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Global Evaluation of Contingent Convertibles: Testing for Evidence of Market Discipline in the CoCo Market

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Abstract

In this paper, we investigate evidence of market discipline from contingent convertible (CoCo) issues. Previous research has focused on the monitoring aspect of market discipline, by testing risk sensitivity of market prices (subordinated notes and debentures (SND)) to accounting measures of bank risk. We take a similar approach using CoCo spreads and additionally use issue specific features. We analyze the CoCo market from the first issue in 2009 to Q1 2014, covering a sample of 118 contingent convertibles. Our findings provide evidence of market discipline, suggesting that investors are sensitive to the risk profile of the issuing bank. Moreover, several features incorporated in the contracts prove to have a significant relationship to the spread of these instruments.

Key words

Contingent convertibles, CoCo bonds, market discipline, monitoring, accounting risk indicators, bank risk, Basel III.

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1. Introduction

In this first chapter an introduction to the subject is given. Starting with a presentation of the background which leads up to our research question and the purpose of this paper. The chapter ends with a discussion about delimitations of the study and a description of key definitions.

1.1 Background

The Global Financial Crisis (GFC) of 2007-2009 revealed weaknesses in national and international financial oversight and resolution frameworks (Pazarbasioglu, Zhou, Leslé and Moore, 2011). In particular, governments in countries hit by the crisis had to provide significant levels of support to financial institutions in order to protect financial stability and contain the crisis (Pazarbasioglu et al., 2011). The interventions contributed to a significant increase in sovereign exposures (Pazarbasioglu et al., 2011), which spurred the recent sovereign debt crisis. As the fragility of the financial system itself and modern financial institutions has been revealed (Buergi, 2013), it has become clear that financial institutions around the world had built up huge and concentrated credit and liquidity risks from their investments (Calomiris & Herring, 2013). The maintained equity capital by financial institutions proved too small and inadequate relative to the risks to properly absorb losses and provide insulation from insolvency when risks materialized (Calomiris & Herring, 2013). Furthermore, during the GFC a majority of existing hybrid capital instruments did not absorb losses as they were designed to do (Pazarbasioglu et al., 2011). This has brought the issue of capitalization of financial institutions, and the extensive amount of implicit guarantees of financial institutions to both the regulators and the public's attention. To address the problem of the so-called *too big to fail* banks, and to address the risk of worsening moral hazard and market discipline regulators have moved to strengthen bank regulation.

A recent move to strengthen bank regulation in Europe was when the European Commission announced in July 2013 that the so-called Capital Requirements Directive IV package, which via a regulation and a directive transposes the Basel III agreement into EU law (European Commission, 2013). Under the new EU law all capital instruments (except common equity) included in regulatory capital of a financial institution must have a loss absorption mechanism;

the instrument should be converted fully into common equity capital or be fully and permanently written down. Financial instruments with this loss absorption mechanism are commonly referred to as contingent convertible capital instruments or contingent convertible bonds.

In 2002, Flannery (2002) proposed a new financial instrument called "Reverse Convertible Debentures" (RCD). The RCD would automatically convert to common equity if a bank's market capital ratio would fall below a predefined level. According to Flannery (2002) the RCD would facilitate a transparent mechanism for reducing leverage in a bank and prevent financial distress without distorting bank shareholders' risk-taking incentives. This financial instrument introduced by Flannery (2002) was arguably the first contingent convertible bond proposal. It was first after the GFC that it received considerable attention by regulators as a potential instrument to ease the impact of future financial crisis (Berg & Kaserer, 2014). Squam Lake Working Group on Financial Regulation (2009) recommended support for a similar financial instrument in the wake of the GFC, which they called Regulatory Hybrid Securities. Squam Lake (2009) argued for a proposed long-term debt instrument to expedite the recapitalization of banks. The new financial instrument would resemble long-term debt in normal times but converts to equity when both the financial system and the issuing bank are under financial stress (Squam Lake, 2009). The automatic conversion of debt to equity facilitates transformation of an undercapitalized or insolvent bank into a well capitalized bank at no cost to taxpayers, instead cost are borne by the bank's investors. The group's proposal aimed at lessening the need for, and expectations of costly government intervention to bailout unhealthy banks in times of financial crisis.

Contingent convertible capital instruments (CoCos) are hybrid capital securities that absorb losses in accordance with contractual agreements when the capital of the issuing bank falls below a certain level (Avdjiev, Kartasheva & Bogdanova, 2013). The loss absorption can take place through a forced conversion of the CoCo into the shares of the issuing bank at a predefined conversion ratio (De Spiegleer & Schoutens, 2013), or through a partial or full principal write-down of the face value of the CoCo (Avdjiev et al., 2013). The trigger that activates this mechanism can be either a predefined mechanical trigger, based on market or book values, or by a trigger referred to as discretionary, based on the supervisors' discretion and judgment about the issuers' solvency prospects.

The concept of CoCos has been a regular topic in major financial news providers during the last year. With increased interest among investors due to the current low interest rate environment, the search for yield has driven the demand for these instruments. However, from the issuers' side the incentive to issue these instruments is closely linked to a more demanding regulatory framework implemented as a consequence of the recent problems in the financial sector. Several articles in the Financial Times cover this product and describe the market for CoCos as a way for banks to raise cheap capital in the current low interest rate environment, and indicating the market potential to be large since investors in fixed income products are trying to find yield (Ross, 2014). A comment by a head at JP Morgan in Germany provide some insight stating that investors may be buying these instruments just for the high yield and not fully understanding the underlying risk (Ross & Thomson, 2014). Since the market is relatively young the theoretical framework and template for pricing these is not fully developed, mispricing is a considerable risk and the track record short, which makes the product time-intensive to analyze. This view is reinforced in another recent Financial Times article, referring to an investor survey by Royal Bank of Scotland Credit Strategy (Keohane, 2014). When investors where asked why they invest in CoCos, close to 70% answered "Yield".

An article by Ross, Thompson and Atkins (2014) published in the Financial Times highlights the recent developments in the market for CoCos. The German finance ministry confirmed in April that CoCo coupons would be tax deductible, acting as a clearance for German banks to proceed with plans to issue CoCos. Numbers from Dealogic indicate that issuance of CoCos have hit a record $11.6 billion in 2014 compared to $4.2 billion for the same period 2013 according to Ross et al. (2014). According to the same article, Morgan Stanley estimate that the market for CoCos could grow to $250 billion in time. Analysts expect about €50 billion in CoCo issuance by European banks in 2014 (Ross et al., 2014), clearly this is a developing and growing market. Deutsche Bank plans to issue €5 billion in CoCos until end of 2015, with a first tranche of €1.5 billion in mid 2014 (Ross, 2014). Commerzbank, Aareal Bank and Nord/LB are other German banks considering issuance of CoCos (Ross et al., 2014). A fixed income investor at Union Investment estimates the German banks will end up issuing more than €10 billion in CoCos (Ross et al., 2014).

CoCos would in theory be a good substitution for government intervention in times of distress. Recent increase in stress tests among banks and debate of higher capital requirements have also been an important factor for the more profound interest (Avdjiev et al., 2013). Since this paper is written at Lund University, the recent debate in the Nordic region regarding contingent capital cannot be ignored. Swedish authorities have made positive comments in this matter (see, e.g. Dagens Industri, 2012), but much however lies in the details since these instruments fast can be become complicated and difficult to fully understand. In our neighbor country Denmark this type of instrument has already been accepted by domestic regulation and several CoCos have been issued (Schwartzkopff, 2013).

1.2 Problem discussion

Given a brief background and introduction to the concept of contingent convertibles, further a common theme in academia is the concept of market discipline in banking. The definition of the term market discipline in banking is commonly separated into two distinct components, market monitoring and market influence (see, Bliss and Flannery, 2002; Flannery, 2001). Market monitoring refers to market investors' (security holders') ability to accurately evaluate changes in the financial condition of a firm, and incorporate those assessments into the security prices of the firm. Market influence refers to the process whereby outside security holders influence a firm's actions, that is the market's capacity to influence managerial actions to reflect the assessment of a firm's condition. A lot of empirical research focuses on the first aspect, market monitoring. This is performed through testing risk sensitivity of market prices with linear regressions of market-based measures of bank risk (e.g. banks' subordinated notes and debentures (SND) spreads) on a set of accounting measures of bank risk (see, e.g. Forssbæck, 2011; Sironi, 2003). A statistically significant relationship between the market-based measure and the accounting risk variables is interpreted as a sign that the market adequately prices risk (Forssbæck, 2011). Therefore, indicating that market discipline can be an effective and useful mechanism to hold back excessive risk taking by banks. A failure to find a significant relationship would in the same way be interpreted as absence of market discipline (Forssbæck, 2011). Pazarbasioglu et al. (2011) argues that by using contingent convertible capital to meet more stringent capital requirements, banks could be less likely to fail and the possibility of burden sharing with investors would help improve market discipline. Market discipline is also

incorporated as the third "pillar" in the Basel III requirements by the Basel Committee on Banking Supervision, aimed at strengthening the role of market discipline through improvement of banks disclosure.

The combination of increasing interest for contingent convertible capital instruments and previous empirical studies in market discipline especially the correlation between SND spreads and bank risk, opens up for additional research. To our knowledge, no previous studies have used subordinated debt in form of CoCos to test for market discipline in banking. Most of the previous research on CoCos has been focusing on suitable approaches to price and value these new instruments, another common research area is development of new designs of CoCos to avoid potential pitfalls in early issues and proposed designs. This leads us to believe that we have identified an interesting and developing research area to make a contribution to. To our knowledge, only a handful of previous student theses in Scandinavia cover the topic of contingent convertible capital, and these exclusively focus on pricing with a more technical approach analyzing and developing existing pricing models (see, e.g., Alvemar & Ericson, 2012; Brandt & Hermansson, 2013; Teneberg, 2012). This paper can in that aspect both add to previous knowledge and possibly encourage more interest for research covering CoCos at Swedish universities.

The background of this new instrument and the discussion of market discipline gives a logic path to implement this discussion further to CoCos, as a new subordinated debt instrument. Since this is a fairly new instrument it is natural that both the academic community and practitioners will focus on the pricing aspect, however many interesting articles covering the qualitative aspects has also been written, which are further described in our theory and literature chapter (see, e.g., Berg & Kaserer, 2014; Chen, Glasserman, Nouri & Pelger, 2013; Hilsher & Raviv, 2014; Roggi, Giannozzi & Mibelli, 2013). The knowledge gap identified is to better understand the market for these instruments with regard to the underlying assets, which as far as we know haven't been analyzed in the same way before. In this way we would be able to build on the established quantitative research with the possibility to use the more qualitative arguments to understand the results. Our approach would be to address the monitoring aspect of market discipline using accounting risk indicators. This is the most common approach in other research papers which investigate market discipline using other subordinated debt instruments.

CoCos instruments could have the same potential as other SNDs and would then become a central piece of banks financing structure (Pazarbasioglu et al., 2011). The fact that the issues have increased exponentially both in size and amount since the introduction in 2009 makes this an interesting area to investigate (Avdjiev et al., 2013). Combining the fact that the market for contingent convertibles is developing and growing in size rapidly, and that CoCos as financial instruments are both complex and created to exert market discipline, leads us to argue that it would be a good choice for testing evidence of the monitoring aspect of market discipline. Moreover, the stability of the financial sector can partly depend on CoCos in the future, which also makes this type of study interesting to conduct. If evidence of market discipline can be found using CoCos as a market-based measure it could implicate both that investors in CoCos actually are monitoring the underlying risk in their investments closely, and that similar evidence using less complicated subordinated debt instrument could potentially be found. On the other hand, if no evidence of market discipline can be found it could be argued that CoCos are not yet promoting market discipline as they are designed to do. This could also be an important indication that market participants have difficulties evaluating and incorporating risks in their pricing of these instruments.

1.3 Research question and objectives

Is there evidence of market discipline in the contingent convertible capital market?

- This will be performed by investigating the correlation between spreads of CoCos and characteristic of banks issuing the instruments. Specifically, using well researched accounting-based indicators of bank risk. Our investigation includes all available issued instruments since the start of the market in 2009.

The purpose of this paper is to be able to understand the behavior the CoCos that to a large extent is available today using previous well studied risk indicators. This paper will investigate if there is evidence of market discipline in the pricing of these instruments. Since no similar approaches have been used to analyze these instruments in the past, we would like to believe that this would add new knowledge to this area. Previous research in this instrument has been mainly

focusing on the pricing and other problematic features of the structure, and with our approach we believe that more understanding of the main drivers behind the spread movements and how investors view the differences in the issues could be better understood. The result could be interesting from both the issuers and investors perspective since a more transparent picture of how closely the underlying risk and issue specific features are linked to the spread, with both parties being able to develop a better understanding, and possibly a more efficient risk management when dealing with CoCos.

1.4 Delimitations

Some delimitations are necessary in order to make the study suited for its purpose. A more detailed explanation will be presented in the chapter four.

- Definition of CoCos vary in previous research, some researchers only consider instruments with equity conversion features as being CoCos. However, the increase of issued instruments including a write-down mechanism that still have the same regulatory treatment under the Basel accords has broadened the definition. This study will include both equity conversion and write-down CoCo instruments, due to the reason that both have a loss absorption capability.
- Since the instrument was introduced in 2009, the sample is limited to that period and so the data availability. This is an important aspect the will be discussed throughout the paper and its affect on the outcome of this empirical investigation. Some of the issuers of CoCos are non-financial firms and will be excluded from our study since the risk indicators are bank-specific and to avoid industry bias.
- Regarding accounting risk indicators, only the most widely used will be included in the empirical investigation. We will focus on those proven in previous research to give the most information about the riskiness of the banks.

1.5 Definitions

- **CoCos:**

  CoCos or contingent convertibles are the definitions that we use throughout the paper, however they are called differently in previous research such as, CCBs, contingent convertible debt/bonds, contingent capital.

- **SND:**

  Subordinated notes and debentures, subordinated debt. Debt with lower seniority than other debt in a firm's capital structure.

- **Market discipline:**

  The process which investors gather and evaluate information about a firm´s operations and incorporate this into its traded securities. Separated into two main features, monitoring and influence, with the former considered in this study.

- **Trigger:**

  The trigger or trigger event is the mechanism through which the loss absorbing function of the CoCo instruments is activated. *Mechanical* - market or book value trigger defined by specific capital ratio, or *Discretionary* - determined by a supervisor and its prospect about the issuer's solvency.

- **Loss absorption:**

  Equity conversion - conversion into shares, or *write-down* - partial or full write-down of the principal

- **RWA:**

  Risk weighted assets. This ratio includes all assets and weights these in regards to their credit risk exposure.

- **Tier 1 Capital:**

  A measure of financial strength and contains core capital in financial firms, introduced in the Basel framework. The Tier 1 capital ratio is calculated by dividing the Tier 1 equity capital by total risk weighted assets (RWA).

1.6 Outline

The rest of the paper is going to be structured in the following way. After the introduction, the following chapter will present a more in depth explanation of the features of CoCos and issues to date and its market potential. Chapter three will give the reader a presentation of the theoretical framework that will be used and a literature review covering previous research on the topic of CoCos, in order to better understand key qualitative problems and pricing models of the instrument. The chapter will also provide a summary of risk indicators commonly used when testing for market discipline. The main theory of market discipline will be discussed more in depth and will lead up to our hypotheses that will be the base of our analysis and conclusion. Chapter four will present the method that we use to test our hypotheses and the process of gathering the data of CoCos, the accounting risk measures and control variables.

Lastly, we will present and analyze our results following our generated hypotheses and conclude with some final thoughts.

2. Understanding Contingent Convertible capital instruments (CoCos)

This chapter presents a more developed explanation of contingent convertible capital and its core features. Further, the chapter includes a brief presentation of CoCos issued to date, its market potential, investors and regulatory environment.

2.1 Regulations

2.1.1 Introduction to the Basel framework

The Basel I accords was introduced in 1988, with the goal to provide minimum capital requirements for banks. Followed by the Basel II accords in 2004, which built on the first accords, provided a more international approach dealing with bank risks and was the beginning of providing different risk weights on different types of assets. The current Basel III accords from 2011 have not been fully implemented to this date, however the core features of this accord are to increase capital requirements and enforce lower leverage among banks.

Basel III is a comprehensive set of reform measures developed to strengthen the regulation, supervision and risk management of the banking sector (BIS, 2014). The Basel Committee on Banking Supervision (BCBS) presented the revised version of the Basel III regulations in 2011. These reform measures aim to improve the banking sector's ability to absorb shocks arising from financial and economic stress (BIS, 2014). Moreover, the measures aim at improving risk management and governance, and strengthen banks' transparency and disclosures. Basel III as an international regulatory framework for banks is a response to the market failures revealed by the GFC, and emphasizes the importance of that banks' risk exposures are backed by a high quality capital base. One of the reasons that the GFC become so severe was the eroding level and quality of the capital base in banking sectors of many countries (BCBS, 2011a). The GFC showed that credit losses and write-downs had to come out of banks' tangible common equity base, primarily out of retained earnings. Moreover, during the crisis a number of banks in distress were rescued by injection of public sector funds (at taxpayers' expense), in form of common equity and other types of Tier 1 capital (BCBS, 2011b). This supported depositors but also meant that Tier 2 capital and in some cases Tier 1 did not absorb losses incurred by the banks. For this reason the

Basel III rules stipulates that the predominant form of Tier 1 capital, the highest quality component of bank's equity capital, must be retained earnings and common shares (BCBS, 2011a). The Basel III framework separates total regulatory capital into three elements of capital:

1. Tier 1 Capital (going-concern capital)

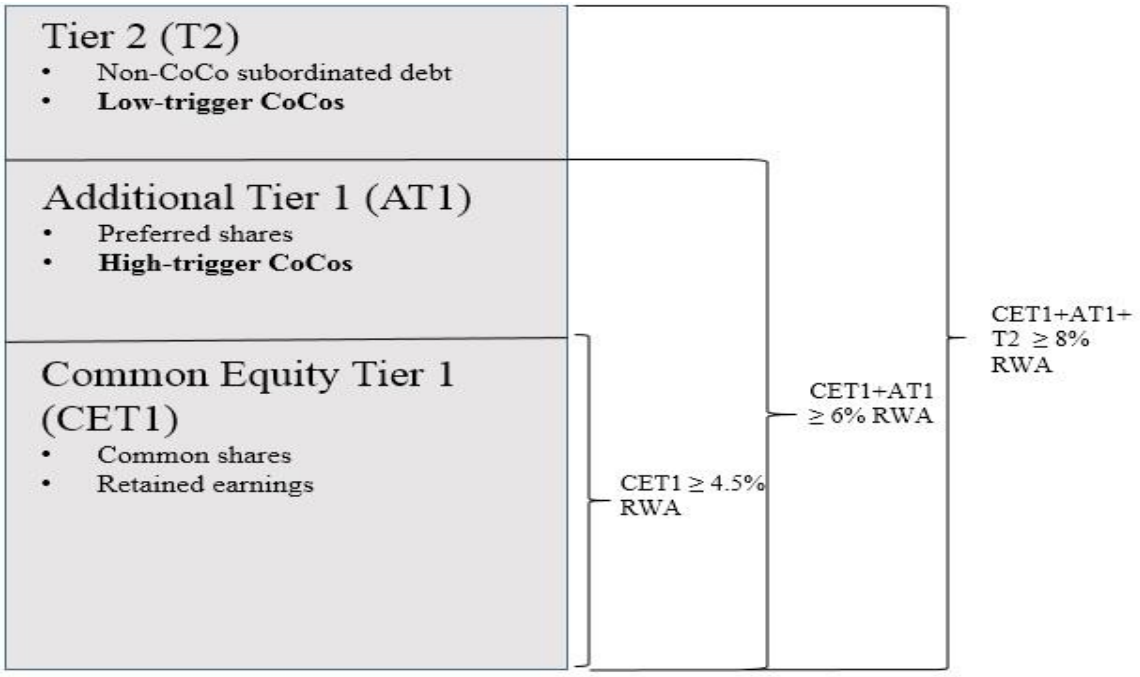
a. Common Equity Tier 1 (CET1)

b. Additional Tier 1 (AT1)

2. Tier 2 Capital (gone-concern capital) (T2)

For capital instruments to be included in these categories they need to meet a single set of associated criteria. One of the criteria for all non-common equity regulatory capital is to provide loss absorption. Additional Tier 1 and Tier 2 are the capital elements where contingent convertibles as a loss absorbing instrument can be eligible for inclusion. Risk weighted assets (RWA) is another core definition used in the Basel framework. This approach was introduced in the Basel I accords with the aim to provide a easy way to compare and calculate risks of banks across different countries, and also to give incentives for banks to hold low risk assets on their balance sheet. RWA is calculated using specific risk weights in regards to the different assets.

Figure 2.1 CoCos in the Basel III framework



(Avdjiev et al., 2013, p.47 graph 2)

2.1.2 Regulation for CoCos

The main driver of issuance of contingent convertible debt has been the regulatory treatment of the securities, and the need for banks to boost their capital to comply with increasing capital requirements (Avdjiev et al., 2013). The BCBS presented the revised version of Basel III regulations in 2011 with the explicit objective to "[…] *improve the banking sector's ability to absorb shocks arising from financial and economic stress, whatever the source, thus reducing the risk of spillover from the financial sector to the real economy"* (BCBS, 2011a, p.1). Under the Basel III regulations hybrid capital instruments that include incentives to be redeemed (e.g., features such as step-up clauses) previously part of the Tier 1 capital base, will be no longer be recognized by the regulators and are now in the process of being phased out (BCBS, 2011a). In addition the Basel III rules stipulates that old Tier 3 capital instruments will be eliminated from regulatory capital and Tier 2 capital instruments will be harmonized (BCBS, 2011a). The changes proposed by Basel III have created room for development of new securities for banks to deal with minimum capital requirements. Under the Basel III, contingent convertible capital instruments can qualify as either Additional Tier 1 (AT1) capital or Tier 2 (T2) capital, both ranking below Common Equity Tier 1 (CET1) (see figure 2.1). For CoCos to be recognized as AT1 capital a set of minimum criteria has to be met (partial list of criteria) (see table 2.1 below):
"*Is perpetual, ie there is no maturity date and there are no step-ups or other incentives to redeem*", "*May be callable at the initiative of the issuer only after a minimum of five years*"
"*Instruments classified as liabilities for accounting purposes must have principal loss absorption through either (i) conversion to common shares at an objective pre-specified trigger point or (ii) a write-down mechanism which allocates losses to the instrument at a pre-specified trigger point.*" (BCBS, 2011a, pp.15-17). For CoCos to be an instrument issued by the bank that meet the T2 criteria, the feature of no maturity date is relaxed and instead a minimum original maturity of at least five years is required (BCBS, 2011a, pp.15-17. In January 2011 BCBS issued requirements in addition to the criteria initially outlined in the Basel III rules. The additional minimum requirements aim at ensuring that all classes of capital instruments fully absorb losses at the point of non-viability. One of the additional requirements for AT1 and T2 capital inclusion is that terms and conditions of the instruments must have a provision that requires the instrument to be written off or converted into common equity at the option of the relevant authority, if a trigger event occurs (BCBS, 2011b). This has come to be known as the PONV trigger (Avdjiev

et al., 2013). The additional requirement of an inclusion of PONV clauses and definition of a trigger event applies to all issues from 1 January 2013.

Table 2.1 Required features in Basel III

Features required	Additional Tier 1	Tier 2
Trigger event	Breaching an objective pre-specified trigger point PONV decision determined by relevant authority	PONV
Trigger level	Must be at least 5.125% Common Equity Tier 1 (CET1)	
Subordinated to	Depositors, general creditors and subordinated debt of the bank	Depositors & general creditors
Maturity	Is perpetual, ie there is no maturity date	At least five years
Callable	At the initiative of the issuer	At the initiative of the issuer
	Only after a minimum of five years	Only after a minimum of five years
Coupon	Full discretion by issuer at all times to cancel	
Other criteria	No step-ups or other incentives to redeem	No step-ups or other- incentives to redeem
		No rights to accelerate the repayment of future schedule payments (coupon or principal), except in bankruptcy & liquidation.

Inspired by Gupta et al. (2013). See BCBS (2011a) for complete information.

In July 2013 the Basel Committee on Banking Supervision published a document with an update on assessment methodology and the additional loss absorbency requirement for Global systemically important banks (G-SIBs) (BCBS, 2013). This was of importance for contingent convertible capital instruments, especially the section about instruments to meet the higher loss absorbency requirement. The committee concluded that to increase the resilience of the institution as a going-concern G-SIBs is required to meet their higher loss absorbency requirement with only CET1 capital (BCBS, 2013). This meant that CoCos could not be used to meet the higher loss absorbency requirement imposed on G-SIBs. A continued review of contingent capital, and support of the use of contingent capital instruments such as high-trigger CoCos to meet higher loss absorbency requirements was emphasized (BCBS, 2013).

The European Commission announced in July 2013 that the so-called CRD IV package will enter into force, which via a Regulation and a Directive transposes the Basel III agreement into EU law (European Commission, 2013). Under the new EU law all AT1 and T2 instruments of an

institution must have a loss absorption mechanism; the instrument should be converted fully into CET1 capital or be fully and permanently written down at the point of non-viability of the institution (European Union Law, 2013).

National regulators such as the Swiss FINMA have shown interest in CoCos as an alternative to additional hard equity (Buergi, 2013). The Swiss regulators have required systemically important institutions (UBS and Credit Suisse) to hold additional capital, which can be issued inform of contingent capital (Hilscher & Raviv, 2014). Sundaresan and Wang (2013) referring to FINMA (2011), states that the Swiss regulator requires its largest banks to have a capital ratio of at least 19%, whereof 10% equity and 9% contingent capital.

A report by the Financial stability oversight council (2012) evaluates the potential for contingent convertibles within the US regulatory framework. The report is written upon requirement stated in the Dodd-Frank Act (section 115c) and later reported to Congress to address the feasibility of the instrument. The council concludes that the benefits of using contingent convertibles would be to strengthening financial institutions and to provide low cost capital. The definition of trigger and timing of the trigger is addressed as potential drawbacks regarding the instrument's structure. However, the experience from similar instruments in the US is limited so the council advices for further investigation in order to better understand the advantages and disadvantages of CoCos before a potential introduction to the US market.

2.2 The Trigger

Avdjiev et al. (2013) provide a useful introduction of different trigger types that currently are being used in issued CoCos. Avdjiev et al. (2013) firstly differentiate between two trigger types, the mechanical and the discretionary. The mechanical trigger can be either a market value trigger or a book value trigger (accounting value) defined numerically in terms of a specific capital ratio. The discretionary trigger (also known as point of non-viability (PONV) trigger) is activated based on the supervisors' discretion and judgment about the issuers' solvency prospects. Book value triggers are commonly defined as a certain regulatory capital ratio, where book value of Common Equity Tier 1 (CET1) capital as a ratio of risk-weighted assets (RWA) is becoming the most frequently used in issues since 2012 (Avdjiev et al., 2013).

2.2.1 Regulatory trigger

As touched upon in the discussion of regulations above, the inclusion of discretionary triggers also known as regulatory triggers (sometimes referred to as point of non-viability (PONV) trigger) in CoCo issues has increased substantially over recent years (Avdjiev et al., 2013). The primary reason for this increase is that under the current Basel III framework a regulatory trigger (PONV) is a required element of contingent capital to be included in Additional Tier 1 (AT1) and Tier 2 (T2), capital that banks use to satisfy capital requirements (Avdjiev et al., 2013). The regulatory trigger allows regulators to activate the loss absorption mechanism of the CoCo when necessary to prevent the issuer from insolvency (Avdjiev et al., 2013). This feature empowers regulators to override any lack of timeliness or unreliability of book value triggers, but at the same time introduces uncertainty about the timing of the activation of the loss absorption mechanism (Avdjiev et al., 2013).

2.2.2 Accounting value trigger

The effectiveness of book value triggers are being analyzed and discussed in several research papers. Existing regulatory capital requirements for banks are primarily based on book values and capital ratios used are based on regulatory accounting measures of debt and capital, rather than market prices (Glasserman & Nouri, 2012). Naturally, triggers based on regulatory capital ratios in CoCos are a common feature of contracts. Such a trigger type can be found in one of the earlier proposals for regulatory hybrid securities by Squam Lake (2009) that suggests using a bank-specific trigger based on the ratio of Tier 1 capital to risk-adjusted assets, a measure used to determine capital adequacy. As pointed out by Avdjiev et al. (2013), the effectiveness of book value triggers depends both on the frequency, at which the ratios are calculated and disclosed, and the accuracy and consistency of internal risk models at the banks. Triggers based on reported capital ratios align with a regulatory framework but tend to be lagging indicators of a bank's financial condition (Pazarbasioglu et al., 2011), this problem is a common critique against the use of triggers based on accounting values. Sundaresan and Wang (2013) follows a similar line of argument stating that accounting triggers tend to be backward looking and are prone to manipulation by bank managers. Calomiris and Herring (2013) similarly argue that book value as an accounting concept is subject to manipulation and is inevitably a lagging indicator of deterioration of a banks' balance sheet. Sundaresan and Wang (2013) highlights the problem

exemplifying with Lehman Brothers and Bear Stearns, whose Tier 1 capital ratio was estimated to be 10.1% (in the month of bankruptcy) and 13.5% (in the month before bailout) respectively, ratios above the capital requirements in Basel III. Calomiris and Herring (2013) criticize Basel III, the authors argue that the reforms will not solve the fundamental problems of accurate risk measurement and maintenance of capital adequacy. The main argument for why the Basel approach to capital requirements produce errors and avoids timely recognition of losses, is that the measure of shareholders' equity relies on accounting principles that combine book values and "fair values" when measuring capital compliance (Calomiris & Herring, 2013). According to Calomiris and Herring (2013) this approach delays recognition of losses and permits banks to conceal losses. The arguments above highlights the critique and potential problems with the use of a book value trigger in the contract terms of CoCo instruments. Despite the critique against the use of book value triggers, inclusion of 5.125% CET1/RWA ratio trigger has increased in CoCo issuance since the end of 2011 (Avdjiev et al., 2013). The development in this direction is driven by regulatory requirements. A criterion for Additional Tier 1 capital under Basel III requires included instruments to have a trigger level for conversion or write down of at least 5.125% CET1 (BCBS, 2011c, p.6).

2.2.3 Market value trigger

Many academic proposals advocate the use of market value and market based measures as trigger events to address potential shortcomings of accounting triggers (book value). Two market based measures for potential use as triggers are Credit Default Swaps (CDS) spreads and share price movements (Calomiris & Herring, 2013). Calomiris and Herring (2013) argue for equity values as the better of the two market-based measures. The authors propose using a "quasi-market-value-of-equity ratio", defined as a 90-day moving average of the ratio of market value of equity to the sum of the market value of equity and the face value of debt. This would limit the effect of share price fluctuations and noise in market value signals, and make it difficult for speculators to force a conversion of CoCos. Flannery (2009) advocated early on for the use of market based measure for the conversion trigger. Flannery (2009) argued that book equity values tend to lag bank's market value, and that these lags are severe when a firm is facing financial difficulties. Flannery (2009) therefore argued for a conversion trigger expressed in terms of equity's "contemporaneous" market value of outstanding common shares as a suitable solution.

Flannery (2009) reasons that market values are forward-looking and promptly reflect changes in a firm's own condition, including so called off-book items. Sundaresan and Wang (2013) also advocates the use of CoCo triggers placed on market prices. The authors argue that common equity should be the natural choice for placing a market trigger. A trigger for forced conversion based on an easily observable market value of a publicly-traded security ensures that *"*[…] *conversion is based on a criteria that is informative, objective, timely, difficult to manipulate, and independent of regulators' intervention, avoiding the problems associated with other types of triggers.*" (Sundaresan & Wang, 2013, p.3). An important factor limiting the possibility to include a trigger based on market values can be linked to fact that many banks are private and hence lack publicly traded shares (see comment below in 2.3).

2.2.4 Systemic trigger

Systemic triggers, triggers linked to system-wide conditions have been suggested in different proposals for contingent capital (see, Pazarbasioglu et al., 2011; Squam Lake 2009). This systemic trigger would be based on the condition of the whole financial system. Pazarbasioglu et al. (2011) exemplifies possible systemic triggers as liquidity conditions, a market volatility index or a declaration by regulators that the financial system is suffering from a systemic crisis. The trigger design discussed by Squam Lake (2009) suggests that a systemic trigger must be accompanied by a bank-specific trigger. A trigger based only on crisis declaration by regulators could put enormous political pressure on regulators making the decision, and it could trigger forced conversion or write-downs for banks with a sound capital base. This could arguably distort incentives for those banks to remain at a sound capital position. Pazarbasioglu et al. (2011) clarifies advantages and disadvantages of a systemic trigger based on either supervisory discretion or declaration of a systemic crisis, or based on predetermined general conditions for the financial sector (loss rates, capitalization or cash to capital ratio). Advantages for the first type, according to the authors, are primarily a broad-based recapitalization of the banking system when regulators think it is needed. Disadvantages could be the strong reliance on regulatory judgment, and a potential lack of differentiation among firms might have unintended consequences resulting in inefficient recapitalization. The advantage with the second type is an automatic increase in the capitalization of the banking system in response to systemic credit losses. Disadvantages with this could be a too narrow trigger, the systemic risk could be caused

by something unrelated to credit losses. Overall systemic triggers have the advantage of addressing and reducing systemic risk. On the other hand, the discretionary element and the difficulty in predicting a systemic crisis have the disadvantage of reducing marketability of the CoCo instruments. These trigger characteristics would make rating and pricing of the instrument very complex. To our knowledge, a systemic trigger have not been included in the issued CoCo instruments to date, arguably the problem of both rating and pricing could be the reason.

2.3 Loss absorption

One of the defining characteristics of CoCos is the principal loss absorption mechanism. Under the Basel III agreement that is implemented to EU law through the CRD IV package, all instruments included in the Additional Tier 1 (AT1) and Tier 2 (T2) layers of regulatory capital must have a loss absorption mechanism (European Union Law, 2013). The two loss absorption mechanisms outlined in the regulation are; the instruments must be capable of being either, fully and permanently written down, or converted fully into Common Equity Tier 1 (CET1) regulatory capital. Further, the regulation states that loss absorption must be activated in the event that the issuing institution reaches the point of non-viability (PONV). An important distinction of the design of CoCos that should be pointed out, is that this type of contingent capital is not constructed to deal with liquidity problems. This is emphasized by both Culp (2009) and Pazarbasioglu et al. (2011) referring to research by Duffie (2010). CoCos does not generate new cash for the issuing bank when conversion is triggered, the conversion would stop the interest payments (coupons) but would other than that not generate additional liquidity, thus CoCos are unlikely to stop a liquidity crisis. Potentially if the conversion is perceived negative by the market, the conversion may actually create a liquidity squeeze for banks (Pazarbasioglu et al., 2011).

Gupta, Akuzawa and Nishiyama (2013) provide a useful clarification of the distinction between AT1 and T2 under Basel III, highlighting the two stages of loss absorption, a gone-concern basis and going-concern basis. Both AT1 and T2 must absorb losses on a gone-concern basis, that is at PONV, or when the regulator determines that the institution would become non-viable without a write-off, or if a decision of a public sector injection of capital has been made (Gupta et al., 2013). The explicit objective of T2 capital is to provide loss absorption on a gone-concern basis, AT1 on the other hand is designed to provide recapitalization at an earlier stage. For AT1, if

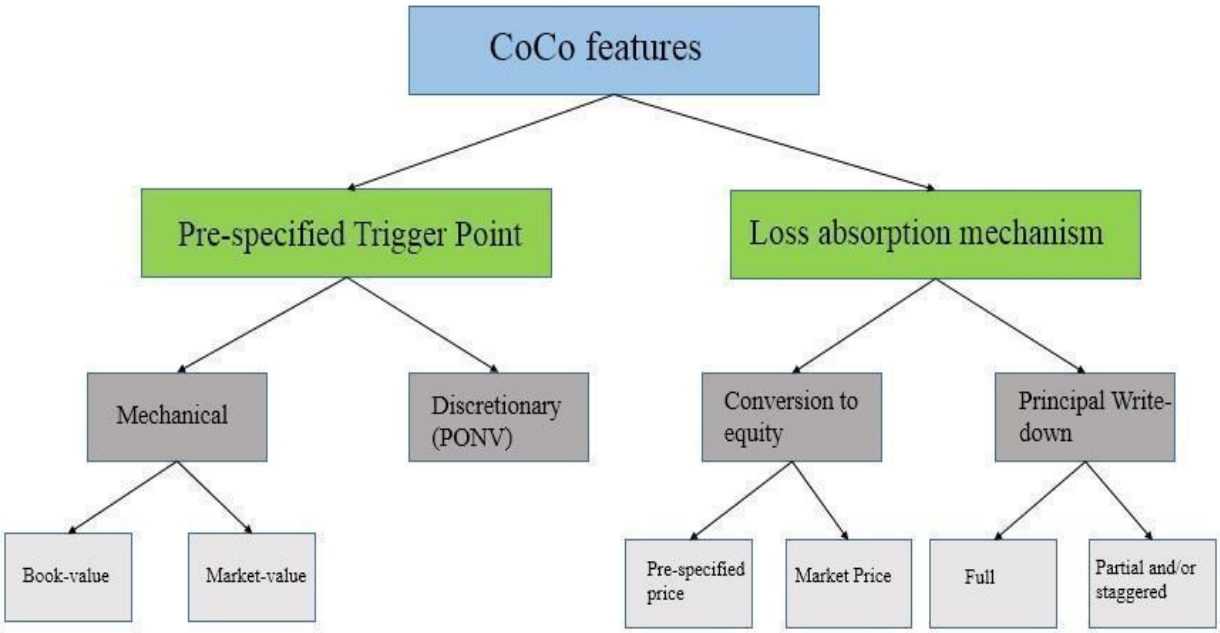
there is a capital shortfall on a going-concern basis the institution must cancel the coupon payments, on further capital shortfall the principal loss absorption must be triggered when an objective pre-defined trigger point is beached (Gupta et al., 2013). For AT1, if the trigger level (minimum 5.125% CET1/RWA) is breached, the aggregate amount to be written-down/converted must be at least the amount needed to return the institutions CET1 capital ratio to the trigger level, or the full principal value of the instruments (BCBS, 2011c).

According to De Spiegeleer and Schoutens (2014), three write-down mechanisms are possible and have been used to date: full principal write-down, partial write-down and staggered write-down. In a CoCo bond with a full principal write-down feature, the face value of the bond will be completely written off if the trigger level is breached. The first CoCo with a write-down feature was issued by Rabobank in 2010 and had a partial write-down, at the trigger event 75% of the face value is written off and 25% is repaid to the CoCo investor (De Spiegeleer & Schoutens, 2014). The staggered write-down mechanism was introduced by Zuercher Kantonalbank (ZKB) in January 2012, when it issued a CoCo bond with a flexible write-down mechanism. De Spiegeleer and Schoutens (2014) describes the novelty in ZKBs issue as the fact that the CoCo investor would be imposed losses (write-downs in multiples of 25%) up to the point where the breach of the trigger was resolved. Principal write-down CoCos have accounted for more than half of CoCo issuance since 2009 and issuance have picked up over time (Berg & Kaserer, 2014), different explanations for this pattern have been put forward. Firstly, the growing interest from fixed-income investors whose mandates prevent them from participating in issues with possible conversion into equity is arguably one feasible explanation (Avdjiev et al., 2013; Berg & Kaserer 2014). Secondly, the concern about the threat of dilution of existing shareholders, and the concern that CoCo investors would own a controlling stake after a conversion, is a strong argument for the choice of CoCos with a write-down feature (De Spiegeleer & Schoutens, 2014). Lastly, the simple fact that the issuing bank has no listed shares might make a write off the only viable solution, as highlighted by Berg and Kaserer (2014), only 41 out of the 124 Euro zone banks subject to ECB supervision is publicly listed, suggesting that this is significant explanation.

Equity conversion is the other possible loss absorption mechanism with a conversion rate linked to either a predefined price or the market price at conversion or a combination of both (Avdjiev et al., 2013). Both De Spiegeleer and Schoutens (2014) and Gupta et al. (2013) provide an easily

accessible description and overview of loss absorption through conversion into common equity of the issuing bank. De Spiegeleer and Schoutens (2014) outline three possible choices for the conversion price; a floating conversion price, a fixed conversion price and floored conversion price. A floating conversion price is equivalent to setting the conversion price equal to the observed share price at the trigger event. A fixed (constant) conversion price on the other hand is a simpler solution, where the conversion price and thus the number of shares delivered are determined at issuance of the CoCo bond (Gupta et al., 2013). The third solution is a compromise of the two previous, where the conversion price is floored or caped. This structure that allows for conversion into a variable number of shares, is based on the determined share price level at the moment the CoCo gets trigger into conversion, but with a pre-specified floor or cap (Gupta et al., 2013). The conversion ratio will be an essential part of the structure since heavy dilution of the current shareholders could become a reality if the trigger is breached. Thus, current shareholders of the issuer will prefer a higher conversion price, and CoCo investors will on the other hand be better off when the conversion price is low. This can result in adverse incentives among investors in the issues and among the issuers, as discussed more extensively in chapter three.

Figure 2.2 Graphical display of CoCo features



Inspired by Avdjiev et al. (2013)

2.4 Investors in CoCos and potential market

The CoCo market is still relatively small compared to other SND, however fast growing when considering the last few years issuance. Since 2009, approximately $ 109 billion worth of CoCos have been issued (see 4.1). According to Avdjiev et al. (2013) banks have issued approximately $550 billion worth of non-CoCo subordinated debt and around $4.1 trillion worth of senior unsecured debt between 2009 and mid 2013, as a comparison to issued CoCos during the same period. According to Avdjiev et al. (2013) the primary demand for CoCos has come from small private banks and retail investors. Demand from large institutional investors has been relatively low so far. In a sample of CoCo issues with a total combined volume of approximately $13 billion, Avdjiev et al. (2013) finds that private banks and retail investor accounted for 52% of demand. Asset management companies accounted for 27% and hedge funds were responsible for 9% of total demand (Avdjiev et al., 2013). Avdjiev et al. (2013) put forward two main factors that are holding back growth of the investor base for CoCos. The first factor is the absence of complete and consistent credit ratings for CoCo instruments. The second factor is the tension between the objectives of issuers' regulators and prospective investor's regulators'. An article in Financial Times from April 23, 2014 (Ross & Thompson, 2014), indicates a changing pattern in investor demand for CoCos. According to research by Union Investments, in seven recent issues of CoCos from leading European banks, asset managers bought over 60% and hedge funds bought less than 20%. The increased interest by asset managers suggests that CoCo bonds are quickly becoming an interesting alternative for investors in the hunt for yield. One important factor concerning investors and holders of CoCos is the risk for contagion effects. Pazarbasioglu et al. (2011) stated in their discussion of economic rationale of CoCos that there could be a case for certain restrictions on holders of the instrument. In particular to avoid investors that is other leveraged financial institutions of systemic importance.

A recent development in the market is construction of indices covering CoCo bonds, which is expected to have a positive market effect since the track record becomes easily available. Bank of America Merrill Lynch has in the beginning of 2014 indicated that they are developing an index following CoCos, which arguably could give investors easier access and facilitate easier comparison to other products making the instrument more suited for a broader commercial market (Durand, 2014). Since CoCos is a fairly new and non-standardized product the process of assigning rating to the instruments by rating agencies has been rather slow. This is also the case

in the regulatory treatment that arguably is holding back the expansion. However, a trend is that an increasing number of countries are starting to include CoCo instruments in their domestic regulatory framework. One recent example is the approval in Germany for banks to be allowed to use CoCos in their financial structure. Rating agencies such as Moody's express that the instrument is new and not analyzed in term of distress making it difficult to assign a rating (Bauer, Fanger, Berg, LaMonte & Wilson, 2013). However with an increasing market size and increased acceptance in regulations, rating agencies should become more comfortable assigning ratings for CoCos. Increased coverage by rating agencies would also open up the market to institutional investors with demands of a particular rating in order (typically "investment grade") to be able to invest (see e.g., Zähres, 2011).

The tax treatment of CoCos has been assigned limited attention in academia, however for the market and potential demand for these instruments it is an important aspect. Banks with regulatory permission to use these instruments as AT1 or T2 under the Basel framework, and in countries with regulations that have the possibility to classify the coupons as tax-deductible are more prone to consider issuance of CoCos. Avdjiev et al. (2013) suggest that over approximately 64% of the currently issued CoCos in their sample have tax-deductible coupons. Arguably this could potentially be a cheap source of financing for banks since it becomes treated as debt for taxation purposes, but have the possibility to count towards equity capital when it comes to the position in the capital structure. Pazarbasioglu et al. (2011) argue that the regulatory treatment of CoCos when it comes to tax treatment and position in the bank's capital structure will have a significant effect on the market development.

3. Theoretical framework and literature review

This chapter will introduce and discuss the theoretical framework and existing research which will be used to construct our hypotheses and guide us in the choice of explanatory variables. Firstly, a presentation of previous key theories covering pricing of CoCos, qualitative aspects and various CoCo design proposals. Secondly, the theory of market discipline will be discussed and related to this paper, ending in our developed hypotheses.

3.1 Pricing models

To understand how changes in various risk indicators for the issuing banks are reflected in the price of CoCos an understanding of how these instruments can be priced is needed. Below is a brief introduction of existing pricing models suggested in academia to date.

A useful starting point for the overview and outline of existing pricing models for CoCo bonds can be found in a paper by Wilkens and Bethke (2014). Wilkens and Bethke (2014) conducts a comprehensive empirical analysis of the pricing of CoCo bonds, and from the findings suggests a "market standard" and preferred practitioner approach to pricing and hedging CoCos. The existing pricing models suggested and analyzed in academia can be grouped into three main approaches:

- **Structural models** (see, e.g., Albul, Jaffee & Tchistyi 2013; Brigo, Garcia & Pede 2013; Cheridito & Xu, 2013; Glasserman & Nouri, 2012)
- **Equity derivatives models** (see, e.g., Corcuera, De Spiegeleer, Ferreiro-Castilla, Kyprianou, Madan and Schoutens 2013; De Spiegeleer & Schoutens, 2011)
- **Credit derivative models** (see, e.g., De Spiegeleer & Schoutens, 2011)

The structural models all share common features but differ in their application. The models are based on the assumption that asset values follow a standard Brownian motion (Geometrical Brownian Motion). Building on the capital structure model by Merton (1974) and literature extending the framework of Merton (1974); Black and Cox (1976) and Leland (1994). Therefore also leaning on the Black-Scholes-Merton Model (1973) for option pricing and valuation of credit risky debt.

Several structural models have been proposed and analyzed by researchers in academia. A commonly cited paper by Albul et al. (2013) builds on the capital structure model of Leland (1994) and assumes that total asset value follows a standard Brownian motion. Albul et al. (2013) uses a capital structure that includes equity and a straight bond, and then allows addition of contingent convertible debt into the structure. The authors focus is capital structure decisions and in the paper develops closed-form solutions for the value of equity conversion CoCos with market-based conversion triggers (stock price). Albul et al. (2013) set up two conditions that must hold, "No default before conversion" and "Monotonicity of equity value". The second condition, explained as equity value is strictly increasing in asset value before conversion, gives a one-to-one correspondence between equity and asset values allowing for equity value to be modeled as a function of asset value, and the conversion trigger used is then an asset level (Albul et.al., 2013).

Glasserman and Nouri (2012) use a similar structural approach starting from the firm's assets, with a model that builds on research on capital structure by Merton (1974), Black and Cox (1976) and Leland (1994). The starting point is a stochastic process, the geometric Brownian motion that models the book value of the bank´s assets. The book value of assets is then used to drive the conversion of the contingent capital and the market value of assets is used to drive the valuation of the contingent capital (Glasserman & Nouri, 2012). A limitation of the model used is emphasized by the authors, the model does not allow for jumps in asset values. Another paper taking the structural approach to default modeling in CoCo pricing is Brigo et al. (2013). Brigo et al. (2013) adopts what is referred to as the *firm value* models area, attributed to Merton (1974) and Black and Cox (1976), and uses a standard Brownian motion as the asset value process. More specifically Brigo et al. (2013) uses a model developed by Brigo and Tarenghi (2004) called *the analytically tractable first passage model*. The approach taken in this paper considers explicitly and at the same time three features: Bond-Equity, Conversion time, Equity price at Conversion and Default time (Brigo et al., 2013 p.5).

Gupta, Akuzawa and Nishiyama (2013) propose a *convertible bond approach* for pricing of CoCos. The authors emphasize that a practical pricing solution should allow for the CoCo instruments to be priced seamlessly and consistently with other existing derivatives, in a single framework. Gupta et al. (2013) suggest a framework that is an extension of existing derivative

pricing models used in practice, and that is theoretically consistent with existing frameworks such as Black-Scholes. The model used is therefore conceptually and technically similar to standard models for convertible bonds (Gupta et al., 2013). Gupta et al. (2013) argues that to effectively discuss the pricing of CoCos in terms of characteristics of the issuer, a concise framework to describe those characteristics in terms of CET1 ratio risk is needed. The approach outlined by Gupta et al. (2013) tries to capture all major risk factors affecting the CET1 ratio in three parameters: target, volatility, and resilience (mean reversion). To be able to capture risk with these three parameters that characterize a bank's CET1 ratio risk, Gupta et al. (2013) propose an approximation of the CET1 ratio as the simplest mean-reverting process that fluctuates around the target CET1 ratio.

A recent paper by Corcuera et al. (2013) uses an equity derivatives approach. In the paper Corcuera et al. (2013) looks at the issue of pricing CoCos under a smile conform model, where credit default swaps (CDS) quotes is used in addition for calibration of equity data. A key feature of this approach is that it goes beyond Black-Scholes modeling. This is performed by employing a smile conform model from the class of Lévy processes allowing for incorporation of fatter tails and jumps, contrasting it with the Black-Scholes setting (Corcuera et al., 2013). An argument for this approach put forward by the authors is that the payoff of CoCo instruments is very sensitive to tail risk; this makes Lévy models from a modeling perspective suitable to investigate price dynamics of CoCos. The CoCo bond is decomposed in a series of barrier-type derivatives to capture and model the effect of a trigger event, breaching of a barrier. In this study the triggering accounting ratio CT1 is replaced in a proxy model with an equivalent event where the stock price drops below a barrier, the reason for this is that CT1 cannot be observed continuously. The findings in the study suggest that this models developed better capture the intrinsic nature of these complex instruments (Corcuera et al., 2013).

Spiegeleer and Schoutens (2011) can be seen as the founders of both the equity derivatives model and the credit derivatives model for pricing CoCos. Spiegeleer and Schoutens (2011) argue for the different approaches from the perspective of the investor. A fixed income investor is interested in the extra yield required over the risk free rate in order to feel comfortable handling the associated risk. An equity investor on the other hand would view the instrument as a

long position in the potential acquired shares at conversion and a barrier option approach would be suitable to price the instrument. The credit derivatives approach is based on the reduced form approach which is used for modeling the default probability of the bond. In the reduced form approach the spread of the bond is connected to its expected default probability and loss given default. The credit spread is calculated using the default intensity factor times one minus the recovery rate. Wilkens and Bethke (2014) argue for a fundamental problem with the credit derivatives approach, pointing out that the non predetermined stream of future coupon payments that the investor in a CoCo loses at conversion is difficult to incorporate into the model. The model in their opinion gives a quasi closed form solution for pricing CoCos.

Wilkens and Bethke (2014) conclude that given the more straightforward approach in the equity derivatives model, they argue for this model to be best for practical implementation. The authors also evaluate the best model for hedging purposes, which can be seen as a strong quality indicator. The equity derivatives model also provides the best empirical result from this aspect. Wilkens and Bethke (2014) only consider a few of the currently issued CoCo and due to the limited time frame, so these results can only be seen as an early indication of the features of available pricing models. The above review of the different pricing approaches indicates that all are based on similar modeling of asset values, commonly used in pricing of other financial instruments, but differ in their application and specific choice of features.

3.2 Incentive problems

Koziol and Lawrenz (2012) wrote one of the first papers with a theoretical contribution that focuses on potential drawbacks of CoCos from distorted risk-taking incentives. The authors demonstrated that if considering incomplete contracts (manager-owners have discretion over banks investment risk), CoCos could potentially increase banks probability of financial distress. A more recent working paper by Berg and Kaserer (2014) discuss and analyze the effect of the conversion price of CoCo bonds on equity holders' incentives. Berg and Kaserer (2014) find that a majority of all existing CoCos are designed in a way that creates a wealth transfer from the holders of CoCo bonds to equity holders at conversion of the security. This highlights that CoCos can have an impact on banks' ex ante incentives. Berg and Kaserer (2014) use a set-up where conversion and default is triggered by the asset value as observed by regulatory authorities' falling below a predefined level. In this setting Berg and Kaserer's (2014) findings

indicate that under imperfect information both the asset substitution and the debt overhang problem becomes enlarged. Banks have an incentive to increase the opaqueness of their assets if the conversion price of CoCos is set too high (Berg and Kaserer, 2014).

The incentive effects of contingent convertible debt and incentives created by varying the two main design features, trigger level for conversion and the conversion ratio (dilution ratio at conversion), is analyzed in a working paper by Chen, Glasserman, Nouri and Pelger, (2013). CoCos that convert into equity is the focus and the authors examine how changes in the capital structure to include CoCos change the incentives for equity holders. Several interesting key findings are highlighted in this paper, one concerns the consequences of substituting straight debt with CoCos. Two opposite effects on firm value are identified, a reduced tax shield from CoCos (if coupon payments are not tax deductible) reduces firm value, but the effect of reduced default probability and reduced bankruptcy cost increases firm value. The net effect is increased firm value when CoCos replace straight debt. The reduction in bankruptcy risk increases debt value, this reduces rollover costs, which in turn increases the flow of dividends to equity holders (and hence equity value). Therefore equity holders have a positive incentive to issue CoCos. This effect combined with the desire to avoid dilution, can also lead equity holders to prefer less risky assets. Chen et al. (2013) also analyze the effect of increasing firm size by issuing CoCos while keeping other forms of debt fixed. In short, when the optimal default barrier is lower than the conversion trigger, the value of additional assets increases the distance to default and hence decreases the default risk. This increases the value of equity as decreased default risk reduces cost of rolling over straight debt. Chen et al. (2013) emphasizes that if coupons on CoCos is treated as tax deductible this increases equity value even further and lowers the cost of capital. Two other findings concern the debt overhang problem and asset substitution. Chen et al. (2013) finds that CoCos can mitigate the debt overhang problem by creating two incentives for new equity investment when the firm's asset value moves towards the trigger. If the CoCo holders receive a fixed number of shares at conversion, the value of issued equity to CoCo holders is largest at the trigger point, the incentive for shareholders to avoid conversion with additional equity infusion is then greatest above this point. Secondly, with tax deductible coupons for CoCos, it becomes optimal for shareholders to invest in the firm to maintain the valuable tax shield and avoid conversion. CoCos effect on asset substitution is identified as two fold according to Chen et al. (2013), firstly when CoCos reduce rollover costs of straight debt this can

result in incentives for equity holders to take on less risk especially when coupons are tax deductible. Secondly, because the cost of conversion for shareholders is lower if it occurs at a lower asset value, CoCos can create incentives for equity investor to increase exposure to tail-risk.

The paper by Hilscher and Raviv (2014) covers the effect of CoCos on risk taking and default probability. The findings by Hilscher and Raviv (2014) suggest that with carefully chosen parameters of CoCos (primarily conversion ratio) any motivation by shareholders to increase or decrease risk can be entirely eliminated. For a low conversion ratio (positive from existing shareholders point of view) shareholders have an incentive to increase asset risk. On the other side, a high conversion ratio leads to an incentive to reduce risk-taking. The findings of Hilscher and Raviv (2014) show that risk-taking incentives for a bank with appropriately designed CoCos are smaller compared to when CoCos are replaced with subordinated debt or additional equity in the capital structure. The authors also find that banks that issue contingent capital instead of subordinated debt are less likely to default. Risk shifting incentives for shareholder and managers of financial institutions that issues contingent convertible bonds is also the topic of Roggi, Giannozzi and Mibelli's (2013) research. Roggi et al. (2013) finds that a contingent convertible capital with a trigger based on Basel III capital ratios and a conversion price at significant discount minimizes risk shifting incentives to for both equity holders and firm management. The authors argue that their proposed design is adequate to minimize the negative impact on bank stability of a solvency crisis, but also indicates that their proposal could generate a *multiple equilibrium problem*.

Sundaresan and Wang (2010) is commonly cited as the first to have identified the *multiple equilibria problem* in CoCos with a market trigger. The multiplicity or absence of an equilibrium in contingent convertibles with a market trigger is a result of the use of a design aimed at a dilutive conversion ratio to induce incentives for bank managers and shareholders to issue equity before the trigger is breached. The authors find that in order to have a unique equilibrium a design with a market trigger and conversion ratio that produces no value transfer at conversion must be used. The *multiple equilibria problem* creates opposite motives for CoCo holders and equity holders, which can lead to manipulation of market prices when approaching the trigger level. Prescott (2011) also addresses this potential problem in the structure of CoCo bonds. Using

a trigger based on market price, Prescott (2011) argues that at conversion the value of equity also change leading to several equilibrium in the instrument. This would trigger conversion at times not desired and a possible solution suggested is to set the value of equity constant at conversion to create a single equilibrium.

The topic of incentive effects of contingent convertible capital instruments is also discussed in a paper by Himmelberg and Tsyplakov (2012). The main emphasizes of the paper is that CoCos if properly designed can create strong incentives for banks to pursue conservative capital structures (Himmelberg & Tsyplakov 2012). Himmelberg and Tsyplakov (2012) show that CoCos with dilutive conversion terms for pre-existing shareholders can mitigate the ex-post conflict between shareholders and bondholders commonly known as the debt overhang problem. It is worth highlighting one detail emphasized by Himmelberg and Tsyplakov (2012), which are the reversed incentive effects for CoCos with a write-down feature. Himmelberg and Tsyplakov (2012) argues that CoCos with a write-down principal can induce shareholders to "burn assets" to accelerate the trigger conversion and write-down of the principal to generate a windfall wealth transfer from bondholders. This suggests that these types of CoCos could actually magnify the debt overhang problem, and hence magnify the debt overhang related incentives that can result in risk shifting, underinvestment and higher social cost at default (Himmelberg & Tsyplakov, 2012).

3.3 Proposed developments and enhancements of CoCo instruments

As a way of understanding CoCos and potential pitfalls, and how the design and contractual structure affect the instrument, presented below is a summary of proposed development in academia.

In a working paper, Coffee (2010) proposes a mandatory change in the capital structure of systemically significant financial institutions. Coffee's (2010) proposal favor contingent capital and suggest a designed solution that addresses shareholder pressure as a key factor that leads issuing banks to take on excessive leverage. The contingent capital design outlined by Coffee (2010) has two significant characteristics that stand out. Firstly, a conversion ratio deliberately designed for diluting existing shareholders and protecting debt holders from a loss. Secondly, the

contingent capital security would convert into a fixed return preferred stock with cumulative arrearages and significant voting rights (Coffee, 2010). Coffee (2010) argues that interests of the after conversion preferred shareholders would be aligned with those of the bank's debt holders, since the new preferred shares would have no share in residual earnings of the firm and only limited return. The significant voting rights given to preferred stockholders would act as an offsetting effect of the voting power of the risk-tolerant common shareholders.

Pennacchi, Vermaelen and Wolff (2013) introduce and analyze a new form of contingent convertible bonds called Call Option Enhanced Reverse Convertible (COERC). COERC instruments are a variant of CoCos designed to address criticism of standard forms of CoCos. The design of COERCs introduces two main characteristics that distinguish them from other CoCos with market value triggers. Firstly, if automatic conversion is triggered (trigger based on a market value capital ratio) a large number of new shares would be issued to COERC holders and as a result existing shareholders of the bank would tend to be heavily diluted (Pennacchi et al., 2013). According to Pennacchi et al. (2013) the market value of the newly issued shares would likely exceed the bonds' par value (conversion price is set significantly below the trigger price), this would give the COERC holders a capital gain and existing shareholder a capital loss. The second main characteristic allows existing shareholder to avoid this dilution of their capital as they are given the right (option) to purchase the newly issued shares at an exercise price equal to the par value of the COERC bond (Pennacchi et al., 2013). With this structure COERCs are not loss absorbing instruments, but instead let equity holders "bail-out" debt holders, the design encourage banks to issue equity and repay debt in risk of financial distress (Pennacchi et al., 2013).

In a paper by Di Girolamo, Campolongo, De Spiegeleer and Schoutens (2012) the concept of a contingent conversion convertible bond ("CoCoCo") is introduced. The authors describe the new instrument as a more complex structure with a hybrid bond that is itself a combination of two hybrids, a convertible bond and a contingent convertible bond (CoCo). The CoCoCo contains the same automatic loss absorbing mechanism that through conversion, if the bank fails to meet a minimum capital level, recapitalizes the bank. The feature that distinguishes the CoCoCo bond is feature that gives the investor an optional conversion possibility (Di Girolamo et al., 2012). The CoCoCo investors can convert the bond into a pre-determined amount of shares in case of good

share price performance, this optional conversion into shares introduces a profitable upside for the holder of the CoCoCo in good states of the world (Di Girolamo et al., 2012).

In a paper by Corcuera, De Spiegeleer, Fajardo, Jönsson and Schoutens (2014) yet another new type of CoCo is introduced and analyzed. The new instrument is Coupon Cancellable CoCos ("CoCa CoCos"), the coupon cancellable feature allows for cancellation of coupons during the lifetime of the bond (Corcuera et al., 2014). By introducing cancellable coupons to the CoCo structure the authors address the undesirable so-called *death-spiral-effect* which equity conversion CoCos can suffer from. According to Corcuera et al. (2014) the *death-spiral-effect* can be induced by investors actively hedging the equity risk, unintentionally forcing the conversion by making the share price decrease and eventually trigger conversion of the CoCo. Adding the coupon cancellation to a typical CoCo with equity conversion allows for an automatic cancellation of coupon payments (one or several) before conversion (Corcuera et al, 2014). In this setting the coupon is paid only if a share price trigger process stays above a certain limit during the time period until maturity of the CoCo. Spiegeleer and Schoutens (2013) suggest another approach to mitigate the *death-spiral-effect* involving using multiple triggers. Issuing several CoCos with smaller size and individual triggers would create less sensitivity of change in equity price compared to one large issue since less money is linked to a specific event.

3.4 Market discipline

In instruments like CoCos and other SND, to be able to understand the underlying risk of such instruments the most important aspect is to analyze the risk of that the bank is not able to fulfill its obligations to investors. Previous research has looked at the information content of accounting variables closely related to the underlying riskiness of the banks compared to market based risk measures such as SND and CDS spreads.

The paper by Flannery and Ellis (1992) is considered a first generation study in the field of market discipline. They define market discipline as *"*[…] *the process by which informed market investors gather and evaluate information about a firm´s activities and prospects, and incorporate this information into its traded securities"* (Flannery & Ellis, 1992, p.1356). Their paper examine the relationship between the riskiness of US banks and the Certificate of Deposit (CD) rates, concluding that a significant default premium is paid and does not reflect market discipline. The study is among the first to analyze if the riskiness of the banks really is reflected

in spreads in the debt market. Similar to Gorton and Santomero (1989) both these studies finds indications but not significant evidence of market discipline in the debt market when looking at accounting based risk measures to subordinated debt spreads. Further, Gorton and Santomero (1989) also question the linearity assumption between subordinated debt and the banks risk, and use a contingent claims valuation approach of SND instead. Arguably regressing the spread of SND on risk indicators could in that sense give a false result.

Flannery and Sorescu (1996) study the subordinated debenture yields and accounting risk measures to find evidence of market discipline. They conclude that the market discipline among investors is more efficient in times of less regulatory guarantees for the banks, higher risk makes the investors more incentivized to account for non-market risk indicators. However no evidence of market discipline was significantly proven in this study. These findings are interesting for our study since the recent crisis (GFC) and the development of CoCos are closely linked to the effort among government to become less tied to "too big to fail" banks. The effectiveness of market discipline in this sense could arguably have become more efficient after the crisis when a increase number of governments introduce non-bailout policies (less regulatory discipline).

Covitz et al. (2004) takes the debate of regulatory effect further and evaluate previous studies in the field to see if their arguments hold. One interesting aspect of this paper is that the correlation of accounting risk measures and subordinated bond prices was quite weak before 1989. This has been recognized in previous studies, but Covitz et al. (2004) conclude that the SND investors had some sensitivity before 1989 but became increasingly sensitive after that year since a deposit insurance were implemented in the US by the FDIC. Similar to Flannery and Sorescu (1996) this effect is explained by the regulation in the US. In the late 1980s, bank regulators made it clear to subordinated debt holders that they would not be fully protected in times of distress. This led to an increased relationship between SND yields and the riskiness of the banks. Further, Covitz et al. (2004) conclude that the market discipline is significant in the US market, and with a decrease in implicit guarantees follows an increase of the risk sensitivity from investors to accounting risk indicators. Sironi (2003) similarly finds that SND investors are sensitive to the riskiness of the issuing bank. More sensitive in the later part of the 90s following a decrease in too big to fail guarantees. Sironi (2003) also found that public sector banks differ from private sector banks, since publicly (government owned or guaranteed institutions) have more protection and hence

market discipline is less apparent. This paper use data from the European market which is useful as a reference for our study.

Krishnan, Ritchken and Thomson (2005) evaluates if issuing risky debt enhances the monitoring of risks and increases the risk control in the bank. Intuitively, if the markets price of the debt issued reflects the underlying risk factors in the firm (market discipline), the incentive for banks to take on excessive risk would hurt them through increasing cost of capital. Krishnan et al. (2005) argue that bank specific information such as accounting risk indicators is highly relevant for CDS spreads, but considering the measurement points in time, quarterly changes only have a weak relationship with changes in the CDS spread since including much noise from the market. This study uses CDS spreads as the dependent variable, nevertheless its findings could be important to consider for our study since more observations not always add additional explanatory power.

So far most of the previous work in this area of research reflects that in recent years more evidence of market discipline has been proven to be significant by using SND spreads. Forssbæck (2011) argue that pure accounting based or market based risk measures is not optimal for measuring bank risks. Forssbæck (2011) argue for accounting based risk measures to be considered superior to market measures in finding the actual riskiness of the bank. However, the market based variables could have a complementary role in explaining the risk, and therefore a mix of accounting and market measures could be optimal. Gropp et.al, (2006) finds similar results when examining ratings of banks, concluding that market and accounting measures have a complementary effect.

Many of the studies related to the concept of market discipline uses SND or CDS spreads/prices and does not cover CoCos, which is the instrument that is the focus of this paper. However the underlying characteristics of CoCos and other SNDs is quite similar since both are built as a bond, the only difference is the forced loss absorption ability using equity conversion or write down in CoCos, which is not used in SNDs or other hybrid instruments. Further, with the previous research in the area we would like to present the transition of non-correlation to significant correlation of accounting based indicators of risk to market traded instruments such as SND and CDS spreads. If the spread of CoCos is considered to be similar to SNDs in non-

distress times, a natural step is to use a similar approach as these past studies using SNDs, and evaluate the explanatory variables behind the movement of the spread of CoCos.

The articles discussed above use different models and variables to test for market discipline, on the next page in table 3.1 a summary is presented to provide a better understanding of how these test were performed. The table includes a range of articles taking similar approaches to investigate if evidence of market discipline can be observed in SND spreads.

Table 3.1 Summary of methods in previous research testing for market discipline

Author	**Name of article**	**Summary**	***Explanatory variables***	***Control variables***	***Model to test-***	***Modifications***	***R-square***
Flannery and Soresco (1996)	Evidence of Bank Market Discipline in Subordinated Debenture Yields: 1983-1991	Test debenture yields during 83-91. Not significant results but strong indication of market discipline	Nonaccrual loans to total asset, accruing loans past due 90 days or more to total assets, other real estate/ total assets. D/E (market value of equity)	LN(TA), Year dummy	Panel regression with period fixed effects	Own calculation of spread and compare it to actual spreads. address the problem of nonlinearity but not mitigated.	R-square of 0.465 using only accounting risk indicators
DeYoung et al. (2001)	The Information Content of Bank Exam Ratings and Subordinated Debt Prices	Supervisor exams add additional information about risks. (regulatory vs market discipline)	Vector of financial information, private insider information, lagged spread	Quarterly dummy, LN(TA), ROA, D/E (book value).non accruing loans/TA , loans past due ninety days+/TA. other real estate/TA	Ordered logit regression.	Spread calculated as in Flannery and Sorescu 1996. Also use fixed effects.	Adjusted R-square of 0.834 using spread (t+1)
Jagtiani et al. (2002)	The effect of credit risk on bank and bank holding company bond yields: Evidence from the post-FDICIA period.	Issuing subordinated debt can enhance market monitoring. Examine the post FDICIA period.	Leverage, Non performing loans, ROA, insured deposits to total deposits at banks,	LN TA, Issuer dummy	Panel regression with control of non linearity and alternative risk measures.	Scale variables to account for capture any nonlinear risk relations, Alternative interactive specifications are estimated.	R-square of 0.6 using accounting risk measures.
Sironi (2003)	Testing for Market Discipline in the European Banking Industry: Evidence from Subordinated Debt Issues	Support evidence of market discipline in European market, related to regulatory environment.	D/E (book value), ROA , net loans /TA , equity investments/TA, liquid assets to customers' deposits and short term funding, loan loss reserves to total loans	Maturity, year, amount, country, Currency, Public or private, Total assets.	Panel regression (linear)	Include interactive term to capture nonlinearity	R-square of 0.675 for accounting variables alone.

Covitz et al. (2004)	A Reconsideration of the Risk Sensitivity of U.S. Banking Organization Subordinated Debt Spreads: A Sample Selection Approach	Test previous studies in market discipline to see if their arguments hold. Comparing time spans and argues for evidence of market discipline in less regulatory times.	Non Accruing loans/TA, accruing loans past due ninety days+/TA, real estate/TA , Callable, maturity with range, coupon frequency, issue size	LN assets, issue size	OLS with the spread calculated with Newton-Ralphson iterative method	Wald, heckman test with mills ratio to address selection problem	R-square of 0.31 for post-FDICIA sample
Krishnan et al. (2005)	Monitoring and Controlling Bank Risk: Does Risky Debt Help?	Use three factor model to construct credit-spread curves , look at risk monitoring for both banks and nonbanks without clear evidence of market discipline since noise in market data.	Firms specific (ROA, Loan assets, Non performing loans, Net charge offs, Leverage), Market variables. (Growth rate in industrial production, S&P buy and hold return CRSP Decreases 5-year Treasury yields, Slope of yield curve (10 year minus 2 year), VIX), Liquidity variables. (Relative trade frequency, TED spread, New issue, Relative trade size)	Buy and hold stock returns, BOPEC ratings for BHCs, CAMEL ratings for banks,	Panel regression, three factor model and own calculations.	Three factor model, forecasts with ordered logit regression models	R-square of around 0.4 for risk indicators
Gropp et al. (2006)	Equity and Bond Market Signals as Leading Indicators of Bank Fragility	Predict default (market/bond signals to rating)	using the percentile ranking of capital, problem loans, cost/income and ROE to form a score	Ratings from rating agencies.	Logit model	Hazard estimation	Pseudo R-square 0.49.

3.5 Risk indicators

Commonly used variables in measurement of bank risks can be divided into two main categories, accounting-based and market-based risk indicators. The accounting risk indicators that are most common, and presented in several of the previously reviewed articles, are:

ROA (Return on assets) (see, e.g., DeYoung et al., 2001; Flannery & Sorescu, 1996; Gropp et al., 2006; Sironi, 2003)
Leverage (D/E) (see, e.g., Covitz et al., 2004; DeYoung et al., 2001; Flannery & Sorescu, 1996; Gropp et al., 2006; Sironi, 2003)
Non-Performing loans (Non-performing loans/total assets) (see, e.g., Covitz et al., 2004; DeYoung et al., 2001; Flannery & Sorescu, 1996; Gorton & Santomero, 1989; Gropp et al., 2006; Sironi, 2003)

Table 3.2 Accounting and market based risk indicators

Market-based risk indicators		Accounting-based risk indicators
	Capital-structure-based	
Equity return volatility (various definitions)		Leverage, or capital ratio (various definitions, e.g. equity/total assets, liabilities/market or book value of equity).
Equity return volatility		
Abnormal equity returns (market model)		Debt or deposit structure
Beta (CAPM or market model)		
Other, equity-based	*Loan- or asset-structure-based*	
		Non-performing loans or similar (non-accruing
Primary-market spreads on subordinated notes and bonds		loans, loans past due, etc)/total assets
		Loan-loss provisions or loan-loss reserves/total
Secondary-market spreads on subordinated notes and bonds Interest rate spreads on large certificates of deposit (CDs)		loans or total assets
		Other, loan structured
Other, debt-based		Non-loan asset structure
	Profitability-based	
		Return on assets
		Earnings volatility
		Other, accounting-based

(Forssbaeck 2011, p 55)

Since our approach is to analyze a new kind of debt-based market risk indicator we are interested in seeing if some of the changes in accounting based risk measures is reflected in the spread, arguably indicating evidence of market discipline. As outlined in the Table 3.2, it is most common to use leverage, non-performing loans or a similar measure, and return on assets or earning volatility, as traditional accounting based risk indicators. Rating agencies such as Moody's use similar measures in the section of financial fundamentals to provide a credit rating on global banks (Bauer et al., 2013) Moody's also includes measures related to the banks risk weighted assets (RWA) and measures on the Tier 1 ratio. Arguably, these measures can add additional information since the structure of the CoCo is closely related to the Basel framework and its risk measures. In addition, Covitz et al. (2004) examines the explanatory variables behind the SND spread for large US banks during 1985-2002, and as inputs to the regression the bond specific features are used as independent variables. Our paper could arguably use a similar approach, since the structure of CoCos issued to this date is quite issue specific and therefore it could be difficult to recalculate each issue to make them comparable.

DeYoung et al. (2001) explain the CAMEL-framework, which is a common concept when evaluating the risk of banks by regulatory agencies in the US. CAMEL stands for: Capital Adequacy, Asset quality, Management, Earnings and Liquidity. This framework gives a rating from 1 to 5, with 1 indicating strong performance and practices, and 5 critically deficient performances. This is a rating reflecting both public information and private on site information received by the regulatory supervisor. In most corporate finance studies a common problem is to measure the role of management for example for the riskiness of banks. The aspects of the CAMEL framework and non-financial risk measures used by rating agencies, is important to consider when it comes to choosing the explanatory variables for the spread in the CoCo issues. Forssbæck (2011) also addresses this aspect and call it the *unobservability problem*, which is important to remember as a limitation for all studies in this field since it makes it difficult to generalize the result as evidence of market discipline. Having these concepts and previous research in mind, to address the wide variety in the characteristics of the issues and also the main underlying risk indicators commonly used for closely related instruments such as SNDs, a combination of explanatory variables are relevant to use. This approach would investigate if the investors in CoCos are primarily interested in the quality of the assets of the underlying bank, or more concerned about contract specific details.

As presented in the theoretical background and previous literature of CoCos, CoCos are still in the stage of development with no standardization in pricing models, and articles with new modifications are presented regularly discussing how to mitigate some of the pitfalls in the original structure. However, the original features of CoCos have some items that always will be a part of each instrument, such as the regulatory capital treatment (Additional Tier 1 or Tier 2), if the loss absorption mechanism is conversion into equity in distressed times or if the principal will be written down. Further, the issue specification express if the CoCo is callable at the issuers' discretion, type and frequency of the coupons, and if the bond has a maturity date or is perpetual. Lastly all these instruments need to include a trigger level or a description if the trigger is to be set by the local regulatory agencies. All these features are included in the prospectus of the issues, and to be able to compare them in a good way these need to be included as explanatory variables in a regression. Previous studies covering market discipline use the spread, that is yield to maturity (YTM) minus the yield of a comparable government bond, instead of the observed price of the instrument, and compare these to different risk indicators. Our empirical study takes a similar stand and uses the spread of issued CoCos as the observed market-based variable. The foundation of our empirical research is to evaluate if evidence of market discipline through analysis of spreads of CoCo bonds. Market discipline is our main theory, however an understanding of previous research within the field of CoCos is vital to be able to understand the structure of the instruments, and the main characteristics reflected in different pricing approaches, but also potential incentives problems that could distort a fair market price.

Overall, this framework leads to the development of the hypotheses that will be the key of our empirical investigation. Since no standardization in the contracts are present, the hypotheses will be constructed to both, investigate the possibility of evidence of market discipline using accounting risk indicators, and considering issue specific features of the instruments influence on market spreads for the instruments. Arguably, a change in risk indicators could have more or less impact on the spread of issued CoCos depending on contract specific details.

3.6 Hypotheses

From the literature review and theoretical background of both CoCos and market discipline, we construct the following hypotheses.

First hypothesis:

The first hypothesis will test if return on assets (ROA) has a significant correlation with the spread of CoCos. Along with an increase in the profitability of the bank, a decrease in spread could be expected since the risk is decreasing.

H_0 - Return on assets do not have a significant correlation to the spread of CoCos.

H_1 - Return on assets have a significant correlation to the spread of CoCos.

Second hypothesis:

The second hypothesis will test if non-performing loans to total assets has a significant correlation with the spread of CoCos. Higher non-performing loans are expected to increase the risk of default and with that an increased spread.

H_0 - Non-performing loans to total assets do not have a significant correlation to the spread of CoCos.

H_1 - Non-performing loans to total assets have a significant correlation to the spread of CoCos.

Third hypothesis:

The third hypothesis will test if a significant correlation can be found between leverage (D/E) and the spread of CoCos. Change in leverage could be either positive or negative depending on the individual banks business profile. Higher leverage is not always interpreted as a negative indication.

H_0 - Leverage (D/E) do not have a significant correlation to the spread of CoCos.

H_1 - Leverage (D/E) have a significant correlation to the spread of CoCos.

Fourth hypothesis:

The fourth hypothesis will test if the Tier 1 ratio has a significant correlation with the spread of CoCos. Higher Tier 1 ratio signals lower risk and arguably could result in a decreased spread. The trigger is usually linked to this type of capital ratio.

H_0 - The Tier 1 ratio have not a significant correlation to the spread of CoCos.

H_1 - The Tier 1 ratio have a significant correlation to the spread of CoCos.

Fifth hypothesis:

The fifth hypothesis will test if any of the contracts specific variables; regulatory treatment, callability, trigger level, perpetual, coupon frequency, coupon type and loss absorption mechanism have a significant effect on the spread of the CoCos.

H_0 – None of the contracts specific variables have a significant correlation to the spread of CoCos.

H_1 – At least one the contracts specific variables have a significant correlation to the spread of CoCos.

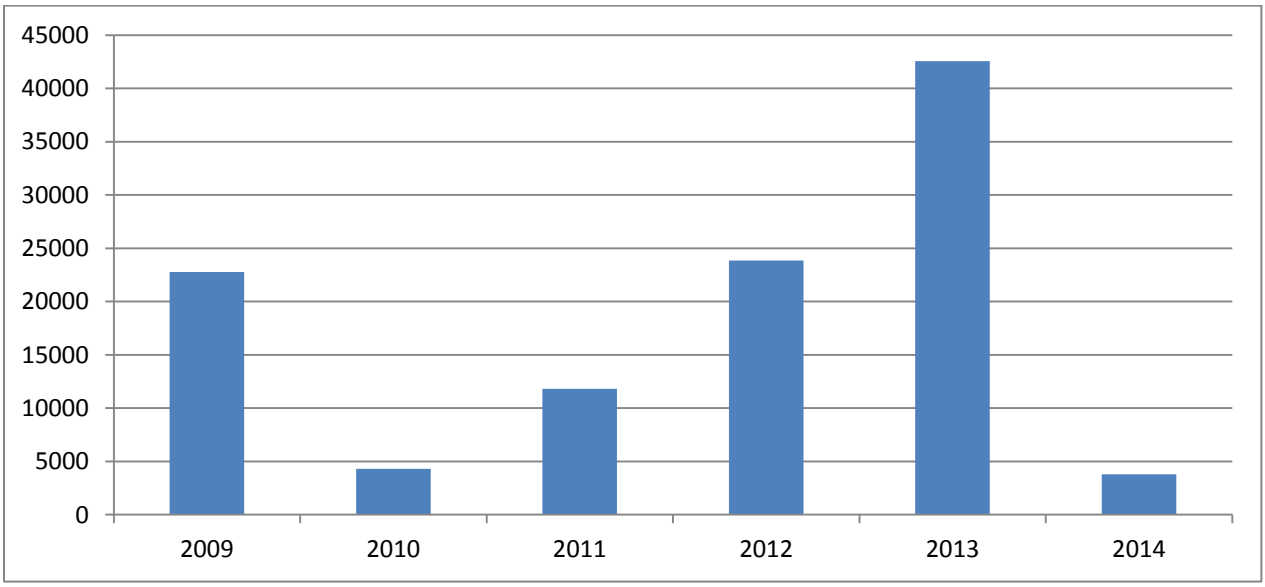
4. Method and Data

The chapter will start with a description of CoCo issues to date and we will continue by presenting our sample and discuss the data collection process and its limitations. Further, the methods used to test our hypotheses will be presented and potential modifications discussed.

4.1 CoCo issuance to date

The CoCo market is still relatively small compared to other SND, however fast growing when considering the last few years issuance. All the numbers below are based on our collected data reaching to end of January 2014. The sample contains 118 issues which is the entire sample before limitations for non-banks and missing values. Since 2009, $ 109 billion worth of CoCos have been issued. (Calculations based on the exchange rate for each issue at 2014-01-01, see appendix 5).

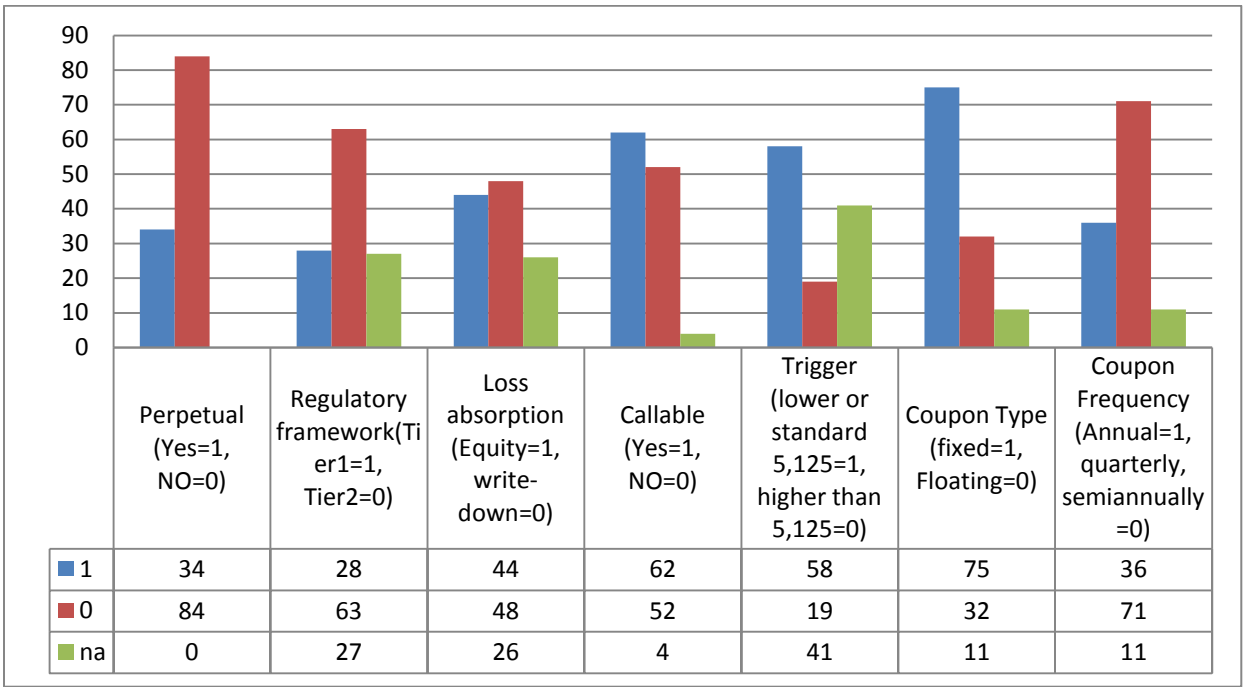
Figure 4.1 Issued CoCos in million USD



As shown in the figure above, the increasing volume of issuance of this instrument is quite substantial. The entire amount in 2009 consists of the issued CoCos by Lloyds in the middle of the financial crisis. Further, the following years displays a significant increase starting with approximately $5 billion in 2010 and last year the issued amount reached $40 billion. All the exchange rates are from the first day of 2014, so the numbers reflect the issue value in early

2014, however this explains the interest and potential bright future of this product following the last years development. (See appendix 1 for more detailed information.)

Figure 4.2 CoCo features constructed as dummy variables

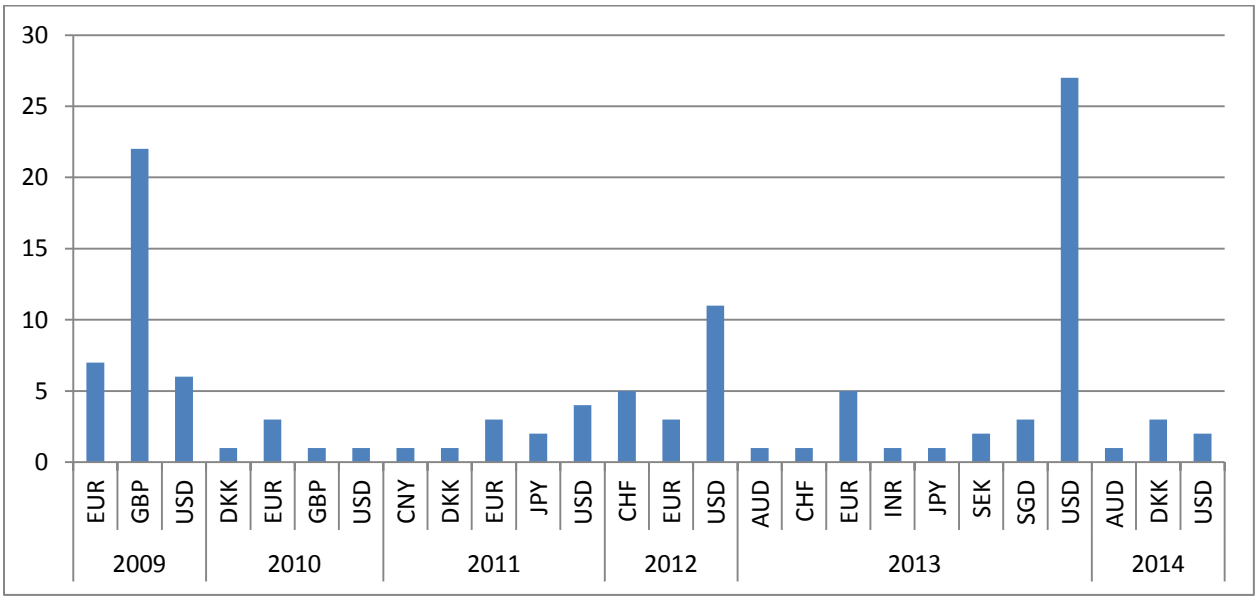


	Perpetual (Yes=1, NO=0)	Regulatory framework(Tier1=1, Tier2=0)	Loss absorption (Equity=1, write-down=0)	Callable (Yes=1, NO=0)	Trigger (lower or standard 5,125=1, higher than 5,125=0)	Coupon Type (fixed=1, Floating=0)	Coupon Frequency (Annual=1, quarterly, semiannually =0)
1	34	28	44	62	58	75	36
0	84	63	48	52	19	32	71
na	0	27	26	4	41	11	11

The figure above describes the contract features of the issued CoCos covered in this paper. Key trends in this data are that a majority of issues are not perpetual, and have trigger that is the typical 5.125% or lower. Further, a majority of the issued CoCo instruments have one or several of the following characteristics, issued under Tier 2, a fixed coupon type and quarterly or semiannually coupon payments. Due to the lack of standardization of the contracts the information of specific issue details was difficult to collect, most clearly noticeable in the missing information on the trigger level.

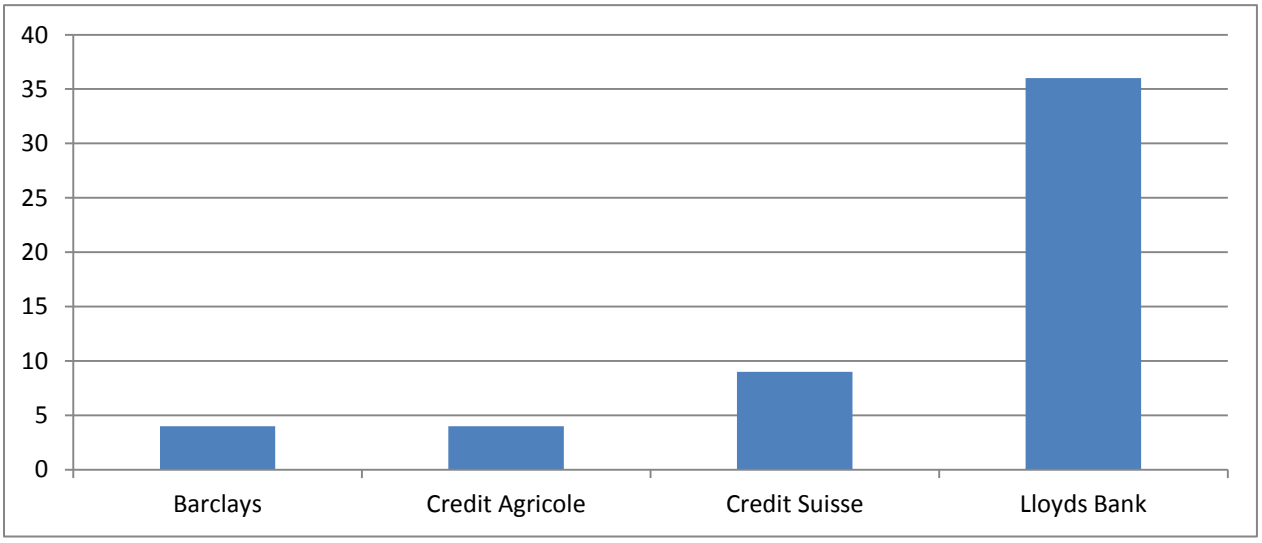
A recent trend however is to set the trigger level at 5.125% and use loss absorption through write-downs. This has become more popular since the demand for these instrument characteristics is high, since institutional investors seeking yield without the desire to become shareholders. In many cases fixed income investors are prevented by their investment mandate to hold securities that convert into equity. (See appendix 2 for more detailed information.)

Figure 4.3 Issuance currency during 2009Q1-2014Q1



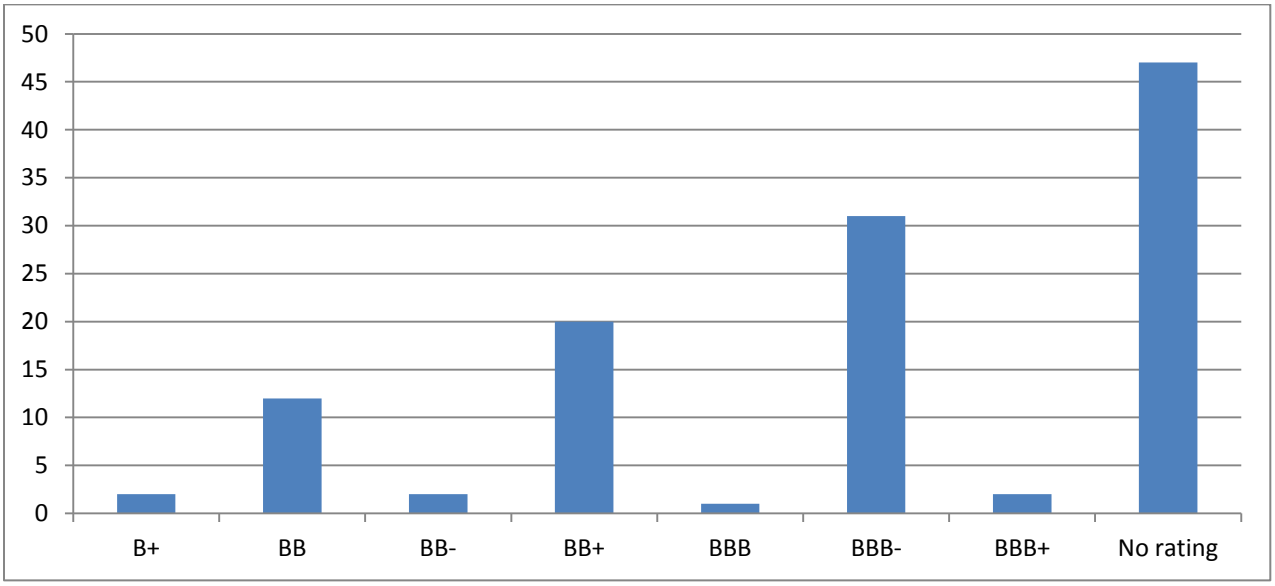
The currency denomination of the issued bonds varies among the issues, with a majority in USD, EUR and GBP. The instruments issued by Lloyds in 2009 was primarily in GBP, with the rest almost equally distributed between USD and EUR. Looking at the yearly development, a trend seems to be an increase in EUR and USD denominated issues, which is expected with regard to their leading position among global currencies. (See appendix 1 for more detailed information.)

Figure 4.4 Number of issues by firm



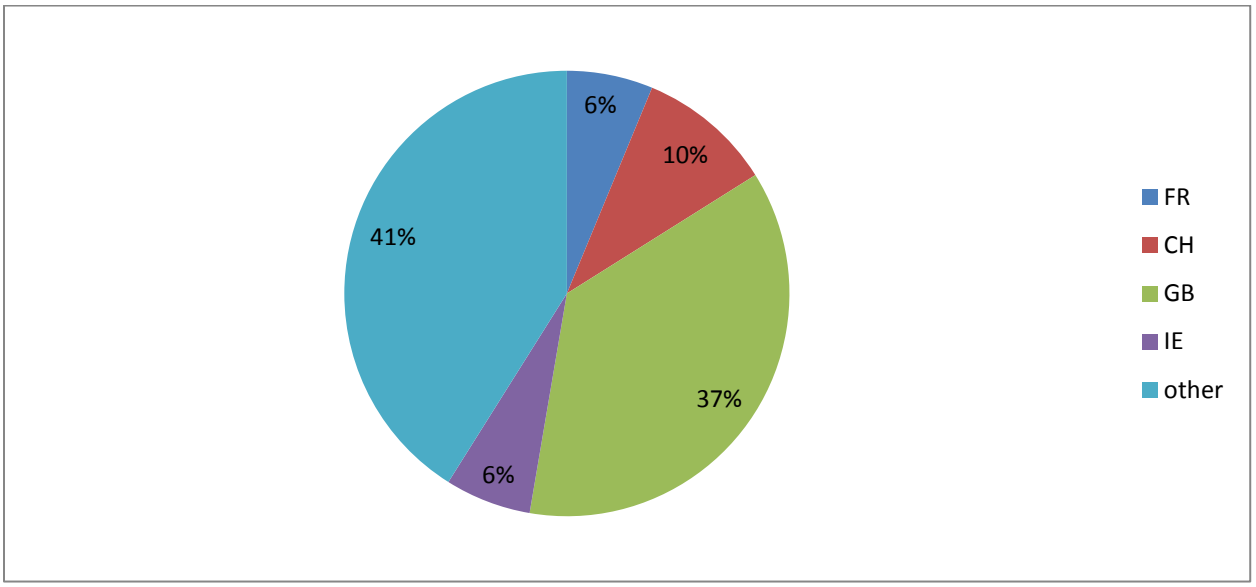
The issued CoCos come from 49 different firms with Lloyds accountable for the most amount of issues. However since 2009 Lloyds have not issued any more instruments and the market is quite diversified with a large number of different firms. Other firms in the top in number of issued CoCos are, Barclays, Credit Agricole and Credit Suisse with 4, 4 and 9 issues respectively. All firms are available in appendix 1.

Figure 4.5 Rating on issued CoCos



In our sample, 71 of 118 issues have a assigned rating by S&P, with a majority being rated BBB-. The figure above present the interval of the rated CoCos so far, however since the instrument was first introduced in 2009, and due to a complex structure, rating agencies have expressed concerns about how to give a fair rating of the product (Bauer et al., 2013). (See appendix 1 for more detailed information.)

Figure 4.6 Issues by country



Presented above is the issuer's domicile indicating a clear majority of firms from Great Britain (GB), with 37% of the issues to date. This number is influenced by the large portion of issues by Lloyds in 2009. Further, Ireland (IE), France (FR) and Switzerland (CH) represent 22% of the issues. The geographical diversification of the other firms (41%) is well spread out with the remaining firms standing for 1 to 5% of the issues each (See appendix 1 for more detailed information.)

4.2 Sample and selection procedure

The initial search for issued contingent convertible capital instruments was performed through the websites AllonHybrids (2014) and ContingentConvertibles (2014) and in previous research papers. The first website is managed by Schoutens which together with De Spiegeleer are one of the most frequent authors of academic research articles covering CoCos. The other website is managed by a CFA charter holder with expertise in contingent convertibles and that is associated with Dollarhane, a private asset management firm located in London. These sources were a necessity, since no index for CoCos could be found in the financial databases Thomson Reuters Eikon, S&P Capital IQ and Thomson Reuters DataStream. According to an article from January 17, 2014 (Durand, 2014), Bank of America Merrill Lynch is in the process of creating a Contingent Capital Index with the ticker COCO. The index contains 48 bonds, including only

securities rated by Moody's, S&P or Fitch with a capital dependent conversion feature. The article indicates that this is the first index to track performance of all publicly issued contingent capital. Screening in Eikon under the asset class convertible fixed income bonds provided a list called "Tier 1 CoCos", including 52 issues. Screening in Capital IQ and DataStream indicated that CoCos can show up under categories such as hybrid capital, convertible bonds, corporate debenture or preferred stock. This aggravated the screening process for issued CoCos. The sources above provided an indicative sample of 118 issued CoCos since the introduction by Lloyds in 2009. The definition of CoCos or CoCo bonds vary in previous empirical research, in some cases researchers only considers equity conversion CoCos ("traditional" CoCos) as being eligible for inclusion in the sample to be researched. In this paper the choice was made to include all available CoCos irrespectively of the loss absorption mechanism, including both equity conversation and principal write-down instruments. The primary reason for not initially excluding either write-down or equity conversion CoCos, is simply the limited data availability due to the relatively young market for these financial instruments. Through this first search process all ISIN numbers for the issued instruments was obtained. With the individual ISIN numbers at hand information about specific issuer could be collected. The sample contains 49 unique issuers, including banks, insurance companies, reinsurance companies and a building society. CoCos issued by non-banks were then excluded from the sample, to avoid distortion by industry specific differences in both issuers and the issued CoCos. This is in line with Avdjiev et al. (2013), who use a similar delimitation when testing the correlation between CoCos spreads, CDS and subordinated debt spreads. After the exclusion of non-bank issuers, 41 unique issuers are left in the sample. The sample quarters are 2009-Q1 to 2014-Q1, limited by the possibility to obtain reported accounting risk indicators for the individual banks. Appendix 1 provides more detailed information about the sample (issued CoCos, unique issuers, ISIN number).

Since no clear regulatory framework have been established in the US to handle these instrument the sample contains mostly European banks and some banks from South America and Asia. The data sample is the same as presented in 4.1, except the exclusion of the non-bank firms. (See appendix 1.)

4.3 Data collection

The initial search for issued CoCos, as described above, involved collection of issue-specific ISIN numbers to enable further search for public prospectus for each issued CoCo instrument. By using the ISIN number, searches in the financial databases Thomson Reuters Eikon, S&P Capital IQ and Thomson Reuters DataStream generated pdf-files with detailed public prospectus for the majority of all CoCos. In some cases prospectus and issue details had to be obtained through the issuers website or other publicly available sources. The more cumbersome part of the data collection process involved screening for issue details in individual prospectus, to obtain variables characterizing different aspects of the CoCo instruments. Bank-specific (issuer) data collection was performed through primarily S&P Capital IQ, and if needed, complementary information from publicly available company reports was obtained. The following section describes the variables used in the analysis, explains some of them in more detail and develops the data collection process further.

4.4 Data

Accounting risk indicators that have been used in similar studies on other subordinated debt will be used in this paper as well. The most frequent measures, as discussed previously, are ROA, leverage and non-performing loans, to describe the risk of individual banks (see e.g. Covitz et al., 2004; DeYoung et al., 2001; Flannery & Sorescu, 1996; Gorton & Santomero, 1989; Gropp et al., 2006; Sironi, 2003). These are the core variables that will be used in this paper to find evidence of market discipline. Furthermore, since CoCos is regulated in the Basel III framework, either the Tier 1 and Core Tier 1 ratio will be included as explanatory variables. As mentioned before these ratios are also used by rating agencies in their assessment of banks in assigning a credit rating for global banks. The issue specific variables are based on the previous theoretical framework describing the core features of CoCos both in aspects of pricing and dynamics of the structure. Krishnan et al. (2005) argue for the use of yearly observations since the underlying risk indicators shows limited change between quarters. However, our time frame cover a period of financial turbulence and due to indication of significant changes between quarters in the sample, quarterly measurement points are used for all data.

4.4.1 Accounting variables

Leverage (*LEV*) – Total book value of liabilities over book value of equity, all of the firms are not public so market values of equity will not be used. The information was collected using S&P Capital IQ with quarterly measurements. We manually calculated the ratio using total liabilities over total equity since the ratio could not be retrieved directly from the software.

Return on assets (*ROA*) – Net income over total assets expressed in percentages. Data collected using S&P Capital IQ with the return directly available so no additional calculations were performed.

Non-performing loans ratio (*NON PERF LOANS*) - Non-performing loans over total assets expressed in percentages. Data collected using S&P Capital IQ with a predefined ratio available.

Tier 1 ratio (*TIER1*) - The Tier 1 Capital Ratio represents Tier 1 Capital as a percentage of Total Risk-Weighted Assets of the Bank. Data from S&P Capital IQ.

Core Tier 1 ratio (*CTIER1*) - Core Tier 1 Capital Ratio is expressed as a percentage of Core Tier 1 capital over risk-weighted assets (RWA).

(See appendix 6 for the definitions in S&P Capital IQ of the collected variables.)

4.4.2 Issue specific variables

Regarding the contract specific variables, they will also be included as explanatory (dummy) variables. We have chosen to use the following:

Loss absorption (*LOSS ABSORPTION*) – 1 if equity conversion, 0 if write down (fully or partly). Data collected from each individual prospectus.

Trigger level (*TRIGGER LEVEL*) – 1 if equal or lower than 5.125% (more widely used after changes in the Basel accords), 0 if higher trigger level than 5.125%. Data collected from each individual prospectus.

Coupon frequency (***COUPON FREQ*)**– 1 if Annual, 0 if semiannual or quarterly. Data collected using Reuter Eikon with searches by ISIN number for each issue.

Callable (***CALLABLE Y/N*)**– Do the issuer have the ability to redeem before maturity. 1 if YES, 0 if NO. Data collected using Reuter Eikon with searches by ISIN number for each issue.

Perpetual (***PERPETUAL Y/N***)– Does the instrument have a predefined maturity date or not. 1 if YES, 0 if NO. Data collected using Reuter Eikon with searches in ISIN number for each issue.

Regulatory treatment ***(REGT AT1ORT2)*** – 1 if treated as Tier 1, 0 of treated as Tier 2 capital. Data collected from each individual prospectus.

Coupon type (***COUPON TYPE***) - 1 if fixed coupon or "Floating: fixed then floating", 0 if floating or defined as Variable: Step Up/Step down in Eikon. Data collected using Reuter Eikon with searches by ISIN number for each issue.

4.4.3 Control variables

Since some of the effect of the spread and risk measures can be due to the size of the firms and the seasonal effects from year to year, a number of control variables will be used in order to correct for some of these variations. Flannery and Sorescu (1996) use both the natural logarithm of total assets and years as control variables. Sironi (2003) use maturity, year, amount, country, public or private, and total assets as control variables. Following these past studies, a number of suitable control variables are presented below.

LN Total assets ***(LN TA)*** - Natural logarithm of total assets. Larger firms can be considered more safe. Since the accounting variables are presented in the issuers local currency, total assets needs to be converted into a default currency in order to make them comparable. We have chosen to use EUR as the default currency since most of the issuers use EUR in their accounting statements. Data from S&P capital IQ choosing EUR instead of local currency before downloading the data.

LN Return on share price ***(LN RETURN)*** - Natural logarithm of market share price returns collected from each bank when available and then recalculated using quarterly changes. Forssbæck (2011) argue for market indicators as a complementary measures of the banks risk. Further, this variable will be included to address possible interests from investors to follow the share price movement since several issues has an equity conversion feature. Each measured in local currency and data collected using Reuters datastream.

LN Issue size ***(LN ISSUE SIZE)*** - Natural logarithm of the issued size. All issues recalculated to EUR using 2014-01-01 exchange rate. FX Data collected from Datastream. (See appendix 5 for all datastream codes for each exchange rate).

Public or private (***PUBLIC OR PRIVATE Y/N)*** **-** 1 if stock price available (Public), 0 if not (Private)

Year – Changes in for example regulation between the years could affect the spreads. By using period fixed effect in Eviews the dummies for each year will be constructed in the software and not manual designed. Arguably the change between years can be affected of a change in the overall riskiness of the business environment for banks, by introduction a fixed effect on the time dimension macro fluctuations will not distort the results and the measurement will be based on the change for firms specific risk measures and the differences in features of the issues.

4.4.4 Spread

CoCo Spread (*COCO SPREAD*) - The yield of the issued CoCos was collected using both Reuters Eikon and S&P Capital IQ since these software had complementary information on the issues. The collected data from Eikon covered the yield of some of the instruments. Using Capital IQ the yield was expressed as "yield to worst" meaning that the lowest yield when comparing both puts and calls and yield to maturity is picked and represent the lowest possible yield that an investor will realize (CFA Institute, 2013, p.503). Each of the yields corresponds to the yield at the end day of each quarter, last March, June, September and December each year. This is a conservative yield however no other data was available and compared to some of the "actual" yields from Eikon, these only differed marginally.

The data for yield to maturity are collected from the secondary market. Potentially, poor liquidity of the secondary market for CoCos could have an effect on spreads. The spread of illiquid instrument could change differently due to the low trading volume, and hence not correspond to the actual change in other explanatory variables. Sironi (2003) emphasize the use of primary market spreads over secondary market, as they can be a more accurate measure of the actual cost of debt for the issuer and of the premiums demanded by issuers. However, in this case we are left to use data from the secondary markets as it is the available source for us.

Since the spread corresponds to the yield of the issue minus a comparable government bond in terms of maturity, some bond yields was collected using Datastream. Sironi (2003) argue for the use of government bonds corresponding to the currency of the issue. Following this approach, 10 year bonds from Denmark, Euro area, Japan, Switzerland, UK, and US was collected and compared to the currency in with the CoCos was issued to determine the spread. An example, an

issue in EUR would use the yield minus the redemption yield from a Euro zone bond for each quarter to determine the spread. The redemption yield is similar to the YTM measure but also include the gain/loss at maturity realize (CFA Institute, 2013, p.505). Some of the currencies lack suitable government bonds in this case the US redemption yield was used as a benchmark.

4.5 Methods to test hypotheses

Many previous studies have focused on testing the correlation between SND spreads and accounting risk indicators (Gorton & Santomero 1989, Flannery & Sorescu 1996, Gropp et al., 2006, Sironi, 2003, Covitz et al., 2004, DeYoung et al., 2001). Since no studies have been testing this with CoCos we will take a similar approach and regress the chosen accounting variables and contract specific variables on the spread of the CoCos. Since the underlying structure of the CoCo is similar to SNDs and other hybrids, we assume a linear relationship on all variables. Previous studies has however been expressing concerns about the assumption of linearity among SNDs and banks risk (Gorton & Santomero, 1989), so this is also something that need to be tested in order to determine the best model to use.

The panel regression will be constructed as follows:

$$COCOSPREAD_{it} = f(X_{it}, Y_{it}, Z_{it}) + \varepsilon_{it}$$

Where,

$COCOSPREAD_{it}$ = The difference between the CoCo yield of maturity or yield to worst and the yield of a similar treasury security related to the issuance currency.

X_{it} = Accounting measures of bank risks

Y_{it} = Issue specific variables related to the structure of the instruments

Z_{it} = Control variables affecting banks CoCo spread

Panel data has the advantages of being more informative than cross sectional data or time series data individually that only captures either the variation across firms or years. In panel data both time and cross section information can be captured. By fixing the time dimension it is possible to

control for heterogeneity and by fixing the parameters in time across CSUs it is possible to control for time-specific variation. Arguably the panel data allows for an increased number of measurement points with more variation, and it helps to mitigate some of the collinearity problems otherwise present between firms or/and time (Brooks, 2008, pp. 487-494).

Addressing the concern about non-linearity among variables, additional robustness tests of the data was performed. This test was performed following previous articles addressing this problem for SND. Sironi (2003) use the product of ROA and Leverage, and also use the product of loan loss reserves and Leverage. Jagtiani et al. (2002) scale all the risk indicators by leverage to control for non-linearity. Similar to these studies we will use the product of ROA, Tier 1, Core Tier 1 and Non-performing loans with leverage to design new variables and add to the final regression to evaluate if the coefficients are significant. If so, the variables are dependent on each other and could bias the result. We will also test for non-linearity by taking the accounting risk variables all squared and if some of these coefficients are significant this can be interpret as a convex (positive) or concave (negative) relationship indicating non-linearity.

Another modification of the panel data is to use the White cross-section coefficient covariance method to mitigate the potential problem of correlated standard errors. The white test is a robust standard error modification which allow for clustering of the standard errors when there is correlation between firms residuals (Brooks, 2008, p.152). This could be a potential problem in our case since the panel data is built on each issue and some of the banks included have several issues within our sample. Petersen (2007) evaluate the problem of unbiased standard error within corporate finance and asset pricing articles, and conclude that several articles published have had this problem and ignores the correlation between residuals leading to a false result. To mitigate this problem either White or Fama-MacBeth models is argued as appropriate methods to use.

4.6 Limitations of data

The proposed method and data could have some limitations, such as lack of measure points. Analyzing instruments as new as CoCos has the disadvantage of limitation of data availability. This could be argued to be an insufficient sample to be able to draw general conclusions from about the features of CoCos. However the sample contains the entire available issued instruments

up to this date, but we are aware of that a larger sample could give more accurate results. Some of the measurement points in the other explanatory variables were also missing, leading to an unbalanced panel data set. Further, Lloyds is responsible for all issues in 2009, therefore they make up a substantial part of the total sample. This could potentially bias the result from our study, but by using different econometric methods we try to mitigate this source of bias (see section 5.3). Arguably this type of study has never been performed in academia before, but it could give an important early indication of the relationship of these variables, but certainty of the result can be restrained by the sample size.

4.7 Replicability, Reliability and Validity

Classical literature in research methodology such as Bryman and Bell (2011, pp. 157-167) argue for the concept of replicability, reliability and validity in quantitative research. Following the method chapter in this paper we believe our study is possible to replicate and through the same process get the same result. Further, the measurements are reliable since we provide a transparent view of the choices made throughout the process and we use previous articles using a similar approach on other subordinated debt, and hence arguably the empirical investigation measures the concept with consistency. Moreover, considering the data sources and the reliability of, and accuracy of these measures, we believe that the quality is high since the software that are used are distributed by respectable firms in the financial industry. One potential source of error in our methodology can be derived from the manual process of collecting issue specific data from prospectuses. Judgments had to be made about the information content and what to include in our data, and what should be incorporated in our Excel spreadsheets as basis for the regressions.

A majority of articles and research papers used throughout this paper are collected using LUBSearch, a search engine at the Library of Lund University. Another important step to find more quality references involved going through reference lists of publications by International Monetary Fund (IMF) and Bank of International Settlements (BIS) covering this particular topic, but also searching for frequently cited authors in research covering Contingent Convertibles. Additionally, searches through search engines was made to gather non-published (or to be published) working papers. Social Science Research Network (SSRN) is one source that frequently gave access to existing up to date research. A consequence of the nature of the topic

and relatively short time frame of the existence of these financial instruments is that a large part of the papers available are working papers.

4.8 Endogeneity

Brooks (2008) and Angrist and Pischke (2008) argue for endogeneity problems in financial research and present four common biases, Omitted variable bias, Simultainity, Measurement error and Selection bias. Considering these, the omitted variable bias seems most appropriate to address in our empirical investigation since a predetermined number of variables is used in the panel data with a possibility to leave out important explanatory variables. Since more important variables in the regression could be left out due to their lack of quantifiability (such as managerial quality), the result is only able to partly reflect the factors influencing the spread movement of CoCos. This is arguable the most important limitation since the paper is expected to provide additional knowledge about the explanatory variables behind the spread change of CoCos. However, since we are using fixed effects in the time dimension these problems will be mitigated as much as possible. It is always possible to add variables to increase the explanatory power, however after reviewing previsions literature the variables included correspond to the most widely used and with most explanatory power when it comes to measuring risk among banks.

Other biases such as concerns if the concept really is measured and a reverse causality problem seems less appropriate to address, since the concept of market discipline is a well researched field and our method follows previous studies. Selection bias and the self selection problem however could be a source of concern, since the banks in our sample decide themselves to be included in the sample after deciding to issue CoCos. Arguably these banks could be a false representation of banks in general and which could lead to a biased result. Since the sample of banks used in our empirical study can be argued to not correspond to the actual populations of all banks, a Heckman mills ratio can be introduced (as in Covitz et al., 2003) to the regression to mitigate potential selection bias. This fact is something that we have had in mind during the process, but it will however not be used in our model due to the time extensive process of collecting the data for all banks (to be able to use the Heckman mills ratio). The mills ratio adds

one explanatory variable into the original regression that corresponds to “all banks” and evaluates if the result holds for the entire population and not only for the firms in the sample.

The measurement error in the variables is expected to be limited since the variables are gathered from software widely use in financial research and should be accurate.

5. Results

In this chapter the result from the empirical study will be presented. Following the developed hypotheses this chapter is divided into three sections. The first sections will present descriptive statistics for all variables, followed by pooled regression on the variable groups separately. Lastly, the constructed model with modifications will be presented and potential problems tested.

5.1 Descriptive statistics

5.1.1 Accounting risk variables

Table 5.1 Descriptive statistics on accounting risk variables

	COCO SPREAD	ROA	LEV	NON PERF LOANS	TIER1	CTIER1
Mean	5.4	0.25	18.75	3.42	12.81	11.1
Maximum	17.33	13.9	45.88	46.28	40.2	29.3
Minimum	-0.29	-18.97	1.94	0.04	7.19	-1.9
Observations	854	1827	1902	1571	1772	1215

All values are quarterly values, measured in percentages

Descriptive statistics for the accounting risk indicators used as explanatory variables in the regression of the CoCo spread can be found in table 5.1. The statistics gives a good picture over the number of observations and distribution of the used variables. Considering the difference among the number of observations, the spread has approximately half of the observations compared to the independent variables. This is expected since the data availability for the market price of issued CoCos is limited, a large number of issues in 2012 and 2013 restrict potential observation points (see chapter four for a more detailed discussion). The range between maximum and minimum in our data could be suspicious at first sight, but since the sample include banks with problems during the financial turmoil in Europe these numbers correspond to actual observations. The mean values give a better representation of a majority of the banks. All variables are measured in percentages.

Table 5.2 Correlation matrix on accounting risk variables

	COCO SPREAD	ROA	LEV	NON PERF LOANS	TIER1	CTIER1
COCO SPREAD	1.00					
ROA	0.03	1.00				
LEV	0.02	-0.16	1.00			
NON PERF LOANS	0.56	-0.18	-0.04	1.00		
TIER1	-0.24	0.16	-0.02	-0.47	1.00	
CTIER1	-0.39	0.15	-0.09	-0.57	0.90	1.00

Table 5.2 provides a correlation matrix of the accounting risk indicators. As presented in the previous chapter, the Tier 1 and Core Tier 1 measure are closely linked and should therefore have a high correlation. Consequently, this is reflected in the matrix with a correlation of 0.9 between the two measures. The Tier 1 ratio has a large number of measurement points, and will hence be used in the regression instead of Core Tier 1. Further, the correlation among the other variables does not indicate a possible multicollinearity problem since the second highest is between non-performing loans and the CoCo spread with a value of 0.57. For the full correlation matrix on all variables see appendix 4.

5.1.2 Issue specific and control variables

Table 5.3 Descriptive statistics on CoCo features dummy and control variables

	Mean	Maximum	Minimum	Observations
CALLABLE Y/N	0.55	1	0	2247
COUPON FREQ	0.32	1	0	2184
COUPON TYPE	0.68	1	0	2247
LOSS ABSORPTION	0.47	1	0	1869
PERPETUAL Y/N	0.29	1	0	2289
REGT AT1ORT2	0.31	1	0	1848
TRIGGER LEVEL	0.75	1	0	1596
LN ISSUE SIZE	6.25	8.01	1.91	2289
LN RETURN	0.03	2.57	-2.71	1906
LN TA	13.1	14.52	7.16	1897

All CoCo features are constructed as dummy variables. Control variables denoted as natural logarithmic terms.

Table 5.3 present descriptive statistics of issue specific features and control variables, the actual values are less interesting since all features are constructed as dummy variables. However, the number of observations are given, resulting in approximately 2000 observations for each variable, except lower for the trigger level variable, this is primarily due to inconclusive information or lack of explicit information in issuer's prospectus. The control variables issue size, stock return and total assets are adjusted with the natural logarithm to get a comparable measurement.

5.2 Pooled regressions

Before adding any modifications and corrections to the regression, we present the regression separately in order to provide a better visualization of the effect of any changes to the original specification.

Table 5.4 Pooled regression on accounting risk variables

$$COCOSPREAD_{it} = f(X_{it}) + \varepsilon_{it}$$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ROA	0.512988	0.147005	3.489592	0.0005***
LEV	0.079088	0.033299	2.375108	0.0180**
NON PERF LOANS	0.687122	0.048841	14.06863	0.0000***
TIER1	-0.009019	0.054194	-0.166428	0.8679
C	1.260305	1.014512	1.242277	0.2148
R-squared	0.350052			

The table reports the output from the OLS regression. *Denotes significance at the 10% level, ** 5% and *** 1%.

Table 5.4 represent a pooled regression using the calculated CoCo spread as dependent variable and our accounting risk variables as independent variables. Given the result, all variables except Tier 1 are significant within a 95% confidence interval. These variables together explain 35% of the variation in the CoCo spread, according to the R-squared measure. Further, since the data in the sample is unbalanced some of the issued CoCos will automatically be excluded in the

regression, leaving us with 80 cross sections and 453 observations using only the accounting risk variables as independent variables.

Table 5.5 Pooled regression on CoCo features dummy variables

$$COCOSPREAD_{it} = f(Y_{it}) + \varepsilon_{it}$$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TRIGGER LEVEL	0.113884	0.359371	0.316900	0.7514
CALLABLE Y/N	0.477761	0.255472	1.870112	0.0619*
COUPON FREQ	0.232110	0.181971	1.275534	0.2026
COUPON TYPE	1.583002	0.367922	4.302553	0.0000***
LOSS ABSORPTION	2.135887	0.362063	5.899217	0.0000***
PERPETUAL Y/N	0.736174	0.429001	1.716020	0.0866*
REGT AT1ORT2	-0.061585	0.427701	-0.143992	0.8856
C	2.300436	0.519978	4.424099	0.0000***
R-squared	0.166345			

The table reports the output from the OLS regression. *Denotes significance at the 10% level, ** 5% and *** 1%.

All CoCo features included as explanatory variables are also regressed separately on the dependent variable in order to give a better interpretation of the relationship. As presented above the output from the regression indicates that the two variables, loss absorption and coupon type have a significant relationship to the spread of the issued CoCos, at 5% significance level. The explanatory power using R-square as a measure indicates that approximately 16% of the variation in the spread of CoCos is related to issue specific features captured in these variables. This is less than half of the explanatory power of the accounting risk variables presented previously. The regression includes spreads of 64 issued CoCos and 649 observations.

Table 5.6 Pooled regression on control variables

$$COCOSPREAD_{it} = f(Z_{it}) + \varepsilon_{it}$$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN ISSUE SIZE	-0.619985	0.070945	-8.738918	0.0000***
LN RETURN	-4.109809	0.384407	-10.69131	0.0000***
LN TA	1.353394	0.158348	8.546951	0.0000***
C	-9.127178	2.268939	-4.022662	0.0001***
R-squared	0.313124			

The table reports the output from the OLS regression. *Denotes significance at the 10% level, ** 5% and *** 1%.

The control variables by themselves regressed on the spread of the CoCos, all have significant coefficients. The change in return of the underlying stock, the size of the issue and size of the firm measured in total assets all seems to have a important role explaining variations in the CoCo spread. The R-squared in this regression is around 30% which is close to the explanatory power of the accounting risk measures. Note that the public or private dummy is excluded in the regression due to a warning for near singular matrix using Eviews. At first glance this could be due to a close correlation to the loss absorption dummy since most banks that are private consequently issue write-down CoCos. However, this was found not to be the case, so we decided to exclude this variable to not risk having a source of error in the final model.

5.3 Model and modifications

Since the structure of the panel data is exposed to potential econometric problems a range of tests are performed in order to evaluate the best possible model to empirically investigate evidence of market discipline. In table 5.7 a summary of the regressions are presented and further discussed in the text on the following page.

Table 5.7 Model results

$$COCOSPREAD_{it} = f(X_{it}, Y_{it}, Z_{it}) + \varepsilon_{it}$$

	1	2	3
Intercept	-18.86*** (4.52)	-18.86 ** (8.24)	10.33*** (1.31)
ROA	0.43*** (0.15)	0.43 (0.36)	-0.12 (0.08)
TIER1	0.31*** (0.07)	0.31*** (0.09)	-0.07** (0.03)
NON PERF LOANS	0.53*** (0.08)	0.53*** (0.14)	0.14*** (0.05)
LEV	-0.11* (0.06)	-0.11 (0.11)	0.04* (0.02)
CALLABLE Y/N	0.43 (0.42)	0.43* (0.23)	0.19 (0.17)
COUPON FREQ	-0.55** (0.24)	-0.55*** (0.13)	-0.56*** (0.10)
COUPON TYPE	1.04 (0.65)	1.04*** (0.36)	1.29*** (0.38)
LOSS ABSORPTION	0.68 (0.54)	0.68 (0.45)	0.12 (0.19)
PERPETUAL Y/ N	0.46 (0.60)	0.46 (0.51)	1.39*** (0.26)
REGT AT1ORT2	1.05 (0.59)	1.05** (0.42)	0.94*** (0. 18)
TRIGGER LEVEL	-0.56 (0.50)	-0.56 (0.46)	-0.74*** (0.19)
LN ISSUE SIZE	-0.54*** (0.10)	-0.54*** (0.07)	-0.48*** (0.06)
LN RETURN	-3.56*** (0.47)	-3.56 (2.39)	0.27 (0.22)
LN TA	1.66*** (0.35)	1.66** (0.67)	-0.16 (0.10)
White standard error correction	No	Yes	Yes
Period fixed effects	No	No	Yes
R-Squared	0.49	0.49	0.93
# Observations	351	351	351

(*Denotes significance at the 10% level, ** 5% and *** 1%. The value in brackets represent the standard errors in each coefficient)

Firstly, all variables will be included in a regular pooled regression without additional effects. In table 5.7 the relationship between the variables differ both for the coefficients and the significance level of the included explanatory variables, compared to regressing these separately. The output present a range of variables that now are significant at 5%-level. All the control variables and ROA, Non-performing loans, Tier 1 and coupon frequency accordingly have an important role in explaining changes in the CoCo spread. The variable capturing the loss absorption mechanism is no longer significant when included in the final regression, unlike the regression with only issue specific features. This is an unexpected outcome considering its importance in the contract structure. The R-square has now increased to 49% and the number of issues include decreased to 55, but still with 351 observations included in the regression.

Since several issuers have issued more than one instrument and the panel data is constructed using ISIN codes as CSU and not the individual firm, a White cross-section standard error correction is necessary in order to create more accurate standard errors and mitigate a possible heteroscedasticity problem. Without introducing this modification we assume that the firms are independent of each other, and using the issue specific ISIN codes were the issuing bank is used multiple times makes that assumption false. In regression 2, Table 5.7, the output is presented when White cross-section is used to correct the standard errors. As expected the significance level of the variables changes quite drastically, arguably emphasizing the importance of this correction. Both ROA and the control variable LN (Return) falls out of being significant at 5% level. However, the issue specific features, regulatory treatment and coupon type is significant at the same level. The only value corrected is the standard error and therefore all coefficients remain the same as in the previous regression.

Lastly, since the time-frame involves a period of turbulent financial markets, the period effect of the data could be substantial. Arguably a fixed effect on cross sections could also be appropriate, but considering the size of the sample with more expected variation between firms then to time, the period fixed effect seems more appropriate to use compared with cross-section fixed effects. The period fixed effect will also address the potential problem of not incorporating variables that capture changes in the macroeconomic variables, that could bias the result through a global increase in risk and a change in the underlying banks. Given the results in regression 3, table 5.7 using both white cross section and period fixed effects have a significant impact on the regression coefficients and the standard errors. By introduction dummy variables for each

quarter, LN (TA) becomes insignificant but perpetual and trigger level becomes significant compared to the previous regression. The R-squared reaches 92% compared to the previous 48%, indicating that half of the variation in the spread is not covered by our explanatory variables. This also highlights the fact that unobserved variables in time have a significant effect explaining the variation of the CoCo spread. Importantly since these unobserved effects are not captured by the included explanatory variables, the period fixed effect neutralizes this problem and gives a more correct interpretation.

Table 5.8 Economic interpretation of the significant variables

	NON PERF LOANS	TIER1	COUPON FREQ	COUPON TYPE	PERPETUAL Y/N	REGT AT1ORT2	TRIGGER LEVEL	LN ISSUE SIZE
Change in spread	0.49	-0.25	-0.56	1.29	1.39	0.94	-0.74	-0.59
P-value	0.0018***	0.0421**	0***	0.0007***	0***	0***	0.0001***	0***

*Denotes significance at the 10% level, ** 5% and *** 1%.

The economic interpretation of the coefficients will be better understood by looking at the effect on the spread by a one standard deviation change in the explanatory variable. Since the significant variables are most interesting, the table above presents these variables with standard deviation times the coefficient in the final regression. However, since the dummy variables only take the value 1 or 0 these will correspond to the actual coefficient and not the change after a change in standard deviation. The result provides numbers indicating that CoCo specific features have a significant impact on the spread of CoCos. The value range from -0.74 to 1.39 which means that a change of one standard deviation in the underlying variable corresponds to -0.74% to 1.39% change in the spread. However, since most of the significant variables are dummy variables this interpretation of one standard deviation change is only applied for the change in the accounting risk measures, non-performing loans and Tier 1. Comparing these two, a one standard deviation increase in non-performing loans will give an increase of 0.49% on the CoCo spread and for the Tier 1 ratio this will lead to a decrease of 0.25% in the spread. This is almost half the change compared to the previous indicating that non-performing loans is important to

determine the spread of this instrument. One standard deviation change in issue size results in a -0.59% change in the spread.

5.4 Robustness tests

To evaluate the necessity of using period fixed effects in the panel data, a redundant fixed effect test is performed. The result is presented in appendix 11, and indicates at a 1% significant level that the null hypothesis of no period fixed effect can be strongly rejected. Period effects are therefore significantly proven to be present in our sample leading to the use of period fixed effect to develop a more accurate model specification.

Since previous articles has expressed concern of non-linearity between accounting risk measures and the spread (market based measure), we perform a test of linearity with the explanatory variables all to the power of two also included in the final regression to find possible evidence of nonlinearity. All variables have insignificant coefficients except Return on assets (ROA), this could be interpreted as ROA and the CoCo spread having a concave (negative) correlation which gives some bias to this coefficient in the final regression (see appendix 8).

Previous studies (Sironi, 2003 & Jagtiani et al. 2002) suggest another method to test for non-linearity by the use of the product of two variables and include these in the final regression to see if they are significant. Taking this approach only the Tier 1 ratio times leverage gives a significant coefficient (see appendix 9). The coefficient is negative could be argued that these two variables have a negative relationship that could distort the result to some extent. This will not have any major change in the interpretation of the final result but is important to have in mind since these identified potential errors could have some influence.

Testing for the normality of the distribution is done with a Jarque Bera test to see if the residuals are normally distributed, which is an assumption in this t-test. The null hypothesis of normal distribution is rejected which lead to lack of robustness in the residuals. The skewness is 0.35 and the kurtosis is 3.67, compared to the normal distribution with a skewness of 0 and kurtosis of 3 (see appendix 10). These values are close to a normal distribution and arguably the assumption in the regression will not be violated to a extent in which the result becomes invalid.

6. Analysis

In this chapter the result will be analyzed in relation to the theoretical framework. The analysis of the empirical result is divided into two sections, market discipline and CoCo specific features.

6.1 Hypotheses

Firstly, this chapter will present and analyze the empirical result in the context of our pre-specified hypotheses. The presented hypotheses generated from theory and the literature review was developed to evaluate the evidence of market discipline with hypotheses 1-4 based on accounting risk measures, and the fifth hypothesis to incorporate the issue specific effects on the CoCo spread (see chapter 3, section 3.6).

From the result of the final regression, the interpretation of the coefficients for the accounting risk measures is that both non-performing loans to total assets and Tier 1 ratio has a significant effect on the spread of issued CoCos (at 5% significance level). This result leads to a rejection of the H_0 of both hypotheses 2 and 4. Since the other variables leverage and ROA has a higher p-value than 0.05, H_0 in hypothesis 1 and 3 are accepted indicating no significant correlation to the change in CoCo spread. With an increase in non-performing loans the riskiness of the bank should go up, which is expected to lead to an increased spread for the CoCo, which correspond to the positive coefficient from our regression output. Further, an increase in Tier 1 ratio is expected to indicate that the overall riskiness of the bank has decreased with a stronger capital position, leading to a decrease in the spread, captured by a negative coefficient in the regression.

Looking at the fifth hypothesis related to the issue specific features of the CoCos, several of the dummy variables included in the final panel regression show significant effect on the CoCo spread. We therefore reject the $H_{0,}$ as at least one of the issue specific features has a significant correlation to the spread. Five out of total seven feature dummies are significant at a 1% significance level. These are variables capturing the following features; coupon frequency, coupon type, perpetual, regulatory treatment and trigger level. From the result the interpretation is that an annual coupon frequency and a trigger level $\leq 5.125\%$ will have a negative effect on the spread. If the issue characteristics has one or more of the features; perpetual (has no maturity

date), classified as Tier 1 and has a fixed coupon type, this results in a positive effect on the spread, according to the output from our model. Moreover, the remaining features, callability and loss absorption mechanism are not significant at 5% significance level.

6.2 Analysis of empirical result

This section provides an analysis of the result from the rejection or acceptance of the hypotheses in relation to the concept of market discipline, and connect this to previous empirical research and theory. Since the purpose of this paper is to evaluate if market discipline is exerted in the market for CoCos, this is the focus in the analysis. However, the design of the instrument can play a significant role as discussed, so this will also be analyzed.

6.2.1 Market discipline - evidence or not

The results from our empirical study of CoCos show that a significant relationship between CoCo spreads as a market-based measure and the benchmark measure (accounting risk indicators) can be established. This can be interpreted as a sign that market participants (investors in CoCos) are sensitive to accounting proxies for bank risk, and that evidence of market discipline through monitoring is apparent.

Previous research on the concept of market discipline (see, Covitz et al., 2004; Flannery & Soresco, 1996; Jagtiani et al., 2002; Sironi, 2003) indicates that in a business environment with less government guarantees, investors tend to become more interested in monitoring the underlying risk of the banks in which they have investments in through SND instruments. After the GFC in 2007-2009 the regulatory approach has been to increase the responsibility among investors to take the loss in distressed times and not expect government bail-outs using taxpayer money, arguably this should lead to more market discipline. The purpose of the introduction of CoCos in the Basel framework is to do just that, to reallocate some of the risk from the government to the investors and stakeholders in the banks. The result generated from our final regression points to some extent of market discipline since two out of four accounting risk indicators has a significant correlation to the spread. This could be interpreted as investors considers these two measures, non-performing loans and Tier 1 ratio as informative predictors of bank risk in their evaluation of a reasonable level of the spread. Furthermore, return on assets

and leverage shows no significant relationship to the variability of the spread, therefore no conclusions or answers can be drawn on the basis of those variables alone. However, our sample size is limited, but the non-significant variables at 5% level is almost significant at 10%, indicating that these are also very close to be deemed an important factor reflected in the spread of CoCos. The significant accounting risk variables are still significant even though the limited sample size, leading to an even stronger indication that these play an important part in the determination of the spread. Thus, arguably the evidence for market discipline is stronger compared to evidence for lack of market discipline when evaluating the result.

As discussed briefly in the result chapter the economic interpretation of the accounting risk indicators points to what could be expected. An increase in non- performing loans is a sign of a weaker business environment and higher spread can be expected from investors. An increase in Tier 1 ratio should equal a positive sign (lower spread) from an investors perspective since the risk of the issuer not being able to fulfill its obligations has decreased and so also the approximation of the firms' probability of breaching the trigger level (and ultimately probability of default). Gupta et al. (2013) use the CET1 ratio as the primary component to model the risk of breaching the trigger in their pricing approach. According to Gupta et al. (2013) the CET1 ratio includes valuable information about the banks risk profile and is also often linked to the trigger level. The Tier 1 ratio does not correspond exactly to the CET1 ratio as discussed, but are closely linked.

Sironi (2003) analyze the non-linearity with an interaction term and argues for a significant interaction between ROA and leverage. Testing our sample no significant correlation between change in ROA and leverage can be found. However, the Tier 1 ratio and leverage shows a significant relationship when included as an interaction term in the model. Banks with higher Tier 1 also appear to have lower leverage. The non-linearity problem addressed by Sironi (2003) and Jagtiani et al. (2002) is not of the same concern when it comes to our sample. Beside the Tier 1 ratio using an interaction term, ROA is the only variable that is significant when included as squared in our model. ROA has a concave (negative) relationship and not linear. However, all the other accounting risk variables have a linear relationship to the spread so the potential bias on the result is presumed to be limited.

Further, only the issue size is significant in our model when considering the control variables. Larger issues are interpreted with less risk when it comes to the spread. Further, Sironi (2003) and Flannery (1996) argue that LN (TA) should be significant since large banks in size measured in terms of total assets, would be consider being less risky from investors. This does not correspond to the result provided from our model since the control variable LN (TA) is not significant.

Considering the explanatory power of these variables, compared to other similar studies examining the market discipline in markets for SNDs, these have R-squared measures in a range of 0.3-0.8 with an average of 0.53 (see summary in table 3.1). This can be compared to our explanatory power of 0.48 before using period fixed effects (see table 5.7). Since almost half of all the variation of the spread can be explained using our chosen variables and about one third using accounting risk variables alone, this leaves room for further analysis. DeYoung et al. (2001) discusses the CAMEL framework for providing a risk approximation of banks. Following this approach both the M (management) and L (liquidity) are not included as variables into our model and could have provided additional explanatory power. However, including proxies of management quality could provide problems since it is not sure that the variables measure the actual concept giving room for measurement error.

The point of non-viability trigger (PONV, regulatory trigger) included in a majority of CoCos that comply with Basel III is a variable that is difficult to quantify, and it is an uncertainty for investors and holders of CoCos. This trigger could have been included as an explanatory variable in our study, to see a difference between issues with or without this trigger. But similarly to proxies of management quality, a PONV variable could also suffer from measurement error and how it actually affects the spread could prove hard to interpret.

Further, Forssbæck (2011) and Gropp et al. (2006) argue for the complementary information about a firm's default probability using both market and accounting risk measures. The unexplained variation in our model could therefore be decreased by introducing additional market based variables. The focus of this paper is however to find evidence of market discipline and therefore accounting based measures are the foundation in our model.

The empirical result indicates market discipline in CoCos and could be interpreted as an early indication, with more secured evidence to be available in the future when a larger sample size becomes available. Comments from market participant in financial newspapers about the most profound sources of the demand for CoCos indicated to be the attractive high yield in these instruments, this do not correspond to the result provided from this study. Investors seem to incorporate the accounting risk indicators non-performing loans and Tier 1 ratio into their investment decisions which is reflected through the spread. The initial purpose from the regulatory perspective in this regard can be argued to be partly fulfilled with evidence of market discipline. However, the potential failure or success of CoCos will be revealed through their loss absorption capabilities in the next period of financial turmoil or crisis. The results are inconclusive since not all accounting risk measures appear to have significant coefficients. Comparing the explanatory power of issuer characteristics by accounting risk measures to issue features, they stand for about 35% and 16% of the variation respectively. This can be interpreted as both the banks risk profile and the contract specific details accounted for in the perceived riskiness of these instruments by market participants.

6.2.2 CoCo specific features

Several issue specific features was significant in the final regression and hence this result needs to be evaluated in order to finds some theoretical explanations for this outcome. As presented throughout this paper the analyzed instruments has a quite unique structure and arguably investors could be more interested in the issue specific details, than other factors such as the underlying riskiness of the banks. As evaluated in the section above, investors to some extent seems to incorporate the riskiness of the underlying into the traded securities, however since many features show up with a significant coefficient as well these needs to be set into context. The issue specific variables alone as explanatory variables for the variability of the spread of CoCos appear to be relatively poor in terms of explanatory power, compared to accounting risk measures.

A statistically significant coefficient for the dummy variable coupon frequency appears in our final regression model. The result suggests that with an annual coupon frequency the spread would decrease compared to other short term payout schemes. The dummy variable for coupon type has a significant positive coefficient, suggesting a higher spread for CoCos with a fixed coupon. Investors arguably add an additional risk margin on the issues having a fixed coupon, this could be due to the current low interest environment since an expected increase in future interest rates would hurt the fixed coupon bonds. Several CoCos (approximately 20 in our sample) have the coupon type "floating: fixed then floating", in our dummy variable these are classified as having a fixed coupon. This could potentially distort the result, but most issues with this feature have a fixed coupon until first allowed call date and are issued recently.

CoCos with the feature perpetual (AT1 classified if issued under Basel III) increases the spread significantly, suggested by the coefficient in our regression. From the perspective of an investor a perpetual bond have more risk included since a larger time span has to be included in both the valuation and the probability of default analysis. If using a credit derivatives approach for pricing the bond for example. CoCo bonds without maturity has been proven to provide several problems considering the credit derivatives approach to pricing since a non-predetermined stream of coupon payments is hard to incorporate into the model (Wilkens & Bethke, 2014). The longer time to maturity of the CoCo bond also increases the probability that a trigger event might occur, this also suggest that investors should demand higher spreads for perpetual feature CoCos.

If the issues regulatory treatment allows them to be included as Tier 1 (Additional Tier 1 under Basel III) then the spread is increased compared to CoCos treated as Tier 2. AT1 CoCos issued to comply with Basel III have cancellable coupons at the issuers' discretion, this is arguably a source of uncertainty for holders of CoCo bonds. It is therefore a reasonable expected outcome, investors appear to demand a higher yield from CoCos with this built in uncertainty of future coupon streams. Moreover, AT1 CoCos have a feature that allows issuer calls after five years (without features that give incentives to redeem at first call) even though they are issued as perpetual. This fact could also partly explain the increased spread for AT1. De Spiegleer and Schoutens (2014) discuss how investors can integrate extension risk when valuing Tier 1 CoCos,

which is the risk that the bonds considered to expire at first call will not be called in. This extension risk (non-call risk) appears to be one explanation for the higher spread.

The dummy variable that captures the issue feature trigger level is statistically significant, the coefficient indicates that issues with a trigger of 5.125% or lower have a negative effect on the spread. The pricing models covered in our literature review (see e.g., Corcuera et al., 2013; Glasserman & Nouri, 2012; Gupta et al. 2013) all try to estimate the probability of breaching a pre-specified trigger using different approaches. The additional risk specific to CoCos compared to other subordinated bonds comes primarily from the loss absorption mechanism activated when the trigger level is breached. With a lower trigger comes a decreased probability of reaching the trigger all else equal. As expected, investors in CoCos arguably appear to incorporate the trigger level in their assessment of the appropriate level of spread demanded.

The two dummies capturing the issue features callable or not, and loss absorption mechanism (write-down or equity conversion) proved to be not statistically significant in our final regression. This is an unexpected outcome, but which presumably could be a result of our limited sample size and observation points. From the theory and literature we expected that these two features would be playing an important role in explaining the variability of the spread. The difference in loss absorption should arguably be an important factor as it determines what loss or conversion the CoCo investors are exposed to and how the issuers (and its shareholders) are affected at conversion. In the same way the issuers ability to call-in (redeem) the instrument (as discussed above) pre-maturely should be a risk factor of significance for the market's perception of CoCos risk and therefore the spreads of the instruments. However, as the coefficients of these variables are not significant we have no secure evidence for arguments either against or for these factors importance. The literature review covering incentive problems where primarily aimed at being related to a discussion of differences in the loss absorption mechanism. As the variable capturing if the issues have an equity conversion or principal write-down is not significant, we leave this analysis to further research.

7. Conclusion

This concluding chapter will give some final thoughts given the outcome from the empirical result and analysis. Lastly, we discuss suggestions for further research in the field of contingent convertibles.

7.1 Implications

To conclude, the result from our study points towards evidence for market discipline in the market for contingent convertible capital. The result from this paper provides an indicative sign of movement in the right direction from a regulatory perspective. The essential target when this automatically loss absorbing instrument was introduced, was to enhance the responsibility of investors to take their part in a potential negative scenario and not leave the bill to the state. With regard to our result, this goal seems to be possible to fulfill, since investors in CoCos are sensitive to changes in bank risk indicators and these changes in risk are reflected in the spread of CoCos. Investors appear to monitor risk associated with the issuing bank when their investments are not backed by government guarantees, and incorporates this assessment of risk into the spreads of these securities. Furthermore, our result indicates that contract specific features of the CoCos in our sample have a complementary explanatory power, but investors appear to factor in issuer characteristics to a larger extent when observing and pricing risk.

As identified in the first part of the paper, a common discussion among market participants is the driving factors for the demand from investors in CoCos. An argument put forward is that investors acting in the current low interest rate environment are prone to invest in CoCos due to the high yield, and not fully incorporating all risk inherent in the product. This argumentation does not correspond to the interpretation of our result. Our findings suggest that investors in CoCos to some extent includes both issuer and issue characteristics in their investment decisions, so yield cannot be the only determining factor.

7.2 Generalizability

Due to the sample size, relatively short time frame and potential for improvements in the econometric model it is hard to generalize the result with complete certainty. The banks included in our sample are included since they have issued contingent convertible bonds and might not be completely representative for banks in general. However, to our knowledge the sample includes all issued CoCos since 2009, and a diverse group of issuing banks in terms of geographic location, size and business profile. This strengthens our result and increases the possibility to generalize the findings to a broader set of banks issuing CoCos. Since no instruments are issued by US banks our findings might not applicable for the US banking industry.

The lack of standardization of the contracts (which sets the issue specific features), the still early stage of market development, and existence of several pricing approaches in academia all leaves room for inconsistency in pricing. This factor could influence the spread and potentially aggravate the generalizability of the result.

7.3 Practitioners

The result from this paper can be important for three target groups, regulators, investors and issuing banks. From the regulators view, we contribute with new empirical evidence of market discipline through CoCos. Our results supports the initial purpose of CoCo bonds, the instruments forced loss absorbing function appear to make investors sensitive to bank risks and through this imposes market discipline. From the investors perspective the implication from our result highlights key issuer characteristics and issue features that plays a significant role in explaining the variability of the spread. It also emphasizes that our model only incorporates some variables which leaves room for evaluating other variables and closely examine contracts details when comparing spreads on different issues. For the issuing banks of CoCo bonds our result provide incentives for banks to have financial soundness since investors appear to reward this behavior with lower spreads in issued CoCos. However to make the instrument attractive for investors the details in the contracts need to be clear since our results provide indications that apart from the riskiness in the banks, the riskiness of the contract will be essential to determine the spread.

7.4 Proposal for further research

The young market of CoCos limits our study in terms of data availability, and for further research in this field a larger sample size could give a more accurate result and greater generalizability from the evaluation of market discipline. Further, since our study includes variables well researched in other subordinated debt, an increased number of variables could be included to try to explain more of the movement of the spread. It would also be interesting to investigate the behavior of CoCos in times of distress, and see if the concept of market discipline applies or if the instruments fail to provide the necessary loss absorption. In the same way incentive problems and the changes in capital structure will be interesting to assess in times of financial turmoil. Lastly, the rating aspect of CoCos could be given more attention as the market develops, a suggestion would be to use ratings assigned as one explanatory variable and its explanatory power of the spread of CoCos compared to studies with other subordinated debt issues.

Since the market only has been active since 2009 and with increased attention in the last year, CoCos have a large potential when it comes to empirical research going forward. Further research should continue to evaluate this instrument to be able to give it a proper design in order to work as firstly intended and mitigate the civil cost of future financial crises**.**

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9. Appendix

Appendix 1 - List of all firms with issued CoCos data

Issuer	*Issuer domicile*	*Coupon*	*Maturity*	*Issue date*	*ISIN*	*Currency*	*Amount Outstanding*	*Amount Outstanding in USD*	*S&P Rating*	*Issue year*
Bendigo and Adelaide Bank	AU	5.427	29/01/2024	2014-01-29	AU3FN0021952	AUD	263.0	235.3	BBB	2014
Credit Agricole	FR	7.875	N/A	2014-01-23	USF22797RT78	USD	1750.0	1750.0	BB+	2014
Credit Agricole	FR	7.875	N/A	2014-01-23	US225313AD75	USD	1750.0	1750.0	BB+	2014
Ostjydsk Bank (EXCLUDED)	DK	9.765	N/A	2014-01-01	DK0030323456	DKK	8.8	1.6	N/A	2014
Den Jyske Sparekasse (EXCLUDED)	DK	11.457	N/A	2014-01-01	DK0030298088	DKK	8.9	1.7	N/A	2014
Spar Nord Bank (EXCLUDED)	DK	9.69	N/A	2014-01-01	DK0030178421	DKK	238.7	44.0	N/A	2014
Press Kogyo (EXCLUDED)	N/A	0	28/12/2018	2013-12-30	XS0976017474	JPY	95.2	1.5	N/A	2013
Banco Santander	MX	5.95	30/01/2024	2013-12-27	US05969BAB99	USD	1300.0	1300.0	BB	2013
Banco Santander	MX	5.95	30/01/2024	2013-12-19	USP1507SAD91	USD	1300.0	1300.0	BB	2013
Societe Generale	FR	7.875	N/A	2013-12-18	US83367TBF57	USD	1750.0	1750.0	BB+	2013
Societe Generale	FR	7.875	N/A	2013-12-18	USF8586CRW49	USD	1750.0	1750.0	BB+	2013
Credit Suisse	CH	7.5	N/A	2013-12-11	US22546DAB29	USD	2250.0	2250.0	BB-	2013
Barclays	GB	8	N/A	2013-12-10	XS1002801758	EUR	1377.0	1897.4	B+	2013
Danske Bank	DK	4.75	05/06/2024	2013-11-26	XS0999631665	SEK	138.7	21.5	BBB-	2013
Barclays	GB	8.25	N/A	2013-11-20	US06738EAA38	USD	2000.0	2000.0	B+	2013
Credit Suisse	CH	7.5	N/A	2013-11-12	XS0989394589	USD	2250.0	2250.0	BB-	2013
United Overseas Bank	SG	4.75	N/A	2013-11-11	SG58I7998534	SGD	402.0	318.2	BBB-	2013
DBS Group	SG	4.7	N/A	2013-11-04	SG59H0999851	SGD	642.3	508.5	N/A	2013
China CITIC Bank	HK	6	07/05/2024	2013-10-31	XS0985263150	USD	300.0	300.0	N/A	2013
Home Credit & Finance Bank	LU	10.5	19/04/2021	2013-10-17	US29843LAC72	USD	200.0	200.0	N/A	2013
Russian Agricultural Bank	LU	8.5	16/10/2023	2013-10-16	XS0979891925	USD	500.0	500.0	N/A	2013
Home Credit & Finance Bank	LU	10.5	19/04/2021	2013-10-10	XS0981028177	USD	200.0	200.0	N/A	2013

Banco Popular Espanol	ES	11.5	N/A	2013-10-10	XS0979444402	EUR	676.1	931.7	N/A	2013
Bank of India	IN	9.8	30/09/2023	2013-09-30	INE084A08045	INR	79.8	1.3	N/A	2013
Gazprombank	IE	7.496	28/12/2023	2013-09-24	XS0975320879	USD	750.0	750.0	N/A	2013
Credit Agricole	FR	8.125	19/09/2033	2013-09-19	USF22797QT87	USD	1000.0	1000.0	BBB-	2013
Credit Agricole	FR	8.125	19/09/2033	2013-09-19	US225313AC92	USD	1000.0	1000.0	BBB-	2013
Credit Suisse	CH	5.75	18/09/2025	2013-09-18	XS0972523947	EUR	1669.8	2300.8	BBB-	2013
Hellenic Bank	N/A	11	N/A	2013-09-15	CY0144170111	EUR	171.9	236.8	N/A	2013
Hellenic Bank	N/A	10	N/A	2013-09-15	CY0144180110	EUR	174.2	240.0	N/A	2013
Banco Bilbao Vizcaya Argentaria	ES	9	N/A	2013-09-05	XS0926832907	USD	1500.0	1500.0	N/A	2013
Credit Suisse	CH	6	N/A	2013-09-04	CH0221803791	CHF	309.9	348.4	N/A	2013
Credit Suisse	CH	6.5	08/08/2023	2013-08-08	XS0957135212	USD	2500.0	2500.0	BBB-	2013
Credit Suisse	CH	6.5	08/08/2023	2013-08-08	US22546DAA46	USD	2500.0	2500.0	BBB-	2013
United Overseas Bank	SG	4.9	N/A	2013-07-23	SG57A1994579	SGD	672.5	532.4	BBB-	2013
Russian Agricultural Bank	LU	8.5	16/10/2023	2013-07-10	US74973DAJ81	USD	500.0	500.0	N/A	2013
Societe Generale	FR	8.25	N/A	2013-06-09	XS0867614595	USD	1250.0	1250.0	BB+	2013
UBS	CH	4.75	22/05/2023	2013-05-22	CH0214139930	USD	1500.0	1500.0	BBB-	2013
Sberbank	LU	5.25	23/05/2023	2013-05-16	XS0935311240	USD	1000.0	1000.0	N/A	2013
Suncorp	AU	5.435	22/11/2023	2013-04-23	AU0000SUNPD6	AUD	746.8	668.1	BBB+	2013
Barclays	GB	7.75	10/04/2023	2013-04-10	US06739FHK03	USD	1000.0	1000.0	BB+	2013
Swiss Re (EXCLUDED)	IE	6.375	01/09/2024	2013-03-12	XS0901578681	USD	750.0	750.0	N/A	2013
Industrial & Commercial Bank of China Asia	HK	4.5	10/10/2023	2013-02-10	XS0976879279	USD	500.0	500.0	N/A	2013
Banco do Brasil	KY	6.25	N/A	2013-01-31	US05958AAK43	USD	2000.0	2000.0	BB	2013
KBC	BE	8	25/01/2023	2013-01-25	BE6248510610	USD	1000.0	1000.0	BB+	2013
Banco do Brasil	KY	6.25	N/A	2013-01-13	USG07402DP58	USD	2000.0	2000.0	BB	2013
Hoist Kredit	SE	12	27/09/2023	2013-01-10	SE0005280591	SEK	51.9	8.1	N/A	2013
Glarner Kantonalbank	CH	3.5	N/A	2012-12-19	CH0201215511	CHF	76.7	86.3	N/A	2012
Barclays	GB	7.625	21/11/2022	2012-11-21	US06740L8C27	USD	3000.0	3000.0	BB+	2012
Julius Baer	CH	5.375	N/A	2012-09-18	CH0194437668	CHF	269.0	302.5	N/A	2012
UBS	US	7.625	17/08/2022	2012-08-17	US90261AAB89	USD	2000.0	2000.0	BBB-	2012
VTB Bank	IE	9.5	N/A	2012-08-06	US91834KAA43	USD	2250.0	2250.0	N/A	2012

Credit Suisse	GG	9.5	N/A	2012-07-31	XS0810846617	USD	1725.0	1725.0	N/A	2012
Banco Popular Espanol	N/A	4.5	29/03/2014	2012-06-29	XS0799651038	EUR	216.7	298.6	N/A	2012
Banco BPI	N/A	8.75	N/A	2012-06-26	PTBBRCOM0037	EUR	1265.1	1743.3	N/A	2012
VTB Bank	IE	9.5	N/A	2012-06-08	XS0810596832	USD	2250.0	2250.0	N/A	2012
Swiss Re (EXCLUDED)	IE	8.25	N/A	2012-03-29	XS0765564827	USD	750.0	750.0	N/A	2012
Macquarie	AU	10.25	20/06/2057	2012-03-26	XS0763122909	USD	250.0	250.0	N/A	2012
Credit Suisse	GG	7.125	22/03/2022	2012-03-22	CH0181115681	CHF	820.0	922.0	N/A	2012
Banco Popular Espanol	N/A	6.75	04/04/2018	2012-03-13	ES0213790035	EUR	1160.9	1599.7	N/A	2012
Credit Europe Bank	NL	10	28/02/2022	2012-02-28	XS0764697842	USD	50.0	50.0	N/A	2012
Banco do Brasil	KY	9.25	N/A	2012-02-27	US05958AAG31	USD	1750.0	1750.0	BB	2012
UBS	JE	7.25	22/02/2022	2012-02-22	XS0747231362	USD	2000.0	2000.0	BBB-	2012
Swiss Re (EXCLUDED)	CH	7.25	N/A	2012-02-09	CH0142132049	CHF	351.4	395.1	N/A	2012
Zuercher	CH	3.5	N/A	2012-01-31	CH0143808332	CHF	640.5	720.1	N/A	2012
Banco do Brasil	KY	9.25	N/A	2012-01-20	USP3772WAC66	USD	1750.0	1750.0	BB	2012
Nomura	JP	2.24	24/12/2021	2011-12-26	JP376260ABC4	JPY	1980.2	32.0	N/A	2011
Nomura Holdings	JP	2.24	24/12/2021	2011-12-26	JP376260BBC2	JPY	201.5	3.3	N/A	2011
Rabobank	NL	8.4	N/A	2011-11-09	XS0703303262	USD	2000.0	2000.0	N/A	2011
Industrial & Commercial Bank of China Asia	HK	6	04/11/2021	2011-10-28	HK0000091832	CNY	236.5	39.1	N/A	2011
BankNordik	VWAP	10.383	N/A	2011-10-24	DK0030278643	DKK	34.2	6.3	N/A	2011
Permanent TSB	N/A	10	28/07/2016	2011-10-19	IE00B712BB11	EUR	490.5	675.8	N/A	2011
Bank of Cyprus	N/A	6	N/A	2011-10-06	CY0141900114	USD	39.7	39.7	N/A	2011
Bank of Ireland	IE	10	30/07/2016	2011-07-29	XS0862044798	EUR	1333.5	1837.5	N/A	2011
Allied Irish Banks	IE	10	28/07/2016	2011-07-27	IE00B51GP956	EUR	2298.1	3166.6	N/A	2011
Credit Suisse	GG	7.875	24/02/2041	2011-02-24	XS0595225318	USD	2000.0	2000.0	BBB+	2011
Rabobank	NL	8.375	N/A	2011-01-26	XS0583302996	USD	2000.0	2000.0	N/A	2011
Intesa	IT	9.5	N/A	2010-10-01	XS0545782020	EUR	657.1	905.4	BB	2010
UniCredit	IT	9.375	N/A	2010-07-21	XS0527624059	EUR	434.8	599.1	BB	2010
Lloyds Bank	GB	7.875	19/03/2020	2010-03-19	XS0496068429	USD	407.6	407.6	BBB-	2010
Rabobank	NL	6.875	19/03/2020	2010-03-19	XS0496281618	EUR	1692.9	2332.7	N/A	2010
Sparekassen Sjaelland (EXCLUDED)	N/A	9.311	N/A	2010-01-11	DK0030265905	DKK	7.5	1.4	N/A	2010

Yorkshire Building Society (EXCLUDED)	GB	13.5	01/04/2025	2010-01-04	XS0498549194	GBP	39.1	64.8	N/A	2010
Lloyds Bank	GB	8.5	N/A	2009-12-17	XS0471770817	USD	276.7	276.7	BB	2009
Lloyds Bank	GB	8.5	N/A	2009-12-17	XS0473103348	USD	276.7	276.7	BB	2009
Lloyds Bank	GB	8	N/A	2009-12-15	XS0471767276	USD	1258.6	1258.6	BB	2009
Lloyds Bank	GB	8	N/A	2009-12-15	XS0473106283	USD	1258.6	1258.6	BB	2009
Lloyds Bank	GB	7.875	01/11/2020	2009-12-10	XS0459093521	USD	985.6	985.6	BB+	2009
Lloyds Bank	GB	11.04	19/03/2020	2009-12-01	XS0459088877	GBP	1223.7	2026.8	BB+	2009
Lloyds Bank	GB	6.385	12/05/2020	2009-12-01	XS0459088794	EUR	999.1	1376.8	BBB-	2009
Lloyds Bank	GB	15	21/12/2019	2009-12-01	XS0459089412	EUR	734.3	1011.9	BBB-	2009
Lloyds Bank	GB	9.875	10/02/2023	2009-01-17	XS0459092127	GBP	95.4	158.0	BBB-	2009
Lloyds Bank	GB	7.588	12/05/2020	2009-01-12	XS0459086582	GBP	1217.2	2016.0	BB+	2009
Lloyds Bank	GB	15	21/12/2019	2009-01-12	XS0459089255	GBP	1288.5	2134.0	BBB-	2009
Lloyds Bank	GB	6.439	23/05/2020	2009-01-12	XS0459088281	EUR	1072.4	1477.8	BB+	2009
Lloyds Bank	GB	7.867	17/12/2019	2009-01-12	XS0459086749	GBP	550.3	911.4	BB+	2009
Lloyds Bank	GB	8.875	07/02/2020	2009-01-12	XS0459087986	EUR	189.2	260.7	BBB-	2009
Lloyds Bank	GB	9.334	07/02/2020	2009-01-12	XS0459088109	GBP	345.0	571.4	BBB-	2009
Lloyds Bank	GB	7.869	25/08/2020	2009-01-12	XS0459093364	GBP	991.8	1642.6	BB+	2009
Lloyds Bank	GB	7.875	01/11/2020	2009-01-12	XS0459093794	USD	985.6	985.6	BB+	2009
Lloyds Bank	GB	7.375	12/03/2020	2009-01-12	XS0459090774	EUR	143.0	197.0	BB+	2009
Lloyds Bank	GB	12.75	10/08/2020	2009-01-12	XS0459091079	GBP	95.1	157.6	BBB-	2009
Lloyds Bank	GB	7.625	14/10/2020	2009-01-12	XS0459091236	EUR	341.4	470.4	BB+	2009
Lloyds Bank	GB	10.5	29/09/2023	2009-01-12	XS0459092473	GBP	114.3	189.2	BBB-	2009
Lloyds Bank	GB	9.125	15/07/2020	2009-01-12	XS0459090188	GBP	245.3	406.3	BBB-	2009
Lloyds Bank	GB	11.875	01/09/2024	2009-01-12	XS0459092556	GBP	58.6	97.1	BBB-	2009
Lloyds Bank	GB	15	22/01/2029	2009-01-12	XS0459089685	GBP	112.8	186.8	BBB-	2009
Lloyds Bank	GB	8.5	07/06/2032	2009-01-12	XS0459092986	GBP	173.4	287.2	BBB-	2009
Lloyds Bank	GB	14.5	30/01/2022	2009-01-12	XS0459091822	GBP	132.1	218.7	BBB-	2009
Lloyds Bank	GB	7.625	09/12/2019	2009-01-12	XS0459091582	GBP	251.7	416.9	BBB-	2009
Lloyds Bank	GB	7.975	15/09/2024	2009-01-12	XS0459086822	GBP	169.6	280.9	BB+	2009
Lloyds Bank	GB	16.125	10/12/2024	2009-01-12	XS0459093281	GBP	102.0	168.9	BBB-	2009
Lloyds Bank	GB	9	15/07/2029	2009-01-12	XS0459092804	GBP	178.6	295.8	BBB-	2009

Lloyds Bank	GB	11.25	14/09/2023	2009-01-12	XS0459092390	GBP	158.1	261.8	BBB-	2009
Lloyds Bank	GB	9	15/12/2019	2009-01-12	XS0459091665	GBP	160.8	266.3	BBB-	2009
Lloyds Bank	GB	11.125	04/11/2020	2009-01-12	XS0459090691	GBP	64.1	106.2	BBB-	2009
Lloyds Bank	GB	3.36	12/03/2020	2009-01-12	XS0459090931	EUR	80.1	110.3	BB+	2009
Lloyds Bank	GB	8.125	15/12/2019	2009-01-12	XS0459091749	GBP	6.7	11.2	BB+	2009

Appendix 2 - Issue features all issues

**Perpetual (Yes=1, NO=0), Regulatory (1, 2) (Tier1=1, Tier2=0), Loss absorption (Equity=1, write-down=0), Callable (Yes=1, NO=0), Trigger (lower or standard 5,125=1, higher than 5,125=0), Coupon Type (fixed=1, Floating=0), Coupon Frequency (Annual=1, quarterly, semiannually=0)*

Issuer	*ISIN*	*Perpetual*	*Regulatory*	*Loss absorbtion*	*Callable*	*Trigger*	*Coupon Type*	*Coupon Frequency*
Bendigo and Adelaide Bank	AU3FN0021952	0	N/A	N/A	1	N/A	0	0
Credit Agricole	USF22797RT78	1	1	0	1	1	1	0
Credit Agricole	US225313AD75	1	1	0	1	1	0	0
Ostjydsk Bank (EXCLUDED)	DK0030323456	0	N/A	N/A	0	N/A	N/A	N/A
Den Jyske Sparekasse (EXCLUDED)	DK0030298088	0	N/A	N/A	0	N/A	N/A	N/A
Spar Nord Bank (EXCLUDED)	DK0030178421	0	N/A	N/A	0	N/A	N/A	N/A
Press Kogyo (EXCLUDED)	XS0976017474	0	N/A	N/A	0	N/A	N/A	N/A
Banco Santander	US05969BAB99	0	0	0	1	1	0	0
Banco Santander	USP1507SAD91	0	0	0	1	1	1	0
Societe Generale	US83367TBF57	1	1	0	1	1	0	0
Societe Generale	USF8586CRW49	1	1	0	1	1	0	0
Credit Suisse	US22546DAB29	1	1	0	1	1	0	0
Barclays	XS1002801758	1	1	1	1	0	1	0
Danske Bank	XS0999631665	0	0	N/A	1	N/A	1	1
Barclays	US06738EAA38	1	N/A	N/A	1	N/A	1	0
Credit Suisse	XS0989394589	1	1	0	1	1	0	0
United Overseas Bank	SG58I7998534	1	1	0	1	N/A	1	0
DBS Group	SG59H0999851	1	1	0	1	N/A	0	0

China CITIC Bank	XS0985263150	0	0	0	1	N/A	0	0
Home Credit & Finance Bank	US29843LAC72	0	0	0	1	1	1	0
Russian Agricultural Bank	XS0979891925	0	0	0	0	1	1	0
Home Credit & Finance Bank	XS0981028177	0	0	0	1	1	1	0
Banco Popular Espanol	XS0979444402	1	1	1	1	1	0	0
Bank of India	INE084A08045	0	0	0	0	N/A	1	1
Gazprombank	XS0975320879	0	0	0	1	1	0	0
Credit Agricole	USF22797QT87	0	0	0	1	0	0	0
Credit Agricole	US225313AC92	0	0	0	1	0	0	0
Credit Suisse	XS0972523947	0	0	0	1	1	0	1
Hellenic Bank	CY0144170111	0	N/A	N/A	N/A	N/A	N/A	N/A
Hellenic Bank	CY0144180110	0	N/A	N/A	N/A	N/A	N/A	N/A
Banco Bilbao Vizcaya Argentaria	XS0926832907	1	1	1	1	1	1	0
Credit Suisse	CH0221803791	1	1	0	1	1	0	1
Credit Suisse	XS0957135212	0	0	0	0	1	1	0
Credit Suisse	US22546DAA46	0	0	0	0	1	1	0
United Overseas Bank	SG57A1994579	1	1	0	1	N/A	1	0
Russian Agricultural Bank	US74973DAJ81	0	0	0	0	N/A	1	0
Societe Generale	XS0867614595	1	1	0	1	1	0	0
UBS	CH0214139930	0	0	0	1	N/A	0	1
Sberbank	XS0935311240	0	0	0	0	1	1	0
Suncorp	AU0000SUNPD6	0	N/A	N/A	1	N/A	0	0
Barclays	US06739FHK03	0	0	0	1	0	1	0
Swiss Re (EXCLUDED)	XS0901578681	0	0	0	1	N/A	0	1
Industrial & Commercial Bank of China Asia	XS0976879279	0	0	0	1	N/A	0	0
Banco do Brasil	US05958AAK43	1	N/A	0	1	0	0	0
KBC	BE6248510610	0	0	0	1	0	0	0
Banco do Brasil	USG07402DP58	1	N/A	0	1	0	0	0
Hoist Kredit	SE0005280591	0	0	0	1	N/A	1	0
Glarner Kantonalbank	CH0201215511	1	N/A	N/A	1	N/A	0	1
Barclays	US06740L8C27	0	0	0	0	0	1	0

Julius Baer	CH0194437668	1	1	0	1	1	0	1
UBS	US90261AAB89	0	0	0	0	1	1	0
VTB Bank	US91834KAA43	1	1	0	1	N/A	0	0
Credit Suisse	XS0810846617	1	1	0	1	0	1	1
Banco Popular Espanol	XS0799651038	0	N/A	1	1	1	1	0
Banco BPI	PTBBRCOM0037	0	1	N/A	0	1	0	0
VTB Bank	XS0810596832	1	1	0	1	N/A	0	0
Swiss Re (EXCLUDED)	XS0765564827	1	N/A	N/A	1	N/A	1	1
Macquarie	XS0763122909	0	0	1	1	1	1	0
Credit Suisse	CH0181115681	0	0	1	1	1	0	1
Banco Popular Espanol	ES0213790035	0	N/A	N/A	0	N/A	N/A	N/A
Credit Europe Bank	XS0764697842	0	N/A	N/A	0	N/A	1	0
Banco do Brasil	US05958AAG31	1	N/A	0	1	0	1	0
UBS	XS0747231362	0	0	0	1	N/A	0	1
Swiss Re (EXCLUDED)	CH0142132049	1	1	1	1	N/A	1	1
Zuercher	CH0143808332	N/A	1	N/A	1	0	1	1
Banco do Brasil	USP3772WAC66	1	1	0	1	0	1	0
Nomura	JP376260ABC4	0	N/A	N/A	1	N/A	1	0
Nomura Holdings	JP376260BBC2	0	N/A	N/A	1	N/A	1	0
Rabobank	XS0703303262	1	1	0	1	0	1	0
Industrial & Commercial Bank of China Asia	HK0000091832	0	N/A	N/A	0	N/A	1	0
BankNordik	DK0030278643	0	N/A	N/A	0	N/A	N/A	N/A
Permanent TSB	IE00B712BB11	0	N/A	N/A	0	N/A	N/A	N/A
Bank of Cyprus	CY0141900114	1	1	1	N/A	N/A	1	0
Bank of Ireland	XS0862044798	0	0	1	0	0	1	1
Allied Irish Banks	IE00B51GP956	0	0	1	0	N/A	1	1
Credit Suisse	XS0595225318	0	0	1	1	0	1	0
Rabobank	XS0583302996	1	1	0	0	0	0	0
Intesa	XS0545782020	1	0	0	1	0	1	1
UniCredit	XS0527624059	0	1	0	1	0	1	1
Lloyds Bank	XS0496068429	0	1	1	0	N/A	1	0

Rabobank	XS0496281618	0	1	0	0	0	1	1
Sparekassen Sjaelland (EXCLUDED)	DK0030265905	0	N/A	N/A	0	N/A	N/A	N/A
Yorkshire Building Society (EXCLUDED)	XS0498549194	0	0	1	N/A	1	N/A	N/A
Lloyds Bank	XS0471770817	1	N/A	N/A	1	N/A	1	0
Lloyds Bank	XS0473103348	1	N/A	N/A	1	N/A	1	0
Lloyds Bank	XS0471767276	1	N/A	N/A	1	N/A	1	0
Lloyds Bank	XS0473106283	1	N/A	N/A	1	N/A	1	0
Lloyds Bank	XS0459093521	0	0	1	0	1	1	0
Lloyds Bank	XS0459088877	0	0	1	0	1	1	0
Lloyds Bank	XS0459088794	0	0	1	0	1	1	1
Lloyds Bank	XS0459089412	0	0	1	0	1	1	0
Lloyds Bank	XS0459092127	0	0	1	0	1	1	1
Lloyds Bank	XS0459086582	0	0	1	0	1	1	0
Lloyds Bank	XS0459089255	0	0	1	0	1	1	0
Lloyds Bank	XS0459088281	0	0	1	0	1	1	1
Lloyds Bank	XS0459086749	0	0	1	0	1	1	1
Lloyds Bank	XS0459087986	0	0	1	0	1	1	1
Lloyds Bank	XS0459088109	0	0	1	0	1	1	1
Lloyds Bank	XS0459093364	0	0	1	0	1	1	0
Lloyds Bank	XS0459093794	0	0	1	0	1	1	0
Lloyds Bank	XS0459090774	0	0	1	0	1	1	1
Lloyds Bank	XS0459091079	0	0	1	1	1	1	1
Lloyds Bank	XS0459091236	0	0	1	0	1	1	1
Lloyds Bank	XS0459092473	0	0	1	0	1	1	1
Lloyds Bank	XS0459090188	0	0	1	0	1	1	1
Lloyds Bank	XS0459092556	0	0	1	0	1	1	0
Lloyds Bank	XS0459089685	0	0	1	0	1	1	0
Lloyds Bank	XS0459092986	0	0	1	0	1	1	1
Lloyds Bank	XS0459091822	0	0	1	0	1	1	0
Lloyds Bank	XS0459091582	0	0	1	0	1	1	1
Lloyds Bank	XS0459086822	0	0	1	0	1	1	0

Lloyds Bank	XS0459093281	0	0	1	0	1	1	0
Lloyds Bank	XS0459092804	0	0	1	0	1	1	1
Lloyds Bank	XS0459092390	0	0	1	0	1	1	0
Lloyds Bank	XS0459091665	0	0	1	1	1	1	1
Lloyds Bank	XS0459090691	0	0	1	0	1	1	1
Lloyds Bank	XS0459090931	0	0	1	1	1	0	0
Lloyds Bank	XS0459091749	0	0	1	0	1	1	1

Appendix 3 - Descriptive statistics on all variables

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability	Sum	Sum Sq. Dev.	Observations
CALLABLE Y/N	0.55	1.00	1.00	0.00	0.50	-0.21	1.04	374.67	0.00	1239.00	555.81	2247
COCO SPREAD	5.40	5.12	17.34	-0.29	2.53	0.53	3.37	44.74	0.00	4614.10	5464.97	854
COUPON FREQ	0.32	0.00	1.00	0.00	0.47	0.79	1.62	398.56	0.00	693.00	473.11	2184
COUPON TYPE	0.68	1.00	1.00	0.00	0.47	-0.78	1.61	409.66	0.00	1533.00	487.12	2247
CTIER1	11.10	10.80	29.30	-1.90	2.55	0.77	6.79	847.40	0.00	13486.76	7877.17	1215
LEV	18.75	19.64	45.88	1.94	6.55	0.12	3.77	52.32	0.00	35657.61	81658.04	1902
LN ISSUE SIZE	6.25	6.52	8.01	1.91	1.23	-0.73	3.03	205.65	0.00	14317.21	3472.23	2289
LN RETURN	0.03	0.02	2.57	-2.71	0.29	-0.38	24.59	37066.65	0.00	53.11	158.97	1906
LN TA	13.10	13.83	14.52	7.16	1.46	-1.92	6.45	2110.38	0.00	24844.85	4022.89	1897
LOSS ABSORPTION	0.47	0.00	1.00	0.00	0.50	0.11	1.01	311.51	0.00	882.00	465.78	1869
NON PERF LOANS	3.42	2.31	46.28	0.04	3.52	3.12	24.60	33095.88	0.00	5370.34	19413.88	1571
PERPETUAL Y/N	0.29	0.00	1.00	0.00	0.46	0.91	1.82	445.92	0.00	672.00	474.72	2289
PUBLIC OR PRIVATE Y/N	0.83	1.00	1.00	0.00	0.37	-1.80	4.25	1390.98	0.00	1911.00	315.58	2289
REGT AT1ORT2	0.31	0.00	1.00	0.00	0.46	0.84	1.70	345.93	0.00	567.00	393.03	1848
ROA	0.25	0.22	13.90	-18.97	1.28	-3.43	61.46	263718.10	0.00	459.53	2975.14	1827
TRIGGER LEVEL	12.81	12.47	40.20	7.19	3.54	2.47	15.31	12983.68	0.00	22702.94	22254.31	1772
TIER1	0.75	1.00	1.00	0.00	0.43	-1.15	2.33	384.22	0.00	1197.00	299.25	1596

Appendix 4 - Correlation matrix on all variables

	CALLABLE Y/N	COCO SPREAD	COUPON FREQ	COUPON TYPE	CTIER1	LEV	LN ISSUE SIZE	LN RETURN	LN TA	LOSS ABSORPTION	NON PERF LOANS	PERPETUAL Y/N	PUBLIC OR PRIVATE Y/N	REGTAT1ORT2	ROA	TRIGGER LEVEL	TIER1
CALLABLE Y/N	1.00																
COCO SPREAD	-0.10	1.00															
COUPON FREQ	0.06	0.11	1.00														
COUPON TYPE	-0.53	0.22	0.20	1.00													
CTIER1	0.09	-0.34	-0.15	-0.18	1.00												
LEV	-0.28	-0.12	-0.21	-0.18	-0.13	1.00											
LN ISSUE SIZE	0.09	-0.32	-0.31	-0.06	0.25	-0.06	1.00										
LN RETURN	-0.01	-0.45	-0.07	-0.09	0.39	0.09	0.05	1.00									
LN TA	-0.27	0.20	-0.07	0.16	-0.36	0.57	-0.15	-0.05	1.00								
LOSS ABSORPTION	-0.55	0.25	0.05	0.36	-0.28	0.32	-0.40	-0.03	0.30	1.00							
NON PERF LOANS	-0.28	0.51	0.27	0.33	-0.59	-0.13	-0.33	-0.32	0.06	0.50	1.00						
PERPETUAL Y/N	0.47	-0.02	0.08	-0.28	0.09	-0.44	0.19	-0.09	-0.32	-0.53	-0.10	1.00					
PUBLIC OR PRIVATE Y/N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
REGTAT1ORT2	0.45	-0.07	0.07	-0.29	0.10	-0.32	0.14	0.01	-0.18	-0.51	-0.25	0.40	NA	1.00			
ROA	-0.03	0.14	-0.08	-0.06	0.18	-0.05	0.03	-0.08	-0.02	0.01	-0.08	-0.01	NA	-0.13	1.00		
TRIGGER LEVEL	-0.59	0.07	-0.03	0.11	-0.01	0.31	-0.30	0.04	0.28	0.65	0.18	-0.39	NA	-0.36	0.07	1.00	
TIER1	0.08	-0.17	-0.17	-0.19	0.90	-0.07	0.24	0.29	-0.24	-0.24	-0.49	0.09	NA	0.07	0.23	0.00	1.00

Appendix 5 - Exchange rates and datastream codes (2014-01-01)

Currency	**Exchange rate**	**DS codes**	**-**	**Currency**	**Exchange rate**	**DS codes**	**-**
USD/AUD	0.89465	S90215	AUSTDO$	AUD/EUR	1.54	Y05448	AUEURSP
USD/CHF	1.1244	Y76698	USDOLSF	CHF/EUR	1.23	Y78376	SWEURSP
USD/CNY	0.16518	S02448	CHINYUS	CNY/EUR	8.34	Y05459	CHEURSP
USD/DKK	0.1845	S02450	DANKRUS	DKK/EUR	7.46	Y05465	DKEURSP
USD/EUR	1.37795	S98991	USEURSP	EUR/EUR	1.00		
USD/GBP	1.65625	S19571	USDOLLR	GBP/EUR	0.83	S242W3	TEGBPSP
USD/INR	0.0161525	S02460	INDRUP$	INR/EUR	85.23	Y05474	INEURSP
USD/JPY	0.0161525	S02465	JAPYNUS	JPY/EUR	144.83	S98992	JPEURSP
USD/SEK	0.15525	S02488	SWEDKUS	SEK/EUR	8.85	Y05508	SDEURSP
USD/SGD	0.7917	S02483	SINGDUS	SGD/EUR	1.74	Y05502	SGEURSP
USD/USD	1			USD/EUR	1.38	S98991	USEURSP

Appendix 6 - Definitions of variables in S&P Capital IQ

Tier 1

Tier 1 Capital Ratio % represents Tier 1 Capital as a percentage of Total Risk-Weighted Assets of the Bank.

Core Tier 1

Core Tier 1 Capital Ratio represents core tier 1 capital ratio which is expressed as a percentage of core tier 1 capital to that of risk-weighted assets.

ROA

(EBIT **[+]** * 0.625) / ((Total Assets **[+]**(t) + Total Assets **[+]**(t-1)) / 2)

Notes:

(1) If both periods of data (t and t-1) are not available then the ratio will be shown as NM

(2) If the denominator is less than or equal to zero then the ratio will be shown as NM

Non performing

Non Performing Loans **[+]** / Total Assets **[+]**

Notes:

(1) If the denominator is less than or equal to zero then the ratio will be shown as NM

(2) If the margin value is less than (300%) then the value will be shown as NM

Total assets

Total Assets is subtotal line item across all templates with the following components:

Banks template:

Cash And Equivalents [+]

Total investments [+]

Net Loans [+]

Net Property, Plant & Equipment [+]

Goodwill [+]

Other Intangibles, Total - (Template Specific) [+]

Investment in FHLB [+]

Other Assets, Total - (Template Specific) [+]

Total Current Assets [+]

Net Property, Plant & Equipment [+]

Long-term Investments [+]

Goodwill [+]

Other Intangibles, Total [+]

Finance Div. Loans and Leases, LT [+]

Finance Division Other Long-Term Assets, Total [+]

Other Assets, Total [+]

Appendix 7 - Government bond yields used to calculate spreads

	Country	Denmark	EURO AREA	JAPAN	SWITZERLAND	UK	US
	Maturity	10y	10y	10y	10y	10y	10y
	Issue currency linked	DKK	EUR	JPY	CHF	GBP	USD, plus other
	Datastream code	DKBRYLD.	EMBRYLD.	JPBRYLD.	SWBRYLD.	UKBRYLD.	USBRYLD.
2009-03-31		3.79	3.69	1.34	1.92	3.89	3.57
2009-06-30		3.79	3.99	1.36	2.31	4.20	4.31
2009-09-30		3.64	3.64	1.29	1.98	3.95	4.05
2009-12-30		3.37	3.53	1.28	1.93	4.44	4.63
2010-03-31		2.68	3.49	1.39	1.81	4.39	4.71
2010-06-30		2.38	3.34	1.09	1.50	3.90	3.89
2010-09-30		3.02	3.03	0.93	1.35	3.46	3.68
2010-12-31		3.57	3.73	1.12	1.59	3.87	4.33
2011-03-30		3.24	4.02	1.26	1.88	4.07	4.51
2011-06-30		2.10	3.91	1.14	1.65	4.10	4.38
2011-09-30		1.68	3.42	1.03	0.94	3.06	2.92
2011-12-30		1.84	3.86	0.99	0.67	2.55	2.89
2012-03-30		1.48	3.33	0.99	0.81	2.84	3.35
2012-06-29		1.26	3.35	0.84	0.58	2.36	2.77
2012-09-28		1.03	3.03	0.78	0.53	2.22	2.83
2012-12-31		1.47	2.67	0.79	0.46	2.34	2.94
2013-03-29		1.88	2.68	0.56	0.63	2.39	3.11
2013-06-28		1.97	2.75	0.84	0.99	2.97	3.50
2013-09-30		1.99	2.94	0.69	1.04	3.07	3.69
2013-12-31		1.99	2.78	0.74	1.09	3.38	3.94
2014-03-31		1.62	2.34	0.63	0.96	3.24	3.56

Appendix 8 – Non-linearity test with squared variables. (Eviews output)

Dependent Variable: COCO_SPREAD
Method: Panel Least Squares
Date: 05/20/14 Time: 14:58
Sample (adjusted): 12/01/2010 12/01/2013
Periods included: 13
Cross-sections included: 55
Total panel (unbalanced) observations: 351
White cross-section standard errors & covariance (d.f. corrected)
WARNING: estimated coefficient covariance matrix is of reduced rank

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ROA	-0.532219	0.203558	-2.614581	0.0094
TIER1	-0.204900	0.261851	-0.782509	0.4345
NON_PERF_LOANS	0.223761	0.145890	1.533759	0.1261
LEV	-0.019502	0.131404	-0.148409	0.8821
CALLABLE__Y_N_	0.185036	0.192527	0.961093	0.3372
COUPON_FREQ	-0.593909	0.083774	-7.089445	0.0000
COUPON_TYPE	1.267000	0.407329	3.110507	0.0020
LOSS_ABSORPTION	-0.084226	0.223744	-0.376440	0.7068
PERPETUAL__Y_N_	1.219786	0.291536	4.184005	0.0000
REGT__AT1ORT2_	0.873334	0.204454	4.271534	0.0000
TRIGGER_LEVEL	-0.798457	0.202166	-3.949505	0.0001
LN_ISSUE_SIZE_	-0.465139	0.061899	-7.514482	0.0000
LN_RETURN_	0.391943	0.200851	1.951407	0.0519
LN_TA_	-0.283768	0.277740	-1.021703	0.3077
ROA2	-0.087857	0.027784	-3.162102	0.0017
TIER12	0.004976	0.008818	0.564299	0.5729
LEV2	0.000946	0.002313	0.408984	0.6828
NON_PERF_LOANS2	-0.008561	0.009974	-0.858260	0.3914
C	13.69150	1.852432	7.391096	0.0000

Effects Specification

Period fixed (dummy variables)

R-squared	0.931164	Mean dependent var	6.425861
Adjusted R-squared	0.924711	S.D. dependent var	2.672636
S.E. of regression	0.733341	Akaike info criterion	2.301762
Sum squared resid	172.0927	Schwarz criterion	2.642743
Log likelihood	-372.9593	Hannan-Quinn criter.	2.437471
F-statistic	144.2913	Durbin-Watson stat	1.034750
Prob(F-statistic)	0.000000		

Appendix 9 - Non-linearity test with all variables as a product of leverage. (Eviews output)

Dependent Variable: COCO_SPREAD
Method: Panel Least Squares
Date: 05/20/14 Time: 15:00
Sample (adjusted): 12/01/2010 12/01/2013
Periods included: 13
Cross-sections included: 55
Total panel (unbalanced) observations: 351
White cross-section standard errors & covariance (d.f. corrected)
WARNING: estimated coefficient covariance matrix is of reduced rank

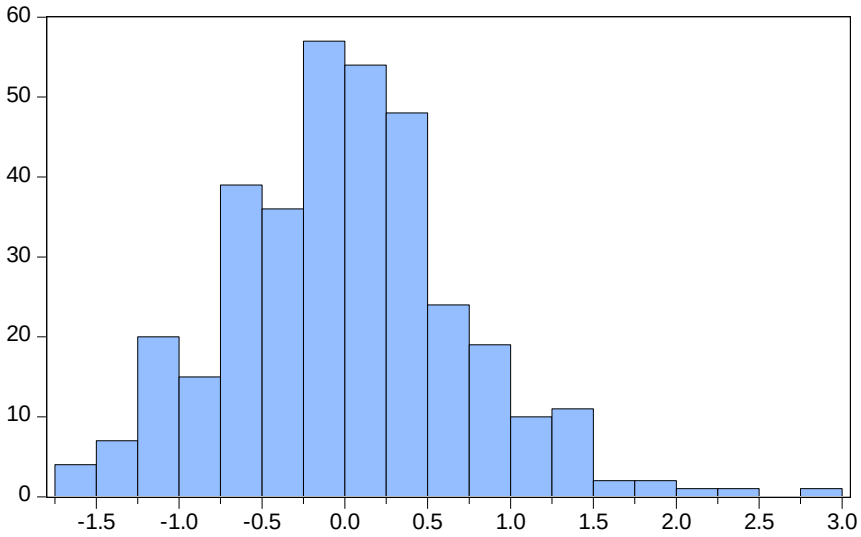
Variable	Coefficient	Std. Error	t-Statistic	Prob.
ROA	0.072520	0.599974	0.120872	0.9039
TIER1	0.380568	0.176696	2.153808	0.0320
NON_PERF_LOANS	0.107730	0.224899	0.479016	0.6323
LEV	0.295859	0.117765	2.512281	0.0125
CALLABLE__Y_N_	0.199125	0.194497	1.023796	0.3067
COUPON_FREQ	-0.579814	0.088656	-6.540033	0.0000
COUPON_TYPE	1.371738	0.369623	3.711186	0.0002
LOSS_ABSORPTION	0.020227	0.345271	0.058582	0.9533
PERPETUAL__Y_N_	1.341338	0.314389	4.266495	0.0000
REGT__AT1ORT2_	0.866310	0.208594	4.153089	0.0000
TRIGGER_LEVEL	-0.797627	0.246934	-3.230127	0.0014
LN_ISSUE_SIZE_	-0.467740	0.060567	-7.722681	0.0000
LN_RETURN_	0.342347	0.298248	1.147861	0.2519
LN_TA_	0.045802	0.116332	0.393721	0.6940
ROALEV	-0.013212	0.043498	-0.303734	0.7615
TIER1LEV	-0.023670	0.008665	-2.731738	0.0066
NON_PERF_LOANSLEV	0.002103	0.015323	0.137277	0.8909
C	2.506491	3.672898	0.682429	0.4955

Effects Specification

Period fixed (dummy variables)

R-squared	0.930164	Mean dependent var	6.425861
Adjusted R-squared	0.923855	S.D. dependent var	2.672636
S.E. of regression	0.737497	Akaike info criterion	2.310487
Sum squared resid	174.5927	Schwarz criterion	2.640468
Log likelihood	-375.4904	Hannan-Quinn criter.	2.441817
F-statistic	147.4309	Durbin-Watson stat	1.052664
Prob(F-statistic)	0.000000		

Appendix 10 - Jarque Bera normality test. (Eviews output)



Series: Standardized Residuals
Sample 12/01/2010 12/01/2013
Observations 351

Mean	-3.67e-17
Median	-0.008797
Maximum	2.873361
Minimum	-1.722053
Std. Dev.	0.712322
Skewness	0.346584
Kurtosis	3.673873
Jarque-Bera	13.66835
Probability	0.001076

Appendix 11 - Redundant fixed effect test (Eviews output)

Redundant Fixed Effects Tests
Equation: Untitled
Test period fixed effects

Effects Test	Statistic	d.f.	Prob.
Period F	168.225000	(12,324)	0.0000
Period Chi-square	694.388872	12	0.0000

Period fixed effects test equation:
Dependent Variable: COCO_SPREAD
Method: Panel Least Squares
Date: 05/20/14 Time: 15:05
Sample (adjusted): 12/01/2010 12/01/2013
Periods included: 13
Cross-sections included: 55
Total panel (unbalanced) observations: 351
White cross-section standard errors & covariance (d.f. corrected)
WARNING: estimated coefficient covariance matrix is of reduced rank

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ROA	0.425286	0.358600	1.185961	0.2365
TIER1	0.308352	0.093708	3.290576	0.0011
NON_PERF_LOANS	0.531534	0.140978	3.770340	0.0002
LEV	-0.105772	0.110376	-0.958289	0.3386
CALLABLE__Y_N_	0.430434	0.231860	1.856436	0.0643
COUPON_FREQ	-0.545668	0.128800	-4.236556	0.0000
COUPON_TYPE	1.042815	0.362955	2.873129	0.0043
LOSS_ABSORPTION	0.678201	0.446198	1.519952	0.1295
PERPETUAL__Y_N_	0.456961	0.505900	0.903263	0.3670
REGT__AT1ORT2_	1.046907	0.416512	2.513511	0.0124
TRIGGER_LEVEL	-0.557009	0.458470	-1.214930	0.2252
LN_ISSUE_SIZE_	-0.540849	0.073101	-7.398690	0.0000
LN_RETURN_	-3.563599	2.387929	-1.492339	0.1365
LN_TA_	1.658557	0.667163	2.485985	0.0134
C	-18.86347	8.243380	-2.288318	0.0227

R-squared	0.486377	Mean dependent var	6.425861
Adjusted R-squared	0.464976	S.D. dependent var	2.672636
S.E. of regression	1.954909	Akaike info criterion	4.220360
Sum squared resid	1284.081	Schwarz criterion	4.385351
Log likelihood	-725.6732	Hannan-Quinn criter.	4.286025
F-statistic	22.72684	Durbin-Watson stat	1.643732
Prob(F-statistic)	0.000000		