CoCo LoCo

An exploration of European CoCo issuances and investor reception

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Abstract

Contingent convertible bonds (CoCos) are recently introduced hybrid financial products that convert into equity or see their principal written-down when a pre-determined trigger is automatically activated. These products are aimed at reducing risk of individual banks and the financial industry in times of financial distress. To reach this goal and to prohibit negative side-effects, the literature provides optimal structures. In this research these theoretical optimal structures are discussed and compared to the structures of CoCos issued by banks in a sample of the (Western) European market from 2009 till Q1 of 2017. Among other things, the characteristics and the height of the triggers of the issued CoCos could lead to a failure in reaching the goal of risk-reduction. For the sample as a whole, equity investors do not react significantly on the issuance of CoCos. However, investors do react statistically significant positive on the issuance of principal write-down CoCos and CoCos with the regulatory minimal trigger, meaning that the funding costs of the bank - ceteris paribus - decrease. Investors react negatively to triggers higher than the regulatory minimum, leading to an increase in funding costs.

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1. Introduction

The contingent convertible bond, known as the friendlier sounding CoCo, was issued for the first time in 2009 and since then it is a widely discussed financial product, especially in the financial press. This is not only due to it being the new kid on the financial block but also because of its complexity, as it shows elements of both debt and equity, and its different possible structures. The hybrid form of CoCos leads to difficult questions within a wide variety of societal and academic subjects, such as banking supervision, tax, financial markets regulation, macroeconomics, asset pricing, and corporate finance, to name a few. For example, do CoCos contribute to the mandatory minimum amount of core capital set by regulators? Are the coupon payments tax-deductible? Should consumers be allowed to invest in these products? Do CoCos contribute to a more stable economy? How are these hybrid products priced? And what position do CoCos take in the financing of banks' operations? In this research a more explorative approach is used to examine these hybrid products in the European context. The approach consists of three parts. First, what are the theoretical optimal structures for CoCos? Second, what designs are issued in practice on the European CoCo market and how do these compare to the answer on the first question? Third and foremost, how are the issuances of these designs perceived by equity investors and how does this affect the funding costs of issuing banks?

After the financial crisis of 2008, measures were sought to reduce excessive risk-taking incentives and to improve the resilience of the financial industry as a whole. The idea behind CoCos is to change the capital structure of banks in such a way that it changes the balance of risk-taking incentives, without changing the supply of risk capital. CoCos can in times of financial stress, in pre-determined circumstances, be triggered and – depending on its exact structure – be converted into shares or be written-down. After this 'trigger event', the stressed bank sees its amount of debt declined and in some cases its amount of equity increased, meaning that CoCos serve as loss-absorbing capital. The first question focusses on these pre-determined circumstances and exact structures. What design is optimal in order to maximise the risk-reducing feature of CoCos? Based on a literature review, I find that the optimal CoCo structure should have a market trigger, preferably multiple triggers by issuing it in smaller tranches, and without an (additional) regulatory trigger. The trigger should be set sufficiently high, at least in order to have the conversion happening before a possible bankruptcy and to

decrease the chance of death spirals. The choice for either equity conversion or principal write-down depends on multiple factors.

The second part of the approach aims to reveal the European CoCo market practices. What structures are actually issued by banks in the time period of 2009 till Q1 of 2017 and how do these differ from the theoretical optimal designs? The research is focussed on the (Western) European CoCo market, as the bulk of CoCos worldwide is issued by banks seated in this area and European (tax) regulations are in some ways facilitating the issuance of CoCos. Using event studies, I find that in the European CoCo market, market based triggers are not used, issuances are not split into multiple tranches, and every CoCo has an additional (and obligatory) regulatory trigger. This is rather different from the theoretical optimal design. Two thirds of issued CoCos have an equity conversion mechanism and the majority of CoCos have their trigger on the regulatory minimum of 5.125%, for which I reason that this could be too low for CoCos to be effective.

The third part focusses on the equity investors´ reception of the issuance of CoCos in general and of issuances categorised by the characteristics of the CoCos itself and of the issuing bank. The sample consists of most European CoCo issuances by banks from 2009 till Q1 of 2017. Using event studies I find evidence that for the sample as whole, the issuance of CoCos has no significant impact on the share price of the issuing banks. This is in line with the only comparable research known till date, by Avdjiev *et al.* (2015). On top of that I provide evidence that investors react positively on the issuance of principal write-down CoCos. This means that – ceteris paribus – the funding costs of the issuing bank would decrease. Investors also seem to react positively on CoCos with a minimum trigger of 5.125% CET1 ratio but negatively on triggers above that level. This means that CoCos with a 5.125% trigger would decrease the funding costs, while CoCos with a trigger above that would increase the costs, which seems counterintuitive given the benefits of a higher trigger. The results are an addition to the work of Avdjiev *et al.*, who present evidence that issuances smaller than the median and issuances by bigger banks can count on a positive reaction of equity investors.

Taken together, this research gives an overview of the European CoCo market and the structures of the issued CoCos, in comparison to the theoretical optimal structures, and provides evidence on the impact on funding costs. The first two parts form an addition to Avdjiev, Kartasheva & Bogdanova (2013), who described the initial years of the worldwide

CoCo market, the third part an addition to Avdjiev *et al.* (2015), who analysed the impact on funding costs. It could also be a starting point for further research in multiple directions. Especially the discrepancies between CoCos in practice and the optimal structures are of importance, as the structures in practice are less risk-reducing than the optimal ones. Lawmakers and regulators should be aware of this and should find ways to respond to these discrepancies. The seemingly counterintuitive reception of investors is also of importance and needs further research. Banks could respond to these findings by optimising the structure of future CoCos, in order to increase risk-reduction, meet the apparent preferences of investors and possibly reduce the banks' funding costs with that.

The outline of this research is as follows. Chapter 2 contains an extensive discussion of the theoretical framework, covering both the technical details and the discussion of the literature on the optimal structure and impact on funding costs. Chapter 3 discusses the methodology and chapter 4 presents the results, of which the tables can be found in the appendices. Chapter 5 concludes.

2. Theoretical framework

In this chapter both the relevant literature and the technical details of CoCos are discussed. The technical details deserve extra attention, as CoCos were only placed on the wide palette of financial products recently. The first part of this chapter consists of these details. The second part contains the discussion of the relevant literature and covers both the optimal structure of CoCos and the impact of CoCos and different CoCo structures on the funding costs.

2.1 Technical details

In the first part of this chapter the technique behind CoCos is discussed extensively. First, the technical definitions from the CoCo structure and the regulatory environment they operate in are summed up. Then, the history of the CoCo in all its varieties is discussed. This part already includes some review of the literature on CoCo structures. Third, the regulatory environment is discussed, including a short discussion of tax regulations. As CoCos and their current structure are highly driven or influenced by regulations, this part is not simply some background information on CoCos, but essential knowledge to get the complete complex picture of these instruments.

2.1.1 Technical definitions

In this paragraph the technical definitions of CoCos are described. Although this entails some referrals to regulatory provisions, the regulatory environment is discussed separately in the next paragraph, for the sake of structure.

Common Equity Tier 1 capital

Common Equity Tier 1 capital entails ordinary shares, reserves, and retained earnings, and is also known as Core Equity Tier 1 capital. From the perspective of regulators Common Equity Tier 1 capital (hereafter: CET1 capital) is meant to take on going-concern losses. There are no redemption costs or mandatory payments on these instruments and in case of bankruptcy or ending of the company, the holders stand last in line with their claim on the assets of the company. Divided by the risk-weighted assets - explained below - this amount results in the CET1 ratio. The Basel III agreements – explained later – set the minimum for this ratio on 4.5%

Additional Tier 1 capital

In general, Additional Tier 1 capital (hereafter: AT1 capital) includes debt instruments with a perpetual duration. However, a call option, at the discretion of the bank, combined with regulatory approval, and not earlier than five years after the issuance, is allowed. Also at the discretion of the bank, is the distribution of coupons, meaning that non-payment of coupons does not lead to default. Events that do lead to default are the failure to pay an amount due and the liquidation of the bank. Note that this is not an event in the sense of a trigger event, which leads to the automatic conversion or write-down (see below for further description of the trigger event). Most CoCos meet the aforementioned requirements. Preferred shares might also be labelled as Additional Tier 1 capital, as long as it is, among other requirements, on a non-cumulative basis. Together with CET1 capital, which is also meant to act as buffer for going-concern losses, Additional Tier 1 capital forms Tier 1 capital. Similar to CET1 capital, AT1 capital is divided by risk-weighted assets in order to calculate the AT1 capital ratio.

Tier 1 capital

Tier 1 capital is the sum of CET1 and AT1 capital. It consists of permanent and completely subordinated capital, of which the distributions are subject to the discretion of the bank and even to mandatory cancellation in times of distress. A minimum of 6% of risk-weighted assets is required by Basel III, meaning that, given the 4.5% CET1 requirement, AT1 should be at 1.5%.

Tier 2 capital

Tier 2 capital also includes hybrid instruments, but without them complying with the strict requirements for CET1 and AT1 capital. For maturity, a minimum of five years is required, although these instruments tend to have longer maturity, as for the last five years regulatory amortisation will be applied. This means that on a straight-line basis, every year, 20% of the amount will be excluded of being treated at Tier 2 capital, ending in total exclusion at maturity. Another difference with Tier 1 is that the distributions can be non-deferrable and cumulative. The same limitations to events of default apply, but the claim of Tier 2 instrument holders comes before that of Tier 1 holders. CoCos with triggers that do not meet the 5.125% CET1 capital ratio requirement in order to be labelled as AT1 capital are seen as Tier 2 capital.

Risk-weighted assets

Risk-weighted assets (hereafter: RWA) are all assets of a bank, including off-balance sheet, but weighted for risk. For example, government bonds would have lower weights than corporate bonds, or non-secured loans would have higher weights than secured loans. Each class of assets is specified under Basel III or European regulations. This way the 'real' exposure of a bank to potential losses can be determined and regulators use RWA to calculate how much of all the different kinds of capital should be sustained by the bank in question. The amount of CET1 capital a bank should have, for example, is expressed as a percentage of RWA, and this expression is called the CET1 capital ratio.

Trigger

The trigger or the (trigger) event are the pre-specified circumstances that activate the mechanisms of equity conversion or principal write-down, which are described below. In fact different sorts of triggers exist, divided into three main categories: book value based, market value based and regulator based. Book and market value based triggers are both mechanical triggers, regulator based ones are sometimes referred to as discretionary triggers. The trigger based on book values entails the accounting measures of equity values of banks, divided by their assets. Book values could be prone to manipulation by managers, are by definition lagging, and could in times of distress even be more lagged because of forbearance by regulators to recognise losses. The latter is especially the case for big, systematically important banks and other financial institutions (G-SIBs and SIFIs), for which judgements by regulators and supervisors come with great sensitivity and public scrutiny (Calomiris & Herring, 2013). Market value triggers can be based on either CDS spreads or share prices. In both cases the trigger is activated if the market value reaches a certain point. Mechanical triggers are expressed as equity as percentage of total assets. Usually, CET1 capital is used for equity and RWA is used for total assets. As said, for CoCos to be included in AT1 capital, a 5.125% CET1 trigger is necessary. Apart from this regulatory point of view, banks could vary with and pile up lower or higher triggers to increase the effectivity of individual CoCo tranches. More on this in paragraph 2.2.1.2.

Regulatory triggers are based on the discretion of national regulators. If the regulator concludes that the bank in question has reached the point of non-viability, the trigger is activated. Even worse than with book value triggers, this judgement comes with great

sensitivity and complexity. Note that discretionary triggers are often used next to mechanical triggers.

Conversion

The trigger activates the typical CoCo mechanism, which is roughly divided into equity conversion on the one hand and principal write-down on the other hand. With the former, CoCos are converted into a pre-determined amount of shares, making CoCo holders shareholders. The conversation rate could be specified by share price or a combination of share price and amount of shares. With principal write-down, no conversion is made but the principal amount is written down, which comes in two categories: permanent write-down or partial write-down. Partial write-down could also be of temporary nature and a write-up or a return of the remaining face value in cash could follow (Avdjiev et al., 2015).

When summarising, a CoCo is a product that is structured by the trigger and the conversion mechanism that is the result of that trigger possibly occurring. Besides that, CoCos have standard bond features like coupon rates, maturity, and call dates. Apart from the fact that not paying out coupons does not lead to the bank defaulting, these standard features are of lesser importance for this research. Now, with the definitions outlined, the next step is a brief discussion of the history of the development of CoCos.

2.1.2 History

Contingent convertible bonds are first mentioned in a 2002 paper by Flannery as 'Reverse Convertible Debentures' (hereafter: RCDs). Approximately the same term is already used by Doherty & Harrington in a seven years older paper, but as their mechanism is based on a trigger at the discretion of the shareholders, their mechanism not exactly 'contingent' (Doherty & Harrington, 1995). The RCDs could introduce more market discipline to large financial institutions instead of them relying on the scrutiny and financial support of national supervisors and governments, according to the authors. With automatic conversion to equity, based on a threshold of the bank's market value of equity, the products provide a mechanism of un-levering. Different from ordinary convertible debt products, RCDs convert at the current market price of the shares (Flannery, 2002). Two years later Raviv proposes roughly the same but with a threshold not based on the market value, but on the book value of equity (Raviv, 2004). Although during the following years some discussions of CoCo-like products are found in the literature, the concept gained particularly more traction after the 2008

financial crisis. The busts and bail-outs of huge financial institutions during that crisis showed that those institutions were unable to withstand big losses on their own. Lawmakers and regulators concluded that more capital buffers were needed, in order to prevent these events from happening in the future. These buffers must consist of capital that is loss-absorbing by being written down or converted to equity. Common equity, other capital instruments, but also certain types of long-term unsecured debt meet this criterion. More details on the exact requirements of these buffers are found in paragraph 2.1.3.2.

In a working paper from 2009, published in 2016, Flannery discusses RCDs again but renames them to 'Contingent Capital Certificates' (hereafter: CCCs). Apart from the 'rebranding', the mechanism is not really changed but practical implications of this product are added. Flannery stresses the importance of a market value based trigger instead of a book value based trigger. The latter would be lagging as changes in book value usually lag behind on the market values, partly since accounting measures provide managers the flexibility in timing the impairment of capital. In 2009, multiple papers were published covering and discussing various parts of the CoCo mechanism, as shown in the overview by Calomiris & Herring in 2011 and published in 2013. Important parts are, for example, the exact form of the trigger or the amount of shares CoCo holders should receive in case of a trigger event (Calomiris & Herring, 2013).

Since Doherty & Harrington's RCDs, authors argue that CoCos would lead to more market discipline, as it would incentivise banks with CoCos on their balance sheet to set up stronger systems of risk governance, in order to reduce the chance of CoCos hitting the trigger. During the 2008 financial crisis, banks and other financial institutions were, despite their dire state, reluctant to issue additional equity. With the low share prices, equity issuance would have led to strong dilution of shareholders (and the share-owning management) and the banks preferred to wait till circumstances would turn more comfortable. On top of that, banks that were too big to fail counted on government guarantees. This situation of consciously waiting lead of course to even worse circumstances. In the situation of CoCos almost hitting the trigger, banks – both their shareholders and management – have a strong incentive to raise additional equity without further due, in order to prevent the CoCos from converting. This could increase the stability of financial markets in times of crisis (Calomiris & Herring, 2013).

In 2010, academics propose further enhancements of the CoCo mechanism, including dual triggers and conversion terms that steer the amount of wealth that is transferred between current shareholders and CoCo holders. Dual or multiple triggers are proposed for various reasons. In one version, for example, a trigger based on the bank's equity is combined with a trigger based on an index of financial institutions. This in order to ensure that conversion only happens during a market crisis.

Although the first CoCo was brought to the market through an exchange offer by Lloyds a year earlier, the first direct issuance of CoCos took place in 2010, when Rabobank issued 'Senior Contingent Notes' worth €1.25 billion.[1] Interestingly enough, this second issuance already shows that a more or less homogeneous CoCo market will probably not be attained, as, different from Lloyds, Rabobank does not derive its capital from shares but from member certificates, which do not provide the same claim on the assets of a company. This means that Rabobank cannot issue equity conversion CoCos but only principal write-down CoCos. Moreover, the CoCos issued by Rabobank not only have a trigger based on the book value of equity, but also a regulatory trigger, meaning that by the discretion of the national financial market supervisor, the CoCos of Rabobank can be triggered. While there are more differences between the first two issuances of CoCos, the described differences illustrate that CoCos can differentiate from one another by many different aspects. Besides pointing out the heterogeneity of CoCos, mentioning these two issuances serves to point out the fact that despite all the academic research and recommendations, in practice, banks design CoCos not necessarily in line with these.

An important factor in the decisions on the exact design of a CoCo, are the regulations in place. In 2011, the Basel III capital requirements by the Bank of International Settlements were issued and these contain that for CoCos to qualify as AT1 capital, the trigger must be at least 5.125% of CET1 capital.[2] This not only shows the need for clarification of the technical and regulatory definitions, but mainly that banks – if they want to meet certain capital requirements – must issue CoCos with a 5.125% trigger. A report of the Norwegian Central Bank shows that during the time period of 2009 till the second half of 2014, the majority of

[1] Lloyds Banking Group, Exchange Offer and Publication of Exchange Offer Memorandum, 3 November 2009; Rabobank Group, Senior Contingent Notes issuance announcement, 12 March 2010.
[2] Basel Committee on Banking, Basel III: A global regulatory framework for more resilient banks and banking systems - revised version June 2011, Bank of International Settlements.

issued CoCos had a 5.125% CET1 capital ratio trigger.[3] Note that these triggers are based on accounting measures. In fact no CoCos with market based triggers had been issued. The report also shows that after 2012, the issuance of CoCos started to grow quickly. For example, during the first half of 2014, 39% of volume of the total European CoCo market was issued. This could be due to the clarity that was provided by first the Basel III requirements and later, in 2013, the EU Capital Requirements Regulation, which transforms the Basel III requirements into the EU regulatory framework.[4] Before that, for banks seated in EU member states, there was uncertainty about whether CoCos would be qualified as regulatory buffer capital. For a more detailed discussion of the regulatory framework I refer to paragraph 2.1.3.1.

After 2013, when the CoCo market grew into a substantial size, certain trends can be observed. For example, between the first issuance by Lloyds and September 2014, 187 CoCos were issued by banks worldwide, of which 86% in volume by European banks (Avdjiev *et al.*, 2015). Like the report of the Norwegian Central Bank, Avdjiev *et al.* show that the percentage of CoCos with a trigger of 5.125% (or higher) has been increasing, to a number of over 60% in late 2014. Secondly, the growth in market volume is still visible, although it is not as strong as earlier. Another interesting observation is about the amount of CoCos that either have an equity conversion or a principal write-down mechanism. Whereas academics focused primarily on CoCos using an equity conversion mechanism, the majority of issued CoCos has a principal write-down mechanism. Although the two mechanisms are treated the same by regulators, they do provide different (risk-taking) incentives, as *Avdjiev et al.* note.

After the report of the Norwegian Central Bank and the paper of Avdjiev *et al.* (2015), some years passed, meaning that a refreshed overview of the key elements is needed. In table 1 the numbers over the period of 2009 till the first quarter of 2017 are presented and in paragraph 4.1 discussed. With the ending of this paragraph an overview of the development of the CoCo product and its market is provided. In the next paragraph the regulatory environment is discussed.

[3] K.B. Nordal & N. Stefano, 'Contingent Convertible Bonds (CoCos) Issued by European Banks', Norges Bank Staff Memo nr. 19-2014.
[4] Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012.

2.1.3 Regulatory environment

After the 2008 financial crisis, worldwide initiatives were started to come up with stricter regulations for the financial industry, in particular the capital buffers of banks and financial institutions. The Basel III requirements from the Bank of International Settlements were the result of these joint efforts and set out the framework for the current regulations on the adequacy of banks´ capital. For the EU, implementation was brought by the Capital Requirement Regulation and the Credit Institutions Directive, discussed in the following paragraphs.

Whereas Basel III is a global and voluntary framework the Capital Requirements Regulation and Credit Institutions Directive are obligatory sets of EU law. The Capital Requirements Regulation (hereafter: CRR) is an important part of the so-called Single Rulebook, an umbrella name for EU laws that directly govern the financial industry, and sets out most prudential rules and requirements for bank and investment firms.[5] Among other things, the CRR contains prescriptive rules on capital, liquidity, leverage, and disclosure requirements, including those on CoCos. The requirements for CoCos to be labelled as AT1 capital can be found in article 52 and further of the CRR, covering more than four pages. In the next paragraph the most important provisions are discussed, as these shape the characteristics of most issued CoCos.

It is important to note that an EU regulation has direct power, meaning that, when passed by the European Parliament, this regulation is directly applicable in all EU member states, without further action needed. The fact that the EU took the road of a regulation instead of a directive is a deviation from the past that saw the use of directives only. Directives are different from regulations as these have no direct power but need to be implemented by national lawmakers. The directives do set out certain limits or targets that the laws of EU member states have to meet, otherwise risking legal and political consequences.

Together with the CRR, the Credit Institutions Directive (hereafter: CRD) forms the successor of three earlier directives on the financial industry, hence the reason why the two together are usually referred to as CRD IV. It governs among other things, prudential supervision, corporate governance, and capital buffers, of which the latter can be funded by

[5] Regulation (EU) 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms.

issuing CoCos.[6] While CRD only contains a few directive rules on CoCos, most rules can be found in the CRR.

2.1.3.1 CoCos in the CRR

As said, in the CRR a considerable amount of provisions is devoted to CoCos, or to be exact – since the CRR does not mention the term CoCo – Additional Tier 1 capital. One could actually argue that AT1 capital constitutes CoCos, and the other way around, but this discussion set aside, the most important provisions are discussed below, in the same sequence as in the CRR.

First, in article 52 paragraph 1 sub d, it is formulated that CoCos, in the event of insolvency, come after Tier 2 capital, and this seniority cannot be enhanced in any way, as is stipulated in the paragraphs that follow. Subsequently, in paragraph g, it is determined that CoCos should be perpetual and should not contain incentives for the issuer to redeem them. In paragraph i some of the typical characteristics of CoCos come forward. Only under certain conditions the instruments may be called, redeemed, or repurchased, and in principle not before five years after the issuance. These conditions are described in the paragraphs 77 and 78 of the CRR. Most importantly, it is necessary to obtain approval of the national supervisor and this approval will only be given if the tranche of CoCos in question is replaced by instruments of the same or higher quality, at terms that are within the boundaries of the income capacity of the bank. The five year principle could only be broken if the rules regarding these instruments change or if the fiscal treatment changes. In paragraph k different provisions on the payment of coupons are described. It is always allowed for the bank to stop the payments for an undetermined period of time and on a non-cumulative basis, when deemed necessary in the view of the bank. This does not constitute defaulting, although one could wonder what signal this gives to the market.

In paragraph n it is stipulated how the consequences of a trigger event should be, in terms of write-down or conversion. In paragraph 2 of article 52 the European Banking Authority is given the task to draft regulatory technical standards to specify, among other things, the procedures and timing for determining the occurrence of a trigger event. According to article 54, a trigger event occurs when the CET1 ratio of a bank falls below 5.125% or below a higher percentage, as is possible to specify in the CoCo's provisions. The bank could also

[6] Directive 2013/36/EU of the European Parliament and of the Council of 26 June 2013 on access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms.

specify multiple triggers. Note that although banks do have the possibility to differ here and there, most specifications in the CRR are obligatory, in that sense, if a CoCo instrument fails to meet of one of the requirements, it is not labelled as AT1 capital. This means that AT1, equals CoCos but not necessarily the other way around. If the predicate of AT1 capital cannot be acquired, the CoCo in question is labelled as Tier 2 capital. This is, however, something banks would try to avoid, as they need at least 1.5% of RWA as AT1 capital and could have fiscal consequences (see paragraph 2.1.3.4). In the next paragraph the capital requirements are be discussed.

2.1.3.2 Capital requirements CRD

The earlier described definitions of the three main categories of capital instruments, Tier 1, AT1 and Tier 2 capital, follow directly from the CRR. With these definitions the EU lawmakers are able to set out the capital requirements. Paragraph 93 states that all times, bank should have a CET1 capital ratio (to RWA) of at least 4.5%, a Tier 1 capital ratio of 6%, and a total capital ratio of 8%. This means that to attain the 6% Tier 1 ratio, a bank has to raise at least 1.5% of AT1 capital, or – less likely – that amount of more of the same CET1 capital. As the total capital ratio needs to be 8%, Tier 2 capital needs to be 2% of RWA. On top of these minimal capital ("Pillar 1") requirements, different other buffers apply, mostly coming from the CRD. In article 128 of the CRD an overview is given. First, from article 129 CRD, the Capital Conservation Buffer, with 2.5% extra CET1 capital, that serves as an extra cushion, in order to prevent all banks in the EU from hitting the minimal requirements in periods of financial distress. Secondly, in article 130, the Institution-specific Countercyclical Capital Buffer is laid down. It follows that the member states shall require banks to maintain this buffer and references are made to the sources that describe how these should be calculated. This buffer should come as an addition to and consist of CET1 capital, up to 2.5% or even more, but without a minimum.

Subsequently, in article 131, the Global Systematically and Other Systematically Important Institutions (hereafter: G- and O-SIIs) buffers are described in great detail. Member states should designate the authority in charge of identifying G- and O-SIIs, within the structure laid down in the same article and in accordance with the guidelines provided by the European Banking Authority. Again, these buffers should consist of CET1 capital and could go up to 5% or more. The last buffer comes from article 133 and is more or less the last resort for a member state to impose additional buffers. In short, Systemic Risk buffers may be introduced

for the financial sector as a whole or subsets of that, in order to prevent long term non-cyclical or macro-prudential risks, not covered by the CRR. It should also consist of CET1 capital and has a limit of 5%. Note that *only* the higher of the G- and SIIs buffers on the one hand and Systemic Risk buffers on the other hand applies to an institution.

All together, these additional requirements are called the Combined Buffer Requirement. On top of these additional requirements could come even more additional capital. With "Pillar 2" requirements the national supervisor could impose the holding of additional capital to cover against specific risks that came to surface after a supervisory assessment. Pillar 2 is split into a Requirements part and a Guidance part, the latter not being not obligatory. The last addition could come from the bank itself, if it wishes so. See figure 1 in the appendices for a visual summary of the capital requirements under CRD and CRR, issued by the European Commission.

Despite this list of requirements that leads to a considerable amount of capital that banks need to attract, the role of CoCos seems rather limited. The average demand from important EU banks for CET1 capital is at a steady 10.6% in 2017 (compared to a 10.4% in 2016).[7] This 'demand' is the result of all the requirements, and should in my view be put down as 'minimum demand', as in 2017 all but one bank had a CET1 capital above the minimum required level (in 2016 this number was five). Actual demand for CET1 capital is thus higher.[8] For CoCos, however, the minimum demand is more than stable, with a fixed 1.5%, within the Pillar 1 requirements. Again, this does not necessarily say something about the actual demand from the banks. Rabobank for example, increased its target for AT1 capital to 3.5% in the beginning of 2017, from already 2% before that.[9] Apart from the question about actual demand, it is certain that the 1.5% from the Pillar 1 requirements already constitutes, in absolute terms, a vast amount of capital that banks need to issue. This shows the importance of a proper understanding of this product and its framework. The last piece of the framework is discussed in the next paragraph.

[7] '2017 SREP methodology booklet', ECB Banking Supervision, accessed at www.bankingsupervision.europa.eu/banking/srep/2017 on 04-19-2018.
[8] A possible explanation for this could be that banks are sorting before the final capital ratios of CRD and CRR, as some of these are gradually phased-in for 2019.
[9] 'Offering of new Rabobank Certificates to further increase capital buffers', accessed on www.rabobank.com, section investor news, on 04-19-2018.

2.1.3.3 Tax policies

Given the cocktail of their hybrid form, EU capital requirements-origin, and size in terms of value that banks need to attract, CoCos take an interesting position in the tax policies of various EU member states. Although CoCos are issued as bonds, they have multiple characteristics of equity. In principle, CoCos have perpetual duration and in case of losses, a CoCo investor can lose (part) of her investment, without it leading to default. Moreover, although the compensation for investors is fixed and has no upward potential, these coupons can be cancelled by the issuer, without the latter being in default. From the regulator point-of-view, this means that CoCos are seen as going-concern capital. From a tax point of view, all these characteristics are highly indicative for CoCos having to be labelled as equity. This is of importance, as in most countries, contrary to debt, payments on equity are not tax-deductible, meaning that if the strong indication of CoCos being equity would be followed, the coupons would not be tax-deductible.

However, in most EU member states, the coupon payments on CoCos actually are tax-deductible.[10] Sometimes this was possible within existing tax regulations and structures, but in some countries provisions on CoCos had to be added, in order to ensure the tax-deductibility of coupon payments.[11] For example, in The Netherlands, a provision was added to the Enterprise Income Tax Law. This article 29a refers directly to the definition of AT1 capital in the CRR and determines that for both the issuer and the holder these products are treated as debt. This means that for investors, the coupon payments are not taxed with dividend withholding tax, and for banks, these payments are deductible from their taxable income. With this kind of tax treatments, EU member states are facilitating banks in their fulfilment of EU capital requirements. Apart from this instrumental approach, these amended tax regulations also add an extra incentive for investors and banks to buy and issue CoCos, respectively. With these observations, an end comes to the description of the framework CoCos are situated in. In the next paragraph this description will serve as the basis for the discussion of the literature on CoCos, covering both the optimal structure and the impact on funding costs.

[10] 'Tax treatment of additional tier 1 capital across the EU', Simmons & Simmons LLP, October 2014, accessed on www.elexica.com, search on title, 04-20-2018.
[11] 'Tax Treatment of Additional Tier 1 Capital under Basel III', Allen & Overy LLP, accessed on www.allenovery.com through www.google.com, on 04-20-2018.

2.2 Literature review

In this part the academic literature on CoCos is discussed. First comes the discussion on the (theoretical) optimal structure, subsequently the discussion on the impact of CoCo issuance on the funding costs, through the effect on the share price of the issuing bank.

2.2.1 Optimal structure

Based on the earlier description of the technical details of CoCos, one could already see that there are many possibilities for CoCo structures. In the years before CoCo issuance took off, academics took on the question of the optimal structure for these instruments. Along the three lines of CoCo structure, this optimal structure will be discussed: the trigger event, the conversion mechanism, and the remaining features. The specific combination of these three is designed by an issuing bank in such a way, that it suits their objective in the most optimal way. This objective is mainly to provide loss-absorbing capital in times of financial distress, on a going-concern basis (Flannery, 2016). CoCos have the potential to provide this stability, while possibly affecting the funding costs (Chen *et al.*, 2013).

2.2.1.1 Optimal trigger

The effectiveness of the trigger event is strongly related to the underlying values of the issuing bank that could lead to a trigger. Non-transparent and non-frequent reporting of these values lead to uncertainty, which the reduces the effectiveness in terms of providing stability (Calomiris & Herring, 2013). Triggers based on book values are usually expressed by CET1 capital ratios. The public disclosure of these ratios is not very frequent and usually it is not very transparent how these ratios are calculated internally. Additional unpredictability comes from the possibility for regulators and management to influence the ratios. This makes quantifying the probability of a CoCo hitting the trigger difficult. Because of these issues, multiple authors came to the conclusion that triggers based on book values are ineffictive (Giacomini & Flannery, 2015), (Pennacchi, Vermaelen, & Wolff, 2014). With the data of banks from before and after the financial crisis, authors modelled the effects CoCos could have had, were they already there at that time. Haldane (2011) writes that "[…] regulatory capital ratios do about as well in predicting crises as a coin toss." From all the banks that had to be bailed-out, none had regulatory capital that would have triggered current CoCos (Haldane, 2011). Flannery & Giacomini provide support that book values tend to over-state the ability of banks to absorb (further) losses, espescially when they are in distress (Giacomini & Flannery, 2015).

Market value triggers are based on the value of publicly traded underlying assets, such as the share price of the issuer or a certain index. Information comes in from exchanges at an extremely high frequency and although share prices are not immune from manipulation of any kind, the influence of management on the share prices is limited compared to book values. Regulators or regulatory judgements have a close to zero influence in this case (Avdjiev *et al.*, 2015). Multiple authors prefer market value triggers over book value triggers (Calomiris & Herring, 2013), (Pennacchi, Vermaelen, & Wolff, 2014). Contrary to book value based triggers, market based triggers would have clearly indicated financial distress (Haldane, 2011).

This doen not mean this design is without difficulties, as these triggers might lead to adverse incentives. Incentives for price manipulation could occur when the bank has made losses recently and for private gain, the share prices may be forced down further. The trigger could be breached strategically for wealth to be transferred from CoCo holders to shareholders. This could be fixed by setting higher triggers, as at higher capital ratios, possible conversion does not mean bankruptcy is near, and probably has little effect on the share price. Even if the trigger is breached, the wealth transfer will be relatively small (Flannery, 2016). Another solution would be to express the trigger as a multi-day average of closing prices (Duffie, 2009), but according to Flannery the drawback of this solution could be that the implemenation of recapitalisation will delayed.

A regulatory trigger is based on the judgement of national supervisors about the solvency of the bank, and if that authority believes the bank has passed the point of non-viability (hereafter: PONV), it can activate the trigger. As said, this is a source of uncertainty for investors, especially since this PONV does not need to be incorporated in the provisions of the CoCo itself but comes straight from the CRD and other EU regulations.[12]

2.2.1.2 Optimal conversion mechanism

When assessing the possibilities regarding the conversion mechanism, it is important to keep two points of view in mind, that of potential CoCo investors and that of current shareholders. In case of equity conversion and the conversion rate being based on a pre-determined share price, CoCo investors prefer a lower pre-determined share price, as this will give them more shares when conversion takes place. Current shareholders prefer a higher share price, as this

[12] See consideration 45 of the CRD and Directive 2014/59/EU of the European Parliament and of the Council.

minimises the dilution of their shareholdings (Chan & Van Wijnbergen, 2016). For equity conversion, the bank's equity should be listed, otherwise principal write-down is the only alternative. Listed banks could still prefer write-down mechanisms, as this does not dilute the holdings of currents shareholders, which could be of even greater importance in case of strategic shareholders owning tight majorities.

Both equity conversion and principal write-down have more specific issues. With regard to the latter, more specifically in case of partial write-down and the remainder being paid out in cash, the liquidity of the bank, which is already in distress, could deteriorate even further (Avdjiev *et al.*, 2015). With regard to the former, current shareholders have a strong incentive to avoid the trigger event from happening, as this dilutes their shares (Chan & Van Wijnbergen, 2016). This could lead them to stimulate or even pressurise management into avoiding the trigger. I think this could go two ways. In one way this could be a positive force, forcing management to initiate cost savings or to sell underperforming parts of the business for example. In the other way, the pressure of shareholders could be too high, forcing management to go for short-sighted earnings management or for the sale of profitable parts of the company.

For equity conversion there are more possible issues. The mechanism could lead to strong dilution, entrenchment of management, and, if combined with a market based trigger, to so-called death spirals (Chan & Van Wijnbergen, 2014). Different solutions could apply. With regard to dilution, banks could set the conversion price or the number of shares upon conversion such that the value of the shares coming from the conversion is lower than the face value of the converted CoCos. This way, the shares of the current shareholders are not diluted, meaning that some wealth is transferred from CoCo holders to shareholders. If the value of the shares is higher than the face value of the CoCos, shareholders are diluted, and some wealth is transferred from shareholders to CoCo holders. Note that in case of equity conversion, CoCo investors and shareholders always share the losses, but the proportions are dependent on the exact structure (Chan & Van Wijnbergen, 2016).

CoCos could also be seen as a pre-packed reorganisation and because of this they could lead to entrenchment of management. In a normal reorganisation, managers are usually replaced, giving room to drastic changes and improvement. With conversion, management remains seated, and those drastic improvement might not take place. To avoid this, it is possible to

impose that the bank should appoint new management within a certain amount of days after conversion (Flannery, 2014).

Death spirals could occur when equity conversion is combined with a market based trigger, and could be started in multiple ways. First, in case investors hedge the equity exposure embedded in CoCos by taking short positions in the underlying shares, a negative movement in the share price could in some circumstances have a self-reinforcing effect. Second, the point of conversion or the point of near-conversion could be strong negative signal towards investors (or depositors) about the quality of the bank and its assets, and this could depress the share prices even further (or lead to a bank-run). Third, in case of a high degree of cross-holdings of CoCos among banks, the conversion for one bank, might impose a negative externality on other banks. This means that systemic risk actually would go up when a conversion occurs (Chan & Van Wijnbergen, 2014). Death spirals can be avoided by changing the structure, either by changing the trigger or by the conversion mechanism. In general, if the size of the CoCos relative to the publicly traded amount of shares is moderate, the chance on death spirals or at least the effects of those are limited. With regard to the negative signal and externality, setting the trigger higher would already reduce the chance of a death spiral happening, as it is less of a strong signal about the quality of the bank. A stronger solution is setting multiple triggers. Instead of one large CoCo issuance, banks should issue in multiple tranches, with triggers across an extended range. This should aleviate the death spiral risk (De Spiegeleer & Schoutens, 2013). Expressing the trigger as a multi-day average of the share price could do the same. (Flannery, 2014).

2.2.1.3 Optimal remaining features

With regard to the remaining features only a few are of importance. The first is that in times of distress, the bank can cancel the coupon payments, on a non-cumulative basis. In the literature this feature does not seem a source of debate, the obligation stemming from the CRR seems accepted. The second feature is that CoCos must be perpetual in nature and although calls are permitted under certain conditions, coupons step-ups are not allowed as these might serve as an incentive to redeem the CoCo. This feature is not debated either.

2.2.1.4 Summary

Everything together, a picture of the ‘perfect CoCo’ could be drawn or at least sketched. It should have a market based trigger, preferably multiple triggers by cutting up the issuance in different tranches, and it should be without an additional regulatory trigger. One (1) market

based trigger is also an option but in that case, it should be based on a multiple-day average. For CoCos to be effective, the trigger should be set sufficiently high too, in order to provide clarity and reduce the risk of death spirals. The choice for either principal write-down or equity conversion depends on the characteristics of the bank, the preferences of the current shareholders (and management), and the type of investors it is aiming for, as some institutional investors are not allowed to invest in shares. In case of equity conversion, it is of importance that the conversion price is fixed in advance as this counters the possibilities for manipulation. Although there are no real disagreements among scholars about the optimal structure of CoCos, disagreement does exist about the possible effects of certain structures and about the models to be used to test for these effects. This goes beyond the scope of this research, but extensive and more technical overviews are for example provided by Flannery (2014) or De Spiegeleer & Schoutens (2014). Now, with essential insights into the (theoretical) optimal structure and issues with other non-optimal structures of CoCos, the next step is the impact of CoCo issuance in general and on the bank´s balance sheet and funding costs.

2.2.2 Impact of CoCo issuance

Both in the (financial) press and in the academic literature a more general discussion on the impact of stricter capital requirements on the funding costs of banks took and takes place. Critics of higher capital buffers – usually the banks itself – state that attracting and holding more equity will result in higher funding costs and to tighter consumer and commercial lending. The proponents say that although more equity could lead to higher costs of credit, banking credit has been too cheap for a long time, caused by explicit and implicit subsidies, which are (also) paid by the public. Moreover, with this thin capitalisation, bank are still too fragile, and with higher capital ratios creditors will have more confidence.[13] Without going into this discussion further, it is important to note that CoCos play a role in this, and to me they seem like a compromise between the critics and proponents. While banks are required to hold 1.5% of CoCos, which reduces the possibility of a bail-out further, one of the implicit subsidies, they do keep one of the explicit subsidies, the tax shield of tax-deductible coupon payments. In the next paragraph the more direct consequences of CoCo issuance are discussed.

[13] See for example Wolf, M. (2017, September 21). Banking remains far too undercapitalised for comfort. *Financial Times.* Retrieved from: www.ft.com on April 24th 2018.

2.2.2.1 Balance sheet effects

In first instance the issuance of CoCos would have two main effects on the bank through its balance sheet. First, as a layer of loss-absorbing capital - contingent on financial distress - is added, the probability of default is reduced. This reduction results in a higher value of the other debt instruments the bank issued to finance its operations. The benefits of the reduced default probability do not only flow towards the debt holders but could also flow towards the shareholders of the bank, in the form of lower bankruptcy costs, as a result of the lower overall risk of the asset. This means that shareholders have an incentive to issue CoCos, which is enforced by the additional tax shield CoCos provide. This possibly leads to lower funding costs (Chen *et al.*, 2013).

Second, CoCos on the balance sheet affect the incentives for risk-taking of shareholders and management. Although both the equity conversion and principal write-down mechanism lead to an additional buffer, the mechanisms could be different in term of risk incentives. With equity conversion, the possibility of equity dilution might suppress the incentive for current shareholders to take risk. For principal write-down this might be the opposite. In general, principal write-down CoCos shield shareholders from insolvency of the bank, without them bearing part of the costs. The latter is, however, dependent on the exact structure (see paragraph 2.2.1.2). This might incentivise current shareholders to take on more risk, which increases the default probability (Avdjiev *et al.*, 2015).

2.2.2.2 Funding costs effects

The actual impact of CoCo issuance on the funding costs of debt and equity is measured in different ways. For debt it is measured indirectly by the movement in CDS prices of other bonds of the issuer. Would the (perceived) default probability increase, the prices of CDS would go up, as these derivative contracts offer coverage against the default of a specific bond. This way, CDS prices can be seen as a proxy for funding costs (Beau *et al.*, 2014). Beforehand, it is hard to predict what the actual impact will be. The effect of additional loss-absorption capacity and the effect of higher risk-taking incentives in case of principal write-down, work against each other. Dependent on which effect dominates the other, CDS prices could either go down or up. Although analysing this side of the funding costs would be highly interesting, it does not fit within the scope of this research.

For equity, the impact of CoCo issuance on funding costs is measured by the impact on the share price of the issuer. Although this measurement is more straightforward than for debt,

the prediction of the actual impact is complicated. With regard to the extra loss-absorption capacity, the lower default probability should make the shares be seen as less risky, leading to higher share prices. According to Avdjiev *et al.* (2015), who use basic Modigliani-Miller logic, the higher leverage could also lead to lower share prices, as shareholders see their claim being decreased. The additional tax shield could limit this effect to some degree. At the same time the authors note that investors' focus on earnings per share, without taking into account the possible additional risk exposure, could make the share price go up as well (Avdjiev *et al.*, 2015).

2.2.2.3 Predictions

Because of these different forces working against each other, it is hard to make a prediction about the direction of the share price movement around CoCo issuances beforehand. On top of that, the issuance of CoCos itself could hold a signal towards investors. It could be a positive signal if investors perceive the issuance as a signal that equity issuances in the future are less likely. Avdjiev *et al.* (2015) reason the other way around: a CoCo issue could hold a negative signal about the bank's balance sheet, even if it is less negative than equity issuance. In case the CoCos are only issued to reach the obligatory 1.5% AT1 ratio, the issuance might hold these signals – both positive and negative – to a lesser degree, I believe.

The ambiguity *ex ante* is supported by the findings of Avdjiev (2015). In this research, across the whole sample, some impact is found but none of these results are statistically significant. Other research on this is not available to this date, apart from research on hybrid bonds with features comparable to those of CoCos (Vallee, 2015). However, when narrowing down on specific CoCo structures, predicting the direction of the impact might be more feasible, as some effects could be more pronounced. For equity conversion, the impact might be more negative, due to the possible diluting effect. Principal write-down could have the opposite effect, as this shields shareholders from default risk to some degree. In both cases this depends on the trigger level: if the trigger is not set high enough, it could remain ambiguous for investors whether the conversion or write-down comes before bankruptcy (Chen et al., 2013). Thus, higher triggers should have a more positive impact, but on the other hand, for equity conversion, a relatively high trigger, also leads to a higher chance of dilution, which should have a negative impact. Here, Avdjiev *et al.* (2015) find stronger results, of which a small amount of the results is statistically significant. For triggers being higher or equal to 6%, the impact is negative and statistically significant in the non-parametric test. Looking at

other characteristics, more significant results are found by Avdjiev *et al.* but mostly within the days after the issuance. For example, for issuers larger than the median size, the impact is negative and highly significant. The same goes for the size of CoCo issuances being smaller than the median. To test for the predictions and to compare to the results found by Avdjiev *et al.*, the impacts of the issuances from a sample from the European market, covering a larger timespan, are measured. The methodology is explained in the next chapter.

3. Methodology

In this chapter the methodology of the second and third part of the approach is explained. As the second part mostly includes simple descriptive statics, the focus is on the third part, the analysis of the impact of CoCo issuance on the share prices of issuing banks. Objects of research are all (Western) European banks (as defined by Bloomberg) in the time period of 2009 - the year in which the first CoCos were issued – till Q1 of 2017.

3.1 Share price effect analysis

To analyse the impact of a CoCo issuance on the underlying share prices, event studies are used, following Avdjiev *et al.* (2015) who apply the method of James (1987) to identify abnormal returns around the issuance date. With this method, the prediction errors, as proxy for abnormal returns, are calculated as the difference between the return of the bank and a market index during the event window. Subsequently, these errors are averaged and standardised. Multiplied by the root of the sample size, this number results in a z-score (Avdjiev *et al.*, 2015). This statistic provides an insight into whether the average prediction error is statistically different from zero and thus, whether abnormal returns are observed around the CoCo issuance. Besides these statistics on the average prediction errors, the prediction errors on an individual basis are examined based on their sign. The proportion of negative (or positive) signs are added together and by using a Wilcoxon Signed Rank Test, the statistical significance of this number is tested (James, 1987). On top of that I use two additional parametric tests, to strengthen the methodology.

3.1.1 Event windows

Whereas James uses an event window of 2 days, consisting of the day of the event and the day before, Avdjiev *et al.* use windows ranging from 6 till 21 days, as for CoCos - different from other events - a clear-cut announcement date does not exist. They find that for the CoCo market there is no moment at which a CoCo issuance is announced, but instead information about the intention of the bank to issue the products is revealed to a small group of potential buyers, around two weeks before the issuance. During this book-building period, information flows to other market participants and gets eventually incorporated in the share prices, even before the actual issuance or when finally a public announcement is made. Avdjiev *et al.* note that despite this process, the issue date could still reveal information with possible impact on the share price, over-subscription for example. The same three windows are used here: full window, consisting of 21 days (15 days before till 5 days after the day of actual issuance);

pre-issuance window, 15 days (15 days before till 1 day before); and post-issuance window, 6 days (day of the issuance till 5 days after). On top of these three windows, a 'super full' window of 41 days (30 days before till 10 days after) is added in this thesis, as I suspect that more days could hold information.

3.1.2 Abnormal returns

Another difference between James and Avdjiev *et al.* is found with the procedure for the estimation of the prediction errors as proxy for abnormal returns. The former deploys the (OLS) Market Model in which first an ordinary least squares estimate of a firm's alpha and beta in relation to the market is made. This estimation is made over a relatively long period around the event date: 120 days before and after the event, of which 20 days before and after are excluded. Subsequently, with these estimates and the market return, the individual prediction errors are calculated as the actual returns minus the estimated returns. The latter uses the method of Market Adjusted Returns. Here, the prediction errors are simply calculated as the individual returns minus the market returns. This small difference in methodology is not motivated, while at the same time Avdjiev *et al.* claim to follow James' methodology. Literature on the methodologies of event studies shows, however, that the OLS Market Model and the Market Adjusted Returns are both well-specified and have, in certain situations, similar power (Brown & Warner, 1980, 1985). In this research the method of the Market Adjusted Returns is used. For this an index of Datastream for European banks is used, from which emerging markets are excluded, meaning that the constituents are all based in Western Europe.

3.2 Significance tests

In the previous paragraph the main lines of the event study methodology were discussed. In the analysis the main objects of research are the abnormal returns. Here the different used approaches to test for the statistical significance of the abnormal returns are discussed. On top of the James' Z-test (as adjusted by Avdjiev *et al.*) and the Wilcoxon Signed Rank Test come Patell's Standardised Residual Test and BMP's Standardised Cross-Sectional Test.

James' Z-test

As put forward by James in 1987 and used by Avdjiev *et al.* (2015) in a slightly adjusted way, in this approach prediction errors are used as proxy for the abnormal returns. For every bank, at each day in the event window, prediction errors are calculated as the return of that bank on that day minus the return of the index on the same day. Subsequently, these errors

are standardised by the standard error that is adjusted by the forecast error, which takes into account the number of days in the estimation window. The standardisation leads to lower weights for abnormal returns of banks with large variances. The standard error itself comes from the estimation of the standard deviation of the prediction errors during the event window. Assuming that the prediction errors are independent and the average prediction errors are zero, the z-score is calculated as the average prediction error over time multiplied by the square root of the sample size (James, 1987). Avdjiev *et al.* note that the independence of prediction errors may be a strong assumption, as a bank's decision to issue CoCos depends on a common regulatory treatment of CoCos.

Patell's Standardised Residual Test

In 1976, Patell developed the Standardised Residual Test. Under the assumption that the abnormal returns are uncorrelated and the variance is constant over time, the abnormal returns are standardised by its estimated standard deviation, which is adjusted by the forecast error of the estimation window. After standardisation the abnormal returns are cumulated over time. Under the null hypothesis, the standardised abnormal returns follow a Student's t-distribution and the expected value of the cumulative standardised returns is zero. The Patell's t-statistic is calculated by first dividing the cumulative standardised abnormal returns of each bank by its standard deviation, summing these products, and dividing this sum by the square root of the sample size. This statistic tests whether the cumulative average abnormal return across the sample is equal to zero. The test is robust to heteroskedastic abnormal returns in the event window, as it assigns lower weights to abnormal returns of shares with relatively large variances (Patell, 1976) .

BMP's Standardised Cross-Sectional Test

In 1991, Boehmer, Musumeci and Poulsen combined Patell's Test with a cross-sectional variance estimate, as they showed that in presence of event-induced variance increases, Patetell's Test rejects the null hypothesis too often. After the same standardisation process, the cumulative standardised abnormal returns for each bank are averaged and with this number the cross-sectional standard deviation is calculated. The BMP t-statistic is calculated as the average cumulative standardised abnormal return divided by this standard deviation, which tests whether the cumulative average abnormal return is equal to zero, but now with robustness to event-induced variance (Boehmer, Masumeci, & Poulsen, 1991).

Wilcoxon Signed Rank Test

The Wilcoxon Signed Rank Test, put forward in 1945, considers both the sign and the magnitude of the abnormal returns. First the absolute returns of the abnormal returns are taken and ranked. Under the assumption that none of those absolute values are equal or zero the Wilcoxon t-statistic tests whether the (cumulative) average abnormal return is different from zero (Wilcoxon, 1945). In the next chapter the results are discussed.

4. Results

In this chapter the results are discussed. Firstly, the descriptive statistics of the sample are presented and compared to the optimal CoCo structures from paragraph 2.2.1. Secondly, the basic results of the analysis of the impact on the share price are discussed. Thirdly, the results of the analysis of the subsamples based on the characteristics of the CoCos and of the issuing banks are discussed. The tables can be found in the appendices.

4.1 Descriptive results and comparison

The total Western European CoCo market at the end of Q1 of 2017 consisted, according to Bloomberg, of 193 CoCo issuances of which 166 also returned share price data from Datastream. By adding Eastern Europe only a couple of extra CoCo issuances were included, while most of those do not fall under the same umbrella of EU regulations. Eastern European issuances were not included in the end. For this descriptive part and the following part on the share price effect, the same 166 CoCo issuances are used as research objects.

This almost complete European CoCo market totals more than 170 billion euros, meaning that the average CoCo issuance is slightly more than 1 billion euros. From the 166 issuances, two thirds has a principal write-down mechanism, the other third equity conversion. Slightly more than half of the total issuances has a trigger on 5.125% CET1. Around one third has a trigger above that level and with almost no exception it is well above 5.125%, namely 7%. When combining the two main characteristics, one looks at the following percentages. Only 8% of CoCos has an equity conversion mechanism combined with a trigger of 5.125%. Almost three times more equity conversion CoCos have a trigger above the regulatory minimum. Almost half of the issued CoCos have principal write-down combined with a 5.125% trigger. Almost four times less principal write-down CoCos have a trigger above that level. Most CoCos were after 2013 and from 2014 till Q1 of 2017 issuance seems evenly divided of the years.

When comparing the actual characteristics of the CoCos to the optimal CoCo structures, as summarised in paragraph 2.2.2.4, the differences are evident. Firstly, there are no CoCos with a market based trigger or multiple market based triggers. There were no issuances that were cut into tranches with different triggers, with one exception: in the beginning of 2015, UBS issued on top of its tranche of CoCos with a 5.125% trigger, a tranche with a 7% trigger.

Secondly, with regard to the height of the triggers, it is hard to say whether these are high enough. Given the average required CET1 ratio of almost 10.6% and most banks surpassing the requirements (see paragraph 2.1.3.2), one could wonder whether 5.125% (or even 7%) is high enough. It could be that before reaching that percentage, the bank in question is already in such a dire state and lacking trust from the markets, that bankruptcy or the regulator's PONV is inevitable. This way the trigger and conversion might not come before bankruptcy or not clearly enough before it. A higher trigger would also reduce the chance of death spirals. At the same time a higher trigger increases the chance of dilution of current shareholders, which could also be the reason that the majority of banks issued CoCos with the minimal trigger. However, when looking at equity conversion CoCos only, one sees that within that group, the majority of CoCos has a trigger higher than the minimum, thus increasing the chance of dilution. Also within principal write-down only, the observation is rather counterintuitive. The large majority within that group has a minimum trigger, while a higher trigger would not lead to dilution at all and would actually strengthen the current shareholders' shield against losses. In the next paragraphs the effect of issuances on the share price is discussed.

4.2 Basic share price effects

With a first glance at the cumulative average abnormal returns of the whole sample, in table 2 of the appendices, interesting observations could be made already. For example, by only looking at the results for the complete sample, it seems as if in the pre-issuance period (-15, -1), positive abnormal returns are cumulated, while in post-issuance period (0, 5) negative abnormal returns are cumulated. The difference between the 21 and 41 days windows are also noteworthy, both in terms of size and sign. However, already with a quick look at the parametric test statistics, the conclusions with regard to the statistical significance of these abnormal returns seems rather simple. None of the parametric tests shows any sign of statistical significance, at none of the event windows.

With the results of the non-parametric test, this does not change, as none of the event windows shows significant numbers for the Wilcoxon Signed Rank Test. This could be explained by the fact that this test takes both the sign and size of the absolute value of the abnormal returns into account. Taken all together, it seems that something is actually going on around the issuance of CoCos, but without statistical significance. The ratios of negative signs for the abnormal returns are on average lower than during the estimation window.

However, in terms of magnitude of these abnormal returns, no significant results are observed. These basic results are in line with Avdjiev *et al.* (2015), who did not find statistically significant results either. Note that they use a different sample, covering issuances worldwide and during a different period of time. The next step is to analyse the results of the sample broken down along the characteristics of the banks and of the CoCos they issued.

4.3 Categorised share price effects

The rest of table 2 is discussed by going down systematically, starting from the results for the sample as a whole, to the next category, and per event window. Firstly, with equity conversion, the impact of CoCo issuance is clearly negative, both in the pre-issuance and post-issuance period, although both are non-significant. The 21 days window shows, with a minus 1.67% cumulative abnormal returns, a negative impact for the equity conversion mechanism. This results is close to being significant within the 5% significance level, significant if one would apply the more relaxed significance level of 10%. Widening the window to 41 days increases the insignificance further. With regard to the principal write-down mechanism a different pattern surfaces. During the pre-issuance period positive abnormal returns are cumulated, while in the post-issuance period a small negative impact is observed. Although these returns are smaller in magnitude than those for equity conversion, they do show clear significance for two of the three parametric tests, albeit not for the post-issuance period. The 21 days window is still positive, but only nears significance. For the 41 days window, principal write-down still gives positive returns, but far from significant.

Taken together, this provides evidence that in the two weeks prior to the issuance, CoCos with a principal write-down mechanism show positive abnormal returns, with possibly a lasting effect on the share price and funding costs. This could also be evidence that, as Avdjiev *et al.* (2015) noted, information on the issuance of CoCos is revealed in a "diffusion-like process", as, according to market participants and regulators, the intention to issue is revealed by the bank to a small group of investors two weeks in advance of the issuance. With this book-building, the information possibly "diffuses" to a bigger group of other market participants and could get incorporated in the share price before the actual issuance. The issue date and the days after that could still reveal additional information, such as over-subscription (Avdjiev et al., 2015). Interestingly enough, the results of this research do not suggest that much information is revealed after the issuance.

The evidence for equity conversion is thinner but shows negative abnormal returns, again with a possibly lasting effect. Here, after the issuance, it still seems to affect the share price, which is rather interesting. My guess is that information about equity conversion CoCos is less spread among market participants beforehand, maybe because the information is less favourable. More clearly is that investors seem to appreciate principal write-down, contrary to equity conversion. This is in line with the theoretical predictions from paragraph 2.2.2, based on the shared benefits of higher debt value and shareholders being shielded from (higher) risk-taking. The results for equity conversion may be weaker but are also in line with the predictions. Investors might be taking the possible dilution from conversion into account. Compared to Avdjiev *et al.*, who do not find significant results for principal write-down nor equity conversion, these are stronger results, but again, they use a different sample in terms of geographical coverage and period of time.

For the categories based on median firm size no significant results are observed. Only for banks larger than the median, a modest positive and close to significant impact is observed. In the post-issuance period, these positive returns are reversed almost completely, although these negative returns are non-significant as well. Although evidence is thin, it seems as if investors appreciate issuances of larger banks more than those of smaller banks. This is different from Avdjiev *et al.*, who find strong significant results for larger banks, in the post-issuance period.

With regard to issue size roughly the same pattern is observed. None of the results is significant, only within the pre-issuance period close to a positive impact is observed, for the issue sizes smaller (not larger) than the median size. This is again reversed in the post-issuance period, on a non-significant basis. Avdjiev *et al.* do find significant results, for issue size smaller than the median size, in the post-issuance period.

In the trigger categories the strongest significant results are observed, especially for triggers that are equal to 5.125%. In the pre-issuance period, the positive impact of 1.63% has a significance within the 5% level and for one of the parametric tests even within the 1% level. The 21 days window has almost the same results, possibly due to the fact that in the post-issuance period almost no correction is made. The 41 days window decreases the positive impact slightly and the significance to non-significant levels. Triggers higher than 5.125% show strong significant results as well, but with a negative impact. The difference is that the negative returns are not necessarily all cumulated in the pre-issuance period. Here, issuances

with triggers higher than 5.125% do have a negative impact, but only near statistical significance within the 5% level. However, in the post-issuance period, additional negative returns are cumulated, with relatively close to significant test results. Together, these lead to the statistical significant minus 2.08% impact in the 21 days event window. For the 41 days window the significance is again decreased, as is the impact. However, the decrease of the latter is in the same direction and therefore different from the equal to 5.125% trigger, which showed a decrease in the opposite direction.

Taken together, investors seem to appreciate CoCos with triggers equal to the regulatory minimum over triggers set higher than that, with a seemingly lasting positive impact for the former, and a possibly lasting negative impact for the latter. This could be due to the fact that higher triggers increase the chance of dilution, at least for equity conversion CoCos. Another possibility I could think of is that investors dislike deviation from a (regulatory) standard and therefore react negatively to issuances with higher triggers. Comparable with the case of equity conversion, it seems as if the information on the unfavourable higher trigger is dispersed more slowly than for standard triggers, as in the post-issuance period, the issuance still seems to affect the share price. CoCos with 5.125% triggers see most of the impact before the issuance. Avdjiev *et al.* do not find significant results but comparison might be troublesome, as they split their sample in two using 6% as dividing line, instead of 5.125%.

All in all, when only focussing on the strong significant results, investors react positively on the issuance of principal write-down CoCos, mostly in the pre-issuance period. This means that - ceteris paribus - the funding costs of the issuing bank would decrease. Investors also react positively on CoCos with the regulatory trigger of 5.125% CET1 ratio but negatively on triggers above that level. Again, most of this is build-up in the pre-issuance period. This means that CoCos with a 5.125% trigger would decrease the funding costs, while CoCos with a trigger above that would increase the costs.

A last remark before the ending of this chapter is that between the different statistical tests, one clear observation can be made. While the results of James' Z-test and the Standardised Cross-Sectional Test are quite similar in terms of score, the Standardised Residual Test gives systematically lower scores. This could be an indication of event-induced increases in variance, as this test seems to over-reject the null hypothesis, compared to the other two parametric tests (see also paragraph 3.2)

5. Conclusions

The approach of this research consisted of three parts. First, the theoretical optimal structures of CoCos were discussed with a literature review. Second, the European CoCo market was assessed and the issued structures were compared to the optimal structures. Third and foremost, the reception by equity investors of the issuance of CoCos in general and of different CoCo structures was analysed.

In order for CoCos to have the highest risk-reducing power and to reduce the chance on death spirals, they should have a market based trigger, preferably multiple triggers by cutting up the issuance in tranches, and otherwise based on a multi-day average. An additional regulatory trigger should not be added, as this leads to uncertainty among investors. For CoCos to be effective, the trigger should be set sufficiently high too, as this reduces the chance of death spirals further and provides clarity about the conversion happening before possible bankruptcy. The choice for either principal write-down or equity conversion depends on the characteristics of the bank, the preferences of the current shareholders (and management), and the type of investors it is aiming for.

Looking at the characteristics of the issued CoCos in the European market, two thirds has a principal write-down mechanism, the other third equity conversion. Slightly more than half of the total issuances has a trigger on 5.125% CET1. In comparison to the optimal structures, the differences are evident. There are no issued CoCos with a market based trigger, based on a multi-day average, or CoCos with multiple triggers, the latter with one exception. Given the average required CET1 ratio of almost 10.6% in 2017, and most banks surpassing the requirements, it is questionable whether 5.125% (or even 7%) is high enough, as this trigger might be too low to prevent or come before bankruptcy. On top of that, it might increase the chance of death spirals. This means that the main goal of CoCos, risk-reduction, is possibly not met sufficiently. When focussing on either equity conversion or principal write-down, the height of the triggers comes with additional questions. These observations come in addition to earlier work by Avdjiev, Kartasheva & Bogdanova (2013) and Avdjiev *et al.* (2015) who examined the worldwide CoCo market in depth, from the start till Q3 of 2015. Further research on the discrepancies between the optimal and issued structures and the ‘why’ behind these is necessary.

Based on the sample consisting of most European CoCo issuances by banks from 2009 till Q1 of 2017, I find evidence that for the sample as a whole, the issuance of CoCos has no significant impact on the share price of the issuing banks, in line with Avdjiev *et al.* (2015). On top of that I provide evidence that investors react positively on the issuance of principal write-down CoCos. This means that - ceteris paribus - the funding costs of the issuing bank would decrease. Investors also seem to react positively on CoCos with a minimum trigger of 5.125% CET1 ratio but negatively on triggers above that level. This means that CoCos with a 5.125% trigger would decrease the funding costs, while CoCos with a trigger above that would increase the costs, which seems counterintuitive given the benefits of a higher trigger. This is an addition to the work of Avdjiev *et al.*, who present evidence that issuances smaller than the median and issuances by bigger banks can count on a positive reaction of equity investors.

This research could be a starting point for discussions among market participants and lawmakers on the (tax) regulations in place, in connection to the goal of risk-reduction. To feed this discussion more academic research is necessary, as this research has its limits, in terms of scope and depth. To extend these limits, the analysis of investor reception on the European debt market could be included, just as the determinants of the abnormal returns around the issuance date. Other suggestions are to analyse the forces that drive the propensity of a bank to issue CoCos and further analysis of the characteristics of issuing banks. A legal and political research into the realisation of the provisions on CoCos in EU law and national tax law is also advised, as these seem to play an important role in the creation of market practices on CoCo structures, of which some – in comparison to theory – seem rather strange.

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Appendices

Table 1: Characteristics Western European CoCo issuances from 2009 till 2017 (Q1)

Size of CoCo categories based on characteristics of the instrument itself and of the issuing bank, in absolute and relative terms, from the total sample taken from Bloomberg and Datastream. Western European as defined by Bloomberg. Banks were excluded if no Datastream data was available. 'Other' includes both triggers below 5.125% and non-specified triggers. Numbers not exactly adding up to 166 is caused by no or miss-specification in Datastream.

		Number	Percentage
Total sample		166	100%
Mechanism	Equity conversion	54	33%
	Principal write-down	111	67%
Trigger	5.125%	93	56%
	>5.125%	59	36%
	Other	12	7%
Firm size	> median	84	51%
	< median	82	49%
Issue size	> median	83	50%
	< median	83	50%
Mechanism, trigger	EC, 5.125%	14	8%
	EC, >5.125%	37	22%
	PWC, 5.125%	79	48%
	PWC, >5.125%	21	13%
Year of issuance	<2013	5	3%
	2013	18	11%
	2014	51	31%
	2015	42	25%
	2016	37	22%
	2017 (Q1)	13	8%

Table 2: Impact of CoCo issuance on the share prices of Western European banks from 2009 till April 2017, categorised

Impact on share prices as measured by the cumulative average abnormal returns (CAAR) across the whole (sub)sample and by the proportion of negative (neg.) cumulative abnormal returns within that (sub)sample. Subsample categories are based on characteristics of the issued CoCo and issuing bank. Four event windows are used: 41 days (from t-30 to t+10), 21 (t-15 to t+5), 15 (t-15 to t-1), and 6 (t-5 to t+1). The sample includes all issuing Western European banks - as defined by Bloomberg – with share price information available in Datastream. In the column below 'James', z-scores are given, calculated as put forward in James (1987) and adjusted by Avdjiev *et al.* (2015). The other two parametric tests, the Standardised Residual Test (SRT) and Standardised Cross-Sectional Test return t-scores, just as the non-parametric Wilcoxon Signed Rank Test (WSRT). Between parentheses the p-values are given, * indicates a p-value below the 5% significance level, ** below the 1% significance level.

			N	CAAR	Neg.	James	SRT	SCST	WSRT
Event window	Category								
41 days (-30,10)	All		166	-0.29%	0.55	-0.30	-0.05	-0.34	0.04
						(0.76)	(0.96)	(0.73)	(0.97)
	Mechanism	Equity conversion	54	-2.12%	0.67	-0.98	-0.16	-1.36	1.15
						(0.33)	(0.87)	(0.18)	(0.25)
		Principal write-down	112	0.60%	0.50	0.37	0.06	0.40	-0.66
						(0.71	(0.95)	(0.69)	(0.51)
	Firm size	>= median	84	-1.13%	0.57	-0.94	-0.15	-1.00	0.83
						(0.35)	(0.88)	(0.32)	(0.41)
		< median	82	0.58%	0.54	0.53	0.08	0.63	-0.70
						(0.60)	(0.94)	(0.53)	(0.49)
	Issue size	>=median	83	0.57%	0.53	0.66	0.10	0.80	-0.63
						(0.51)	(0.92)	(0.43)	(0.53)
		<median	83	-1.15%	0.58	-1.07	-0.16	-1.14	0.81
						(0.28)	(0.87)	(0.26)	(0.42)
	Trigger	5.125%	93	1.50%	0.45	1.36	0.21	1.57	-1.24
						(0.17)	(0.83)	(0.12)	(0.22)
		>5.125%	59	-2.25%	0.68	-1.45	-0.23	-1.81	1.32
						(0.15)	(0.82)	(0.08)	(0.19)
21 days (-15,5)	All		166	0.13%	0.47	0.32	0.07	0.34	0.62
						(0.75)	(0.94)	(0.73)	(0.54)
	Mechanism	Equity conversion	54	-1.67%	0.56	-1.68	-0.37	-1.83	1.98
						(0.09)	(0.72)	(0.07)	(0.05)
		Principal write-down	112	1.00%	0.43	1.56	0.34	1.65	-0.62
						(0.12)	(0.74)	(0.10)	(0.54)
	Firm size	>= median	84	0.31%	0.42	0.91	0.20	0.97	0.44
						(0.36)	(0.84)	(0.34)	(0.66)
		<median	82	-0.06%	0.52	-0.46	-0.10	-0.50	0.46
						(0.64)	(0.92)	(0.62)	(0.65)
	Issue size	>=median	83	-0.60%	0.54	-0.67	-0.15	-0.79	0.61
						(0.50)	(0.88)	(0.44)	(0.54)

		<median	83	0.86%	0.40	1.12	0.24	1.11	0.30
						(0.26)	(0.81)	(0.27)	(0.76)
	Trigger	5.125%	93	1.71%	0.39	2.52*	0.55	2.84**	-0.99
						(0.01)	(0.59)	(0.01)	(0.32)
		>5.125%	59	-2.08%	0.59	-2.02*	-0.44	-2.25*	1.66
						(0.04)	(0.66)	(0.03)	(0.10)
15 days (-15,-1)	All		166	0.57%	0.50	1.08	0.28	1.21	-0.40
						(0.28)	(0.78)	(0.23)	(0.69)
	Mechanism	Equity conversion	54	-0.71%	0.57	-1.09	-0.28	-1.16	1.05
						(0.28)	(0.78)	(0.25)	(0.30)
		Principal write-down	112	1.18%	0.45	2.07*	0.53	2.43*	-1.19
						(0.04)	(0.60)	(0.02)	(0.24)
	Firm size	>=median	84	0.80%	0.46	1.74	0.45	2.00	-0.90
						(0.08)	(0.66)	(0.05)	(0.37)
		<median	82	0.33%	0.54	-0.23	-0.06	-0.25	0.31
						(0.82)	(0.95)	(0.80)	(0.76)
	Issue size	>=median	83	-0.09%	0.53	-0.36	-0.09	-0.44	0.36
						(0.72)	(0.93)	(0.66)	(0.72)
		<median	83	1.22%	0.47	1.88	0.48	1.96	-0.83
						(0.06)	(0.63)	(0.05)	(0.41)
	Trigger	5.125%	93	1.63%	0.42	2.59*	0.67	3.20**	-1.59
						(0.01)	(0.51)	(0.00)	(0.11)
		>5.125%	59	-1.32%	0.61	-1.63	-0.42	-1.84	1.25
						(0.10)	(0.68)	(0.07)	(0.22)
6 days (0,5)	All		166	-0.44%	0.53	-0.96	-0.39	-0.99	0.57
						(0.34)	(0.70)	(0.32)	(0.57)
	Mechanism	Equity conversion	54	-0.95%	0.65	-1.46	-0.59	-1.79	1.58
						(0.14)	(0.55)	(0.08)	(0.12)
		Principal write-down	112	-0.19%	0.47	-0.16	-0.06	-0.15	-0.25
						(0.88)	(0.95)	(0.88)	(0.80)
	Firm size	>=median	84	-0.49%	0.51	-0.88	-0.36	-0.80	0.38
						(0.38)	(0.72)	(0.42)	(0.70)
		<median	82	-0.38%	0.55	-0.48	-0.19	-0.58	0.41
						(0.63)	(0.85)	(0.57)	(0.69)
	Issue size	>=median	83	-0.52%	0.54	-0.64	-0.26	-0.79	0.76
						(0.52)	(0.80)	(0.43)	(0.45)
		<median	83	-0.35%	0.52	-0.72	-0.29	-0.65	0.07
						(0.47)	(0.77)	(0.52)	(0.95)
	Trigger	5.125%	93	0.08%	0.42	0.83	0.34	0.88	-0.47
						(0.41)	(0.74)	(0.38)	(0.64)
		>5.125%	59	-0.77%	0.66	-1.28	-0.52	-1.79	1.25
						(0.20)	(0.61)	(0.08)	(0.22)

Figure 1: Overview capital requirements under CRD IV, issued by the European Commission