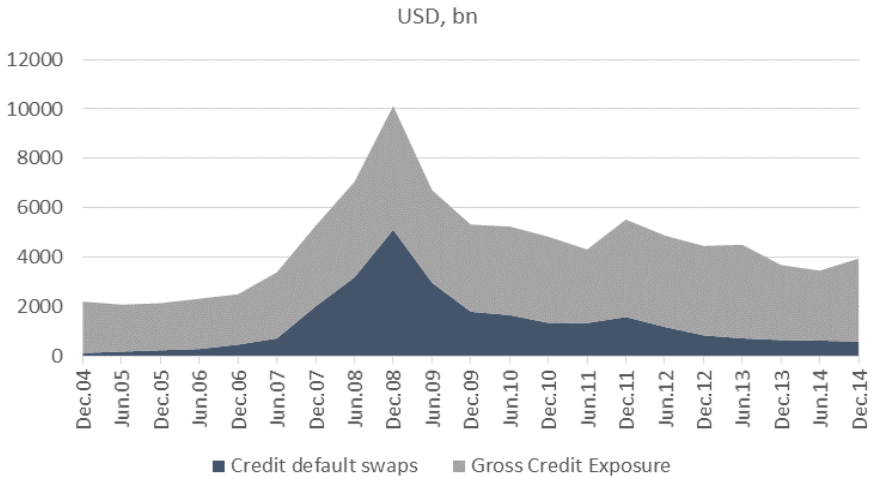
**Chart 7: OTC derivatives - Gross market value**




Source: Bank for International Settlements

As can be seen in chart 8, in 2008 credit default swaps covered the total gross market value of credit exposure. Starting with 2009 the gross credit exposure had a significant decline. In 2014 credit default swaps account only for 17,66 % of the total credit exposure, that is estimated at USD 3358,23 bn. Credit default swaps dominate the market on credit derivatives, holding more than 98% share. In what follows, the credit default swap market will be discussed in more detail in the next section on Basic Credit Derivative Structures.

**Chart 8: Gross market value of credit exposure**




Source: Bank for International Settlements

## 2.2 Basic Credit derivatives structures

The most complex structures of credit derivatives can be engineered by merging 3 main building blocks:

a. Credit Default Swaps
b. Total return swaps

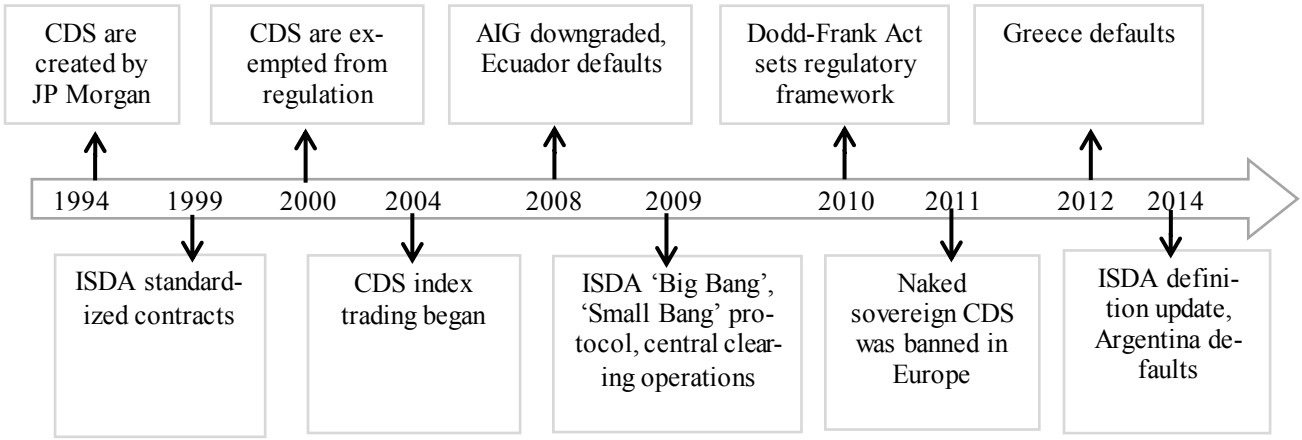
c. Credit options

Next, we will analyse each building block by addressing the following points: 1. development, 2. structure and functionality, 3. categories of instruments, 4. credit events and settlement mechanisms, 5. motivation to enter the transaction. In the end, we will briefly refer to the use of hybrid products.

### 2.2.1 Credit default swaps

Credit default swaps are bilateral OTC contracts that transfer a credit exposure on a reference entity across market participants. The protection buyer pays an annuity premium based on the notional amount in return for a contingent payment from the protection seller should a credit event happen. CDS references to bonds or loans of a sovereign or corporate entity. Even though it is comparable with an insurance contract, two main differences apply: 1. it is not subject to the insurance regulation, 2. standardized through the ISDA framework[46]

*Development in the CDS market*




As presented in the timeline, the CDS market is quite young. In 1994 JP Morgan sold the credit risk coming from a credit line to Exxon to the European Bank of Reconstruction and Development. Thus, initiating the development of what is now a huge market for transferring sovereign and corporate credit risk. Speaking before the National Italian American Foundation on October 12, 2005 Alan Greenspan, the then chairman of FED states: '*These increasingly complex financial instruments have contributed to the development of a far more flexible, efficient, and hence resilient financial system than the one that existed just a quarter-century ago… The new instruments of risk dispersal have enabled the largest and most sophisticated banks, in their credit-granting role, to divest themselves of much credit risk by passing it to institutions with far less leverage. Insurance companies, especially those in reinsurance, pension funds, and hedge funds continue to be willing, at a price, to supply credit protection*[47].'

[46] The ISDA master agreement is published by the International Swap and Derivatives Association and it is used for OTC derivatives transactions. The framework represents a set of documents meant to ensure that OTC derivatives are documented in full, setting standard terms that are applicable to all transactions between the parties. It comprises a master agreement, schedule, confirmations, definition booklets, credit support annex.

[47] GREENSPAN, A., Speech, FED, 2005, available on: <http://www.federalreserve.gov/Boarddocs/speeches/2005/20051012/default.htmfinds>.

The lack of regulation contributed to the massive expansion of the CDS market. The implementation of ISDA CDS Big Bang and CDS Small Bang protocol in 2009, for US and European markets came with important changes. Among others: standardization of the coupon, elimination of restructuring among triggering events, and implementation of the auction settlement mechanism.

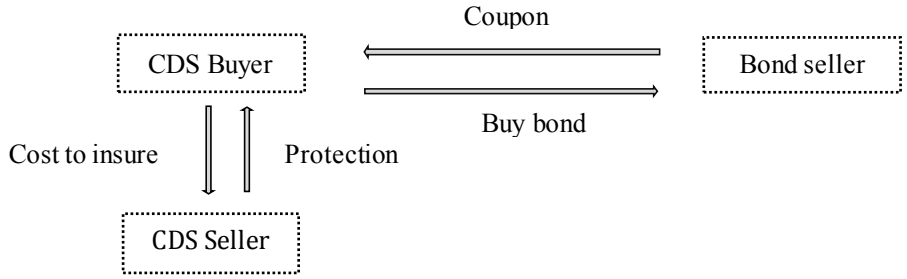
Starting with 2005 it is estimated that 103 CDS credit events took place, but only two of them were publicly settled. The most known is the Greek sovereign CDS that suffered a triggering event in March, 2012. Something like EUR 200 bn of Greek government bonds were exchanged for new bonds, being the largest restructuring event in history.

*Structure and functionality*

While first CDS sellers were insurance companies, currently, reporting dealers dominate the market. From 2010 there is an increase in central counterparties. In 2014 central counterparties account for roughly 20 % of the total counterparties by bought and sold CDS notional outstanding (Chart 9 and 10).

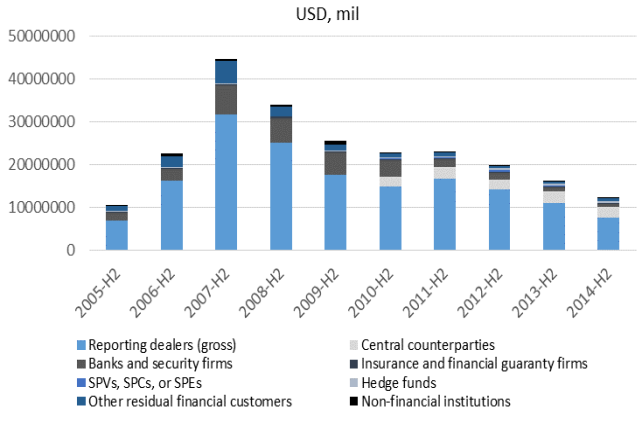
- Protection buyer - short position in bonds of the underlying reference entity. If it holds a:
    a. 'naked' CDS, then it does not have any direct exposure to the reference entity;
    b. 'over-insured' CDS, in case the value of the CDS contract is higher than the exposure itself;
- Protection seller - leveraged long position in bonds of the underlying reference entity

**Figure 4: Basics of the CDS structure**



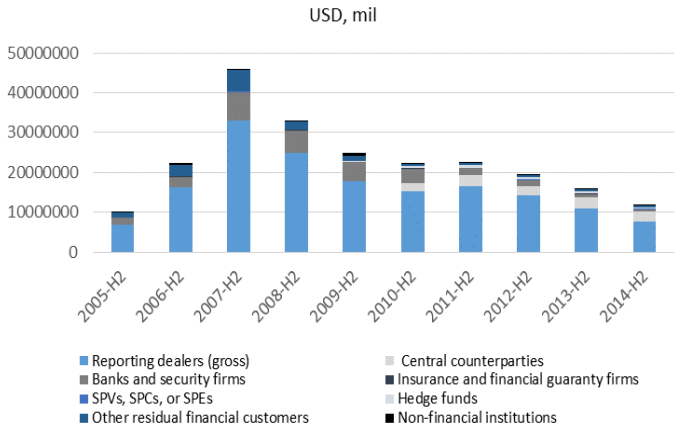

Source: JP Morgan

**Chart 9: Bought CDS by counterparty**




***Note:*** *Notional amounts outstanding*
Source: Bank for International Settlements

**Chart 10: Sold CDS by counterparty**




***Note:*** *Notional amounts outstanding*
Source: Bank for International Settlement

CDS instruments are primarily classified into two main groups:

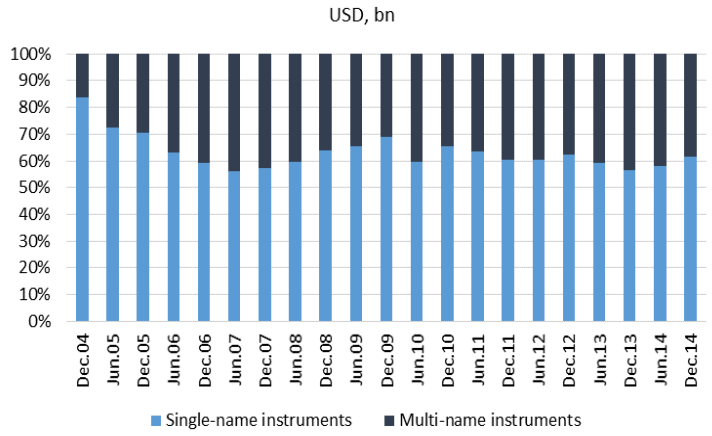
- *Single name CDS* – is based on one single underlying entity, e.g. a corporation, sovereign;
- *Multi-name CDS* – is based on more than one underlying entity, e.g. portfolio, indices.

The market on CDS is dominated by single-name instruments, that account for roughly 60% of the market share (Chart 11). If we refer to the development in CDS gross notional amount, then in 2004 single-names were estimated to USD 111,7 bn and multi-name CDS accounted for USD 21,8 bn. During 2008 it was recorded their highest values with USD 3262,7 bn in single-name instruments and USD 1853,5 bn in multi-name instruments. In 2014 both instruments made only for 11% of their 2008 gross notional level.

Multi-name CDS can be further classified as:

a. Basket CDS – will make the contingent payment in case that any of the multiple reference entities defaults. The contract sets the number of defaults after which the payout is being made, considering if it is a first-to-default, second-to-default, or n-th to default. For tranched CDS, specific loss limits apply: 1.) first loss tranched CDS, 2.) mezzanine tranched CDS, 3.) senior tranched CDS[48]
b. Index CDS – is defined by an average CDS spread taken over a portfolio of reference entities. Typical examples are CDX NA IG covering 125 investment grade companies and iTraxx Europe covering 125 investment companies in Europe[49].

**Chart 11: CDS gross notional by instrument type**




Source: Bank for International Settlements

Table 20 contains data from DTCC for a three month period beginning with March 20, 2015 through June 21, 2015. According to it multi-name CDS with the highest daily average notional are all untranched with significant difference in value among them. If we compare the average daily notional amounts and average number of trades per day with the information for tranched multi-names in Table 21, we can see that tranched multi-names have much lower notional with trade fre-

[48] BANK FOR INTERNATIONAL SETTLEMENTS: *Guidelines for semi-annual credit default swaps statistics at end-June*, Monetary and Economy DEPARTMENT Statistics, 2015, available on: <http://www.scb.se/Statistik/FM/FM5001/_dokument/Uppgiftslamnare/BIS-derivat/Guidelines-CDS.pdf>.
[49] WITZANY, J.: *Credit Risk Management*, Script, University of Economics, Prague.

quency per day in some cases equal to zero. Consequently, the number of clearing dealers in higher, as well.

**Table 20: Multi-name CDS with the highest daily average notional**

| | | Total No. | Average Monthly | Average Daily | Average No. |
|---|---|---|---|---|---|
| **Reference Entity** | **Product Type** | **Clearing Dealers** | **Clearing Dealers** | **Notional (USD EQ)** | **Trades/Day** |
| CDX.NA.IG.23 | Untranched | 10 | 8.3 | 4,250,000,000 | 38 |
| CDX.NA.IG.24 | Untranched | 12 | 10.7 | 11,025,000,000 | 199 |
| ITRAXX EUROPE CROSSoVER SERIES 23 | Untranched | 14 | 12.3 | 4,450,000,000 | 330 |
| ITRAXX EUROPE SERIES22 | Untranched | 12 | 11.3 | 4,275,000,000 | 67 |
| ITRAXX EUROPE SERIES23 | Untranched | 12 | 12 | 14,275,000,000 | 311 |

**Table 21: Tranched multi-name CDS with the highest daily average notional**

| | | Total No. | Average Monthly | Average Daily | Average No. |
|---|---|---|---|---|---|
| **Reference Entity** | **Product Type** | **Clearing Dealers** | **Clearing Dealers** | **Notional (USD EQ)** | **Trades/Day** |
| CDX.NA.IG.21 | Tranched | 5 | 3 | 50,000,000 | 0 |
| CDX.NA.IG.9 | Tranched | 8 | 7.7 | 100,000,000 | 1 |
| ITRAXX EUROPE SERIES4C | Tranched | 2 | 0.7 | 50,000,000 | 0 |
| ITRAXX EUROPE SERIES 5C | Tranched | 4 | 1.3 | 50,000,000 | 0 |
| ITRAXX EUROPE SERIES 9 | Tranched | 7 | 6.3 | 50,000,000 | 1 |

Source: DTCC

*CDS spread*

CDS spread should embed a precise estimation of the probability weighted expected loss. In summary, CDS pricing is defined by the following formulas:

*(1) PV of the CDS spread = PV of the Expected Loss at Default*
*(2) Expected Loss at Default = Loss Given Default * Probability of Default*
*(3) Loss Given Default = Protection Notional*(1-Estimated Recovery Rate)*

Under perfect market conditions, CDS spread should be roughly the same as bond spreads. Even though in the long-run we assume that both spreads tend to be equal, for the short-run there may be major deviations of CDS spreads from bond spreads. A main interference is made by new infor-

mation. Blanco et al. (2005) argues that in the short-run corporate CDS are more sensitive to credit risk changes than bonds. Heinz and Sun (2014) study the development in sovereign CDS spreads within the Central, Eastern and South-eastern Europe (CESEE). They find that CDS spreads during the financial crisis were considerably higher than during the recent debt crisis. Sovereign CDS markets absorbed information quicker in emerging markets at an early stage of the financial crisis compared to developed economies where it accelerated throughout the crisis. According to them CDS spread is a function of global investor sentiment, country specific economic fundamentals, and CDS market liquidity. Economic fundamentals such as growth or current account forecasts turned out to weight the most for the spread's dynamics. Coudert and Gex (2010) claim that during market unrest CDS spreads will lead the pricing role within European countries with lower ratings. In contrast, for countries with higher rating, large and liquid bond markets, the price will be set by the bond market.

After the bankruptcy of Lehman Brothers standard coupon payment dates, upfront payment[50] and standard coupon amounts have been introduced. As can be seen in the table below, the highest coupon is available in Europe, with Japan setting the most conservative approach.

**Table 22: Coupon standardization by region**

| Region | Europe | North-America | Asia ex-Japan | Japan |
|---|---|---|---|---|
| Standard coupons (in bp) | 25<br>100<br>500<br>1000 + exchange of upfront | 100<br>500 + exchange of upfront | 100<br>500 + exchange of upfront | 25<br>100<br>500 + exchange of upfront |

Source: Credit Suisse

In order to lower the cost of the protection we can enter into:

- Contingent credit swaps – hybrid instruments that apart from the specified typical credit event have an extra trigger, which is bound to another reference entity. The highest advantage: the events are not correlated;
- Dynamic credit default swaps – its notional outstanding is connected to the mark-to-market value of another swap/portfolio of swaps. When calculating the payout, the notional is derived from the positive mark-to-market value of the reference swap when the credit event occurs. If uncorrelated parties, the probability of joint default is unlikely.

*Reference entity*

Table 23 and 24 below contain data on corporate and sovereign CDS with the highest daily average notional outstanding. As we can notice 8 out of 10 corporate CDS are on European entities. Among sovereigns, CDS on Brazil and Italy account with the highest daily average amounts[51].

[50] It is paid at trade origination and is equal to the present value of the difference between the quoted spread and standard coupon.

[51] Note, that even though the use of naked CDS is forbidden in EU, this type of contracts can still be bought if they have the purpose to hedge an asset portfolio its value had a correlation not lower than 70 % with the government bond at least for the last 12 months

IOSCO analyzes the size of the CDS market relative to the underlying debt[52] for listed banks and top 100 reference entities by gross notional value based on data from DTCC. It concludes that, by gross notional amount, banks and corporates CDS were stable relative to the underlying debt during 2008-2011. In terms of net notional, the ratio has decreased. For corporates, however, at the end of 2011 the CDS gross notional was much higher than the debt amount. Furthermore, small corporate firms seem to have higher CDS net notional to debt than banks. For sovereigns, it claims that with the debt crisis the demand for CDS for hedging did not raise. The only exception is for the peripheral countries exposed to the crisis were the gross notional to public debt increased, while the net ratio decreased[53].

**Table 23: Corporate CDS with the highest notional as from DTCC**

| Reference Entity | Region | No. Clearing Dealers | Notional (USD Eq)* | No. Trades* |
|---|---|---|---|---|
| Anglo American Plc | Europe | 13 | 75,000,000 | 12 |
| Arcelormittal | Europe | 14 | 75,000,000 | 19 |
| Banco Bilbao Vizcaya Argentaria, Sociedad Anonima | Europe | 13 | 100,000,000 | 15 |
| Banco Santander, S.A. | Europe | 13 | 100,000,000 | 12 |
| Freeport-Mcmoran Inc. | Americas | 12 | 75,000,000 | 14 |
| Glencore International Ag | Europe | 12 | 75,000,000 | 15 |
| Intesa Sanpaolo | Europe | 13 | 100,000,000 | 11 |
| Marks And Spencer P.L.C. | Europe | 12 | 75,000,000 | 11 |
| Tesco Plc | Europe | 10 | 100,000,000 | 16 |
| Transocean Inc. | Americas | 12 | 125,000,000 | 23 |
| **daily averages* | | | | |

Source: DTCC

**Table 24: Sovereign CDS with the highest notional as from DTCC**

| Reference Entity | No. Clearing Dealers | Notional (USD Eq)* | No. Trades* |
|---|---|---|---|
| Federative Republic Of Brazil | 14 | 825,000,000 | 100 |
| Kingdom Of Spain | 14 | 150,000,000 | 12 |
| Malaysia | 11 | 150,000,000 | 16 |
| People's Republic Of China | 14 | 300,000,000 | 28 |
| Republic Of Indonesia | 12 | 175,000,000 | 20 |
| Republic Of Italy | 13 | 825,000,000 | 43 |
| Republic Of South Africa | 14 | 300,000,000 | 33 |
| Republic Of Turkey | 15 | 650,000,000 | 51 |
| Russian Federation | 16 | 550,000,000 | 63 |
| United Mexican States | 14 | 425,000,000 | 41 |
| **daily averages* | | | |

Source: DTCC

[52] It refers to balance sheet short-term and long-term debt at the end of year.

[53] IOSCO: *The Credit Default Swap Market*, Report, 2012, available on: <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD385.pdf>.

*Credit event*

According to ISDA credit events can be classified into:

- Hard credit events - bankruptcy, failure to pay, repudiation/moratorium, obligation acceleration, obligation default[54];
- Soft credit events - restructuring will not automatically trigger the CDS. The protection seller or buyer is to decide if the contract will be triggered or not. Voluntary debt restructuring is not perceived as a common restructuring. The exceptions applies when adhering to a Collective Action Clause (CAC). If the majority voluntarily agree to the restructuring, then it becomes mandatory for all the creditors[55].

According to Table 25, sovereign and corporate CDS differ with respect to the definition of the triggering event. In case of sovereigns, the event of bankruptcy typical for corporates is replaced with repudiation or moratorium.

**Table 25: Credit events by contract type**

| | **Bankruptcy** | **Failure to pay** | **Restructuring** | **Repudiation /Moratorium** | **Obligation acceleration** |
|---|---|---|---|---|---|
| **Corporates** | | | | | |
| European Corporate | Yes | Yes | Yes | No | No |
| Emerging European Corporate | Yes | Yes | Yes | Yes | Yes |
| Latin America Corporate | Yes | Yes | Yes | Yes | Yes |
| North-American Corporate | Yes | Yes | Yes | No | No |
| Australia Corporate | Yes | Yes | Yes | No | No |
| Asia Corporate | Yes | Yes | Yes | No | No |
| **Sovereigns** | | | | | |
| Western European Sovereign | No | Yes | Yes | Yes | No |
| Emerging European & Middle Eastern Sovereign | No | Yes | Yes | Yes | Yes |
| Latin America Sovereign | No | Yes | Yes | Yes | Yes |
| Australia sovereign | No | Yes | Yes | Yes | No |
| Asia sovereign | No | Yes | Yes | Yes | No |

Source: ISDA

[54] Repudiation - the reference entity or a governmental entity disagrees and questions the legitimacy of the obligation; obligations acceleration – the obligation becomes due before its primary maturity date as a result of the default of the reference entity; obligation default – the obligation can be declared due before its primary maturity date as a result of the default of the reference entity.

[55] This was the case for Uruguay in 2003. The Samurai bond had CAC and the majority by vote decided to amend the payment conditions with the other participants being required to adhere to it as well.

*Settlement mechanism*

After a credit event occurred, delivering on commitments could be made mainly by:

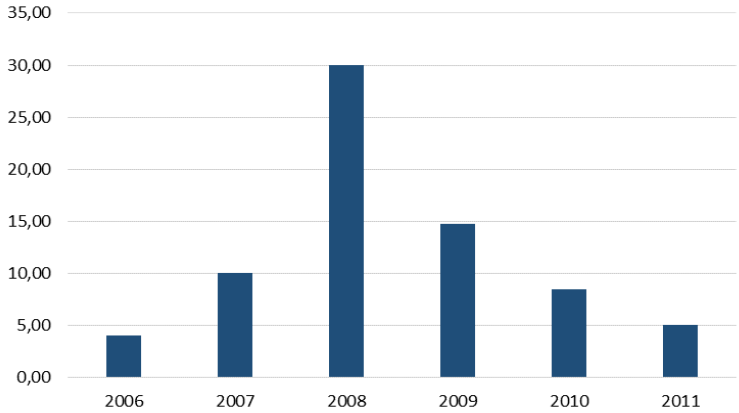
- Cash settlement – the protections seller pays to the protection buyer the difference between par value and the market price of the obligation of the reference entity;
- Physical Settlement – the protection buyer delivers the obligation to the protection seller and receives the payment of its face value.

With the development of the credit derivatives market and such instruments as 'naked' or 'over-insured' CDS the credit auction was introduced. According to it parties have to choose between cash and physical settlement, however, within physical settlement only the net position is settled. Among benefits. is the use of the same settlements prices for all trades within the market eliminating the basis risk. The auction process is set into two steps. In first stage, physical settlement requests are placed and the inside market midpoint[56] is set. The market midpoint, the size and direction of the open interest is then made public. In the second stage, market participants place limit orders which are matched with the open interest.

*Contract changes*

Contract changes can be made through 'novation'. Novation refers to the replacement of one of the counterparties with another under market conditions. 'CCP novation' is a special type of novation in which both contractors hand in the trade to a CCP, maintaining the commitments by the original contractors. Alternatively, termination clauses or 'compression'. If the counterparties hold offsetting positions that reflect similar market conditions, then these positions can be replaced with a new contract based on net exposures using compression. Vause (2010) states that gross notional CDS amount dropped by 50% relative to 2007 because of compression practices and that CDS trading grew even after 2007. According to TriOptima[57] compression had a significant increase in 2008 (Chart 12). Alternatively, offsetting transactions may be entered. Currently, offsetting exposures are the most popular, on the other hand they contribute to enhanced counterparty credit risk.

**Chart 12: Notional value of compressed CDS**




***Note**: in USD, trillions*
Source: IOSCO

[56] Dealers advance orders on the debt of the entity that has suffered a credit event. The inside midpoint is then calculated based on the price range of the orders.
[57] TriOptima is one of the main providers of OTC derivatives compression services.

*Reasons to enter into a CDS*

- Hedging, diversification, higher yields;
- Increased market depth and lower bid-offer spreads – higher liquidity;
- Transferring risk exposure without the permission of the customer with no repercussions on bank-client relationship;
- Tool for measuring financial distress within markets;
- Short-selling without causing a liquidity shortage.

## PRIMER: CDOs

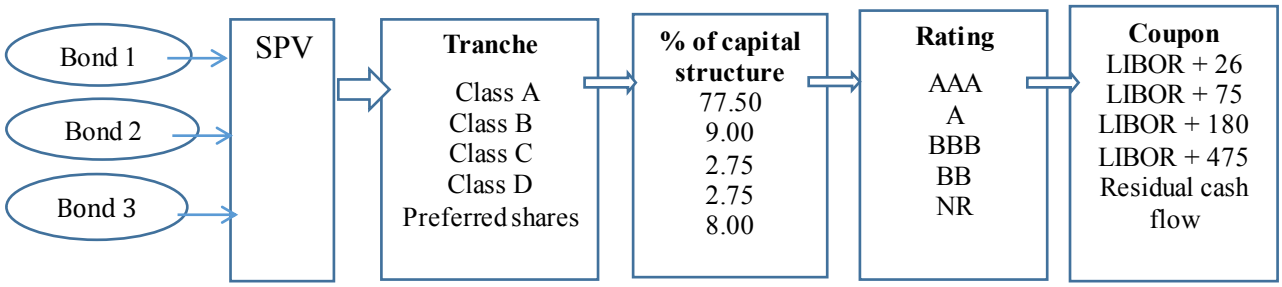
CDOs are an outcome of the securitization process. By using credit derivatives, CDOs can be engineered without the practical sale of loans to a Special Purpose Entity (SPE), thus creating synthetic CDOs which will be addressed in more detail further in the context.

A CDO is an instrument which enables to trade slices of credit risk of a credit portfolio. In other words, it represents a set of claims that underline different credit exposure to the cash flow of the reference portfolio, which can consist of bonds, loans or credit default swaps[58].

As a short introduction to the development in CDO products: 1st CDOs were engineered in 1987, accounting with portfolios of highly-yielded bonds. Around 1989 CDOs initiate using corporate loans and real estate loans in their structure, implying the today collateralized loan obligations (CLOs). In 1994 1st CDOs on emerging market corporations and sovereign governments.

are launched. One year later, the residential mortgage-backed securities were introduced. Hereafter evolved a new class of instruments incorporating characteristics of commercial mortgage-backed securities and asset-backed securities known as structured finance. Below we can find the characteristics of a typical CDO.

**Figure 5: Basics of CDO structure**




Source: ECB

Next, we will analyze CDOs based on the criteria in the Table 26.

[58] SCHEIDER, M.: *How has CDO market pricing changed during the turmoil, evidence from CDS index tranches*, Working Paper, 2008, available on: <https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp910.pdf>.

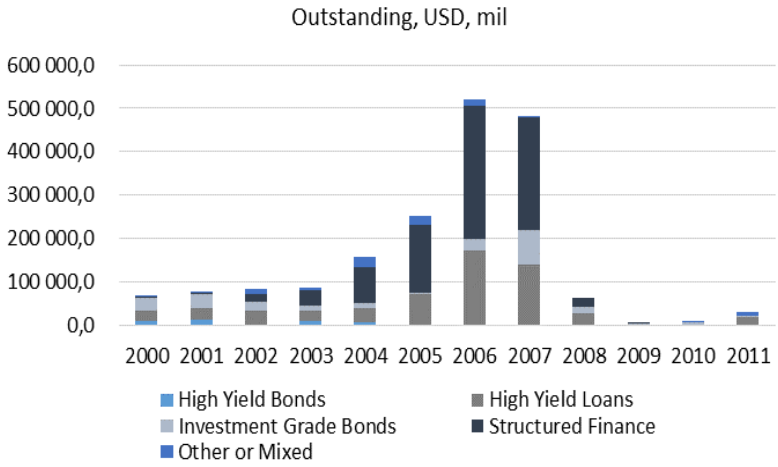
**Table 26: The building blocks of CDOs**

| Assets | Liabilities | Purpose | Credit structure |
|---|---|---|---|
| High-yield loans<br>High-grade structured finance<br>Mezzanine structured finance<br>Capital notes<br>High –yield bonds<br>Emerging market bonds<br>Synthetic assets | Fixed/floating rate | Arbitrage<br>Balance sheet | Cash flow<br>Market value |

Source: Yale International Centre for Finance

According to the data provided by SIFMA, CDOs with the underlying asset in the form of structured finance dominated the market, with the highest value of USD 307705 mil. recorded in the pre-crisis period of 2006. In the same period high yielded loans accounted for USD 171906 mil. Starting with 2008 global CDO issuance dropped sharply. In 2011 issuance of structured finance CDOs was only 0.006% from the amount issued in 2006.

**Chart 13: Global issuance of CDOs by collateral**




***Note:*** *Data for high yield bonds from 2008 -2011 are missing*

Source: SIFMA

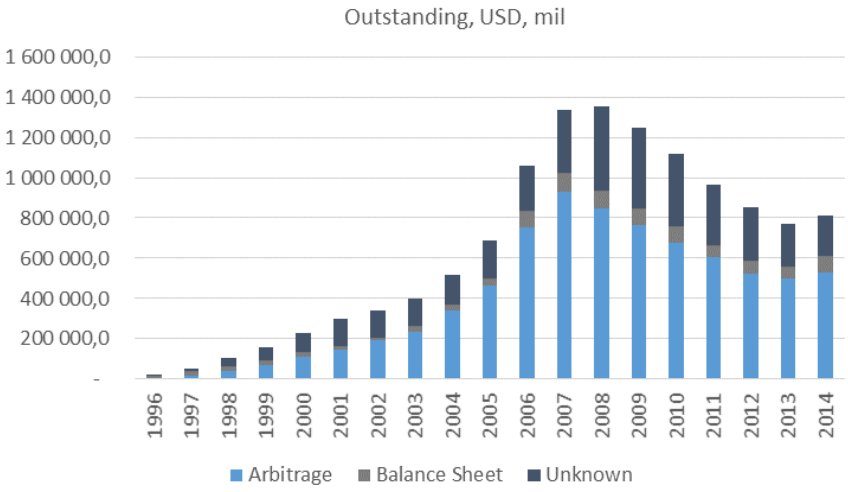
Based on the purpose of the CDOs we can divide the instruments in:

- ***Balance sheet*** – holders of assets want to cut their balance sheet amount in order to lower regulatory capital demands and decrease their funding costs;
- ***Arbitrage*** – asset managers want to increase the amount of assets under management and receive enhanced fees. It underlines the difference between the costs of buying the collateral assets (plus the managerial fees) and the gains from selling the CDO[59].

As can be seen in chart 14, global arbitrage CDOs dominate by notional outstanding, recording its highest value of approximately USD 927829 mil. in 2007. Afterwards a decreasing trend followed. In 2014 however arbitrage CDOs increase slightly (5,5%) in comparison to 2013, accounting for USD 530408,50 mil.

[59] MALEK, J.:'*Risk management*', Course script, 2010, University of Economics, Prague.

**Chart 14: Global CDOs by purpose**



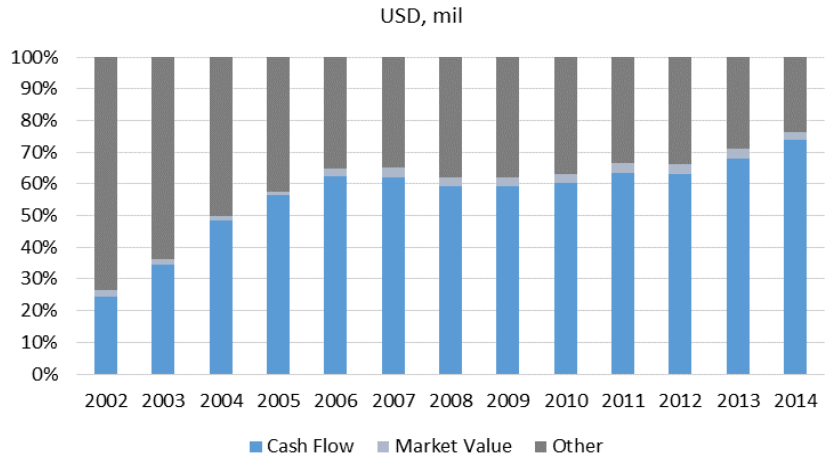

Source: SIFMA

Due to their dominating importance, in what follows we will focus on analyzing only arbitrage CDOs.

By the qualitative credit structure, arbitrage CDOs can be classified in:

- *Market value protection* - underlines the capacity of the CDO to sell its assets and pay back debt interests and principal payments;
- *Cash flow protection* – in the aftermath of the default, the cash flow should be able to meet payments on interest and principal with a particular level of assurance. Typically, is backed by overcollateralization and interest coverage tests that aim to foster additional credit increase to senior CDO tranches.

**Chart 15: Global CDOs by purpose**




Source: SIFMA

As shown in Chart 15 the category of market value protection is under-represented. For entire period from 2002 to 2014 it did not record more than 3%. During 2004 and 2005 accounting with only 1% of the total share. The 'other' group stands for unknown, hybrids or synthetic structures that will be referred to later in this section. In what follows we will analyze in more detail Cash flow CDSOs

which account for more than 60% of the market, its highest level being estimated to USD 597688,4 mil in 2014 (74% of the total CDOs outstanding).

**Cash flow CDOs**

The goal of the asset manager is to ensure cash flows for making tranche payments. In doing that, it has to safeguard the noteholders and adhere to restrictions imposed by rating agencies that provide the issued tranches with ratings. When we proceed with the payments, the cash flow CDOs apply the 'waterfall' principle:

| **WATERFALL** | |
|---|---|
| **on Interest** | **on Principal** |
| Trustee fees + senior expenses (tax/registration) | Unpaid senior fees and expenses |
| Senior management fee | Class A till paid in full |
| Class A | Class B till paid in full |
| Interest<br>OC test – if the test is failed amortization of class A till it is satisfied | Class C till paid in full<br>Class D till paid in full |
| Class B | Unpaid subordinated fees and expenses |
| Interest<br>OC test - if the test is failed amortization of class A and B till it is satisfied | Equity tranche |
| Class C | |
| Interest<br>OC test - if the test is failed amortization of class A, B and C till it is satisfied | |
| Class D | |
| Interest<br>OC test - if the test is failed amortization of class A, B, C, D till it is satisfied | |
| Subordinated expenses | |
| Subordinated management fee | |
| Equity tranche | |

A major role in the waterfall cash flow is played by the OC tests that are discussed below. Meaning, that if for e.g. class A does not pass it then:

- On interest waterfall - the surplus interest is used to pay the principal on notes for class A and cash flows from the other classes will be also used to cover this payment;
- On principal waterfall - are covered by seniority, the remaining additional collateral being paid to the equity tranche.

Investors are protected by two tests applicable to the underlying assets:

a. Coverage tests
   - Overcollateralization ratio (OC ratio) – the higher the ratio the better the protection. The OC for particular tranches as mentioned above is compared to the minimum triggering level set in the CDO guidelines. Its par level ought to be higher or equal to the trigger.

*OC = Principal par value of the portfolio's collateral / (Principal of that tranche + Principal of all senior tranches)*

- Interest coverage ratio (IC ratio) – the same applies, the higher the test ratio the better the protection. Hence, we assess the IC level relative to the minimum IC trigger.

  *IC = Scheduled interest due on underlying collateral portfolio / (Scheduled interest of that tranche + Scheduled interest of all senior tranches)*

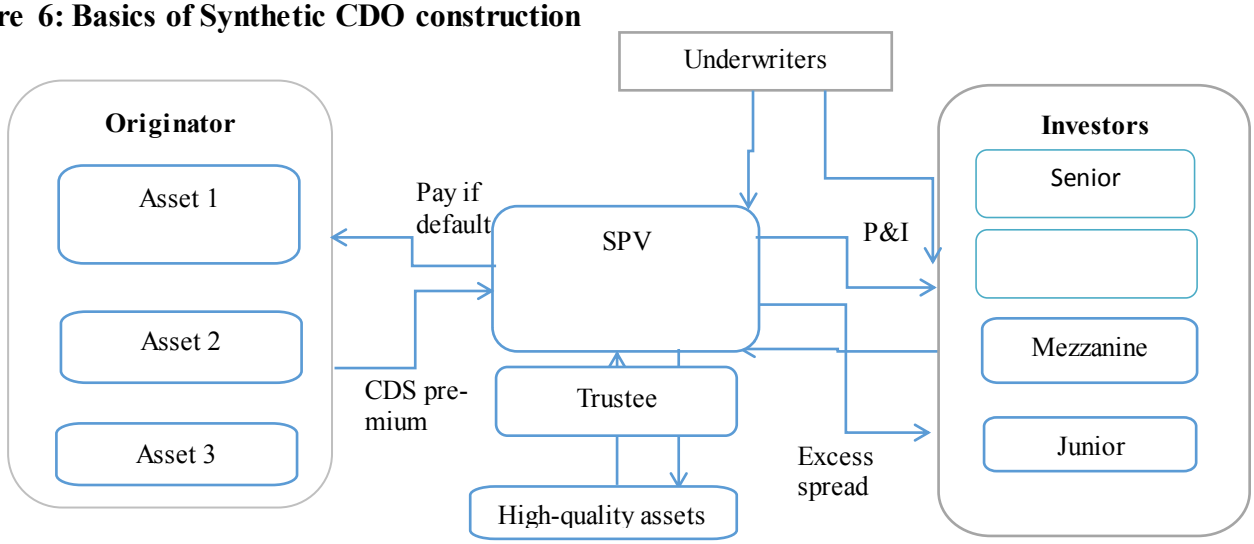
b. Quality tests
   - As asset managers have the incentives to cover worsening asset quality over time, rating agencies impose testing that address maturity restrictions, diversification level, credit ratings of collateral. The rating of a cash flow CDO depends on how diversified is the collateral, the probability of default, recovery rate.

Following, the basics of Synthetic CDOs, as it has direct implications in respect to CDS instruments discussed in the main section.

**Synthetic CDOs**

First synthetic CDO was issued in 1997 with the aim to lower regulatory capital requirements without directly selling the loans. The word synthetic means that the asset pool that accounts for the credit risk is not actually hold by the SPV. The vehicle is exposed only through the sale of CDS protection. On the other hand it buys protection through the tranches it issues to investors. A scheme that shows a general construction for a Synthetic CDO is presented below.

**Figure 6: Basics of Synthetic CDO construction**




Source: Barrie, D.

Similar to simple CDOs we can divide them into balance sheet and arbitrage types. Currently synthetic arbitrage CDOs are significantly more popular than balance sheet ones'. Thus, we will continues assessing only arbitrage CDOs.

Arbitrage CDOs can be classified as:

a. Full capital structure – relate to all the tranches, from senior to junior. The portfolio in case can be static or rely on the manager who actively trades it;
b. Single-tranche – the risk of CDO tranches is being hedged with single-name CDS.

The construction of CDOs might be from:

a. Static pools – the portfolio does not change composition over time and the investor after evaluating it can request to eliminate some instruments from it or refuse to invest. Moreover, no regular managerial contributions need to be paid. The only inconvenience is that if the quality of some loan worsens it is impossible to exempt it from the portfolio.
b. Managed transactions – it is possible to replace a limited number of credits satisfying particular requirements.

**Table 27: Example of synthetic arbitrage CDOs**

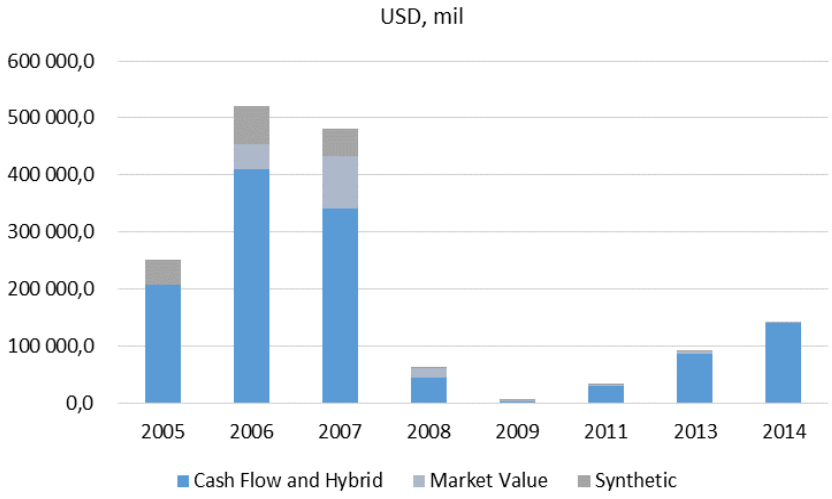
| | | **CDO 1** | | **CDO 2** | |
|---|---|---|---|---|---|
| Pool amount | | EUR 1bn | | EUR 1bn | |
| No of reference entities | | 100 | | 100 | |
| Management | | Static | | Managed | |
| **Class** | **Capital structure** | **Amount in %** | **Spread in bp** | **Amount in %** | **Spread in bp** |
| | Super senior | 86.50 | 6 | 88.00 | 6 |
| A | AAA | 5.00 | 45 | 3.50 | 50 |
| B | AA | 3.50 | 85 | 3.50 | 83 |
| C | A | 0.50 | 180 | 1.50 | 127 |
| D | BBB | 1.50 | 410 | 2.00 | 280 |
| E | Equity | 3.00 | | 1.50 | |
| | *Coverage test* | No | | Cash collateral/ (class A+B+C+D)>111% | |
| | *Maturity* | 5Y | | 5 Y | |
| | *Write-down specification* | Instantly at default | | At the maturity | |
| | *Settlement of swap* | Cash | | Physical | |

Source: Yale International Centre for Finance

Analyzing the examples above we can further specify the mechanics of these instruments. First, the higher equity stake in CDO 1 is compensated by the absence of any coverage test. The lower equity tranche in CDO 2 is due to the waterfall structure of its interest. At the beginning, collateral interest and CDS premium income cover all senior fees. Then, investors receive payouts based on their seniority, from A to D. Follows a coverage test. If the test is passed, then the remaining funds will pay subordinated fees and equity holders. If the test is failed then the cash flow is set aside in a reserve account. All the available cash in the reserve is used to meet the required test level and only after the subordinated fees and equity holders will get their payments. Upon maturity, this reserve is incorporated into the principal waterfall. Moreover, equity holders in the first CDO are paid only a fixed coupon with no rights to any remaining cash flow. If we refer to the write-down requirements, then within CDO 1 there is a cash settlement every time a credit default happens. Consequently, the credit is excluded from the pool. The incurred losses are being paid, with tranches being written down from the less senior up. CDO 2 implies physical settlement. Even though the security will be put on sale, the written-down process is activated only at maturity. All this features result in wider spreads for CDO 1 in comparison with CDO 2 for classes BBB and less.

Hybrid structures include portfolios with both cash assets and CDS contracts to engineer their tranches. As can be seen in Chart 17, global CDOs issuance boosted in 2006 and 2007. In 2006 the highest level recorded, Cash Flow instruments accounted for USD 410504 mil, Market instruments for USD 43638, and synthetic instruments for USD 66503 mil. In 2008, CDO issuance suffered a massive drop, Cash Flows being estimated at only 10%, Market values at 38.8%, and Synthetic at only 2% of their levels in 2006. Issuance continued to drop also in 2009, recording the lowest level for the analysed period. Total issuance amounts was USD 4336 mil, making for only 0.08% compared to 2006 estimates of USD 520 644,6 mil.

**Chart 16: Global CDOs by type**




Source: SIFMA

**Single tranche CDO**

The main difference between the single tranche CDO and the CDOs discussed above is that the credit risk only for a specified stake of the portfolio is being transferred by CDS. It is highly customized, the investor may choose for e.g. the composition, maturity, rating, tranche size, level of subordination, currency, etc. It is also very flexible during its life-cycle, the parties being able to make major changes to contract specifications, cancel it before maturity, etc. The reference portfolio can include for e.g. a large number of corporates, Dow Jones CDX.IG. NA and other indices, or structured finance. The protection buyer commonly applies dynamic delta hedging; this approach will be discussed at the end of this subtopic.

Steps in creating a synthetic single tranche CDO:

1. *Determining the reference portfolio*, that may be static or moderately managed;
2. *Setting the size and subordination*, the attachment point defines the point when losses start to accrue to the tranche, whereas the detachment point the maximum losses that the tranche can possibly incur.

The examples below show a simplified comparison between two tranches. Tranche B is riskier than A as it starts to incur losses at 5% of the 1bn portfolio notional amount. In addition, it has a lower rating. Different from the typical CDOs, single ones' can have overlapping subordination levels, e.g. tranche A: 6.5% - 8% and tranche B: 6% - 7.5%.

**Table 29: Example of single tranche synthetic CDO**

| | Tranche A | Tranche B |
|---|---|---|
| Underlying portfolio | EUR 1bn of 125 investment-grade European corporates | |
| Structure | Static | Static |
| Tranche size | 3% | 3% |
| Subordination level | 6.5% | 5% |
| Maturity | 5Y | 5Y |
| Assigned rating | AAA | AA |

Source: Nomura Fixed Income Research

Single-tranches can be funded, the investor actually does pay a principal when buying the note, the credit risk being traded through a CDS between the SPV and the sponsor. As common CDO, they can also have the form of credit-linked notes issued on behalf of a SPV. If the CDS is primarily being traded between the investor and the sponsor, we are talking about an unfunded CDS, with no principal payment from the investor.

In order to diminish the effect of spread changes on tranche value, delta hedging is applied. The approach underlines the ability to calculate the theoretical value of a CDO tranche with the help of market-implied default risk rate embedded in credit spreads. Delta hedging can be performed with:

a. **CDS index or portfolio of CDS** – it refers to an aggregate change in spreads and not the change for a single credit CDS spread. A tranche long position – sell the protection – can be hedged by going short – buy the protection – in an appropriately diversified portfolio of CDS. The decrease in value of the tranche is covered by the increased value of the CDS index. In calculating the size of the needed hedge we calculate the 'delta hedge' ratio as follows:
   *Tranche delta = - (Δ in tranche mark-to-market value) / (Δ in index value),*
   *assuming 1 bp change in the average of all CDS spreads in the underlying portfolio.*
b. **Single-name CDS** - we calculate the 'single-name' delta as follows:
   *Single-name CDS delta = - (Δ value of the tranche) / (Δ value of an individual CDS),*
   *assuming 1 bp change in single-name spread* [60].

## 2.2.2 Total Return Swaps

*Development in the Total Return Swap market*

The first Total Return Swap (TRS) is dated back to 1987 with the first mortgage swap agreement issued by Salomon Brothers. In 1996 TRS accounted for 32 % of the total credit derivatives market. During 1995-1997 they were very popular particularly in Asia and have played a significant role in the Asian crisis. In 2006 the instrument is included in the group of 'other credit derivatives' making only for 5.7% of the total credit derivatives market. Similar as with credit default swaps, the bailout of AIG in 2008, introduced new regulatory requirements on contract standardization. In 2012 The Securities and Exchange Commission and the US Commodity Futures Trading Commission pub-

[60] NOMURA: *The Bespoke – A Guide to Single-Tranche Synthetic CDOs*, Working Paper, 2004, available on: <http://www.derivativeslawyer.com/doctemplates/1000065.pdf>.

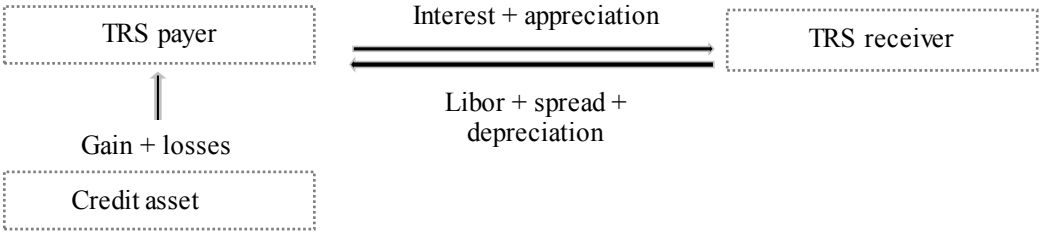
lished new policies to address issues like manipulation of the reference rate and tax avoidance on dividends in relationship to TRS.

*Structure and functionality*

The mechanics of the TRS relies on transferring credit risk by exchanging the total return on a bond or other credit asset for a reference rate plus spread. The TRS payer efficiently removes its exposure to the underlying instrument. The TRS receiver takes on this exposure without directly purchasing the asset. No initial exchange of notional does take place (Figure 7).

- TRS payer – pays the total return of the relevant asset which may include interest, dividends, fees and change in market value of the asset;
- TRS receiver – pays the negative changes in market value of the reference asset and the agreed spread.

**Figure 7: Basics of the TRS structure**




Source: Malek, J.: *Risk Management*, Script

Major counterparties within the market:

- TRS payers – international banks, insurance companies, big corporations, institutional money managers;
- TRS receivers - mutual pension funds, state agencies, insurance companies, regional and international banks, leveraged investment funds, brokerage companies[61].

*Instrument type*

The reference asset of a TRS can be in the form of bonds[62], loans, indexes, or any other instruments that entails exposure to credit risk[63].

- *Plain vanilla total return swap* - the underlying asset is on the payer's balance sheet, the rights to the asset are preserved, even though often is may imply also the transfer of servicing and voting rights. The maturity of the swap hardly ever matches with that of the underlying asset. As illustrated above, the swap receiver will gain from positive funding or carry that enables him to renew short-term funding on a longer-term asset. On the other hand, the return payer is protected without the need to liquidate the asset.

- *Synthetic total return swap* is meant to remove for a short term the reference asset out of the balance sheet. Among reasons to apply this approach is precisely the need to remove low

[61] MALEK, J.: *Risk Management*, Script, University of Economics, Prague.
[62] Bonds - emerging markets, sovereigns, bank debt, mortgage backed securities, corporates.
[63] TAVAKOLI, J.: *Credit Derivatives and Synthetic Structures: A guide to Instruments and Applications*, 2nd edition, ISBN: 0-471-41266-X.

quality assets from the balance sheet if the bank is at risk to drop under the required regulatory capital. TRPs are similar to repos. If the TRS is used for regulatory capital reasons it has the features of a synthetic repo. In a synthetic repo, we sell the assets (potentially repurchase them in future) and at the same time enter into a TRS. The economic risk is retained, while the parties in between exchange changes in market value of the asset, as with repos. The TRS could be entered with a third party apart from those involved in the selling of assets, however, this is not very common. Among reasons to use synthetic TRS instead of simple repos are: the use of standardized ISDA documentation that is suitable for longer-term transactions, low-quality assets usually lack liquidity and cannot be easily traded, thus the TRS allows moving them into off-balance sheet trades.

- *Index total return swaps* – the underlying asset is a bond index. Large-bond market indexes are commonly classified in sub-indexes such as: corporate, commercial mortgage-backed securities, asset-backed securities sector, etc. For instance, Markit iBoxx TRS give market participants exposure to Markit global iBoxx indices. The products reference Euro, Sterling, USD investment grade and high yield bond markets. Table 28 provides a brief comparison of its features with other credit instruments.

**Table 28: TRS index comparison**

| Instrument | Funding | Interest Rate Risk | Liquidity | Exposure diversification | Can be shorted? |
|---|---|---|---|---|---|
| Cash Bonds | Funded | Yes | Medium | None, unless in a diversified portfolio | Difficult |
| **Markit iBoxx TRS** | Unfunded | Yes | Medium | Yes | Yes |
| Single- name CDS | Unfunded | No | Medium | None, unless in a diversified portfolio | Yes |
| CDS Indices | Unfunded | No | High | Yes | Yes |

Source: Markit

Commonly, information on TRS outstanding and credit options, which will be discussed further, are not tracked in detail as for CDS. The Swiss National Bank, however, publishes TRS information (Table 29). According to it, contract volumes tripled in 2007 in comparison with 2005, major banks holding a dominate position all over the sample period. The outstanding recorded a sharp drop in 2009, from the 2007 level of CHF 188709.922 mil to CHF 28520.156 mil. Volume contracts continue to fall until 2014, the only exception is made by a small revive in 2012. This confirms the conservative business culture adopted by major banks in respect to credit derivatives after the financial crisis.

**Table 29: Total Return Swap outstanding for banks in Switzerland**

| **All banks, in CHF, mil** | | | | | | |
|---|---|---|---|---|---|---|
| Year | Positive replacement value | Negative replacement value | Contract volumes | *of which* | | |
| | | | | Big banks, in CHF, mil | | |
| | | | | Positive replacement | Negative replacement | Contract volumes |

| | | | | value | value | |
|---|---|---|---|---|---|---|
| 2005 | 1949.4 | 2005.246 | 62611.789 | 1949.206 | 2005.246 | 62523.231 |
| 2006 | 6347.002 | 6685.752 | 119677.388 | 6347.002 | 6645.153 | 119637.623 |
| 2007 | 9731.028 | 7253.382 | 188709.922 | 9720.322 | 7226.336 | 188467.659 |
| 2008 | 9877.541 | 1135.669 | 59727.128 | 9813.584 | 1104.156 | 55312.805 |
| 2009 | 1689.778 | 976.942 | 28520.156 | 1639.402 | 951.892 | 24750.749 |
| 2010 | 3848.486 | 1438.209 | 23867.594 | 3804.129 | 1428.428 | 20989.069 |
| 2011 | 597.473 | 641.041 | 14431.178 | 541.582 | 631.449 | 10150.933 |
| 2012 | 597.626 | 367.912 | 22597.807 | 539.872 | 363.604 | 18876.945 |
| 2013 | 454.811 | 234.075 | 16792.054 | 400.979 | 227.986 | 13089.489 |
| 2014 | 518.203 | 458.287 | 14444.305 | 456.297 | 453.419 | 13098.278 |

Source: Swiss National Bank

*TRS spread*

The spread for TRS is a function of:

- The credit rating of the swap counterparty;
- The amount and value of the reference asset;
- The credit quality of the reference asset;
- The funding costs of the beneficiary bank;
- Any required profit margin;
- The capital charge associated with the TRS swap[64].

*Settlement mechanism*

Both cash and physical settlement are possible. Alternatively to cash settlement which is based on the final mark-to-market value, physical settlement underlines that the TRS receiver at maturity would pay the initial value of the reference asset and receive the underlying obligations, which should be liquid and with observable prices.

*Reasons to enter into a TRS*

- Possibility to engineer assets the maturity of which is not currently traded in the market;
- Investors get access to certain asset classes that otherwise would not have due to accounting, tax or legal constraints;
- Enable to manage the regulatory capital requirements imposed by Basel, by moving the assets off-balance sheet;
- Hedging credit exposures to corporates from trade receivables, long-term purchases, or credit exposures to banks from long-term financing, loan facilities;
- Hedging of contingent credit risk incorporated in assets already hedged with currency swaps;
- Hedging against emerging market risk, in case a guarantee can't be obtained or alternative hedges are too expensive;
- Higher return on capital due to highly leveraged positions;
- The underlying asset is illiquid;
- Direct shorting of certain instruments is frequently hardly achievable.

[64] CHOUDHRY, M.: *Total Return Swaps: Credit Derivatives and Synthetic Funding Instruments*, Working Paper, 2004, available on: <http://www.yieldcurve.com/mktresearch/learningcurve/trs.pdf>.

### 2.2.3 Credit Options

*Development in the Credit Options market*

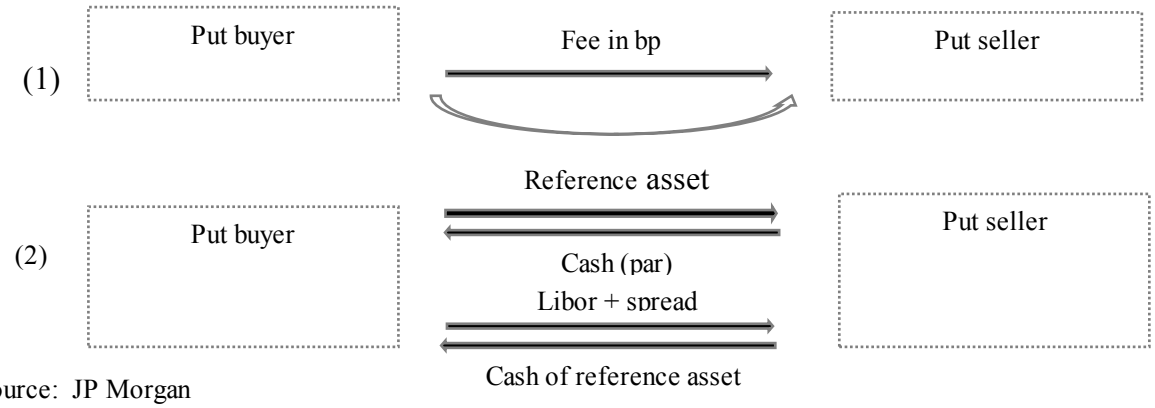
Beginning with an irregular market in repackaging deals, it extend substantially in 2003. The market started to engage in bond options, spread options, options on portfolios and CDO tranches. The reason behind the sharp increase was the then trending low level of credit spreads and spread volatility within the market. Referring to options on CDS, their development is compatible with the development in the CDS markets that became highly liquid. The market, as for other credit derivatives, boomed during the 2008 financial crisis. Currently, the credit option market is mostly active in index products.

*Structure and functionality*

Credit Options are put or call options on the price of a:

- *floating rate note, bond, loan* – Call/Put Options entail the right, never the obligation, of the option buyer to buy/sell the underlying float rate asset at a future time for the exercise price;
- *'asset swap' package* - comprises credit instruments with payment features and a corresponding derivative contract that exchanges the cash flow on that reference instrument for floating rate cash flows. The mechanism of the Put Option is as follows: 1. the put buyer pays a fee to the Put seller for the right to sell him a reference asset, and at the same time 2. enters a swap position, where the Put buyer pays the Libor + spread and receives coupon payments on the underlying asset. The put seller pays the par value of the package at exercise. (Figure 8).

**Figure 8: Basics of Credit Put Option on 'asset swap' package**




Source: JP Morgan

Major counterparties within the market:

- Credit Option Buyers – highly leveraged banks, dealers that aim to hedge their mark-to-market exposures to moves in credit spreads;
- Credit Option Seller – institutional investors that are in a 'run for yields' under current low market levels.

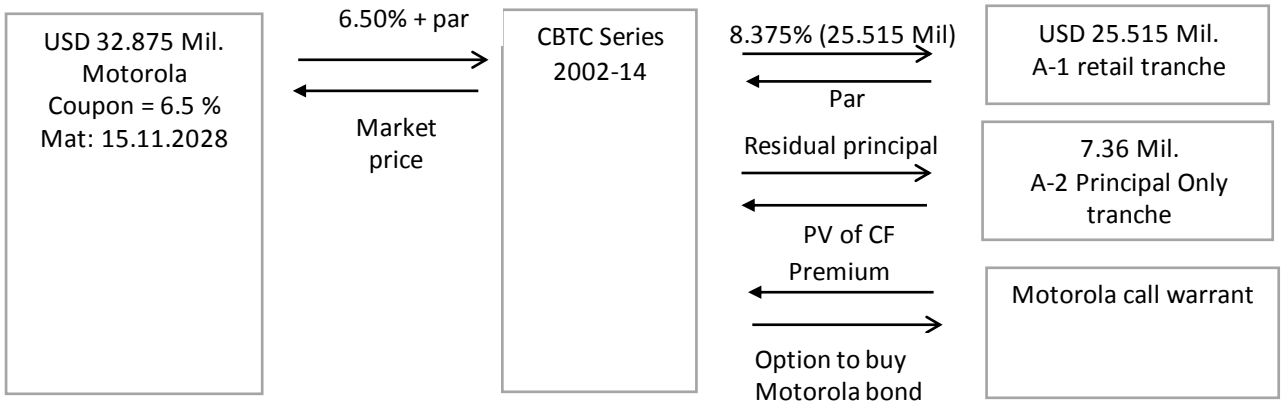
*Instruments*

**a. Repack trades**

As mentioned above the first combination of credit and option instruments were in the form of repack trades. According to it, Lehman would buy USD 32,875,00 mil. of Motorola 2028 bonds and

allocate the in the Lehman CBTC Trust. Then, the trust issued A-1 certificates to retail investors. The coupon, however, was higher than the initial Motorola one (8.375%:6.5%). Hence, the trust was demanded to have extra collateral in order to be able to pay the difference in coupons. The A-2 'Principal Only tranche' incorporated the extra principal. Both types of certificates had attached a call option that was put on sale as a separate instrument, namely a long-term warrant. Thus, the warrant owner had the right but not the obligation to buy Motorola bonds from the trust. The simplified mechanics of the transaction is shown below.

**Figure 9: Mechanics of the first Repack Trade**




Source: Lehman Brothers

**b. Put bond stripping**

Under the conditions of this bond, the holder has the right but never the obligation to sell it back to the issuer for the par at some dates in future. If the option is not exercised then the maturity of the bond would be prolonged. As a form of hedging, the investor can go long in the put bond and sell a call option at the 1st put date for a predetermined price.

**c. Bond options**

- Price based option – when exercised, the option holder would pay the strike price and get the reference bond. Price Options can be further classified as covered calls or naked puts.
  - *Covered call strategy* - the holder of the reference bond sells an out of the money call option consistent with the face value of the bond. In case that the bond price at maturity is higher than the exercise price, the investor gets the exercise price for delivering the bond. For the opposite situation, the investors retains the bond and the call premium;
  - *Naked put strategy* – the investor does not actually hold the bond, but plans to buy it at a cheaper price. The investor writes an out of the money put option on the reference bond. If the exercise price is higher than the bond price at maturity than the investor receives the bond. If however the exercise price is lower than the bond price, the investor gets only the premium.
- Spread based option – when exercised, the option holder would receive the bond for a price derived from the strike spread. The spread relates to the difference in the bond's yield and Treasury or LIBOR spread. In the second case it implies the physical delivery of floating rate notes, other instruments such as asset swaps. If the strike spread on one year options having an underlying instrument with the maturity in five years is in or out of the money de-

pends on the implied five-year spread within a one year timeframe. The implied spread is derived from the actual 1x6 year spot credit spreads[65].

**d. Default swaptions and callable CDS**

Default swaptions are options on credit default swaps, they imply the investors' opinion on the level and dynamics of future default swap spreads for a certain issuer. Besides outright traded, they can also be incorporated in callable CDS.

- Swaption payer – gets the right but never the obligation for a premium to buy the CDS protection on the underlying entity for an agreed spread at a date in future. The contract may have embedded knock-out provisions in case a credit event occurs between the trade date and the maturity date. Thus, to remain fully covered for the whole period, the buyer should separately purchase protection on the reference name till maturity of the swaption. Should spreads tighten, the option will not be exercised;
- Swaption receiver - the opposite side of the contract, in which we buy the right but never the obligation for a premium to sell CDS protection on an underlying entity for a specified spread at a certain time in future. For put types we do not include the knock-out feature within the contract, as in case of credit event between trade and maturity dates the option would simply expire.

Callable default swaptions – are made of two instruments: a plain vanilla CDS and a short receiver swaption. According to it, the sell side is long in the credit exposure. However, the buy side it able to terminate it at some strike spread at a time in future.

**e. Credit portfolio options**

In the 2nd half of 2003 began to trade portfolio options which had TRAC-X North America portfolio as the reference asset. The portfolio was built on 100 credits. The contracts were traded for at the money and out of the money put/call options with short-term maturity ranging from 3 to 9 months. Common was physical delivery. Should the TRAC-X spread tighten relative to the strike on maturity date, then the holder of the receiver default swaption will exercise the option. The opposite is applicable when the spread is widening. In 2004 the TRAC-X was merged with iBoxx to form CDX North America and iTraxx for Europe and Asia. Since 2007 both indices are administrated by Markit. Presently, among most traded indexes are CDX IG and HY, iTraxx XOver index, etc. (Table 30).

**Table 30: Gross Notional for Index Swaptions by Put/Call**

| Index/Sub-Index/Index Tranche | Product Type | Put/Call | Gross Notional (USD EQ) | Contracts | Week |
|---|---|---|---|---|---|
| CDX.NA.HY.21 | Untranched | Call | 3,151,710,000 | 70 | 21/03/2014 |
| CDX.NA.HY.21 | Untranched | Put | 29,654,470,000 | 520 | 21/03/2014 |
| CDX.NA.IG.21 | Untranched | Call | 33,375,900,000 | 331 | 21/03/2014 |
| CDX.NA.IG.21 | Untranched | Put | 123,022,545,000 | 1,519 | 21/03/2014 |
| ITRAXX EUROPE CROSSOVER SE- | Untranched | Call | 6,410,787,076 | 107 | 21/03/2014 |

[65] JP MORGAN: *The JP Morgan Guide to Credit Derivatives*, available on: <http://www.investinginbonds.com/assets/files/Intro_to_Credit_Derivatives.pdf>.

| | | | | | |
|---|---|---|---|---|---|
| RIES 20 | | | | | |
| ITRAXX EUROPE CROSSOVER SERIES 20 | Untranched | Put | 13,785,282,016 | 283 | 21/03/2014 |
| ITRAXX EUROPE SERIES 20 | Untranched | Call | 28,335,885,726 | 187 | 21/03/2014 |
| ITRAXX EUROPE SERIES 20 | Untranched | Put | 108,477,690,246 | 3,149 | 21/03/2014 |
| Index Swaptions - Other | Untranched | Call | 4,812,978,861 | 48 | 21/03/2014 |
| Index Swaptions - Other | Untranched | Put | 22,083,282,072 | 283 | 21/03/2014 |
| **Total** | | | 373,110,530,997 | 6,497 | 21/03/2014 |

***Note:*** *As of Mar 21, 2012*
Source: DTCC

Investors can enter into bearish or bullish strategies based on their perception of future spread development.

- Bullish spread strategy – long into an at the money payer swaption and short in farther out of the money payer swaption;
- Bearish spread strategy – long into an at the money receiver swaption and short in farther out of the money receiver swaption.

Other combinations are possible, like entering into straddle credit portfolio options, by going long as a payer and receiver, thus going long volatility and neutral to the potential spread change direction[66].

*Reasons to enter into a credit option*

- Enables investors limited by tax, regulation or other constraints to hold only investment grade instruments, to switch the bond in case its credit quality worsens;
- Hedging of future borrowing costs;
- Strengthen investor confidence;
- Protect from negative carries without the need to increase the balance sheet;
- Earning increased yields;
- Enhanced flexibility.

### 2.2.4 Hybrid Instruments

Hybrid credit derivatives are instruments that besides credit risk incorporate additional market risks like interest or currency risk.

*Clean and perfect asset swaps*

It is challenging to set a precise boundary between credit risk and other risks. Investors in European CDO might want to hold USD collateral without being exposed to the currency risk. Commonly, cross-currency asset swaps are being used to convert fixed-rate bonds denominated in foreign cur-

[66]LEHMAN BROTHERS: *Guide to Exotic Credit Derivatives*, available on:<http://www.investinginbonds.com/assets/files/LehmanExoticCredDerivs.pdf>

rency into float ones' denominated in the local currency. Even so, we are left with the credit risk and currency risk that is not completely eliminated. If for instance an European investor buys one USD asset, the payments he will receive are based on Euribor and spreads in Euros. In case of default of the underlying asset, the investor will be paid only the recovery rate from the face value, which is expressed in dollars. In a cross currency swap payments are not affected by the default of the reference asset. Hence, the investor may continue to pay them or unwind the position under market conditions, which might result in considerable losses conditional upon the developments in the currency and interest rates. Consequently, the hybrid may eliminate this risk with: a. clean asset swap – the mark-to-market risk from the unwinded position is assumed by the issuer, and b. perfect asset swap – besides assuming the risks on the unwinded position, the issuer ensures that the recovery rate is paid to the investor in the local currency. These structures are commonly present within the CDO market; meant to offset the risks for high-yielded bond portfolios denominated in different currencies. The efficiency of the approach is conditional on the currency and interest rates variability, quality of the underlying credit, correlations, etc.

*Counterparty risk hybrids*

The investor may enter into a contract, say interest rate swap where the other side is exposed to enhanced credit risk. In case of default of the counterparty, the position is unwinded under market conditions and we can be at loss. By buying credit protection against the default of the counterparty, the payout is meant to cover the costs of replacing the swap. The same approach can be applied for other types of instruments.

*Diminishing hedge costs*

Hybrids can be also used to lower the costs when hedging credit contingent FX and interest rate risk typical for internationally active entities. For instance, we can buy default protection conditional on if the FX rate is higher or lower than a predetermined threshold. It is also less costly than vanilla derivatives. In this case, investors expect a bullish trend for the underlying credit[67].

## 2.3 Implications under Basel III

As capital requirements became significantly demanding, banks search for regulatory capital relief by engaging in credit derivatives transactions. The stake of credit derivatives used for regulatory relief is still small relative to the total size of the credit derivatives market, but it is growing at fast pace. Although Basel III has made changes in tightening regulation related to securitization and lower the interconnectedness, banks are still able to get regulatory capital relief if they are protected by means of CDS, total return swaps and eligible guarantees. The main problem in assessing the impact of enhanced use of credit derivatives on risk weighted assets and risk-based capital is the lack of consistent information for these transactions. Even though US regulators have imposed requirements on information disclosure for credit derivatives used for capital relief, this does not hold for guarantees or securitization. BCBS raised concerns that too high risk weights for securitisation

[67]LEHMAN BROTHER: *Guide to Exotic Credit Derivatives*, Guidance, available on:< https://translate.google.com/#en/cs/guidance>.

might oblige banks to enter into transactions. with non-financial institutions that are not subject to regulatory capital requirements. The problem is that we are unable to quantify the build-up of systemic risk within non-regulated sectors, which might be unsustainable. In 2008 when AIG was in distress, European banks were exposed to loosing around USD 290bn in CDS bought precisely for regulatory capital relief. Levin (2012) asks himself on: 'Why didn't the FED prohibit banks from reducing regulatory capital via CDS?', even with the devastating outcome of the financial crisis which proved that these instruments where misused.

The Office of Financial Research tries to quantify the capital relief gained by using credit derivatives in USA. According to them in Q2 2009, 13 banks bought USD 70 bn of credit protection, these banks recording USD 5.5 trillion in RWA. The notional credit protection amount for Q2 2012 decreased to USD 50 bn, accounting for USD 3 trillion in RWA. It is assumed that the capital relief may better the risk-based capital ratio with almost 3.38 %. If till 2010 no bank in USA with assets under USD 50bn did use capital relief transactions, starting with 2013 their number is even greater than that of medium sized and large banks. Based on disclosed data to DTCC, for the purpose of capital relief banks engage more in total return swaps than CDS[68].

Another issue is the CVA requirement introduced in 2013[69]. According to IAS 39 and FASB 157 banks are obliged to reflect in their income mark-to-market unrealised losses from counterparty risk. CVA measures the difference in value of a transaction when the counterparty is risk-free with its value when the creditworthiness of the counterparty changes. 'Eligible hedges' lower the amount an entity must hold relative to CVA risk. Under 'eligible hedges' fall single-name CDS and index CDS. Over-hedging of positions with single-name CDS within the advanced method is not allowed. The use of tranched or $n^{th}$ to default CDS and credit-linked notes is also not permitted.

The value adjustment is commonly calculated with the help of implicit default probabilities from CDS spreads. Banks implementing the Internal Model Approach estimate VAR of a portfolio market value accounting with the credit value adjustments derived from market factors and counterparty credit spreads. Banks applying the standardized approach calculate the capital charge as a percent from each exposure conditional on: counterparty rating, maturity of the transaction, available counterparty credit risk protection. The calculations are then cumulated for the entire portfolio. Witzany (2010) states that under the independence assumption between time to default and exposure, the simplified regulatory CVA formula can be estimated as:

$$CVA = l \sum_{j=1}^{m} e^{-r(tj)*tj} * EE(tj) * q(tj) * \Delta tj \quad ,$$

where: l – constant loss rate, r(t) – discount rate and q(t) – counterparty default forward intensity are deterministic time functions. The time is set in subintervals: $0=t_0<\ldots t_m=T$. The expected exposure EE(t) can be assessed using Monte Carlo simulation[70].

[68]CETINA, J.; MCDONOUGH, J.; RAJAN, S.: *More Transparency Needed for Bank Capital Relief Trades*, OFC brief, 2015, available on: <http://financialresearch.gov/briefs/files/OFRbr-2015-04-bank-capital-reflief-trades.pdf>.

[69] Banks do not have to calculate it for central counterparty transactions or financing securities transactions.

[70]WITZANY, J.: *Financial Derivatives: Valuation, Hedging and Risk Management*, ISBN 978-80-245-1980-7, Prague, 2013.

BCBS underlines some negative implications of the CVA charge as it may stimulate banks to buy more CDS protection and be discharged from paying CVA. Moreover, the enhanced demand for CDS protection is compatible with periods of wide credit spreads.

With the examples above we can conclude that the regulatory framework is quite contradictory in respect to credit derivatives. CDS and total return swaps which produced major losses with the 2007 crisis are still assessed as appropriate instruments to mitigate credit risk and lower regulatory capital. Moreover, with the CVA implementation, the regulators themselves incentivise more transactions in credit derivatives which again can result in build-up of systemic risk and financial contagion.

## 2.4 Related literature

Jones (2000) claims that a big part of the credit risk transfer initiative was a response to inconsistent approach for bank capital allocation. According to Yorulmazer (2013) regulatory arbitrage stimulates banks to be riskier when accounting with the protection. Allen (1994) suggests that CDS help to better market risk sharing and optimize bank lending, although they may imply spillover contagion. Duffie (2008) claims that CDS play a complementary role in the market as it provides investors with more diversified assets, hedging flexibility, and reduction in debt costs. Acharya and Johnson (2007) assume that banks can take advantage of information asymmetry and buy derivative protection before making public negative news. Duffie and Zhou (2001) discuss the information asymmetry issue and conclude that there is an adverse selection problem within the credit derivative markets that might be bridged by holding credit derivatives with shorter maturity than that of the reference asset. Morrison (2005) finds that the protection buyer after fully covering its position stops to monitor it further. DeMarzo and Duffie (1999) state that by retaining a certain percent of the subordinated asset class, banks lower the total lemon's premium and are keener to identify themselves with the interests of the protection seller. Thompson (2010) also studies the moral hazard of the protection buyer and the counterparty risk of the protection seller. He claims that the counterparty risk represents a negative externality for the protection buyer that obliges him to indirectly absorb part of the risk. Biais (2014) states that if the protection seller assesses its position as a liability it will take on additional risk exposures. He finds that the seller's moral hazard is offset by the initial margin, while the variation margin lowers risk taking for a particular position. Biais (2012) continues by claiming that protection sellers could be attracted to sell higher amounts of protection relative to their ability to cover resulting losses. Hakenes and Schnabel (2009) also argue that CDS stimulate banks to loosen their monitoring and take on riskier projects. Peltonen, Scheicher, Vuillemey (2013) address the development in CDS network size and activity. According to them CDS volatility has a larger impact on network size and activity than the level of the CDS spreads. Girardi, Lewis, Getmansky (2014) discuss the interconnectedness within the CDS market. They find that sovereign CDS concentration is significantly higher than corporate. Kokholm and Cont (2014) analyse whether advantages from multilateral netting for a single class of derivatives will outweigh the benefits from bilateral netting for different classes. They conclude that the most useful way to reduce exposures is when only one CCP clears all the asset classes. This, however, is compatible with the build-up of large systematic risk within the CCP. Blanco et al (2005) argues

that CDS market plays a leading role in the price discovery process in comparison to bond markets because its investors are more sophisticated are able to open short positions more easily.

Even though the popularity of single CDS has dropped sharply after 2008, market participants expressed the intention to restore their earlier influence. The British Bankers Association brief (2015) states that: '*Wall Street is considering reviving single-name credit defaults ... today banks and investors are looking for ways to prevent volatility when interest rates rise'.* Moreover, the co-head of electronic trading and market structure at BlackRock insists that: *Single name CDS offers a clean and efficient way to express credit exposure which the current market structure of the underlying secondary corporate bond market doesn't afford us'*[71].

## 2.5 Conclusion

Credit derivatives changed the mode in which credit risk originates, is distributed, quantified and managed. According to the section on credit derivatives markets of this chapter, we have seen that trading in credit instruments even though growing exponentially from its origination, dropped sharply after the financial crisis. The diversity in credit market participants comprising banks, hedge funds, insurers, reinsurers, money market funds, etc., is likely to further expand. Basic product structures enable market participants to engineer complex instruments that entail significant risks but also important advantages. It is claimed that credit derivatives enhance efficiency in risk management, better credit pricing and aggregate liquidity. However, accounting with the losses of the financial crisis, credit default swaps did turn out to be a 'weapon of mass destruction', as claimed by Warren Buffet. Mainly due to the build-up of systemic risk, lack of transparency, moral hazard, adverse selection, poor ratings, etc. On the other hand, the concept of transferring credit risk and the way it was employed by credit default swaps, total return swaps and credit options represents a revolutionary development within the credit markets. It offers opportunities for arbitrage, speculation and hedging. Many market participants compare them with a free lunch, as they are highly customized, and both the buyer and the seller benefit from it. For risk managers, their flexibility allows to restructure the liquidity of credit portfolios. The diversity of instruments combination is impressive, creating challenges for adequate pricing. Structuring, created a new class of credit assets, moving forward the development within the financial markets. Credit derivatives also play a major role in lowering the requirements on regulatory capital.
This approach is quite contradictory as regulators on one hand try to lower the risk and mitigate the root causes of the financial crisis, and on the other hand allow credit derivatives to serve as officially recognized tools in risk mitigation. None can possibly deny that credit derivatives are able to make a significant difference in credit risk mitigation, however it is a mistake to apply a 'fit-all' approach. Under current market conditions when banks are constrained to meet higher and more qualitative capital ratios it may result in increased risk taking within CDS. The regulators exclude from eligible collateral n-th to default, tranched and credit linked note instruments which is quite reasonable. But how about single name CDS on governments such as Greece, Ecuador, Argentina, Brazil, Russia, Cyprus, how much stability do these instruments bring? To conclude, it is market discipline

[71] BBA brief, Press Release. Date Release: May 2015, available on: <https://www.bba.org.uk/news/bba-brief/bba-brief-20-may-2015/#.VcH57PkrXIU>.

fostered by rational reforms from the regulators that will shape the added value that credit derivatives can bring for the global financial market development.

# III Modelling a logistic scoring function

Basel III requires banks to use their capital in the most efficiently possible way. Internal credit rating models are a good tool in quantifying credit risk, enabling banks to spear regulatory capital.

The aim of this chapter is to develop a logistic scoring function. According to Witzany (2010) it is one of the most widely used technique in banking to assess the creditworthiness of the borrowers. We will begin with making a short theoretical introduction to the basics of the logistic function and goodness-of-fit measures that will be mentioned in the next sections. Section 2 and 3 will present the methodology and the results for our function. We will end with a conclusion.

## 3.1 Introduction

The logistic regression models binary output variables such as credit default, where the binary result takes values of '1' or '0', depending on whether it expresses failure or success.
The logistic function can be defined as:

$$yi^* = \beta'^*xi + ui \qquad (1)$$

If $y_i^* \leq 0$, then the value of the variable will trigger the default $y_i = 1$. Thus,

$$pi = Pr[yi = 1|xi] = Pr[ui+\beta'^*xi \leq 0] = F(-\beta'^*xi) \qquad (2)$$

With F representing the distribution function of ui . The link function is set to convert the score: $zi = \beta'^*xi$, that may take values in the interval $(-\infty, +\infty)$ to the appropriate probability of default values in (0,1). In other words, $z_i = \beta'^*xi$ expresses the debtor's credit capacity probability of default. With the left side expressing that should the k-th variable increase by 1 today, with $u_i$ assigning the unknown change of its capacity in future. A default event is recorded if the future total score breaches the predefined threshold. If the residuals, $u_i$, are determined by the logistic distribution then:

$$F(x) = \Lambda(x) = \frac{e^x}{e^x + 1} = \frac{1}{e^{-x} + 1} \qquad (3)$$

The logit function is preferred when modelling the probability of default due to its ability to transform the ratio of two complementary probabilities, namely the odds. In the equation below, on the right we have the good-bad odds, expressing the probability of survival relative to the probability of default. Assuming that the k-th variable will increase by 1 unit, then the odds will increase $e^{\beta k}$ times. Alternatively, the odds can be expressed as a logarithm.

$$e^{\beta' x_i} = \frac{1-p_i}{p_i} \quad (4)$$

When building a model, it is important to include only significant variables, excluding correlated variables and variables with low explanatory power. Among common applications to select adequate variables is the forward/backward selection procedure or the univariate analysis. Additionally, there should be a linear dependence between the log-odds and the tested variable. For non-linear dependence the variable should be adjusted to imply a linear dependence[72], otherwise it should be eliminated. Within the retail sector we can also find categorical explanatory variables, such as education or marital status. In this case, the Wight of Evidence (WoE) and the Information Value (IV) are broadly used to assess the discrimination power of a variable. For a categorical variable k, the WoE expresses the change in the aggregate log odds ratio relative to the log odds ratio given the information k[73].

$$\text{WoE}(k) = \ln\Pr[k|\text{Good}] - \ln\Pr[k|\text{Bad}] \quad (5)$$

On the other hand, the IV assesses the discrimination power of all categories of a variable. As from the formula below, it represents an average WoE. In case that a categorical variable has an unnecessarily high number of categories that will eventually lower the robustness of our model, we merge them based on similar WoE. Taking into account that the IV after the merger should change insignificantly.

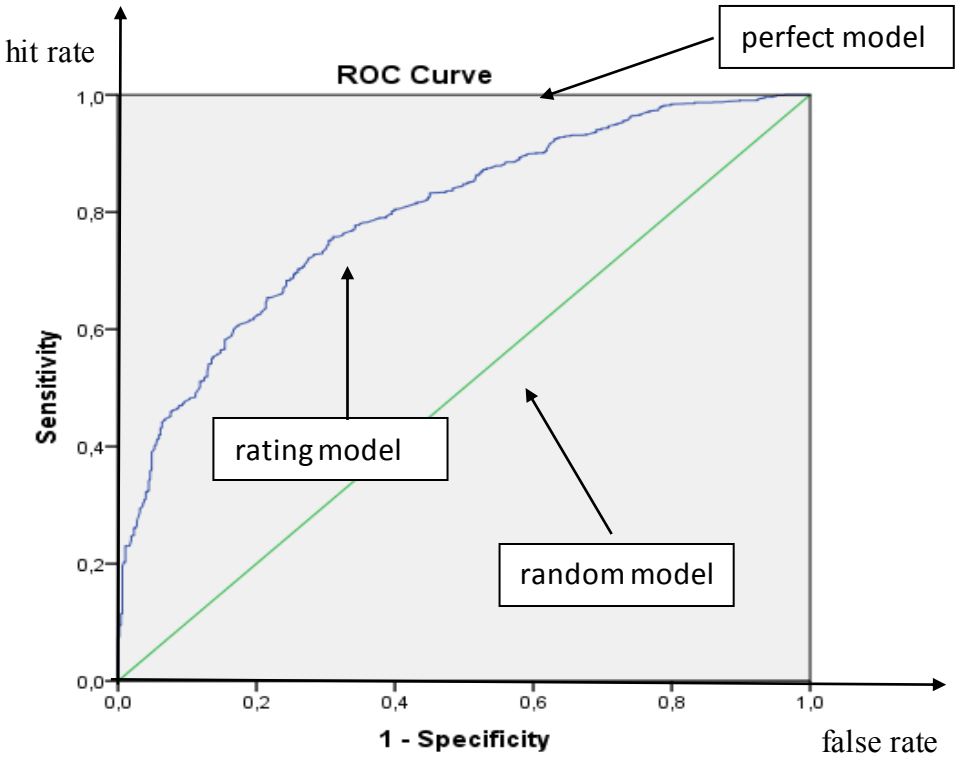
$$\text{IV} = \sum_{k=1}^{K} WoE(k) * (\Pr[k|Good] - \Pr[k|Bad]) \quad (6)$$

After we developed the model, we need to validate it. There are two commonly used goodness-of-fit measures, specifically the Accuracy Ratio (AR) known also as Gini coefficient and the Area Under the Receiver Operating Characteristics curve (AUC). Ratings discriminate ex-ante between good and bad borrowers. If ex-post Y is a good borrower and Z is a bad one, then we claim that the rating was: a. successful, when rating Y > rating Z, b. failed, when rating Y < rating Z, c. useless, when rating Y = rating X. Thus, AR represents the difference between the probability of successful and failed discrimination. On the other hand, AUC represents the average ability of the model to make a precise delimitation between defaulted and non-defaulted borrowers. Note that AR = 2*AUC-1. AR can take values in the interval [-1,1] and AUC in the interval [0,1]. The discrimination by rating is always: a. accurate, if AR = AUC = 1, b. non-accurate, if AR = -1 and AUC = 0, c. random classification, if AR = 0 and AUC = 0.5. AR can be illustrated geometrically with the help of the Cumulative Accuracy Profile (CAP) or with the ROC curve. We will further define only the ROC curve as the 'Results' part of this chapter will refer only to it. As shown in the figure below, a random model is represented by the diagonal, a perfect model links the origin with (0,1)x(1,1), and our model is likely to be somewhere between the two of them. The hit rate, refers to the relative number of borrowers with low score within the total sample of good borrowers. The false rate, on the other hand, relates to the relative number of borrowers with low score within the total sample of bad borrowers. AR is equivalent to two times the area between the rating and random models.

[72] One method is to use fractional polynomials.

[73] WITZANY, J.: *Credit risk management and modelling*, Script, University of Economics, Prague, 2010.

**Figure 10: Example of ROC curve**




## 3.2 Methodology

In what follows, we will model a logistic scoring function. The used dataset is for the retail sector, and was made available during the course of 'Credit Risk Management' at the University of Economics, Prague. It contains 2232 observations and 25 variables (see Annex). From the total number of observations 473 were defined as bad cases and 1759 as good cases. The model was developed and validated based on a 70:30 sample split, namely, a training sample of 70 % and a testing sample of 30 %. All the calculations were executed in SPSS and Microsoft Excel.

We develop the model in several steps:

1. First run of applying the logistic regression;
2. Course classification of the variables;
3. Second run of applying the logistic regression;
4. Calculate in- and out-of-sample Gini coefficients.

## 2.3 Results

First step, we analyze the variables without using the software. We find that Home_ownership_type_ID has 1626 observations (72.85%) that are 'N/A', thus we eliminate it from the dataset. We also eliminate Application ID, as it does not have any explanatory power for the capacity to repay a loan. At this point, we have left 23 variables on which we apply the logistic regression. The outcome showed that many of the variables became statistically insignificant. We performed the univariate analysis of the variables, taking into account the presence of linear dependence of the log-odds on the tested variables and a correlation less than 50%. From all the varia-

bles, we have pre-selected only 6. The pre-selected variables are: payment history, maximum interest, loan duration, income from principal employer, other income, and gender. We have tried to add back the variable Applied Amount considering that it might have some explanatory power for the loan status, however, the outcome showed that 1 unit increase of the variable has 0 impact on the loan status, so we have left it aside also. The next tables provide information on the first run of the logistic regression for the restrained dataset. From the p-values in the Omnibus Tests of Model Coefficients, we observe that the model is statistically significant. The p-value of the Hosmer-Lemeshow Test is above 10%, thus we assess it as satisfactory. The variables are all significant as certified by the values in Sig. and Wald columns. The outcome for the ROC curves can be seen further below. The AR in both cases have acceptable values above 40 % (set as a minimum starting point).Table 31: 1st Run Omnibus Tests of M. Classification

| | | Chi-square | df | Sig. |
|---|---|---|---|---|
| Step 1 | Step | 374,614 | 6 | ,000 |
| | Block | 374,614 | 6 | ,000 |
| | Model | 374,614 | 6 | ,000 |

**Table 32: 1st Run Hosmer and Lemeshow Test**

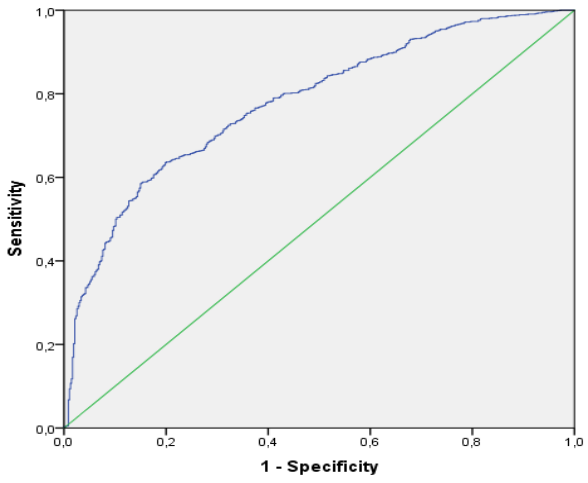
| Step | Chi-square | df | Sig. |
|---|---|---|---|
| 1 | 12,292 | 8 | ,139 |

**Table 33: 1st Run Variables in the Equation**

| | | Wald | df | Sig. |
|---|---|---|---|---|
| Step 1[a] | PaymentHistory | 80,112 | 1 | ,000 |
| | MaxInterest | 45,634 | 1 | ,000 |
| | LoanDuration | 65,255 | 1 | ,000 |
| | income_from_principal_employer | 56,361 | 1 | ,000 |
| | income_other | 15,749 | 1 | ,000 |
| | Gender | 17,268 | 1 | ,000 |

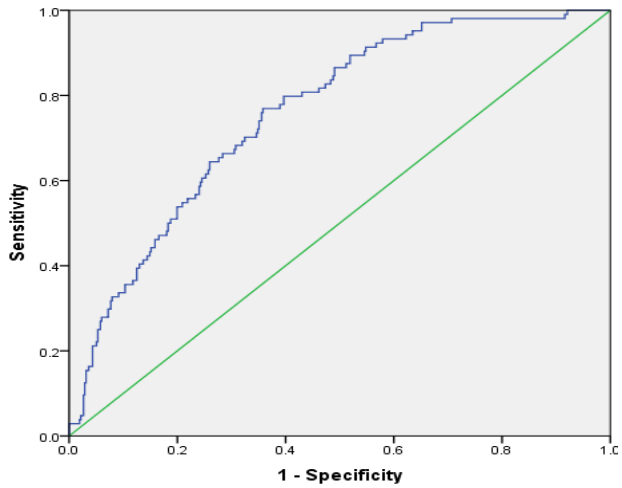
a. Variable(s) entered on step 1: PaymentHistory, MaxInterest, LoanDuration, income_from_principal_employer, income_other, Gender

**Figure 11:1st Run In-Sample ROC**




***Note:*** *AUC = 0.778 (AR = 55,6%)*

**Figure 12: 1st Run Out-of-Sample ROC**




***Note:*** *AUC = 0.761 (AR = 52,2%)*

Next, we perform course classification of the restricted dataset in order to improve the predictive power of the model. The table below illustrates the approach for the variable Payment History. At first we decide to merge categories 0-500 as they all relate to active payment problems and the number of observations in each bin was much lower than 50, set as minimum. We calculate the WoE for categories 600-900 as they relate to different periods of payment problems. Afterwards, we merge categories 600-900 even though the WoE for '700' is higher than for the others. We fuse the bins mainly because of the low number of bad observations in each of them. The IV before merger is 0,15718312 and after merger is 0,15147295. The decrease in IV is also acceptable = 0,00571017.

**Table 34: Example of categorical variable classification**

| Pay_H | No. G | No. B | Pr[c\|G] | Pr[c\|B] | lnPr[c\|G] | lnPr[c\|B] | WoE | WoE_2 |
|---|---|---|---|---|---|---|---|---|
| 1000 | 1099 | 230 | 0,62478 | 0,48625 | -0,47034 | -0,72102 | 0,25067 | 0,250671 |
| 900 | 123 | 32 | 0,06992 | 0,06765 | -2,66032 | -2,69336 | 0,03304 | 0,045738 |
| 800 | 87 | 25 | 0,04946 | 0,05285 | -3,00659 | -2,94022 | -0,0663 | |
| 700 | 91 | 17 | 0,05173 | 0,03594 | -2,96164 | -3,32588 | 0,36424 | |
| 600 | 135 | 38 | 0,07674 | 0,08033 | -2,56723 | -2,52151 | -0,04571 | |
| 0<br>100<br>200<br>300<br>400<br>500 | 224 | 131 | 0,12734 | 0,27695 | -2,06085 | -1,2839 | -0,77695 | -<br>0,776956 |
| *Total* | *1759* | *473* | | | | ***IV*** | ***0,157183*** | ***0,151472*** |

| | |
|---|---|
| 0, 100, 200, 300, 400, 500 | Active payment problems |
| 600 | Payment problems finished <6m ago |
| 700 | Payments problems finished 6-12 m ago |
| 800 | Payments problems finished 12-24m ago |
| 900 | Payments problems finished 24-36m ago |
| 1000 | No previous payments problems |

For the other variables, we have also decided to put them into categories by using Visual Binning function in SPSS. Note, that some variable do not have equitable label length, this due to low number of observations, thus we merged them accordingly.

**Table 35: Categorization of variables**

| Resulting categories | Labels | | | | |
|---|---|---|---|---|---|
| | Max Interest | Loan duration | Income from principal employer | Income other | Payment history |
| 1 | ≤25 | ≤3 | ≤299 | ≤99 | 0, 100, 200, 300, 400, 500 |
| 2 | 26-30 | 4-12 | 300 - 599 | 100 -199 | 600, 700, 800, 900 |
| 3 | 31-35 | 13-18 | 600 - 899 | 200 - 299 | 1000 |
| 4 | 36≤ | 19-24 | 900 ≤ | 300≤ | |

We now run the logistic regression with the restricted dataset, in which all the 6 variables have been regrouped. The outcome is presented below. The Omnibus Tests of Model Coefficients states that the

model is still significant. On the other hand, the Sig. statistics of the Hosmer and Lemeshow Test has improved by 0,285. In the Variables in the Equation table, we can see that all the variables are significant. The ROC curves show considerable improvement in the AR ratios, which are estimated at 59,2% in-sample, and 58,0% out-of-sample.

**Table 36:2nd Run Omnibus Tests of M. Coefficients**

| | | | | |
|---|---|---|---|---|
| Step 1 | Step | 861,223 | 6 | ,000 |
| | Block | 861,223 | 6 | ,000 |
| | Model | 861,223 | 6 | ,000 |

**Table 37: 2nd Run Hosmer Lemeshow Test**

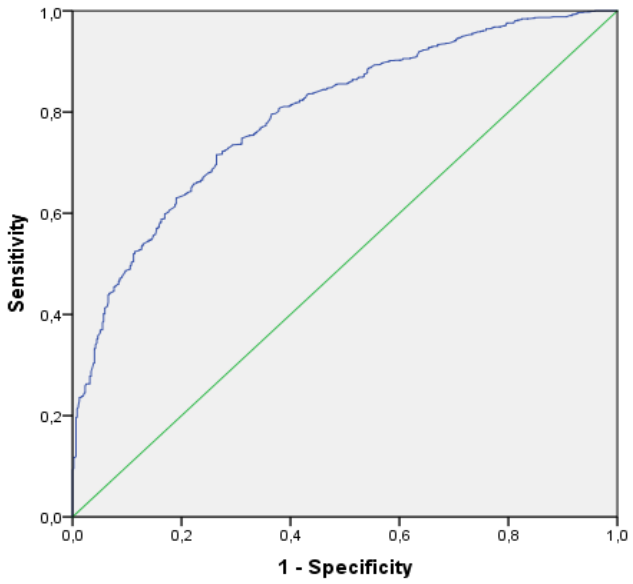
| Step | Chi-square | df | Sig. |
|---|---|---|---|
| 1 | 8,103 | 8 | ,424 |

**Table 38: 2nd Run Variables in the Equation**

| | | Wald | df | Sig. |
|---|---|---|---|---|
| Step 1[a] | PaymentHistoryC | 22,074 | 1 | ,000 |
| | LoanDurationC | 95,870 | 1 | ,000 |
| | Gender | 19,642 | 1 | ,000 |
| | IncomeOtherC | 18,830 | 1 | ,000 |
| | IncomePrincipalC | 155,907 | 1 | ,000 |
| | MaxInterestC | 64,655 | 1 | ,000 |

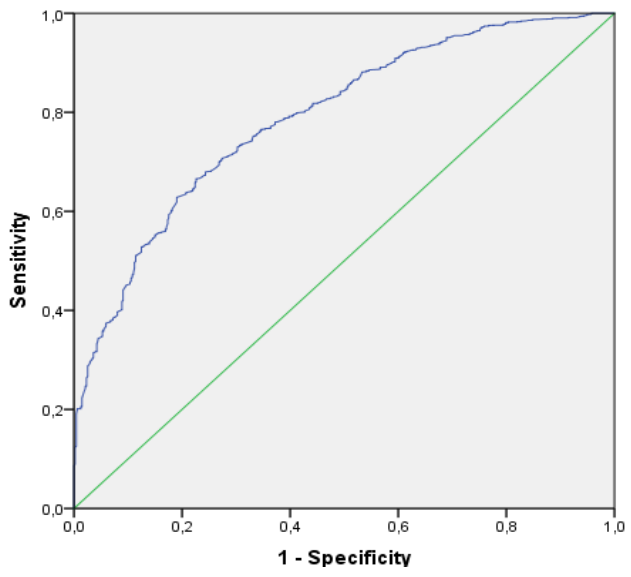
a. Variable(s) entered on step 1: PaymentHistoryC, LoanDurationC, Gender, IncomeOtherC, IncomePrincpalC, MaxInterestC.

**Figure 13: 2nd Run In-sample ROC**




*Note: AUC = 0,796 (AR = 59,2%)*

**Figure 14: 2nd Run Out-of-Sample ROC**




*Note: AUC = 0,790 (AR=58%)*

To better interpret the performance of our model we have transposed the resulting probabilities of the model to Excel. For the maximum profit-loss analysis we have used only the data from the validation sample. We calculated cumulative Bad and Good statistics, as well as cumulative Bad avoided by using the scoring model, as shown in the table below. Assuming that 665 people apply to get a loan, of which 524 are good borrowers, if we give the loans only to the first group, then 12,214% of good applicants will get the loan, 1,418% of bad applicants will also get the loan, but we have avoided 98,582% of other bad applicants to get it. Assuming that we do not use any credit scoring model, then 100% of good borrowers, as well as 100% of bad borrowers would get the loan. Only illustratively, we have assumed that if we give the loan to a good borrow we make 100 EUR in profit and if to a bad one we lose 700 EUR. The outcome of the calculations show that if we use the credit scoring model, we will maximize our profit (11800 EUR) if we give the loan to the first three groups. Meaning, that we would give the loan to 35,878% of good applicants, to 7,092% of bad applicants, but we prevent 92,908% of bad borrowers to receive it. Without using the model we would potentially incur a significant loss (- 46300 EUR). Lastly, we can see below summarized the Gini coefficients for the first run and second run, plus other four iterations for comparison.

**Table 39: Maximum loss-profit analysis**

| | | | | | | Sensitivity | 1-Specificity | Specificity | |
|---|---|---|---|---|---|---|---|---|---|
| Decile | Good | Count of Decile | Bad | Cum Good | Cum Bad | Cum Good % | Cum Bad % | Cum Bad avoided | Profit in EUR |
| 1 | 64 | 66 | 2 | 64 | 2 | 12,214% | 1,418% | 98,582% | 5000 |
| 2 | 64 | 66 | 2 | 128 | 4 | 24,427% | 2,837% | 97,163% | 10000 |
| 3 | 60 | 66 | 6 | 188 | 10 | 35,878% | 7,092% | 92,908% | 11800 |
| 4 | 56 | 66 | 10 | 244 | 20 | 46,565% | 14,184% | 85,816% | 10400 |
| 5 | 56 | 66 | 10 | 300 | 30 | 57,252% | 21,277% | 78,723% | 9000 |
| 6 | 55 | 66 | 11 | 355 | 41 | 67,748% | 29,078% | 70,922% | 6800 |
| 7 | 52 | 66 | 14 | 407 | 55 | 77,672% | 39,007% | 60,993% | 2200 |
| 8 | 45 | 66 | 21 | 452 | 76 | 86,260% | 53,901% | 46,099% | -8000 |
| 9 | 40 | 66 | 26 | 492 | 102 | 93,893% | 72,340% | 27,660% | -22200 |
| 10 | 32 | 71 | 39 | 524 | 141 | 100,000% | 100,000% | 0,000% | -46300 |
| Grand Total | 524 | 665 | | | | | | | |

**Table 40: Summary in- and –out of sample Gini coefficients**

| | Gini coefficient | |
|---|---|---|
| | *In-sample* | *Out-of-sample* |
| 1st Run | 55,6% | 52,2% |
| + Reclassification of the variables | | |
| 2nd Run | 59,2% | 58,0% |
| R_Modeling 1 | 58,2% | 59,0% |
| R_Modeling 2 | 59,0% | 58,6% |
| R_Modeling 3 | 59,4% | 58,8% |
| R_Modeling 4 | 58,8% | 59,2% |

## 2.4Conclusion

The aim of this chapter was to provide an illustrative example of logistic function modelling and to enhance its performance by reselection and course classification of the variables. The approach is sensitive to the way we select the variables, the outcome may be different if using another methodology. When reducing the number of categories, we were led not only by software output and Excel calculations, but also by subjective reasoning. Lastly, only 6 variables were selected as appropriate for our model, considering explanatory power, possible correlation and significance. We conclude, that the predictive power of the resulting function is better than of the initial one. The out-of-sample Gini coefficients presented above are higher in the second run of the logistic function than in the first run. Although the robustness of the model increased, it should be noted that it needs further improvement as we assume that in practice it will perform worse than our measurements.

# Conclusion

The 2007-2008 financial crisis was an important lesson for market participants in terms of risk management. The message behind it, is that at micro level, as well as at macro level market participants failed to implement adequate risk management. Broadly speaking, the credit risk embedded in the mortgage market was the root cause of the financial crisis. It originated in the USA, with FED promoting a policy of low rates and a weakly regulated derivatives markets. Hence, stimulating market participants to engage in complex transactions the risks of each they did not understand, consequently being unable to manage them. The OTC market was growing exponentially, financial institutions switched to an "Originate and Distribution" business model, which allowed them to raise earnings without the necessity to enhance the capital base. The equity culture pushed banks into the sub-prime mortgage market, with Basel II stimulating its growth by setting lower risk weights for mortgages than in Basel I.

In order to address the failures of the financial crisis Basel III was introduced, namely to raise the quality and transparency of the capital, enhance the risk coverage, tackle pro-cyclicality, systemic risk and interconnectivity. These rules, as the previous Basel series, are quite contradictory. On one hand, it aims to raise the quality and transparency of the capital, but includes in the capital base innovative instruments like CoCos, which by rule are rated by rating agencies. The instruments do entail many advantages, one of the most important being to safeguard the taxpayers from saving failing financial institutions. On the other hand, it is also a highly customized instrument, that puts pressure on investors to accept very inconvenient conditions in a 'run for yield'. This run being stimulated by approaching deadlines to comply with higher regulatory capital and the persistent environment of low

rates. A major risk is that these instruments are bought in big amount by other banks and regulated entities, thus only shifting the risks from one sector to another and not mitigating it. The regulators insist on increasing the risk coverage, by setting a new capital charge for mark-to mark losses, increasing the collateral and margining requirements, favoring risk exposures to CCPs, etc. A main issue is that the market-to-market capital charge can be lowered by 'eligible hedges', under which fall single-name and index CDS, which many take with skepticism due to their role in the financial crisis. Lower risk-weights for exposures to CCPs can be easily motivated, however, it may lead to concentration of systemic risk within these institutions. In order to tackle pro-cyclicality, fostered by inadequate accounting standards, margining practices and unreasonable leveraging, the conservation and counter-cyclical buffer were introduced. Among main advantages are the intention to reduce excessive credit granting and limit distributions if banks fall short in capital. Besides the bail-in and CoCo approaches, systemic risk is addressed with capital surcharges. On one hand, it may have a positive impact, as banks will tend to lower their systemic importance, but on the other hand it may also push SIFIs to engage in riskier transactions in order to deliver and comply with them.

Major economies have adopted Basel III, adjusting it to their local needs. Overall, we have assessed consistency with Basel rules that have direct implications for credit risk in other 5 countries, namely, USA, Switzerland, Hong Kong SAR, India and Australia. We found, that these countries are largely compliant with Basel, imposing even higher capital adequacy requirements. Hong Kong SAR capital standards are the closest to Basel. Switzerland sets one of the highest capital demands, due to the importance of the banking system for its economy. USA also implements more restrictive rules, a distinguishing feature is that financial institutions are strongly limited in using external credit ratings. India has a special regulatory regime as a great majority of its banks are state-owned. Australia, as the over analyzed countries tend to rely heavily on the Standardized approach to assess credit risk; the Standardized approach however is adjusted to local needs, for e.g in the USA ratings are replaced with risk weights. Altogether, we can say that Eurozone banks seem to be less capitalized and more prone to crisis scenarios, underlying significant systemic risk due to the contagion effect.

Authors express different opinions on the impact of the new capital requirements. In the short-run, they claim that even though Basel will produce an annual growth drop, it will lower the probability of banking crisis and decrease the spillover effect. In the long-run, systemic banking crisis costs are estimated to more than 60% of the pre-crisis GDP. Based on this, they conclude that the benefit from lowering the probability of crisis and output fluctuations out-weight short-term costs.

Referring to the credit derivative instruments as a way to manage credit risk, we find that their popularity has significantly decreased after the financial crisis. Starting as hedge products, they have turned into complex structures for trading credit risk. Among their advantages are the possibility to engineer assets the maturity of which is not available on the market, higher returns, the underlying asset may be illiquid, direct short selling, etc. Among disadvantages is the build-up of systemic risk, lack of transparency, moral hazard, adverse selection, etc. A distinctive characteristic is that credit derivatives enable market participants to manage regulatory capital.

By developing a credit risk scoring function, we have attempted to illustrate the importance of appropriate credit risk measurement and management. As we have seen, appropriate credit risk management not only safeguards the bank from potential losses, but also gives it the opportunity to profit.

In conclusion, I believe that the implementation of Basel III will have a positive impact on mitigating credit risk in the long-run, and that credit derivatives are an important instrument to manage credit risk and their trading is likely to increase in the near future. My main concerns are related to CoCos as I believe that these instruments embed significant risks. Due to their high correlation, massive write-offs will inevitably affect the market and may result in another banking crisis that only changed shape. CoCos are untested instruments, and we are not able to foresee the reaction of market participants in the aftermath of a triggering event. What more, is that they underline the same systemic risk which Basel attempts to prevent, as they are traded between major financial institutions. I see similarity between the current situation and the situation before the financial crisis. Alike CDS, they are innovative instruments, that relate to regulatory capital, are rated by credit agencies, and the market is trading them in large amounts. I am skeptical about the fact that regulators give them so much credit within the capital base without accurately assessing their underlying risks. As for credit derivatives, market participants insist on gaining back their past importance. Due to their implications under Basel and their overall benefits this is highly probable. Credit derivatives have the great potential to further develop the way credit risk is managed. This, however, is conditional on market discipline supported by an adequate regulatory framework.

Personally, this paper represented and added value for me, not only due to the knowledge I gained during its writing, but also because it boosted my interest in systemic risk which I would like to further research in more detail.

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# List of Tables

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# Annex

**No.1: List of pre-selected variables from the initial number of variables.**

| ApplicationID | |
|---|---|
| LoanDate | |
| CreditGroup | |
| PaymentHistory | ✓ |
| AppliedAmount | |
| MaxInterest | ✓ |
| LoanDuration | ✓ |
| MoPaymentDay | |
| UseOfLoan | |
| ApplicationDuration | |
| ApplicationType | |
| education_id | |
| marital_status_id | |
| nr_of_dependants | |
| employment_status_id | |
| Employment_Duration_Current_Employer_m | |
| work_experience | |
| occupation_area | |
| home_ownership_type_id | |
| income_from_principal_employer | ✓ |
| income_other | ✓ |
| income_total | |
| language_code | |
| Age | |
| Gender | ✓ |