OESTERREICHISCHE NATIONALBANK
EUROSYSTEM

WORKING PAPER 236

Determinants of Contingent Convertible Bond Coupon Rates of Banks: An Empirical Analysis

Michael Sigmund, Kevin Zimmermann

The *Working Paper series of the Oesterreichische Nationalbank* is designed to disseminate and to provide a platform for discussion of either work of the staff of the OeNB economists or outside contributors on topics which are of special interest to the OeNB. To ensure the high quality of their content, the contributions are subjected to an international refereeing process. The opinions are strictly those of the authors and do in no way commit the OeNB.

The Working Papers are also available on our website (http://www.oenb.at) and they are indexed in RePEc (http://repec.org/).

Publisher and editor *Oesterreichische Nationalbank*
Otto-Wagner-Platz 3, 1090 Vienna, Austria
PO Box 61, 1011 Vienna, Austria
www.oenb.at
oenb.info@oenb.at
Phone (+43-1) 40420-6666
Fax (+43-1) 40420-046698

Coordinating editor *Martin Summer*

Cover Design *Information Management and Services Division*

DVR 0031577

ISSN 2310-5321 (Print)
ISSN 2310-533X (Online)

Determinants of Contingent Convertible Bond Coupon Rates of Banks: An Empirical Analysis

Michael Sigmund[1], Kevin Zimmermann[1]

Abstract

In this paper, we analyze the determinants of coupon rates of contingent convertible bonds (CoCos). We construct a data set of additional Tier 1 (AT1) CoCos issued by banks in the European Economic Area between 2014 and 2020. Following elements of the standard asset pricing model with additional factors motivated by the arbitrage pricing theory, we empirically test whether different conversion types as well as several other factors determine the coupon rate besides the yields of other portfolios. We find that CoCo coupon rates are sensitive to risk variables at the instrument-, bank-, country- and market-level. In contrast to theoretical pricing models, we cannot confirm the expected price premium for the conversion type permanent-principal-write-down (PPWD) compared to conversion-to-equity (CE) and temporary-principal-write-down (TPWD). Our findings suggest that there is risk-shifting incentive induced by CoCo investors as well as a selection process into different conversion types, with the majority of PPWD CoCos being issued in Switzerland and most of the CE CoCos being issued in Great Britain and Spain.

Keywords: Contingent convertible bonds; asset pricing; banks; risk factors

Email addresses: michael.sigmund@oenb.at (Michael Sigmund), kevin.zimmermann@oenb.at (Kevin Zimmermann)

[1]Oesterreichische Nationalbank (OeNB), Otto-Wagner-Platz 3, A-1090 Vienna, Austria. The views expressed in this paper are those of the authors and do not necessarily reflect those of the Eurosystem or the OeNB.

Non-technical Summary

During the global financial crises many financial institutions faced severe capital constraints due to large write downs on loans and other assets. Following the banks inability to recapitalize themselves on the stressed capital markets and the sentiment of "too big to fail", banks around the world were bailed out with taxpayer money to avoid potential further chain reactions. As a possible solution to mitigate the risk of balance-sheet insolvencies, contingent convertible bonds (CoCos) gained popularity. These are "going concern" hybrid-dept instruments, which are converted into equity or written down in the case a pre-specified trigger event occurs. Theoretically, this loss absorption mechanism should enable a "bail-in" in case of imminent balance sheet stress.

Since the implementation of Basel III in 2014, CoCos are eligible as additional Tier 1 (AT1) regulatory capital if they fulfill certain criteria. If a bank decides not to issue AT1 it must instead hold a larger percentage (6% instead of 4.5%) of the highest quality regulatory capital – common equity Tier 1 (CET1). The amount of AT1 CoCos issued since 2014 has roughly tripled with around 60 billion euro in 2019.

Empirically, we try to find the best determinants for the CoCo coupon rate at issuance. To this end we augment a standard capital asset pricing model (CAPM) with several firm- as well as bond-specific risk factors and test their effects with different OLS models on a comprehensive data set of approximately 200 AT1 CoCos with fixed coupon rates, issued between the third quarter of 2014 and the second quarter of 2020 in EEA countries and Switzerland. Our findings suggest that CoCo coupon rates are sensitive to various risk variables on the instrument-, bank-, country- and market-level, which supports the idea of a risk sensitive CoCo market. Surprisingly, we find a discount for the riskier principal-write-down (PWD) Cocos, most likely caused by conversion type clusters (for PWD CoCos in Switzerland and for conversion-to-equity (CE) CoCos in Great Britain and Spain), which suggests that there might be a selection process at play. Following these surprising results, we also take a deeper look into the selection process of CoCo conversion types by utilizing a multinomial logistic regression (MLR). We find that "riskier" banks, which already offer higher CoCo coupon rates, also need to offer the "investor friendly" CE and TPWD conversion types.

Our findings highlight country-specific conversion type cluster and the need to better understand the different incentives following different CoCo types, as e.g., non-equity-diluting principal-write-down (PWD) CoCos might lead to moral hazard, by benefitting shareholders through the reduction of the bankâs overall debt. The varying incentive structures behind different CoCo types eligible as regulatory capital call for a rigorous examination, in order to confirm the intended reduction in the probability of balance-sheet insolvencies and the often-following bailouts.

1. Introduction

During the global financial crises many financial institutions faced severe capital constraints due to large write downs on loans and other assets. Between 2007 and 2013 no less than 114 European banks benefited from government support (Gerhardt & Vander Vennet, 2017). Following the banks inability to recapitalize themselves on the stressed capital markets and the sentiment of "too big to fail", banks around the world were bailed out with taxpayer money to avoid potential further chain reactions. Eurostat reported total costs of 241.3 billion euro for the general governments in the EU-28 countries to support financial institutions between 2007 to 2017 (Eurostat, 2015, 2018).

As a possible solution to mitigate the risk of balance-sheet insolvencies, contingent convertible bonds (CoCos), first suggested by Flannery (2005), gained popularity. These are "going concern"[2] hybrid-dept instruments, which are converted into equity or written down in the case a pre-specified trigger event occurs. Theoretically, this loss absorption mechanism should enable a "bail-in" in case of imminent balance sheet stress.[3] On the one hand, CoCos should create incentives for highly-exposed creditors to monitor banks very closely (Liikanen Commission, 2012; Hesse, 2018). On the other hand, these instruments allow financial institutions to meet capital requirements and still maintain a high leverage, enjoy tax advantages in numerous countries (Hanselaar et al., 2017) as well as to mitigate pressure on the Return on Equity (ROE) caused by the regulatory minimum capital requirements.

The increasing importance of CoCos for banks is also highlighted in the new Basel III regulatory framework. Basel III was transposed into European legislation with the Capital Requirements Directives (CRD)[4] and the Capital Requirements Regulation (CRR), which both came into effect in 2014 (Basel Committee, 2010). According to the CRR, CoCos are eligible as additional Tier 1 (AT1) regulatory capital if they fulfill certain criteria (European Commission, 2013).[5] The capital adequacy standards were enhanced with Basel III by introducing – among other measures – a stricter definition of capital. These changes resulted in new requirements for Tier 1 and Tier 2 capital, where Tier 1 can be further divided into common equity Tier 1 (CET1) and AT1 capital (see Table A.4 in Appendix Appendix A). The minimum Pillar 1 own funds requirements depicted here are laid down in the CRR Art 92 (European Commission, 2013). If a bank decides not to issue AT1 it must instead hold a larger percentage of the highest quality regulatory capital CET1 (6% instead of 4.5%). Therefore, the issuance of AT1 CoCos of up to 1.5 % of risk-weighted assets (RWA) is a reasonable option for banks to comply with the minimum of 6% Tier 1 capital requirement. Moreover there are national regulations with even stricter capital requirements promoting CoCos like for example the "Swiss Finish".[6]

[2]"Going concern" refers to the going concern assumption in accounting and indicates that the instrument is supposed to safeguard the bank from liquidation.

[3]For an example on how the balance sheet is improved due to a CoCo conversion see e.g. Flannery (2005).

[4]The Capital Requirements Directives is a supervisory framework in the European Union, which defines the Basel II and Basel III rules on capital measurement and capital standards. The new CRD IV package (commonly known as Basel III) was published on the 17th of July 2013, came into force in January 2014 and includes the EU Directive 2013/36/EU and the EU Regulation 575/2013.

[5]These criteria are defined in the CRR Art 51 et seq (European Commission, 2013), as well as in the supplementing regulatory technical standards for own funds (European Commission, 2014). CoCos may also be eligible as Tier 2 regulatory capital, for details on the requirements see CRR Art 62 et seq (European Commission, 2013).

[6]A Swiss regulation going beyond the capital requirements of Basel III, applicable to Switzerland's "too-big-to-fail" banks Credit Suisse and UBS. The Swiss Finish dictates a total capital ratio of up to 19%, which mostly can be met by issuing CoCos. For more details see McNamara et al. (2014).

Thus, the European legislation makes CoCos attractive from a capital requirement perspective but for banks who want to issue CoCos also the cost of equity in comparison to CoCo coupon rates has to be taken into account. Based on the estimations of Belkhir et al. (2019) the average cost of equity for banks in European Economic Area (EEA) is around 11% which is between 3-4pp higher than the coupon rates for all our observations. Belkhir et al. (2019) use an ex-ante cost of equity measure implied by stock prices and analysts' earnings forecasts that has been developed in recent literature (Bekaert & Harvey, 2000; Hail & Leuz, 2006; Pastor et al., 2008). Belkhir et al. (2019) also shows that an increase in the leverage ratio of 10 percentage points reduces the cost of equity by around 1.86 percentage points. CoCos are therefore an attractive instrument from a regulatory and a market-based perspective and a legit alternative to issuing new equity.

After the European Union's (EU) Capital Requirements Directive II (CRD II) established legitimacy for CoCos to act as AT1 and Tier 2 capital, their relevance accelerated fast (Greene, 2016). The global issuance of CoCos was estimated by Jang et al. (2018) to account for approximately 360 billion USD. Avdjiev et al. (2020) even suggest it to be over 500 billion USD by 2015.

With the majority of the literature being theoretical and only little empirical work, mostly focused on who issues CoCos (Goncharenko et al., 2021), their effect on CDS spreads (Avdjiev et al., 2020; Ammann et al., 2017) as well as on the determinants of daily CoCo yields (Hesse, 2018), there is a need to better understand CoCo coupon rates at issuance, since this is the central and most direct price variable available and at the core of decision making of investors and issuing banks alike. Investors receive the coupon payments and banks compare their CoCo coupon rate with their cost of equity.

To this end we build on the standard capital asset pricing model (CAPM) (Sharpe, 1964; Lintner, 1965) and follow the suggestion of Ross (1976) by looking for additional factors besides the yields of other portfolios which is motivated by the credit derivatives approach (De Spiegeleer & Schoutens, 2011, 2012). We, therefore, also contribute to the long discussion in the empirical asset pricing literature, whether the betas from the CAPM and/or firm-specific factors load on the yield of risky assets. In the end, the complex structure of CoCos might make a (perfect) hedging strategy very difficult.

The effects of these variables are tested through a number of different models on a sample of up to 211 AT1 CoCos with fixed coupon rates, issued between the third quarter of 2014 and the second quarter of 2020 in EEA countries and Switzerland. Additionally, we investigate what determines the conversion type of a CoCo. Our findings suggest that CoCo coupon rates are sensitive to various risk variables on the instrument-, bank-, country- and market-level. Surprisingly, we find a discount for the riskier permanent-principal-write-down (PPWD) Cocos, most likely caused by conversion type clusters (for PPWD CoCos in Switzerland and for CE CoCos in Great Britain and Spain), which suggests that there might be a selection process at play. One could also speculate that in some countries there are stricter regulations on potential bail-ins.

The rest of the paper is structured as follows. In Section 2 we briefly discuss the theoretical and empirical literature on CoCos. Section 3 explains and describes the data used and gives an overview on how the sample was constructed. In Section 4 the theoretical foundation of our empirical model is explained. In Section 5, our empirical CoCo coupon rate models are presented. We also provide additional multinomial logistic regression results for the selection into CoCo conversion types. We discuss our findings in Section 6. Finally, Section 7 provides our conclusions.

2. Literature Review

Hybrid-securities – the combination of equity and bond attributes – have been around since the mid-19th century, supporting the railway expansion in the United States (Herring et al., 2017). Flannery (2005) was the first to suggest CoCos as regulatory capital for banks. Since then, most of the literature has been focused on the qualitative characteristics of CoCos. The basic idea of a trigger goes back to Leland (1994), thereafter the ideal characteristics of such a trigger have been discussed in depth. The original proposal from Flannery (2005) and many other authors like Claessens et al. (2010); Haldane (2011); Herring & Calomiris (2011) advocate a capital ratio trigger using the market value of equity and the Risk weighted assets, because market values are continuously updating, forward looking and less susceptible to accounting manipulation (Glasserman & Nouri, 2012a). However, there are potential problems like incentives for stock price manipulation (Hillion & Vermaelen, 2004; Avdjiev et al., 2013) or the possibility of multiple equilibrium prices (Sundaresan & Wang, 2015; Calomiris & Herring, 2013; Pennacchi, 2011; Prescott, 2012), but most of these issues are negligible. Although introducing a lag into the reaction time of the trigger as noted by Murphy et al. (2012), other authors like Flannery et al. (2011); Herring & Calomiris (2011) suggest using moving averages of the market values to avoid stock price manipulation. Glasserman & Nouri (2012b); Pennacchi & Tchistyi (2019a) argue that a unique equilibrium price exists if realistic assumptions are used.

Furthermore capital ratio triggers using the book value of equity provide lagged information per design (Sundaresan & Wang, 2015; Flannery, 2016) and are prone to balance sheet manipulation (Avdjiev et al., 2013; Sundaresan & Wang, 2015). Many later troubled banks where well capitalized during the financial crises until shortly before making the headlines (Haldane, 2011; Duffie, 2009). There are reasonable arguments for both market value and book value triggers, but it needs to be noted, that in reality CoCos are issued with book value triggers and are subject to point of non-viability (PONV) triggers.[7]

Aside from capital ratio and PONV triggers there are also other proposals like for example asset-level triggers (Raviv et al., 2004) and stock price triggers, which activate if a change in stock price of a pre-specified magnitude takes place (Claessens et al., 2010). Furthermore several authors (McDonald, 2013; Squam Lake Working Group, 2009) suggest dual triggers, where conversion only occurs if a second trigger, usually indicating distress of the whole banking system, activates simultaneously. Unfortunately, this design would fail to save the first troubled bank (Flannery, 2016).

There is also a substantial amount of literature discussing the ideal conditions of the conversion process following a trigger event. The initial suggestion of Flannery (2005) is conversion-into-equity (CE),[8] where the CoCo is converted partial and ongoing which is called "progressive conversion" by Acharya et al. (2010). CE CoCos tend to be cheaper (Avdjiev et al., 2013) and – if the conversion price is high enough (Hilscher & Raviv, 2014; Berg & Kaserer, 2015; Chan & van Wijnbergen, 2017) – exhibit lower risk-shifting incentives,[9] as conversion dilutes equity shares (Avdjiev et al., 2013;

[7]PONV-triggers are required for CoCos to be eligible as AT1 regulatory capital by Basel III (Avdjiev et al., 2013). Art 59 BRRD provides resolution authorities with the power to convert or write down capital instruments. This might be well in advance of any resolution action (European Parliament and Council, 2014).

[8]The different conversion types are introduced in section 3.1.

[9]If a trigger event only affects CoCo investors negatively, this would shift risk away from equity holders and incentivise riskier behaviour.

Calomiris & Herring, 2013). In the case of principal-write-down (PWD) CoCos the write down may even be beneficial for equity holders and therefore lead to moral hazard.[10] Nevertheless, in practice we observe a majority of PWD CoCos, which theoretically also fulfill the desired bail-in function by increasing the capital ratio due to the debt reducing effect of the write-down (Murphy et al., 2012). Additionally, PWD CoCos allow certain investors, which are not allowed to hold equity like instruments because of their mandate, to invest (Avdjiev et al., 2013).

Martynova & Perotti (2018) compare write-down CoCos and converted to equity CoCos. They show theoretically that there are two effects on CoCo coupon rates. Write-down CoCos should be more expensive, since conversion leads to a complete loss of value. The resulting higher yield may reduce incentives to control risk (and will require a higher trigger). At the same time, write-down CoCo debt induces higher risk control than converted to equity CoCos because of the absence of any equity dilution effect.

As far as maturity is concerned, the main issue discussed in the literature is the extension or rollover risk associated with refinancing debt[11] (Murphy et al., 2012; Avdjiev et al., 2013). Flannery (2016) argues that a minimum maturity is an essential feature, which was outdone by requiring AT1 regulatory capital instruments to be perpetual (Basel Committee, 2010).[12] On the other side, CoCos are callable by the issuing financial institution after a minimum of five years (Basel Committee, 2010), which allows it to refinance its bonds.

The empirical literature on CoCos is less developed, which is probably due to these instruments being relatively new. Nevertheless, there is a number of different pricing models used in the context of CoCos. De Spiegeleer & Schoutens (2012) use an equity derivatives model, which assumes that the main determinant of the pricing is the share price of the issuing bank. They also use, like Serjantov (2011), a credit derivatives model, where the price supposedly mainly depends on the financial health and default probability of the issuing bank.

Most work was done using structural models (see e.g. Albul et al. (2015); Pennacchi (2011); Hilscher & Raviv (2014)), which are considered economically fundamental since a banks assets and liabilities are modeled and their difference represents the bank's capital. This means that the balance sheet is assumed to be driving the price (Wilkens & Bethke, 2014).

Avdjiev et al. (2020); Ammann et al. (2017); Hau & Hrasko (2018) analyse the effects of CoCo issues on the CDS spread and find significant reductions, while Avdjiev et al. (2020) further note that this effect is only significant with capital ratio triggers and stronger for CE CoCos as well as for CoCos with high trigger levels. Hau & Hrasko (2018) on the other hand find the CDS spread reduction to be higher and only on par with equity for PWD CoCos. Goncharenko et al. (2021) point out that riskier banks are less likely to issue CoCos.

Hesse (2018), using a similar sample as Avdjiev et al. (2020), investigates the cross-sectional differences of CoCo prices in different time periods utilizing subordinated bonds as control group. He

[10]Moral hazard refers to the disregard of risk if e.g. the equity holders are protected from negative consequences.

[11]If interest rates have increased, refinancing might lead to higher interest charges.

[12]CoCos eligable as Tier 2 regulatory capital need to have an original maturity of at least five years (European Commission, 2013).

finds a premium of 0.75% for PWD CoCos compared to CE CoCos. Furthermore, his work supports the ideas of CoCo investors acting as additional monitors and that non-diluting PWD CoCos entail a moral hazard problem. Fatouh et al. (2020) also find higher risk taking associated with less dilutive CoCos. On the other hand, Hau & Hrasko (2018) find no evidence of risk-shifting incentives for PWD CoCos, in contrast to what the empirical literature suggests.

Goncharenko et al. (2021) mainly focus on the capital structure of banks issuing CoCos, but also investigate the spread between CoCo coupons and the yield of comparable government bonds. Fiordelisi et al. (2017); Hau & Hrasko (2018) find a stronger positive effect of CE CoCos on bank asset volatility. Fiordelisi et al. (2020) argue that the effects of CoCos depend on the investor's believe if there is a conversion prior to the failing of the bank, which they find to be more likely for CE CoCos, but in general they observe a decline in the spread between CoCos and standard subordinated debt yields.

Bologna et al. (2018) find CoCo specific contagion channels following stress events, even though the extent was lower for the second event. The findings of the papers mentioned above are mostly consistent with the theoretical literature discussed earlier.

Caporale & Kang (2021) analyze the preferences of CoCo bond buyers and sellers based on CoCos issued worldwide between 2009 and 2020, assuming that they are mutually exclusive and that buyers prefer CoCo bonds with higher safety-adjusted returns. They find that sellers prefer bankruptcy protection and to comply with Basel III financial regulation. On the other hand, CoCo buyers desire to increase their income from this fixed income instrument.

This paper adds to the literature by combining elements of the standard asset pricing model (CAPM) with additional factors that could be motivated by the arbitrage pricing theory. We explore possible additional determinants of CoCo coupon rates besides the yields of other portfolios, building on the work of Ross (1976). Besides coupon rates not being at the center of any empirical work on CoCos so far, they are the central and the most direct pricing variable available and therefore at the core of decision making of investors and issuing banks alike.

3. Data

Before diving into the specifics of the data, it is imperative to elaborate on the two main features of CoCos, the pre-specified trigger as well as the conversion, which takes place in case of a trigger event.

3.1. CoCo Trigger and Conversion

There is a number of different possible triggers for CoCos, namely point-of-non-viability (PONV) and capital ratio triggers, as well as other less known versions like asset-level and dual triggers. The PONV or discretionary trigger is activated by the decision of authorities depending on the solvency prospects of the bank[13] whereas capital ratio triggers are triggered if certain capital ratios of either

[13]Art 46 BRRD grants resolution authorities the power to convert or write down capital instruments in resolution (European Parliament and Council, 2014). Additionally, Art 59 BRRD provides resolution authorities with the power to convert or write down capital instruments. This might be well in advance of any resolution action, particularly when the

book- or market-values of capital and (risk-weighted) assets reach a pre-specified level. In order to qualify as AT1 regulatory capital CoCos need to have a CET1 capital ratio trigger not lower than 5.125% (European Commission, 2013).

In the case of a CE CoCo, the principal is converted into equity using the market price of the stock at the time the trigger is breached, a pre-specified price like the stock price at issuance, or a combination of both (Avdjiev et al., 2020). A PWD CoCo is not converted but either fully or partially written down. This write down may either be permanent, called permanent-principal-write-down (PPWD), or temporary. In the case of a temporary-principal-write-down (TPWD) CoCo, there are additional conditions under which the write-down can be reversed. In order to be eligible as AT1 regulatory capital CoCos need to be converted or written down either completely or until the minimum CET1 capital ratio of 5.125% is restored (European Commission, 2013).

3.2. CoCos Data

We obtain CoCo data from Bloomberg, including the coupon rate, conversion type, trigger level, amount issued, the years to the bank's first call-option as well as the date of issuance and the ultimate parent country of risk.[14] After taking a subsample of countries from the EEA in order to minimize regulatory discrepancies 514 of 711 CoCos remain. This number further reduces to 493 after removing unspecified conversion types as well as partial permanent-principal-write-down (PPPWD) CoCos, of which only 11 are present. Additionally, institutional differences are mitigated by keeping only AT1 CoCos,[15] which leaves the sample at 437 CoCos.

Bank specific data like the CET1 ratio, total assets, the loan to asset ratio, the loan to deposit ratio or the Fitch, Moody's and S&P ratings are attained from the SNL database. Matching the Bloomberg and SNL data is done by using the bank name. This process leaves a sample of 385 CoCos.

We further augment the combined data by adding the returns of the Markit iBoxx EUR Contingent Convertible Liquid Developed Market AT1 Index and the Stoxx Europe 600 Index from Bloomberg, as well as the logged GDP per capita data from the World Bank's WDI database. In a final step, we omit CoCos issued prior to the third quarter of 2014,[16] which leaves us with a sample of 360 observations (see Table 1).

The average CoCo coupon is 5.63% which is considerably below the average cost of equity per country as reported by Belkhir et al. (2019) for all countries in our sample.

As presented in Table 1 there is no full data coverage, especially the variable Mean rating of the full sample is considerably incomplete. Hence, a regression sample, containing the data for the models I–VI of Table 2, is defined and compared with the full sample, showing that the distortion from

issuer is no longer viable or extraordinary public financial support is required (European Parliament and Council, 2014).

[14]Usually the country of domicile, but depends on factors like management location, country of primary listing, country of revenue and reporting currency of the issuer. For more details see the Bloomberg definition.

[15]This also guarantees that all CoCos in our sample have a CET1 capital trigger and are perpetual (European Commission, 2013).

[16]This is done in order to restrict the sample to CoCos issued after the new AT1 Coco criteria in the CRR came into force in January 2014. We omit the first two quarters of 2014 in order to allow for national ratifications to take place.

Table 1: Summary Statistics – Full Sample

Variable name	Min.	1st Qu.	Median	Mean	3rd Qu.	Max	Variance	Data.Cov
CoCo coupon rate	1.00	4.29	5.75	5.63	6.86	10.95	2.70	100.00
CET1CR - Trigger Level	1.89	6.43	7.81	8.63	10.56	24.93	9.37	78.89
CET1CR	7.01	12.14	13.69	14.27	15.87	31.93	8.49	78.89
Trigger Level	5.12	5.12	5.12	5.74	7.00	8.00	0.78	100.00
Log(Amount issued)	14.51	18.83	20.03	19.75	20.72	21.82	1.79	100.00
Years to call	5.00	5.00	5.00	6.18	7.00	12.00	3.16	99.72
Mean rating	3.00	5.33	6.67	6.66	8.00	13.33	3.01	65.83
Loan/Asset ratio	12.20	37.72	59.34	58.81	76.21	91.64	365.40	76.67
Loan/Deposit ratio	2.19	85.98	105.36	113.41	128.08	567.01	2223.01	76.11
Log(Total Assets)	13.89	17.79	20.15	19.30	20.90	21.99	4.16	79.44
Markit iBoxx AT1	-7.69	2.10	6.25	7.58	14.19	27.22	62.01	95.28
Markit iTraxx ESF	-59.09	-31.48	2.73	2.89	33.69	131.77	1528.23	95.28
Stoxx Europe 600	-41.68	-16.22	-4.73	-2.14	8.94	57.57	414.94	95.28
EU	0.00	0.00	1.00	0.67	1.00	1.00	0.22	100.00

This table presents all variables of the full sample included in the main model specifications, the full sample being all AT1 CoCos issued in the EEA and Switzerland between 2014Q3 and 2020Q3, after matching Bloomberg and SNL data (360 observations).
CET1CR stands for the common equity Tier 1 capital ratio and the Mean rating is the average of the ratings from Fitch, S&P and Moody's.
The years to call variable indicates the years until the bank is allowed to call the CoCo for the first time.
The three market indices refer to the Markit iBoxx EUR Contingent Convertible Liquid Developed Market AT1 Index, the Markit iTraxx Europe Senior Financials Index and the Stoxx Europe 600 Index and are depicted in year-over-year growth rates.

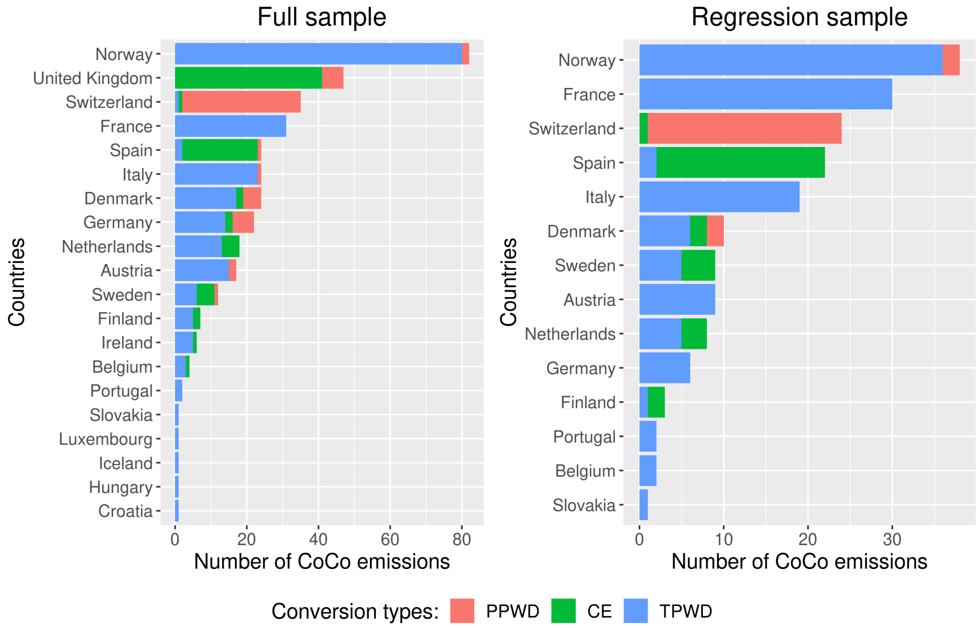
including e.g. Mean rating is not too severe. Figure 1 shows the different conversion types issued by country for the full sample and the regression sample. In both samples the majority of CoCos are of conversion type TPWD. In the full sample, they amount to 222 bonds or 61.67% and in the regression sample to 135 bonds or 61.09% of the sample. Apart from most of the emissions being centered around western Europe, the high number of PPWD CoCos in Switzerland as well as the concentration of CE CoCos in the United Kingdom and Spain stand out.

Figure 2 shows the CoCo emissions over time and again differentiated by conversion types. The numbers of CoCos issued every year exhibit a growing trend, considering the major shock in 2020 and only the first three quarters being included in the sample. The composition of conversion types issued is not changing drastically in time or between the two samples, besides the loss of observations in the year 2014.

Figure 3 shows the coupon rate grouped by conversion types. The coupon rate distribution of CE and PPWD CoCos are almost the same for both samples, only the rates for the TPWD CoCos tend to be higher on average in the regression sample.[17]

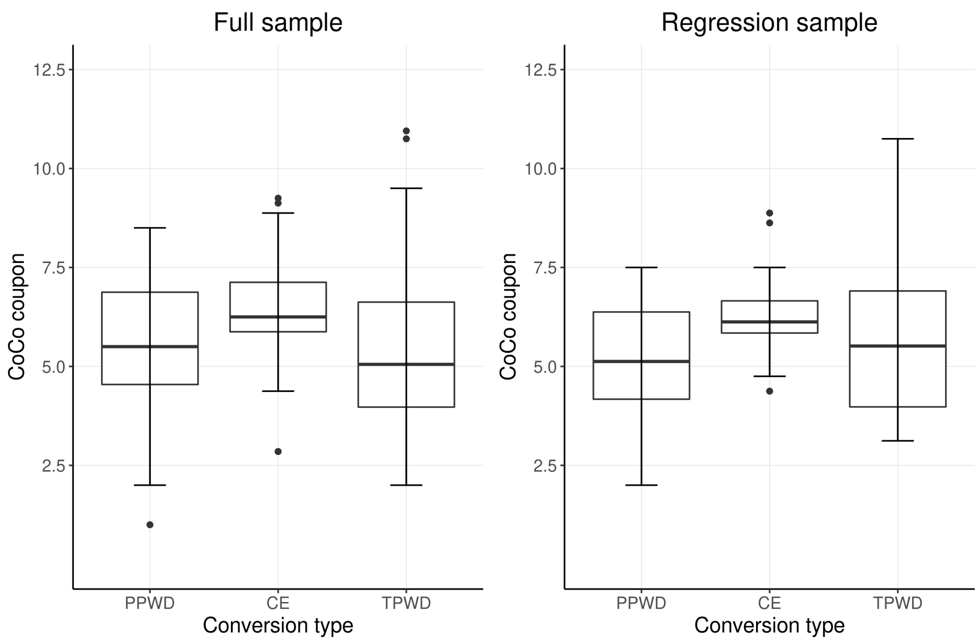
[17] This is most likely caused by the loss of several TPWD CoCos issued in Norway.

Figure 1: CoCos by Country and Conversion Type



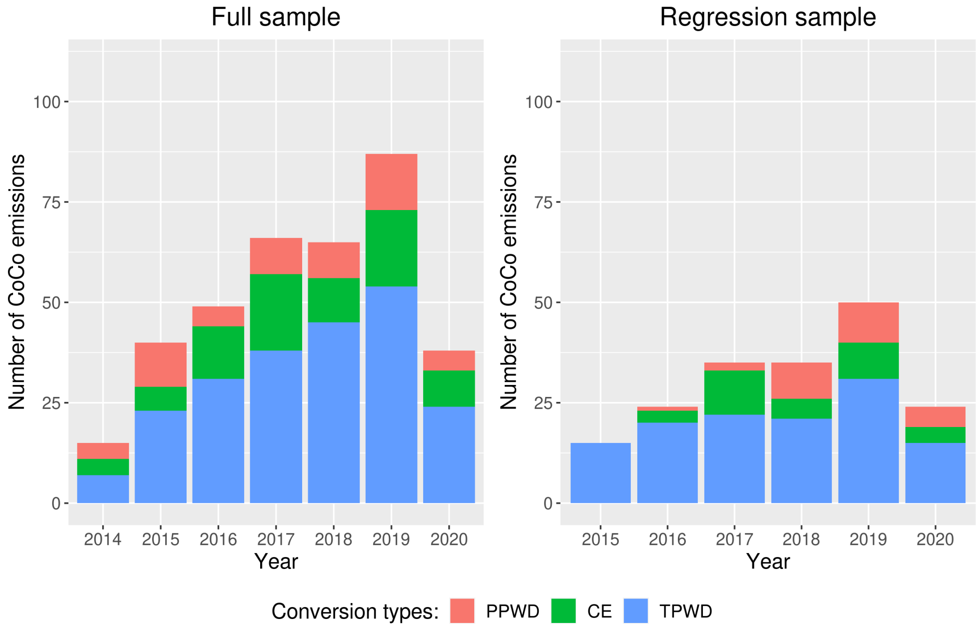
AT1 CoCos issued in the EEA between 2014Q3 and 2020Q3. The left figure shows the full sample after matching the Bloomberg and SNL data and the right figure shows the regression sample containing the data used for the models I–VI of Table 2. Emissions are grouped by country of issue and conversion type, namely permanent-principal-write-down (PPWD), conversion-to-equity (CE) and temporary-principal-write-down (TPWD).

Figure 3: CoCo Coupon Rate by Conversion Type



AT1 CoCos issued in the EEA between quarter 3 of 2014 and quarter 3 of 2020. The left side shows the full sample after matching the Bloomberg and SNL data and the right side shows the regression sample containing the data used for the models I–VI of Table 2. Emissions are grouped by conversion type, namely permanent-principal-write-down (PPWD), conversion-to-equity (CE) and temporary-principal-write-down (TPWD).

Figure 2: CoCos by Year and Conversion Type



AT1 CoCos issued in the EEA between 2014Q3 and 2020Q3. The left figure shows the full sample after matching the Bloomberg and SNL data and the right figure shows the regression sample containing the data used for the models I−VI of Table 2. Emissions are grouped by year of issue and conversion type, namely permanent-principal-write-down (PPWD), conversion-to-equity (CE) and temporary-principal-write-down (TPWD).

4. CoCo Pricing Models

In order to investigate possible determinants of CoCo coupon rate, we estimate a number of different models, with the coupon rate as the dependent variable. In our data set, all CoCos are sold at par, which sets the coupon rate equal to the CoCo yield at issue. The simplest assets pricing model that could be used to approximate the price of a CoCo is called the credit derivatives approach (De Spiegeleer & Schoutens, 2011, 2012).

The CoCo spread over a risk-free asset can be derived in this way

$$\text{Spread}_{CoCos,T} = -\frac{1-RR}{T}\log(1-p_T)\,, \tag{1}$$

where RR is the recovery rate in a case of a trigger event and p_T is the probability of default. In line with the standard capital asset pricing model (CAPM) (Sharpe, 1964; Lintner, 1965), we can express the CoCo yield y_t as the sum of the risk-free interest rate r_t and the CoCo spread ($\text{Spread}_{CoCos,t}$):

$$y_t = r_t + \text{Spread}_{CoCo,t}\,. \tag{2}$$

In the next step, the price of a CoCo under the credit derivative approach follows with:

$$P_{CoCo} = \sum_i c_i e^{-y_{t_i} t} + N e^{-y_T T} \tag{3}$$

More complex models have been derived in the literature such as the equity derivative model (De Spiegeleer & Schoutens, 2012), the J.P. Morgan model (Henriques & Doctor, 2011) and structural models (Glasserman & Nouri, 2012a; Pennacchi et al., 2014; Pennacchi & Tchistyi, 2019b; Sundaresan & Wang, 2015; Hilscher & Raviv, 2014; Albul et al., 2015). However, we are mostly interested in the drivers of the coupon rates at issue and not the price changes of the CoCo during its life span.[18]

Under the hypothesis of no arbitrage, all information about the CoCo is summarized and priced in y_T in Eq. (2). Since all CoCos in our sample were sold at par, we know that $y_T = c_i/N$, where c_i is the coupon payment and N is the face value of the CoCo.

In the empirical asset pricing literature, there is a long debate whether the betas from the CAPM and/or firm-specific factors load on the yield of a risky asset. The debate started for equities (Fama & French, 1992, 1993; Daniel & Titman, 1997; Davis et al., 2000) but also for the corporate bond market (Gebhardt et al., 2005). Theoretically justified by the intertemporal CAPM (Merton, 1973), Fama & French (1993) suggest to use a two-factor asset pricing model involving default and term factors. However, going from absolute prices in the CAPM to relative prices in the context of the arbitrage pricing theory, Ross (1976) suggests that additional factors that are not only related to yields of other portfolios might load on bond yields, equity returns and perhaps CoCo coupon rates. Hence, we look for additional factors that are bank specific.

Eq. (1) shows that any variable that reduces the probability of a trigger event, any variable that increases the recovery rate or a reduction in duration of the CoCo would reduce the CoCo coupon rate (and spread). Clearly, a greater distance of the current capital ratio (CET1 ratio) to the (CoCo) trigger level and the current CET1 capital ratio itself would reduce the probability of a trigger event. Another variable that is related to the bank's probability of default is the bank rating. A better bank rating should also reduce the chance of a trigger event.

The CAPM would suggest useing the Markit iBoxx EUR Contingent Convertible Liquid Developed Market AT1 Index (Markit iBoxx AT1). It is utilised to proxy the more general market conditions on the CoCo market. A high index price and the underlying high face value a CoCo indicate lower market risk and high demand and consequently should lead to lower coupon rates. Since CoCos are hybrid instruments, we also add the returns of the EURO STOXX Banks Index (SX7E) and the Markit iTraxx ESF as market risk factors.

To test if CoCo conversion types load on CoCo coupon rates, dummies for TPWD and CE are included. These CoCos offer the possibility of regaining at least part of their principals prior to the trigger event and accordingly increase expected coupon payments. This in turn should translate into lower coupon rates compared to PPWD CoCos. In the case of CE CoCos, investors would receive a terminal equity value and potentially dividend payments along the way, which should lead to a higher discounted stream of payments and a lower coupon in comparison to PPWD and TPWD CoCos.

[18] Empirical tests of these pricing models can be found in Wilkens & Bethke (2014). They conclude that the equity derivatives model performs best.

Although AT1 CoCos need to be perpetual and may not be called before 5 years after the date of issuance (Basel Committee, 2010; Avdjiev et al., 2013), so far almost all CoCos where called at the earliest possible date. Hence, we control for the years to first call. We also include two variables, the Loan/Asset ratio and the Loan/Deposit ratio, in order to control for business model of a bank. The amount issued per CoCo in logged form (Log(Amount issued)) is also included, as banks might face limits on how much amount they can issue at an acceptable price. Finally, as its significance has been documented in the work of Goncharenko et al. (2021), we include the logged total assets (Log(Total Assets)) as additional control variable for the likelihood of a bank to issue CoCos.

Based on the above discussion, we estimate 6 different models:

$$y_i = \alpha + \beta_0 r_{i,k} + \sum_{j=1}^{J} \beta_j x_{i,j} + \epsilon_i \;, \tag{4}$$

where $i = 1, ..., N$ refers to CoCo i. $r_{i,k}$ is the risk-free interest rate in country k for which we use the 10-year zero coupon government bond yield spread in country k from Bloomberg. All the control variables $j = 1, ..., J$ are used to approximate the CoCo coupon rate (see Eq. (1)). These sets of control variables differ between the six models estimated in Table 2.

In Appendix C, we follow a slightly different empirical strategy and use the CoCo spread defined as the CoCo coupon rate minus the German 5-year zero coupon bond yield as our dependent variable. We assume that the German 5-year zero coupon bond yield proxies the risk-free interest rate r_t in Eq. (2) and that CoCo investors are able to hedge against exchange rate risk, since some CoCos are issued in USD.

5. Results

In Section 5.1, we present our main results about the determinants of the CoCo coupon rates. In Section 5.2, we take a deeper look into the selection process of CoCo conversion types in form of a Multinomial Logistic Regression (MLR), since we obtain some results in Section 5.1, which do not agree with the pricing theory in Section 4.

5.1. Main Results – CoCo Coupon Rate

In Table 2, we present the OLS results of the main model specifications I-VI with the CoCo coupon rate at issuance as the dependent variable. In Models I-III, we do not include country or time fixed effects. These fixed effects are then added in the three remaining models.

Table 2: OLS CoCo Models (robust SE)

	I	II	III	IV	V	VI
Intercept	−1.0677	−2.0485	−0.9091	−1.4570	−1.7880	−1.8355
	(2.1290)	(2.1921)	(2.0810)	(2.1076)	(2.3327)	(2.0321)
CET1CR - Trigger Level	-0.3540^{***}		-0.3406^{***}	-0.2906^{**}	-0.3803^{***}	-0.2411^{**}
	(0.0938)		(0.0927)	(0.0997)	(0.1052)	(0.0916)
$(\text{CET1CR - Trigger Level})^2$	0.0121^{***}		0.0113^{**}	0.0105^{**}	0.0137^{***}	0.0095^{**}
	(0.0034)		(0.0036)	(0.0037)	(0.0038)	(0.0034)
CET1CR		−0.0638				
		(0.0359)				
Trigger Level		0.0188				
		(0.1046)				
Log(Amount issued)	0.3355^{**}	0.3640^{**}	0.3408^{***}	0.4005^{**}	0.4497^{***}	0.4749^{***}
	(0.1271)	(0.1277)	(0.0892)	(0.1271)	(0.1251)	(0.1203)
Years to call	0.0165	0.0265		0.0305	0.0312	0.0351
	(0.0329)	(0.0365)		(0.0324)	(0.0304)	(0.0290)
Mean rating	0.2516^{***}	0.2612^{***}	0.2498^{***}	0.3005^{***}	0.2982^{***}	0.3200^{***}
	(0.0444)	(0.0464)	(0.0376)	(0.0433)	(0.0527)	(0.0473)
Loan/Asset ratio	-0.0126^{*}	-0.0187^{**}	-0.0141^{**}	-0.0115^{*}	-0.0184^{*}	−0.0120
	(0.0063)	(0.0059)	(0.0053)	(0.0057)	(0.0074)	(0.0070)
Loan/Deposit ratio	−0.0011	0.0006		−0.0021	−0.0025	-0.0035^{*}
	(0.0017)	(0.0015)		(0.0017)	(0.0021)	(0.0017)
Log(Total Assets)	0.0100	−0.0217		−0.0448	−0.0419	−0.0734
	(0.1021)	(0.0980)		(0.0955)	(0.1083)	(0.1060)
10Y gov bond yield	0.2189	0.2310	0.2340^{*}	0.0418	0.9043^{***}	0.4788^{*}
	(0.1187)	(0.1423)	(0.1129)	(0.1355)	(0.1697)	(0.2007)
Markit iBoxx AT1	-0.0463^{*}	-0.0500^{*}	-0.0461^{*}	−0.0322	−0.0370	-0.0436^{*}
	(0.0231)	(0.0239)	(0.0222)	(0.0248)	(0.0208)	(0.0219)
Markit iTraxx Europe Senior Financials	0.0102^{***}	0.0103^{***}	0.0099^{***}	0.0078^{*}	0.0053	0.0024
	(0.0029)	(0.0029)	(0.0029)	(0.0031)	(0.0031)	(0.0032)
Stoxx Europe 600	0.0096	0.0103	0.0102	−0.0019	−0.0045	−0.0110
	(0.0066)	(0.0069)	(0.0063)	(0.0071)	(0.0058)	(0.0061)
EU	0.6495^{**}	0.7275^{**}	0.6856^{**}	0.6215^{*}		
	(0.2460)	(0.2700)	(0.2090)	(0.2526)		
TPWD	0.6272	0.3554	0.5430	0.5767	0.6243	0.3232
	(0.3300)	(0.3410)	(0.2999)	(0.3812)	(0.4323)	(0.4467)
CE	0.6134	0.4981	0.5535	0.6383	1.5219^{***}	1.3940^{**}
	(0.3721)	(0.4053)	(0.3269)	(0.4229)	(0.4398)	(0.4682)
Country FE					Yes	Yes
Year FE				Yes		Yes
N. of Obs.	204	204	210	204	204	204
Adjusted R-squared	0.66	0.64	0.67	0.72	0.72	0.78
Shapiro-Wilk	0.41	0.23	0.40	0.16	0.12	0.02
Breusch-Pagan	0.13	0.08	0.45	0.06	0.06	0.00

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$.
In this table the dependent variable is the coupon rate.
CET1CR stands for the common equity Tier 1 capital ratio and the Mean rating is the average of the ratings from Fitch, S&P and Moody's. The years to call variable indicates the years until the bank is allowed to call the CoCo for the first time.
As only two of our three conversion types are included as dummies, PPWD CoCos are the reference type in the intercept.
The three market indices refer to the Markit iBoxx EUR Contingent Convertible Liquid Developed Market AT1 Index, the Markit iTraxx Europe Senior Financials Index and the Stoxx Europe 600 Index and are depicted in year-over-year growth rates.
The EU-dummy is dropped in the model specification of V and VI with Country FE to avoid multicollinearity.
The null hypothesis of the Shapiro-Wilk Normality test is that the residuals are normally distributed. The null hypothesis of the Breusch-Pagan test is homoskedastic residuals. Robust standard errors (White) are in parenthesis.

The variable CET1CR - Trigger Level, a risk variable with variation on the instrument level, is significant in all model specifications and consistently has negative coefficients. This is in line with our expectations, since a higher difference between current CET1 capital ratio and trigger level indicates a lower probability of default, which should result in investors accepting lower coupon rates as suggested by theory (De Spiegeleer & Schoutens, 2011, 2012). Additionally, we include this term in squared form as well to capture a potential non-linearity in the relation between the CoCo coupon rate and CET1CR - Trigger Level. We find positive and significant coefficients in all model specifications, suggesting that the coupon discount decreases with every additional percent of distance between CET1 capital ratio and the trigger level.

The coefficients of CoCo amount issued in logged form are statistically significantly positive in all models, which supports the idea of a limit on the CoCo quantity a bank can issue at an acceptable price.

The variable Years to first call mainly serves as an control variable to check the premium for CoCos that have a longer time period than 5 years before they can be called by the bank.

The coefficients of the variable Mean rating are all highly significant and positive. As the coding of this variable is such that a Mean rating equal to 1 represents the best possible rating, and higher values correspond to worse ratings, the positive coefficients are again in line with our expectations. A worse rating, representing higher risk on the bank level, increases the coupon rate the bank must investors.

Goncharenko et al. (2021); Hesse (2018) also find that banks of higher quality (with less volatile assets) are more likely to successfully issue Cocos compared to riskier banks. To alleviate effects of a possible selection bias, we follow the findings of Goncharenko et al. (2021) on significant determinants for CoCo emissions and include the logged total assets as additional control variable.[19]

The Loan/Asset ratio coefficients are negative and significant in all models expect Model VI, indicating that banks with higher relative levels of loans pay less coupon rates for their CoCos. This indicates that commercial banks might face a lower probability of default, which leads to a lower coupon rate.

The coefficients of the variable Log(Total Assets), a control variable for the selection into issuing CoCos, are mostly small, negative and insignificant.

The 10-year zero coupon government bond yield should proxy each country's risk-free interest rate. In all models, the coefficients are positive and in three cases also significant at 5%.

Apart from models IV and V, the Markit iBoxx AT1 has negative and significant coefficients. This is also consistent with our expectations, since higher index returns mean that the face values of the contained CoCos are higher, indicating lower expected market risk or/and higher demand. Investors should accept smaller coupon rates when faced with lower market risk.

The coefficients of the Market iTraxx Europe Senior Financials variable is positive and highly significant in all model specifications besides models V and VI, indicating a substitutional relationship between CoCos and the senior dept included in the index.

The Stoxx Europe 600 index return is insignificant with a positive coefficient in all model specifications without year fixed effects, which indicates a substitutional relation between CoCos and stock returns.

[19] It needs to be emphasized that the instrument specific data we obtain from Bloomberg is subject to a selection process, since only CoCos which were successfully placed on the market are entering the database. As there is no systematical documentation of failed CoCo emissions, we can only try to ease potential biases as best as possible.

Interestingly, but in accordance with a stricter regulation in the EU on CoCos and potential bail-ins, CoCo coupon rates are statistically significantly higher in EU countries of our sample.

The coefficients of the two dummy variables TPWD and CE are all positive although mostly insignificant. This contradicts most of the theoretical considerations in the literature (see Section 4), as the return rate of a PPWD CoCo (the reference group in the intercept) should be lower. We would expect the coupon rates of TPWD and CE CoCos to be lower, since in case of a trigger event the expected financial flows afterwards are greater than 0 in contrast to PPWD CoCos, which have their value as well as other possible financial flows reduced to 0.[20] As a consequence, we take a deeper look into the conversion types in Section 5.2. However, Martynova & Perotti (2018) argue that PPWD CoCos coupon rates (which is equivalent to the yield at issue) could be lower than the other conversion types as these CoCos induce higher risk control than mainly CE CoCos because of the absence of any "equity dilution" effects. According to Martynova & Perotti (2018), the CoCo dilution has the effect of reducing "equity dilution" and thus also banks' risk-shifting incentives. In the extreme case of principal write down CoCo debt, the "equity dilution effect" is minimized to zero. They also present a plausible set of parameters where the "equity dilution effect" outweighs the "yield effect" which would be higher for PPWD CoCos in case of a trigger event.

As additional robustness checks we follow the unbalanced distribution of conversion types we observe in some countries (see Figure 1), we estimate the models of Table 2 while omitting Switzerland, Great Britain and Spain one by one (see Tables B.6, B.8&B.7 in Appendix Appendix B) and find results mostly consistent with Table 2. Furthermore, we include a correlation table of the variables used in the specifications I-VI in Table E.11 of Appendix Appendix E.

5.2. Supplementary Results – Conversion Types

Apart from the possibility of sample selection caused by only certain banks being able to successfully place CoCos on the market, there might be a selection process determining what conversion types certain banks are able to place on the market. For the purpose of examining this possibility multinomial logistical regression (MLR) models are estimated. This method uses logistical regressions on k-1 categories of a nominal variable, with k being the number of categories. This allows to determine the effect of variables on the log odds[21] of being in on of the k-1 categories over the reference category.

[20]This is because in the case of the bank's survival after a trigger event investors of CE CoCos have an expected value from their converted equity >0 and investors of TPWD CoCos also have an expected value >0, since they have a probability >0 that the write-down may be reversed if certain criteria are met.

[21]The log odds are the log of odds, where the odds are the probability of being in one category over the probability of being into another category. For example, if the probability of A and B are 80% and 20%, then the odds of A in reference to B are 0.80/0.20=4. A is 4 times more likely than B.

Table 3: Multinomial Logistic Regression (MLR)

	Benchmark: PPWD			
	CE (I)	TPWD (I)	CE (II)	TPWD (II)
Intercept	-26.287^{***}	10.477^{*}	-19.444^{***}	15.584^{***}
	(5.110)	(5.471)	(1.699)	(3.352)
CoCo coupon rate	2.181^{***}	1.999^{***}	2.851^{***}	2.551^{***}
	(0.802)	(0.775)	(0.934)	(0.930)
CET1CR - Trigger Level	-6.411^{*}	-5.792^{*}	-8.812^{***}	-7.909^{***}
	(3.401)	(3.403)	(2.922)	(2.882)
(CET1CR - Trigger Level)^2	0.397^{**}	0.370^{*}	0.531^{***}	0.491^{***}
	(0.191)	(0.191)	(0.158)	(0.156)
Log(Amount issued)	0.145	−0.928	0.030	−0.995
	(0.953)	(0.900)	(0.968)	(0.927)
Years to call	−0.352	−0.086	−0.549	−0.299
	(0.334)	(0.319)	(0.392)	(0.379)
Mean rating	−0.333	−0.283	−0.440	−0.448
	(0.440)	(0.406)	(0.508)	(0.487)
Loan/Asset ratio	0.237^{***}	0.166^{**}	0.292^{***}	0.213^{**}
	(0.086)	(0.082)	(0.089)	(0.092)
Loan/Deposit ratio	−0.023	−0.004	−0.020	−0.001
	(0.015)	(0.013)	(0.016)	(0.014)
Log(Total Assets)	1.326	0.666	1.576^{*}	0.614
	(0.949)	(0.883)	(0.950)	(0.922)
Markit iBoxx AT1	−0.049	−0.145	−0.129	−0.045
	(0.239)	(0.228)	(0.287)	(0.273)
Stoxx Europe 600	0.055	0.057	0.028	0.031
	(0.072)	(0.069)	(0.087)	(0.084)
Markit iTraxx Europe Senior Financials	−0.032	−0.041	−0.037	−0.026
	(0.032)	(0.031)	(0.037)	(0.035)
EU	8.574^{***}	6.258^{***}	9.616^{***}	7.551^{***}
	(2.222)	(1.962)	(2.284)	(2.087)
TD 2015			1.233^{**}	8.164^{***}
			(0.577)	(0.573)
TD 2016			-7.901^{***}	−0.487
			(1.567)	(1.948)
TD 2017			−1.647	2.202
			(2.333)	(2.123)
TD 2018			-4.490^{***}	0.412
			(1.094)	(1.165)
TD 2019			-4.879^{***}	1.366
			(1.371)	(1.350)
TD 2020			−1.760	3.928^{**}
			(2.001)	(1.928)
Prediction error	0.18	0.18	0.18	0.18
Akaike Inf. Crit.	250.26	250.26	253.99	253.99

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$.
The dependent variables in this table are the log odds of conversion type CE over PPWD in the Model CE (I) and conversion type TPWD over PPWD in the Model TPWD (I).
The same holds true for Model CE (II) and Model TPWD (II).
The coefficients indicate the change in the respective log odds ratios if the explanatory variable in question is increased by one unit.
CET1CR stands for the common equity Tier 1 capital ratio and the Mean rating is the average of the ratings from Fitch, S&P and Moody's. Interest/operating income is the net interest income divided by the operating income.
The three market indices refer to the Markit iBoxx EUR Contingent Convertible Liquid Developed Market AT1 Index, the Markit iTraxx Europe Senior Financials Index and the Stoxx Europe 600 Index.
The prediction error refers to the in-sample prediction error. Standard errors are in parenthesis.
For the estimation, we use code from the R-package nnet (Venables & Ripley, 2002).

In Table 3, we present the estimation results of two MLR model specifications. For all columns PPWD is the reference category, hence all estimated coefficients increase (if positive) or decrease (if negative) the probability that a certain CoCo has the conversion type CE (or TPWD) over PPWD.

Based on the estimated coefficients in columns CE (I) and TPWD (I) it is possible to calculate the predicted probabilities for each CoCo to be in one of the three conversion types. If the realized conversion type of CoCo i also has the highest predicted probability, then the multinominal logistic regression model classifies CoCo i's conversion type successfully. The calculated prediction errors in Table 3 of 18% and 17.6% report the share of misclassified CoCos.

The interpretation of the coefficients in Table 3 is not straightforward. The coefficients are log odds ratios with respect to the reference CoCo conversion type of PPWD. The coefficient of CoCos coupon in CE (I) therefore means that a one unit increase in the CoCo coupon rate increases the log odds ratio of the CE conversion type by 2.18 with respect to PPWD. The other reported coefficients of CoCo coupon rate are also positive and highly significant. We argue that "weaker" or "riskier" banks not only have to offer a higher CoCo coupon rate but also CE or TPWD conversion types in order to successfully sell their CoCos. One theoretical explanation could be the "equity dilution effect" explained by Martynova & Perotti (2018). Investors might anticipate that CE and TPWD Cocos induce lower risk control and therefore require higher CoCo coupon rates.

This argument is further supported by the coefficients of CET1CR - Trigger Level which indicate that banks whose common equity tier 1 capital ratio is far away from the trigger level offer PPWD CoCos with a higher probability.

We do not include country fixed effects in any specification, since in many countries not all three conversion types are observed. Consequently, the country fixed effect would pick up very large positive or negative values reflecting the facts that in some countries certain conversion types have a probability of 0 or 1. However, country specific conversion type preferences do not interfere with including an EU dummy. Since all coefficients are positive, the log odds ratios of CE and TPWD over PPWD increase if the CoCo is sold by a bank from an EU country.

Coming back to the unexpected positive TPWD and CE coefficients in Table 2 in Section 5.1, we see in Table 3 that the conversion type is also statistically significantly influenced by the CoCo coupon rate. Thus, "weaker" or "riskier" banks do not only have to offer higher coupon rates but also more favorable conversion types (i.e. CE and TPWD instead of PPWD) for investors to be able to sell their CoCos. We argue that CoCos coupon rates and conversion types are determined simultaneously and are offered as a package to investors.

6. Discussion

In this section, we discuss the results of our empirical analyses and compare it with the literature review in Section 2 as well as with the theoretical foundation presented in Section 4.

The results from our main model specifications in Table 2 can be split into two main outcomes. First, our proxies for risk and the probability of default are mostly significant. In particular, the mean bank rating is highly significant. The signs of the coefficients unanimously confirm the expectation derived from Eq. 1 and 2, that higher risk associated with a higher probability of default leads to a higher CoCo coupon rate. This result supports the idea of CoCo investors monitoring banks as suggested by Liikanen Commission (2012) and further encouraged by the empirical work of Hesse (2018).

Second, instead of the anticipated lower coupon rates for the safer CE and TPWD CoCos, following a higher rate of return in case of a trigger event, we actually find consistently positive and in some specifications statistically significant coefficients. This indicates higher coupon rates for CE and

TPWD CoCos. It is possible that CoCo investors do not charge significantly different prices for different conversion types, since the likelihood of survival after a trigger event might not be considered very high. Another explanation for higher PPWD CoCo coupons would be a higher demand from investors who are not allowed to hold CE CoCos because of their mandate (Avdjiev et al., 2013). Avdjiev et al. (2013), on the other hand, suggest that CE CoCos tend to be cheaper and Hesse (2018) actually finds a statistically significant price premium on yields of 0.75% for PWD[22] over CE CoCos using 41 CoCo yield differentials. To investigate if we can confirm a premium for the aggregated PWD CoCos in the case of coupon rates, we split our regression sample into CE and PWD Cocos by adding PPWD and TPWD CoCos together (see Appendix Appendix D). In this exercise we again find positive but mostly insignificant coefficients for the CE CoCo dummy, indicating that there is no price premium for PWD CoCos in our sample.

Taking a closer look at the issue, in Figure 1 we see that almost all of the riskier PPWD CoCos in our sample are issued in Switzerland, which could be explained by differences in the regulatory framework, like for example less possibilities in EU countries to avoid bail-ins, following the BRRD (European Parliament and Council, 2014). In order to further inquire the possible direction of the resulting bias, Table B.5 and Figure B.4 in Appendix Appendix B depict the coupon rates and other characteristics for CoCos issued in Switzerland in comparison to CoCos not issued in Switzerland. In our regression sample we find a lower mean coupon rate for CoCos issued in Switzerland, even though the average values of our risk proxies (with variation on the instrument and bank level) are inferior. Especially the net loan to asset ratio is significantly lower in Switzerland, with 37.79% compared to 57.50% in the rest of the sample, indicating that in our sample the banks in Switzerland are leaning more towards the investment banking sector. These findings would actually suggest that we might be underestimating the effect of PPWD CoCos, even though our results are already indicating discounts for PPWD CoCos. Considering the theory, the empirical literature, as well as our results, we believe that there are unobserved factors which lower CoCo coupon rates of banks in Switzerland.

The MLR results in Table 3 suggest that CoCos coupon rates and conversion types are determined simultaneously and are offered as a package to investors. The log odds ratios of choosing CE and TPWD over PPWD significantly increase with the CoCos coupon rate.

Coming back to the ongoing discussion in the empirical asset pricing literature whether market and/or firm-specific factors load on the yield of a risk asset, our results show that both categories matter. Adding only our three market portfolio returns (Market iBoxx AT1, Markit iTraxx Europe Senior Financials & Stoxx Europe 600) and our proxy for the risk-free interest rate as explanatory variables results in a significant drop in adjusted R^2 to around 17.8%.[23] All intercepts in Table 2 are not statistically different from 0, which should be the case for a well-specified asset pricing model (Merton, 1973).

To analyze if the decision on the conversion type is governed by a selection process, we estimate MLR models. Even though a similar approach by Hesse (2018) did not reveal significant differences between banks issuing CE or PWD CoCos, our results in Table 3 suggest that safer banks are more likely to issue PPWD CoCos, which is in line with our initial expectations. Our MLR model further

[22]He does not make it explicit if his definition of PWD CoCos include TPWD CoCos as well.

[23]We do not show the results of this small model in Table 2. The included explanatory variables are 10Y gov bond yield, Markit iBoxx AT1, Markit iTraxx Europe Senior Financials, Stoxx Europe 600 and time fixed effects.

indicates that PPWD CoCos are more likely to be issued in times of low market risk and less likely in the EU countries of our sample.

The findings in our MLR models highlight the need to study the reasons for conversion type cluster in certain countries, especially as CE CoCos exhibit lower risk-shifting incentives, as argued by e.g. Avdjiev et al. (2013), and PPWD CoCos on the other hand might lead to moral hazard.

7. Conclusion

In pursuit of finding the drivers of CoCo coupon rates, we construct a comprehensive data set of over 200 AT1 CoCos issued between 2014 and 2020 in the EEA and Switzerland. As possible drivers we identify proxies for the recovery rate and the probability of default (see Eq. (1)). We find that the coupon rates are sensitive to various risk proxies on the instrument-, bank-, country- and market-level, which we interpret as evidence for a risk sensitive CoCo market. We find that the coupon rates are not fully explained by the (market) “betas”, as suggested by the CAPM, but are also sensitive to various risk proxies on the instrument-, bank-, and country-level. This also supports the idea of a risk sensitive CoCo market.

In search of pricing differences between the CoCo conversion types CE, TPWD and PPWD, we find that they are heavily clustered in certain countries, with most of PPWD CoCos being issued in Switzerland and the majority of CE CoCos being issued in Great Britain and Spain. This causes us to view our results of statistically mostly insignificant but consistently lower coupon rates for PPWD CoCos with caution.

We also run MLR models to investigate the selection process into different conversion types and find evidence for such a process, consistent with the observation of clusters in Switzerland, Great Britain and Spain. We also find that the conversion type is significantly influenced by the CoCos coupon rate. A higher CoCos coupon rate increases the log odds ratios of CE and TPWD with respect to PPWD. Hence, “riskier” banks that already offer higher CoCo coupon rates also need to include the “investor friendly” CE and TPWD conversion types.

Our findings suggest that future research should dive more deeply into the reasons for the observed conversion type clusters, especially since non-equity-diluting PWD CoCos might lead to moral hazard. If investors price the risk of bail-ins in countries differently despite a common regulatory framework, there is room for regulatory arbitrage. It might even be possible that investors expect that the CoCo conversion type is less important, since the trigger level is already so low that regulatory authorities might intervene before the trigger level was breached.

References

Acharya, V. V., Cooley, T. F., Richardson, M. P., Walter, I., of Business, N. Y. U. S. S., & Scholes, M. (2010). *"Regulating Wall Street: The Dodd-Frank Act and the new architecture of global finance"*, volume 608. Wiley Hoboken, NJ.

Albul, B., Jaffee, D. M., & Tchistyi, A. (2015). *"Contingent convertible bonds and capital structure decisions"*. Available at ssrn 2772612.

Ammann, M., Blickle, K., & Ehmann, C. (2017). Announcement effects of contingent convertible securities: Evidence from the global banking industry. *European financial management*, 23(1), 127–152.

Avdjiev, S., Bogdanova, B., Bolton, P., et al. (2020). Coco issuance and bank fragility. *Journal of Financial Economics*.

Avdjiev, S., Kartasheva, A. V., & Bogdanova, B. (2013). *"CoCos: a primer"*. Bis quarterly review.

Basel Committee (2010). *"Basel III: A global regulatory framework for more resilient banks and banking systems"*. Basel committee on banking supervision, basel.

Bekaert, G. & Harvey, C. R. (2000). Foreign speculators and emerging equity markets. *The Journal of Finance*, 55(2), 565–613.

Belkhir, M., Naceur, S., Chami, R., & Samet, A. (2019). Bank capital and the cost of equity. *IMF Working Paper*, No. 19/265.

Berg, T. & Kaserer, C. (2015). Does contingent capital induce excessive risk-taking? *Journal of Financial intermediation*, 24(3), 356–385.

Bologna, P., Miglietta, A., & Segura, A. (2018). Contagion in the cocos market? a case study of two stress events. *A Case Study of Two Stress Events (November 6, 2018). Bank of Italy Temi di Discussione (Working Paper) No*, 1201.

Calomiris, C. W. & Herring, R. J. (2013). How to design a contingent convertible debt requirement that helps solve our too-big-to-fail problem. *Journal of Applied Corporate Finance*, 25(2), 39–62.

Caporale, G. M. & Kang, W.-Y. (2021). On the preferences of coco bond buyers and sellers. *Journal of International Financial Markets, Institutions and Money*, 72, 101314.

Chan, S. & van Wijnbergen, S. (2017). *"Coco design, risk shifting incentives and capital regulation"*. C.e.p.r. discussion papers.

Claessens, S., Herring, R., Schoenmaker, D., & Summe, K. A. (2010). *"A safer world financial system: Improving the resolution of systemic institutions"*. International Center for Monetary and Banking Studies Geneva.

Daniel, K. & Titman, S. (1997). Evidence on the characteristics of cross sectional variation in stock returns. *The Journal of Finance*, 52(1), 1–33.

Davis, J. L., Fama, E. F., & French, K. R. (2000). Characteristics, covariances, and average returns: 1929 to 1997. *The Journal of Finance*, 55(1), 389–406.

De Spiegeleer, J. & Schoutens, W. (2011). *The handbook of convertible bonds: Pricing, strategies and risk management*, volume 581. John Wiley & Sons.

De Spiegeleer, J. & Schoutens, W. (2012). Pricing contingent convertibles: A derivatives approach. *The Journal of Derivatives*, 20(2), 27–36.

Duffie, D. (2009). *"Contractual methods for out-of-court restructuring of systemically important financial institutions"*. Submission requested by the us treasury working group on bank capital, draft of november.

European Commission (2013). 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.

European Commission (2014). Regulation (eu) no 241/2014 supplementing regulation (eu) no 575/2013 of the european parliament and of the council with regard to regulatory technical standards for own funds requirements for institutions.

European Parliament and Council (2014). Directive 2014/59/eu of the european parliament and of the council of 15 may 2014 establishing a framework for the recovery and resolution of credit institutions and investment firms and amending council directive 82/891/eec, and directives 2001/24/ec, 2002/47/ec, 2004/25/ec, 2005/56/ec, 2007/36/ec, 2011/35/eu, 2012/30/eu and 2013/36/eu, and regulations (eu) no 1093/2010 and (eu) no 648/2012.

Eurostat (2015). *Eurostat Supplementary Table for the Financial Crisis*. Background note, Eurostat.

Eurostat (2018). *Eurostat Supplementary Table for Reporting Government Interventions to Support financial Institutions*. Background note, Eurostat.

Fama, E. F. & French, K. R. (1992). The cross-section of expected stock returns. *the Journal of Finance*, 47(2), 427–465.

Fama, E. F. & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of financial economics*, 33(1), 3–56.

Fatouh, M., Neamtu, I., & van Wijnbergen, S. (2020). Risk-taking, competition and uncertainty: Do coco bonds increase the risk appetite of banks?

Fiordelisi, F., Pennacchi, G., & Ricci, O. (2020). Are contingent convertibles going-concern capital? *Journal of financial intermediation*, 43, 100822.

Fiordelisi, F., Ricci, O., & Stentella Lopes, F. S. (2017). The unintended consequences of the launch of the single supervisory mechanism in europe. *Journal of Financial and Quantitative Analysis*, 52(6), 2809–2836.

Flannery, M. (2005). No pain, no gain? effecting market discipline via reverse convertible debentures. *Capital adequacy beyond Basel: Banking, securities, and insurance*, (pp. 171–196).

Flannery, M. (2016). Stabilizing large financial institutions with contingent capital certificates. *Quarterly Journal of Finance*, 6(02), 1–26.

Flannery, M., Perotti, E., et al. (2011). Coco design as a risk preventive tool. *VoxEU. org, February*, 9.

Gebhardt, W. R., Hvidkjaer, S., & Swaminathan, B. (2005). The cross-section of expected corporate bond returns: Betas or characteristics? *Journal of Financial Economics*, 75(1), 85 – 114.

Gerhardt, M. & Vander Vennet, R. (2017). Bank bailouts in europe and bank performance. *Finance Research Letters*, 22, 74–80.

Glasserman, P. & Nouri, B. (2012a). Contingent capital with a capital-ratio trigger. *Management Science*, 58(10), 1816–1833.

Glasserman, P. & Nouri, B. (2012b). Market-triggered contingent capital: equilibrium price dynamics. In *Working Paper*. Citeseer.

Goncharenko, R., Ongena, S., & Rauf, A. (2021). The agency of cocos: Why contingent convertible bonds are not for everyone. *Journal of Financial Intermediation*, 48, 100882.

Greene, R. (2016). Understanding cocos: What operational concerns & global trends mean for us policymakers. *Harvard University, John F. Kennedy School of Government, M-RCBG Associate Working Paper*, (62).

Hail, L. & Leuz, C. (2006). International differences in the cost of equity capital: Do legal institutions and securities regulation matter? *Journal of accounting research*, 44(3), 485–531.

Haldane, A. G. (2011). Capital discipline. *based on a speech given at the American Economic Association*.

Hanselaar, R., Purnanandam, A., & Zeume, S. (2017). Risk-taking implications of contingent convertible bond.

Hau, H. & Hrasko, G. (2018). Are coco bonds a good substitute for equity? evidence from european banks. *Evidence from European Banks (October 16, 2018). Swiss Finance Institute Research Paper*, (18-67).

Henriques, R. & Doctor, S. (2011). Making cocos work. *JP Morgan: Europe Credit Research*.

Herring, R. J. & Calomiris, C. W. (2011). Why and how to design a contingent convertible debt requirement. *Available at SSRN 1815406*.

Herring, R. J. et al. (2017). *CoCos: a promising idea poorly executed*, volume 61. World Scientific.

Hesse, H. (2018). *Incentive effects from write-down CoCo bonds: An empirical analysis*. Working paper No. 212, SAFE.

Hillion, P. & Vermaelen, T. (2004). Death spiral convertibles. *Journal of Financial Economics*, 71(2), 381–415.

Hilscher, J. & Raviv, A. (2014). Bank stability and market discipline: The effect of contingent capital on risk taking and default probability. *Journal of Corporate Finance*, 29, 542–560.

Jang, H. J., Na, Y. H., & Zheng, H. (2018). Contingent convertible bonds with the default risk premium. *International Review of Financial Analysis*, 59, 77–93.

Leland, H. E. (1994). Corporate debt value, bond covenants, and optimal capital structure. *The journal of finance*, 49(4), 1213–1252.

Liikanen Commission (2012). High-level expert group on reforming the structure of the eu banking sector. *Final Report, Brussels*, 2.

Lintner, J. (1965). Security prices, risk, and maximal gains from diversification. *The journal of finance*, 20(4), 587–615.

Martynova, N. & Perotti, E. (2018). Convertible bonds and bank risk-taking. *Journal of Financial Intermediation*, 35, 61–80.

McDonald, R. L. (2013). Contingent capital with a dual price trigger. *Journal of Financial Stability*, 9(2), 230–241.

McNamara, C. M., Tente, N., & Metrick, A. (2014). Swiss finish to basel iii.

Merton, R. C. (1973). An intertemporal capital asset pricing model. *Econometrica: Journal of the Econometric Society*, (pp. 867–887).

Murphy, G., Walsh, M., & Willison, M. (2012). Precautionary contingent capital. *Bank of England Financial Stability Paper*, (16).

Pastor, L., Sinha, M., & Swaminathan, B. (2008). Estimating the intertemporal risk–return tradeoff using the implied cost of capital. *The Journal of Finance*, 63(6), 2859–2897.

Pennacchi, G. (2011). *"A structural model of contingent bank capital"*. Federal reserve bank of cleveland working paper 10-04.

Pennacchi, G. & Tchistyi, A. (2019a). Contingent convertibles with stock price triggers: The case of perpetuities. *The Review of Financial Studies*, 32(6), 2302–2340.

Pennacchi, G. & Tchistyi, A. (2019b). Contingent convertibles with stock price triggers: The case of perpetuities. *The Review of Financial Studies*, 32(6), 2302–2340.

Pennacchi, G., Vermaelen, T., & Wolff, C. C. (2014). Contingent capital: The case of coercs. *Journal of Financial and Quantitative analysis*, (pp. 541–574).

Prescott, E. S. (2012). Contingent capital: the trigger problem. *FRB Richmond Economic Quarterly*, 98(1), 33–50.

Raviv, A. et al. (2004). *"Bank stability and market discipline: Debt-for-equity swap versus subordinated notes"*. Working paper.

Ross, S. A. (1976). The arbitrage theory of capital asset pricing. *Journal of Economic Theory*, 13(3), 341 – 360.

Serjantov, A. (2011). On practical pricing hybrid capital securities. *Presentation, Global Derivatives Trading and Risk Management*.

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *The journal of finance*, 19(3), 425–442.

Squam Lake Working Group (2009). An expedited resolution mechanism for distressed financial firms: Regulatory hybrid securities. *Council on Foreign Relations*, 10.

Sundaresan, S. & Wang, Z. (2015). On the design of contingent capital with a market trigger. *The Journal of Finance*, 70(2), 881–920.

Venables, W. N. & Ripley, B. D. (2002). *Modern Applied Statistics with S*. New York: Springer, fourth edition. ISBN 0-387-95457-0.

Wilkens, S. & Bethke, N. (2014). Contingent convertible (coco) bonds: A first empirical assessment of selected pricing models. *Financial Analysts Journal*, 70(2), 59–77.

Appendix A. Regulatory Capital Requirements

Table A.4: Minimum Capital to Risk-weighted Assets (RWA) Ratios (Basel III)

Common Equity Capital	4.5%
+ Additional Tier 1 Capital	+1.5%
Tier 1 Capital	6.0%
+ Tier 2 Capital	+2.0%
Total Capital	8.0%
+ Countercyclical capital buffer	+2.5%
Total Capital (+ buffer)	10.5%

Source: Basel Committee (2010) Annex 4

Appendix B. Country Characteristics

Following the cluster of PPWD CoCos in Switzerland (see Figure 1), Table B.5 highlights the characteristics of CoCos in our regression sample issued in Switzerland compared to the regression sample excluding Switzerland. The mean coupon rate in Switzerland is lower, even though on average there is a lower distance to the CET1 trigger, an inferior mean rating and a lower loan to asset and loan to deposit ratio.

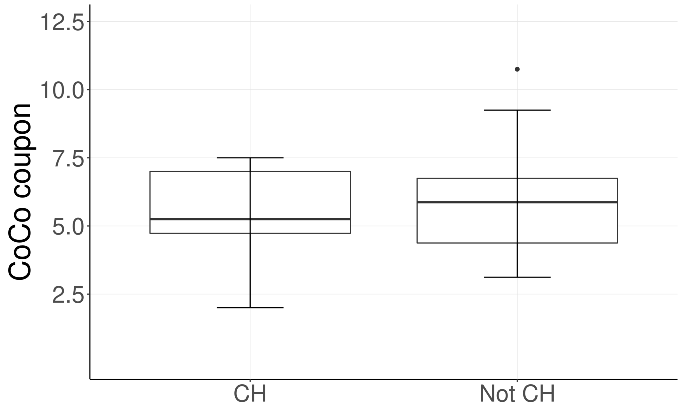
Table B.5: Summary Statistics – Regression Sample

Variable Name	Mean - CH	Mean - not CH
CoCos coupon	5.43	5.66
CET1CR	12.91	14.06
Trigger Level	6.92	5.31
CET1CR - Trigger Level	5.98	8.74
Log(Amount issued)	20.66	20.12
Years to call	6.17	6.28
Mean rating	7.10	6.64
Loan/Asset ratio	37.79	59.81
Loan/Deposit ratio	78.21	125.04
Log(Total Assets)	20.36	19.85

In this table the variables used in the model specifications I-VI in Table 2 of the Switzerland observations in the regression sample are compared with the regression sample excluding Switzerland.

Figure B.4 depicts the coupon rates for CoCos in our regression sample issued in Switzerland and not issued in Switzerland in more detail. As there are also significant conversion type clusters in Great Britain and Spain, Table B.6, B.8 and B.7 picture the main model specifications deployed in Table 2 excluding Switzerland, Great Britain and Spain one by one.

Figure B.4: CoCo Coupon Rates – Regression Sample.



The left figure shows the coupon rates of CoCos from the regression sample issued in Switzerland, the right figure shows the coupon rates from the regression sample excluding CoCos issued in Switzerland. The regression sample contains the data used for the models I−VI of Table 2.

Table B.6: OLS CoCo Models Excluding Switzerland (robust SE)

	I	II	III	IV	V	VI
Intercept	1.5272	0.7633	2.1740	1.3204	0.0784	0.7603
	(2.3711)	(2.4625)	(2.2167)	(2.4072)	(2.8007)	(2.3354)
CET1CR - Trigger Level	-0.3360^{***}		-0.3244^{***}	-0.2618^{**}	-0.3957^{***}	-0.2446^{**}
	(0.0946)		(0.0917)	(0.0940)	(0.1026)	(0.0854)
(CET1CR - Trigger Level)^2	0.0117^{***}		0.0107^{**}	0.0098^{**}	0.0146^{***}	0.0100^{**}
	(0.0034)		(0.0035)	(0.0034)	(0.0037)	(0.0032)
CET1CR		−0.0502				
		(0.0337)				
Trigger Level		−0.0263				
		(0.0995)				
Log(Amount issued)	0.0932	0.1089	0.1861	0.1462	0.1918	0.2061
	(0.1300)	(0.1300)	(0.1049)	(0.1337)	(0.1176)	(0.1080)
Years to call	0.0041	0.0062		0.0125	0.0272	0.0201
	(0.0358)	(0.0392)		(0.0346)	(0.0330)	(0.0308)
Mean rating	0.2321^{***}	0.2126^{***}	0.2097^{***}	0.2755^{***}	0.3314^{***}	0.3386^{***}
	(0.0585)	(0.0589)	(0.0449)	(0.0506)	(0.0654)	(0.0505)
Loan/Asset ratio	−0.0124	-0.0166^{**}	-0.0154^{**}	-0.0120^{*}	-0.0185^{*}	−0.0129
	(0.0065)	(0.0061)	(0.0055)	(0.0059)	(0.0078)	(0.0072)
Loan/Deposit ratio	−0.0012	0.0001		−0.0023	−0.0024	-0.0033^{*}
	(0.0016)	(0.0014)		(0.0015)	(0.0020)	(0.0017)
Log(Total Assets)	0.1089	0.0707		0.0476	0.1242	0.0704
	(0.1117)	(0.1057)		(0.0982)	(0.1248)	(0.1106)
10Y gov bond yield	0.3282^{*}	0.4235^{*}	0.3370^{*}	0.1766	0.8556^{***}	0.3908
	(0.1459)	(0.1736)	(0.1390)	(0.1618)	(0.1767)	(0.1999)
Markit iBoxx AT1	-0.0471^{*}	-0.0505^{*}	-0.0479^{*}	−0.0284	−0.0414	-0.0556^{*}
	(0.0223)	(0.0230)	(0.0221)	(0.0267)	(0.0211)	(0.0244)
Markit iTraxx ESF	0.0091^{**}	0.0090^{**}	0.0090^{**}	0.0068	0.0047	0.0000
	(0.0033)	(0.0033)	(0.0033)	(0.0038)	(0.0036)	(0.0040)
Stoxx Europe 600	0.0080	0.0080	0.0090	−0.0041	−0.0034	−0.0103
	(0.0062)	(0.0066)	(0.0062)	(0.0071)	(0.0057)	(0.0062)
EU	0.9695^{**}	1.2717^{***}	0.9817^{***}	0.9908^{***}		
	(0.3205)	(0.3469)	(0.2675)	(0.2948)		
Temp. write down	0.6926	0.6889	0.5095	0.7762	0.5819	0.4018
	(0.4484)	(0.4429)	(0.3811)	(0.5729)	(0.4730)	(0.4608)
Equity conversion	0.6505	0.7884	0.5244	0.8208	1.3301^{*}	1.4198^{*}
	(0.4876)	(0.4779)	(0.4112)	(0.6069)	(0.5596)	(0.5691)
Country FE					Yes	Yes
Year FE				Yes		Yes
N. of Obs.	180	180	186	180	180	180
Adjusted R-squared	0.67	0.65	0.68	0.74	0.7325	0.80
Shapiro-Wilk	0.81	0.33	0.81	0.17	0.07	0.62
Breusch-Pagan	0.44	0.24	0.68	0.08	0.02	0.01

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$.
In this table the dependent variable is the coupon rate.
CET1CR stands for the common equity Tier 1 capital ratio and the Mean rating is the average of the ratings.
The years to call variable indicates the years until the bank can call the CoCo for the first time. As only two of our three conversion types are included as dummies, PPWD CoCos are the reference type in the intercept.
The three market indices refer to the Markit iBoxx EUR Contingent Convertible Liquid Developed Market AT1 Index, the Markit iTraxx Europe Senior Financials Index and the Stoxx Europe 600 Index and are depicted in year-over-year growth rates.
The EU-dummy is dropped in the model specification of V and VI with Country FE in order to avoid multicollinearity.
The null hypothesis of the Shapiro-Wilk Normality test is that the residuals are normally distributed. The null hypothesis of the Breusch-Pagan test is homoskedastic residuals. Robust standard errors (White) are in parenthesis.

Table B.7: OLS CoCo Models Excluding Spain (robust SE)

	I	II	III	IV	V	VI
Intercept	−1.9593	−2.5397	−1.7696	−2.5886	−2.2552	−2.5046
	(2.1368)	(2.1732)	(2.0988)	(2.0812)	(2.4944)	(2.1314)
CET1CR - Trigger Level	-0.3649^{***}		-0.3441^{***}	-0.2993^{**}	-0.4020^{***}	-0.2463^{*}
	(0.0995)		(0.0983)	(0.1033)	(0.1187)	(0.1018)
$(\text{CET1CR - Trigger Level})^2$	0.0123^{***}		0.0113^{**}	0.0108^{**}	0.0145^{***}	0.0098^{**}
	(0.0036)		(0.0037)	(0.0037)	(0.0042)	(0.0037)
CET1CR		−0.0684				
		(0.0381)				
Trigger Level		−0.0782				
		(0.1308)				
Log(Amount issued)	0.3706^{**}	0.4051^{**}	0.3839^{***}	0.4299^{***}	0.5071^{***}	0.5294^{***}
	(0.1290)	(0.1277)	(0.0900)	(0.1275)	(0.1282)	(0.1206)
Years to call	0.0175	0.0264		0.0336	0.0378	0.0424
	(0.0363)	(0.0403)		(0.0350)	(0.0326)	(0.0306)
Mean rating	0.2456^{***}	0.2734^{***}	0.2496^{***}	0.3140^{***}	0.2622^{***}	0.3054^{***}
	(0.0474)	(0.0542)	(0.0425)	(0.0475)	(0.0619)	(0.0556)
Loan/Asset ratio	−0.0111	-0.0164^{**}	-0.0137^{*}	−0.0101	-0.0208^{*}	−0.0139
	(0.0067)	(0.0063)	(0.0057)	(0.0060)	(0.0081)	(0.0078)
Loan/Deposit ratio	−0.0011	0.0003		−0.0020	−0.0020	−0.0030
	(0.0017)	(0.0016)		(0.0017)	(0.0020)	(0.0017)
Log(Total Assets)	0.0220	−0.0092		−0.0262	−0.0432	−0.0740
	(0.1053)	(0.1007)		(0.0984)	(0.1128)	(0.1123)
10Y gov bond yield	0.1991	0.1860	0.1959	0.0262	0.8975^{***}	0.4722^{*}
	(0.1207)	(0.1417)	(0.1169)	(0.1382)	(0.1835)	(0.2199)
Markit iBoxx AT1	−0.0491	-0.0531^{*}	-0.0495^{*}	−0.0403	-0.0452^{*}	-0.0618^{*}
	(0.0253)	(0.0261)	(0.0244)	(0.0282)	(0.0225)	(0.0242)
Markit iTraxx ESF	0.0100^{**}	0.0102^{***}	0.0097^{**}	0.0069^{*}	0.0039	−0.0005
	(0.0031)	(0.0030)	(0.0030)	(0.0033)	(0.0033)	(0.0035)
Stoxx Europe 600	0.0117	0.0130	0.0124	0.0028	−0.0020	−0.0066
	(0.0072)	(0.0076)	(0.0070)	(0.0083)	(0.0062)	(0.0070)
EU	0.6110^{*}	0.6927^{*}	0.5934^{**}	0.5913^{*}		
	(0.2535)	(0.2743)	(0.2187)	(0.2611)		
TPWD	0.6633	0.2658	0.6758^{*}	0.6374	0.5277	0.2203
	(0.3376)	(0.3507)	(0.3212)	(0.3896)	(0.4336)	(0.4448)
CE	0.6732	0.6073	0.7436^{*}	0.7283	1.6785^{***}	1.6042^{***}
	(0.3755)	(0.3998)	(0.3482)	(0.4147)	(0.4290)	(0.4653)
Country FE					Yes	Yes
Year FE				Yes		Yes
N. of Obs.	182	182	187	182	182	182
Adjusted R-squared	0.66	0.64	0.67	0.71	0.7346	0.79
Shapiro-Wilk	0.89	0.11	0.77	0.03	0.07	0.02
Breusch-Pagan	0.19	0.09	0.82	0.01	0.02	0.01

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$.
In this table the dependent variable is the coupon rate.
CET1CR stands for the common equity Tier 1 capital ratio and the Mean rating is the average of the ratings. The years to call variable indicates the years until the bank is allowed to call the CoCo for the first time.
As only two of our three conversion types are included as dummies, PPWD CoCos are the reference type in the intercept.
The three market indices refer to the Markit iBoxx EUR Contingent Convertible Liquid Developed Market AT1 Index, the Markit iTraxx Europe Senior Financials Index and the Stoxx Europe 600 Index and are depicted in year-over-year growth rates.
The EU-dummy is dropped in the model specification of V and VI with Country FE to avoid multicollinearity.
The null hypothesis of the Shapiro-Wilk Normality test is that the residuals are normally distributed. The null hypothesis of the Breusch-Pagan test is homoskedastic residuals. Robust standard errors (White) are in parenthesis.

Table B.8: OLS CoCo Models Excluding Great Britain (robust SE)

	I	II	III	IV	V	VI
Intercept	1.1506	−0.9523	0.9111	0.7597	−0.4663	−1.0151
	(2.1978)	(2.2086)	(2.1414)	(2.1756)	(2.5407)	(2.2417)
CET1CR - Trigger Level	−0.4255***		−0.3660**	−0.3436**	−0.3763**	−0.2431*
	(0.1254)		(0.1174)	(0.1308)	(0.1332)	(0.1170)
(CET1CR - Trigger Level)^2	0.0154**		0.0121*	0.0126*	0.0123*	0.0084
	(0.0055)		(0.0051)	(0.0056)	(0.0053)	(0.0047)
Log(Amount issued)	0.2916*	0.3399*	0.2873**	0.3784**	0.3801**	0.4336***
	(0.1260)	(0.1314)	(0.0900)	(0.1261)	(0.1292)	(0.1269)
Years to call	0.0154	0.0021		0.0199	0.0275	0.0293
	(0.0342)	(0.0361)		(0.0339)	(0.0329)	(0.0329)
Mean rating	0.2001***	0.1674**	0.2121***	0.2548***	0.2469***	0.2924***
	(0.0482)	(0.0545)	(0.0400)	(0.0468)	(0.0625)	(0.0580)
Loan/Asset ratio	−0.0175*	−0.0318***	−0.0204***	−0.0175**	−0.0220**	−0.0151
	(0.0069)	(0.0068)	(0.0055)	(0.0059)	(0.0083)	(0.0078)
Loan/Deposit ratio	−0.0022	0.0018		−0.0027	−0.0021	−0.0030
	(0.0019)	(0.0015)		(0.0018)	(0.0023)	(0.0020)
Log(Total Assets)	−0.0039	−0.1052		−0.0749	−0.0137	−0.0541
	(0.1015)	(0.1036)		(0.0945)	(0.1131)	(0.1119)
10Y gov bond yield	0.3452**	0.5538**	0.3491**	0.1742	1.0595***	0.6140**
	(0.1224)	(0.1828)	(0.1179)	(0.1334)	(0.2016)	(0.2227)
Markit iBoxx AT1	−0.0503*	−0.0485	−0.0511*	−0.0332	−0.0362	−0.0385
	(0.0244)	(0.0247)	(0.0234)	(0.0232)	(0.0219)	(0.0208)
Markit iTraxx ESF	0.0087**	0.0078*	0.0086**	0.0063*	0.0052	0.0026
	(0.0033)	(0.0034)	(0.0032)	(0.0032)	(0.0034)	(0.0032)
Stoxx Europe 600	0.0089	0.0069	0.0103	−0.0041	−0.0047	−0.0119
	(0.0068)	(0.0071)	(0.0066)	(0.0070)	(0.0061)	(0.0060)
EU	0.6724**	0.7844**	0.6662***	0.6032*		
	(0.2333)	(0.2449)	(0.1973)	(0.2403)		
Temp. write down	0.5750	0.7095*	0.5158	0.5337	0.6836	0.3649
	(0.3132)	(0.3276)	(0.2829)	(0.3614)	(0.4311)	(0.4501)
Equity conversion	0.8799*	1.0819**	0.8464*	0.9405*	1.4797***	1.3790**
	(0.3747)	(0.3919)	(0.3307)	(0.4237)	(0.4399)	(0.4717)
CET1CR		−0.0984**				
		(0.0353)				
Trigger Level		0.4350**				
		(0.1429)				
Country FE					Yes	Yes
Year FE				Yes		Yes
N. of Obs.	183	183	189	183	183	183
Adjusted R-squared	0.67	0.66	0.68	0.73	0.7171	0.78
Shapiro-Wilk	0.58	0.42	0.33	0.05	0.11	0.01
Breusch-Pagan	0.26	0.01	0.67	0.00	0.04	0.01

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$.
In this table, the dependent variable is the coupon rate.
CET1CR stands for the common equity Tier 1 capital ratio and the Mean rating is the average of the ratings from Fitch, S&P and Moody's. The years to call variable indicates the years until the bank is allowed to call the CoCo for the first time.
As only two of our three conversion types are included as dummies, PPWD CoCos are the reference type in the intercept.
The three market indices refer to the Markit iBoxx EUR Contingent Convertible Liquid Developed Market AT1 Index, the Markit iTraxx Europe Senior Financials Index and the Stoxx Europe 600 Index and are depicted in year-over-year growth rates.
The EU-dummy is dropped in the model specification of V and VI with Country FE to avoid multicollinearity. The null hypothesis of the Shapiro-Wilk Normality test is that the residuals are normally distributed. The null hypothesis of the Breusch-Pagan test is homoskedastic residuals. Robust standard errors (White) are in parenthesis.

Appendix C. Estimation of CoCos Spread

In this section, we search for the best determinants of CoCo spreads. Instead of CoCo coupon rate, we construct a slightly different dependent variable, namely the CoCo spread by subtracting the 5-

year German zero coupon government bond yield from the CoCo coupon rate. The estimated CoCo spread models can be found in Table C.9. The results are similar to the CoCo Coupon rate estimation in Table 2. Some differences can be found in the coefficients of "Temp. write down" and "Equity conversion" which are both positive and statistically significant in most models. As mentioned in Section 5.1, these results contradict the theoretical considerations in the literature, as we would expect negative coefficients. We found a possible explanation for this fact in Section 5.2.

Table C.9: OLS CoCo Models (robust SE)

	I	II	III	IV	V	VI
Intercept	−0.8359	−1.5164	−0.8965	−0.3701	−0.1956	−1.4840
	(2.1894)	(2.2800)	(2.0510)	(2.0837)	(2.6161)	(2.3413)
CET1CR - Trigger Level	−0.3464***		−0.3484***	−0.2719**	−0.4833***	−0.3190**
	(0.0937)		(0.0882)	(0.0887)	(0.1210)	(0.1114)
(CET1CR - Trigger Level)^2	0.0123**		0.0120***	0.0103**	0.0175***	0.0124**
	(0.0037)		(0.0034)	(0.0035)	(0.0045)	(0.0041)
CET1CR		−0.0466				
		(0.0300)				
Trigger Level		−0.0848				
		(0.1155)				
Log(Amount issued)	0.3557**	0.3778**	0.3424***	0.4125***	0.4042***	0.4362***
	(0.1188)	(0.1217)	(0.0902)	(0.1109)	(0.1199)	(0.1059)
Years to call	0.0188	0.0349		0.0298	0.0323	0.0405
	(0.0418)	(0.0428)		(0.0413)	(0.0405)	(0.0380)
Mean rating	0.3039***	0.3221***	0.3050***	0.3058***	0.3286***	0.3481***
	(0.0478)	(0.0490)	(0.0393)	(0.0446)	(0.0640)	(0.0567)
Loan/Asset ratio	−0.0136*	−0.0195**	−0.0127*	−0.0157**	−0.0187*	−0.0111
	(0.0063)	(0.0062)	(0.0052)	(0.0059)	(0.0088)	(0.0079)
Loan/Deposit ratio	−0.0008	0.0007		−0.0018	−0.0031	−0.0040*
	(0.0017)	(0.0017)		(0.0016)	(0.0020)	(0.0018)
Log(Total Assets)	−0.0204	−0.0379		−0.1077	−0.0078	−0.0246
	(0.0922)	(0.0947)		(0.0872)	(0.1139)	(0.1016)
Markit iBoxx AT1	−0.0452	−0.0510	−0.0447	−0.0150	−0.0490	−0.0478
	(0.0266)	(0.0274)	(0.0257)	(0.0316)	(0.0260)	(0.0290)
Markit iTraxx Europe Senior Financials	0.0073*	0.0072*	0.0074*	0.0081*	0.0056	0.0019
	(0.0035)	(0.0036)	(0.0034)	(0.0041)	(0.0035)	(0.0038)
Stoxx Europe 600	0.0031	0.0039	0.0043	−0.0063	0.0023	−0.0098
	(0.0071)	(0.0073)	(0.0069)	(0.0085)	(0.0067)	(0.0075)
EU	0.4217	0.4938*	0.4942*	0.4969*		
	(0.2222)	(0.2269)	(0.2004)	(0.2073)		
Temp. write down	0.9371**	0.5639	0.8117**	0.6608*	0.5359	0.2773
	(0.2821)	(0.3243)	(0.2652)	(0.2678)	(0.4159)	(0.3726)
Equity conversion	0.9804**	0.8264*	0.8588**	0.7725*	1.4514**	1.2994**
	(0.3176)	(0.3343)	(0.2965)	(0.2994)	(0.4716)	(0.4180)
Country FE					Yes	Yes
Year FE				Yes		Yes
N. of Obs.	197	197	203	197	197	197
Adjusted R-squared	0.63	0.62	0.64	0.69	0.69	0.76

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.
In this table the dependent variable is the CoCo spread.
CET1CR stands for the common equity Tier 1 capital ratio and the Mean rating is the average of the ratings from Fitch, S&P and Moody's. The years to call variable indicates the years until the bank is allowed to call the CoCo for the first time.
As only two of our three conversion types are included as dummies, PPWD CoCos are the reference type in the intercept.
The three market indices refer to the Markit iBoxx EUR Contingent Convertible Liquid Developed Market AT1 Index, the Markit iTraxx Europe Senior Financials Index and the Stoxx Europe 600 Index and are depicted in year-over-year growth rates.
The EU-dummy is dropped in the model specification of V and VI with Country FE to avoid multicollinearity.

Appendix D. Aggregated PWD CoCos

In Table D.10, we combine the principal write-down CoCo types PPWD and TPWD to derive coefficients more relatable to empirical work, where the distinction between those CoCo types is not made. Even after aggregating PWD CoCos we are still able to confirm our results on higher coupons for CE CoCos in the model specifications with Country FE.

Table D.10: OLS CoCo Models – Aggregated PWD CoCos (robust SE)

	I	II	III	IV	V	VI
Intercept	-0.5524	-1.5585	-0.5674	-0.8482	-1.5636	-1.6951
	(2.2547)	(2.3229)	(2.1739)	(2.3332)	(2.3603)	(2.0336)
CET1CR - Trigger Level	-0.3128^{***}		-0.2971^{***}	-0.2486^{**}	-0.3736^{***}	-0.2355^{*}
	(0.0907)		(0.0876)	(0.0940)	(0.1050)	(0.0909)
(CET1CR - Trigger Level)^2	0.0107^{**}		0.0099^{**}	0.0091^{**}	0.0136^{***}	0.0094^{**}
	(0.0033)		(0.0034)	(0.0035)	(0.0037)	(0.0033)
CET1CR		-0.0590				
		(0.0344)				
Trigger Level		-0.0185				
		(0.1071)				
Log(Amount issued)	0.3345^{*}	0.3606^{**}	0.3273^{***}	0.4000^{**}	0.4603^{***}	0.4812^{***}
	(0.1292)	(0.1286)	(0.0922)	(0.1295)	(0.1262)	(0.1189)
Years to call	0.0123	0.0247		0.0256	0.0309	0.0340
	(0.0326)	(0.0360)		(0.0323)	(0.0308)	(0.0290)
Mean rating	0.2203^{***}	0.2465^{***}	0.2291^{***}	0.2693^{***}	0.3036^{***}	0.3231^{***}
	(0.0442)	(0.0466)	(0.0371)	(0.0423)	(0.0530)	(0.0478)
Loan/Asset ratio	-0.0117	-0.0177^{**}	-0.0132^{*}	-0.0111	-0.0172^{*}	-0.0113
	(0.0064)	(0.0058)	(0.0054)	(0.0058)	(0.0076)	(0.0071)
Loan/Deposit ratio	-0.0010	0.0004		-0.0021	-0.0026	-0.0036^{*}
	(0.0017)	(0.0015)		(0.0016)	(0.0020)	(0.0017)
Log(Total Assets)	-0.0060	-0.0238		-0.0655	-0.0380	-0.0721
	(0.1058)	(0.0994)		(0.0990)	(0.1109)	(0.1069)
10Y gov bond yield	0.3515^{***}	0.2901^{*}	0.3468^{***}	0.1693	0.9095^{***}	0.4704^{*}
	(0.1045)	(0.1258)	(0.1026)	(0.1184)	(0.1684)	(0.2022)
Markit iBoxx AT1	-0.0481^{*}	-0.0515^{*}	-0.0495^{*}	-0.0318	-0.0389	-0.0451^{*}
	(0.0234)	(0.0241)	(0.0225)	(0.0251)	(0.0211)	(0.0220)
Markit iTraxx Europe Senior Financials	0.0092^{**}	0.0097^{**}	0.0089^{**}	0.0072^{*}	0.0051	0.0021
	(0.0031)	(0.0030)	(0.0030)	(0.0033)	(0.0032)	(0.0033)
Stoxx Europe 600	0.0083	0.0098	0.0092	-0.0035	-0.0041	-0.0113
	(0.0068)	(0.0070)	(0.0065)	(0.0075)	(0.0057)	(0.0061)
EU	0.9614^{***}	0.8820^{***}	0.9339^{***}	0.9010^{***}		
	(0.1724)	(0.1972)	(0.1549)	(0.1566)		
CE	-0.0029	0.1649	0.0279	0.0758	0.9907^{***}	1.1250^{***}
	(0.1747)	(0.1991)	(0.1603)	(0.1599)	(0.2685)	(0.2535)
Country FE					Yes	Yes
Year FE				Yes		Yes
N. of Obs.	204	204	210	204	204	204
Adjusted R-squared	0.6553	0.6396	0.6646	0.7136	0.7172	0.7781
Shapiro-Wilk	0.60	0.21	0.47	0.01	0.06	0.01
Breusch-Pagan	0.13	0.07	0.86	0.02	0.02	0.01

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$.
In this table the dependent variable is the coupon rate.
PPWD and TPWD are added to one reference category for CE conversion.
CET1CR stands for the common equity Tier 1 capital ratio and the Mean rating is the average of the ratings. The years to call variable indicates the years until the bank is allowed to call the CoCo for the first time.
The three market indices refer to the Markit iBoxx EUR Contingent Convertible Liquid Developed Market AT1 Index, the Markit iTraxx Europe Senior Financials Index and the Stoxx Europe 600 Index and are depicted in year-over-year growth rates.
The EU-dummy is dropped in the model specification of V and VI with Country FE to avoid multicollinearity.
The null hypothesis of the Shapiro-Wilk Normality test is that the residuals are normally distributed. The null hypothesis of the Breusch-Pagan test is homoskedastic residuals. Robust standard errors (White) are in parenthesis.

Appendix E. Correlation Table

Table E.11: Correlation Table – Regression Sample

	CET1CR	Trigger	Log(Amt. iss.)	Years to call	Mean rating	Loan/ Asset	Loan/ Deposit	Log(Total Assets)	10Y gov bond	iBoxx	iTraxx	Stoxx
CET1CR	1.000											
Trigger Level	0.064	1.000										
Log(Amount issued)	-0.210	0.157	1.000									
Years to call	-0.224	-0.009	0.198	1.000								
Mean rating	-0.253	0.071	-0.079	0.011	1.000							
Loan/Asset ratio	0.483	-0.213	-0.573	-0.345	-0.013	1.000						
Loan/Deposit ratio	0.472	-0.284	-0.242	-0.142	-0.203	0.516	1.000					
Log(Total Assets)	-0.215	0.178	0.775	0.281	-0.309	-0.623	-0.244	1.000				
10Y gov bond yield	0.030	-0.581	-0.303	-0.063	0.294	0.440	0.194	-0.331	1.000			
Markit iBoxx AT1	0.139	-0.073	-0.062	0.167	0.103	0.169	0.089	-0.091	0.166	1.000		
Markit iTraxx ESF	-0.143	0.063	0.044	-0.122	-0.017	-0.191	-0.098	0.065	0.035	-0.834	1.000	
Stoxx Europe 600	0.117	-0.121	-0.096	0.146	0.094	0.150	0.102	-0.091	0.319	0.873	-0.619	1.000
EU	-0.230	-0.276	0.290	0.293	0.133	-0.260	-0.025	0.308	-0.040	-0.019	-0.001	0.032

None of these explanatory variables deployed in the same model specifications, excluding the dummies and squared variables, have an inflation factor > 2.5. CET1CR stands for the common equity Tier 1 capital ratio and the Mean rating is the average of the ratings from Fitch, S&P and Moody's. The three market indices refer to the Markit iBoxx EUR Contingent Convertible Liquid Developed Market AT1 Index, the Markit iTraxx Europe Senior Financials Index and the Stoxx Europe 600 Index and are depicted in year-over-year growth rates.

Index of Working Papers:

June 15, 2015	Anil Ari	202	Sovereign Risk and Bank Risk-Taking
June 15, 2015	Matteo Crosignani	203	Why Are Banks Not Recapitalized During Crises?
February 19, 2016	Burkhard Raunig	204	Background Indicators
February 22, 2016	Jesús Crespo Cuaresma, Gernot Doppelhofer, Martin Feldkircher, Florian Huber	205	US Monetary Policy in a Globalized World
March 4, 2016	Helmut Elsinger, Philipp Schmidt-Dengler, Christine Zulehner	206	Competition in Treasury Auctions
May 14, 2016	Apostolos Thomadakis	207	Determinants of Credit Constrained Firms: Evidence from Central and Eastern Europe Region
July 1, 2016	Martin Feldkircher, Florian Huber	208	Unconventional US Monetary Policy: New Tools Same Channels?
November 24, 2016	François de Soyres	209	Value Added and Productivity Linkages Across Countries
November 25, 2016	Maria Coelho	210	Fiscal Stimulus in a Monetary Union: Evidence from Eurozone Regions
January 9, 2017	Markus Knell, Helmut Stix	211	Inequality, Perception Biases and Trust
January 31, 2017	Steve Ambler, Fabio Rumler	212	The Effectiveness of Unconventional Monetary Policy Announcements in the Euro Area: An Event and Econometric Study
May 29, 2017	Filippo De Marco	213	Bank Lending and the European Sovereign Debt Crisis
June 1, 2017	Jean-Marie Meier	214	Regulatory Integration of International Capital Markets

October 13, 2017	Markus Knell	215	Actuarial Deductions for Early Retirement
October 16, 2017	Markus Knell, Helmut Stix	216	Perceptions of Inequality
November 17, 2017	Engelbert J. Dockner, Manuel Mayer, Josef Zechner	217	Sovereign Bond Risk Premiums
December 1, 2017	Stefan Niemann, Paul Pichler	218	Optimal fiscal policy and sovereign debt crises
January 17, 2018	Burkhard Raunig	219	Economic Policy Uncertainty and the Volatility of Sovereign CDS Spreads
February 21, 2018	Andrej Cupak, Pirmin Fessler, Maria Silgoner, Elisabeth Ulbrich	220	Exploring differences in financial literacy across countries: the role of individual characteristics and institutions
May 15, 2018	Peter Lindner, Axel Loeffler, Esther Segalla, Guzel Valitova, Ursula Vogel	221	International monetary policy spillovers through the bank funding channel
May 23, 2018	Christian A. Belabed, Mariya Hake	222	Income inequality and trust in national governments in Central, Eastern and Southeastern Europe
October 16, 2018	Pirmin Fessler, Martin Schürz	223	The functions of wealth: renters, owners and capitalists across Europe and the United States
October 24, 2018	Philipp Poyntner, Thomas Reininger	224	Bail-in and Legacy Assets: Harmonized rules for targeted partial compensation to strengthen the bail-in regime
December 14, 2018	Thomas Breuer, Martin Summer	225	Systematic Systemic Stress Tests
May 20, 2019	Helmut Stix	226	Ownership and purchase intention of crypto-assets – survey results
October 17, 2019	Markus Knell, Helmut Stix	227	How Peer Groups Influence Economic Perceptions

February 26, 2020	Helmut Elsinger	228	Serial Correlation in Contingency Tables
March 2, 2020	Mariarosaria Comunale, Markus Eller, Mathias Lahnsteiner	229	Assessing Credit Gaps in CESEE Based on Levels Justified by Fundamentals –A Comparison Across Different Estimation Approaches
April 30, 2020	Martin Brown, Nicole Hentschel, Hannes Mettler, Helmut Stix	230	Financial Innovation, Payment Choice and Cash Demand – Causal Evidence from the Staggered Introduction of Contactless Debit Cards
July 30, 2020	Katharina Drescher, Pirmin Fessler, Peter Lindner	231	Helicopter Money in Europe: New Evidence on the Marginal Propensity to Consume across European Households
November 20, 2020	Michael Sigmund	232	The Capital Buffer Calibration for Other Systemically Important Institutions – Is the Country Heterogeneity in the EU caused by Regulatory Capture?
January 13, 2021	Maximilian Böck, Martin Feldkircher, Burkhard Raunig	233	A View from Outside: Sovereign CDS Volatility as an Indicator of Economic Uncertainty
May 20, 2021	Burkhard Raunig	234	Economic Policy Uncertainty and Stock Market Volatility: A Causality Check
July 8, 2021	Thomas Breuer, Martin Summer, Branko Uroševi	235	Bank Solvency Stress Tests with Fire Sales
December 14, 2021	Michael Sigmund, Kevin Zimmermann	236	Determinants of Contingent Convertible Bond Coupon Rates of Banks: An Empirical Analysis