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## Abstract

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# Which Factors Play a Role in Coco Issuance? Evidence from European Banks.

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**Abstract**

This paper explores empirically the reasons why some banks issue Contingent Convertible Bonds while others do not. For this purpose we use a binary logistic model and control for the determinants suggested by the literature on optimal capital structure which considers four drivers of capital structure: corporate taxes, costs of financial distress, agency costs and asymmetric information.. Our findings suggest that the banks with bigger size and those with higher Tier 1 capital, higher net loans, higher wholesale funding, lower level of leverage and lower risk weighted assets have a higher tendency to issue CoCos. Our results also suggest that banks in countries with higher annual growth rate of GDP per capita and those listed as G-SIBs are more likely to issue CoCos.

## 1. Introduction

At the inception and throughout the recent financial crisis a large number of financial institutions had to be bailed out by governments, in particular subordinated debt holders. Although in theory a subordinated debtholder should suffer major losses in bankruptcy, it was politically difficult to impose these losses.. A vast number of preventive measures and remedies has been proposed to prevent the reoccurrence of such situations or facilitate their resolution. One of them, as first proposed by Flannery (2005), is the issuance by banks of so-called CoCos, a form of contingent convertible bond. CoCo is a hybrid security which is a debt instrument in good states of the world but converts into shares when the bank is in financial distress. Distress is reached when the capital ratio of the bank falls below a pre-determined trigger. As a result the conversion boost the capital levels and reassure the regulators that recapitalization is done in a timely manner. The fact that the debt automatically converts makes it also impossible for politicians to use tax payers money to bail out debtholders. While the original coco bond mechanism assumed conversion into equity, in recent years cocos switched to a principal write-down mechanism: the issuer can write down the principal (partially/fully and permanently/temporarily), or cancel the coupons. This increases the losses to bondholders significantly if the write-down is permanent and actually creates some incentives for shareholders to take excessive risks to wipe out the debt holders. Some banks try to reassure the coco investors by stating that banker bonuses will be paid in cocobonds. CoCos are favored by both regulators and bankers to maintain higher safety buffers and to avoid the high cost of capital associated with issuing new shares. Unlike the conventional convertibles which provide the holders' and issuers' right to put and call, CoCos' conversion or write down is activated automatically. Such prearranged bail-in therefore decreases the probability of a bailout burden falling upon taxpayers. Such loss absorption feature increases the resilience of the capital structure of the issuer since the balance sheet is better able to absorb unforeseen losses.

Recent academic literature has proposed various CoCos structures with respect to trigger events and levels, as well as conversion features: RCD (Flannery, 2005), CCC (Flannery, 2009), CAB (Bolton & Samama, 2012), COCOCO (Di Girolamo et al., 2012), CoCa CoCos (Corcuera et al., 2013) and COERC (Pennacchi, Vermaelen and Wolff, 2014). Though the CoCo literature has witnessed a rapid expansion in a short time, potential issues associated with CoCos need to be researched and addressed before they can be considered as a part of regulatory capital (Flannery, 2014). Despite a good deal of research effort devoted to design an optimal CoCo structure with minimum drawbacks, only a limited number of efforts (see Avdjiev et al., 2017) has been made to discover the factors behind CoCos issuance in the first place. What seems to be lacking in term of academic literature is an explanatory study to analyze the CoCos issuance across different banks.

This paper aims to shed some light on CoCo bond issuance determinants by proceeding as follows: In section 2 we present the literature review. In section 3 the determinants of CoCos' issuance will be discussed. In section 4 we present a brief summary of the data and variables. Section 5 presents the empirical settings and section 6 the results. Finally, section 6 provides concludes.

## 2. Literature Review

A bank generally has several financing alternatives available. It can initially issue equities or debt instruments such as straight bonds, convertibles and contingent convertibles. The question here is which factors motivate banks to issue CoCos. This chapter aims to empirically address this issue considering the issuer's features like size or financial stability measures like leverage. To identify these determinants we look at two different branches of literature namely the convertibles literature and the bankruptcy literature.

The issuance of CoCos is either a choice made by the banks or it is motivated and even in some cases dictated by the regulators[1]. Banks issue CoCos based on their characteristics and regulators encourage the banks to do so based on banks financial health. To study the former we look at convertible literature as convertibles are known to be closest instruments to CoCos and they are well developed in terms of literature. To study the latter we look at bankruptcy literature which highlights the bankruptcy indicators. These indicators can act as early alarming signals and reveal if the bank's financial situation is not sound enough so the potential distress can be avoided by regulatory measures such as issuing CoCos.

### 2.1. CoCos vs. Convertible Bonds

CoCo bonds and regular convertible bonds are somewhat different. Banks issue CoCos considering the 'Too Big to Fail' doctrine. CoCos offer high coupon rates and their conversion happens automatically when a trigger event is breached any time before the maturity. CoCos are issued with the purpose of recapitalization of distressed banks when raising other sources of funds seems to be impossible. On the contrary, convertible bonds are mostly issued by small and growth firms and have a low coupon rate. A convertible bond gives the holder the right to convert the par amount of the bond for common equity of the issuer at some fixed ratio during a particular period. As a result the conversion is likely to happen when the stock price is high. A firm issues convertibles to minimize negative investor interpretation of its corporate actions. Convertible bond also helps to resolve some conflicts between equity and debt holders.

### 2.2. Convertibles Literature



[1] The issuance of CoCos was forced in Switzerland.

A convertible bond is a hybrid security with the potential conversion to common stock which shares some characteristics with straight bond. Similar to a straight bond, the value of the convertible is influenced by the prevailing level of interest rates, the coupon rate, maturity and the default risk. The general belief about the motivation for issuing convertible debt is that convertibles provide issuers with “cheap” debt in the sense that they carry lower coupon rates than straight debts. There exist a number of studies which attempt to find the reasons behind issuance of convertible debt and how firm’s characteristics may influence this choice. Baxter and Cragg (1970) pioneer the study on determinants of debt, convertible bond, preferred stock and equity issuances and find that the higher the leverage, higher the P/E ratios and lower the total asset, the higher is the probability that a firm will issue equity or equity like securities. Essig (1991) shows that issuer’s characteristics like the ratios of R&D to sales, market value to book value of equity, and long-term debt to equity as well as the volatility of the firm's cash flows, are all positively associated with firms' propensities to employ convertible debt. Stein (1992) proposes the so called “backdoor equity hypothesis” which explains the financing preference for convertible debt over straight debt. Mayers (1998) proposes that corporations use convertible debt to solve sequential-financing problems and argues that the convertible economizes on issue costs because conversion leaves funds in the firm and reduces leverage when the investment option is valuable. Dong et al. (2016) use in-depth interviews with top corporate executives to examine why companies issue convertible bonds and find that firms issue convertibles when they perceive these securities to be a cheaper form of financing than straight bonds and equity. They obtain evidence for the theory that convertible bonds are more suitable than straight debt when management and investors disagree about the riskiness of the firm. According to this branch of literature, firm characteristics are namely leverage, firm size, growth opportunities, profitability, and net operating cash flow. The general results conclude that relatively smaller companies with higher debt ratio, lower profitability and lower growth

opportunity are more likely to issue convertible debt. However, financial institutions are mostly excluded in those studies. The exclusion of finance companies is due to their remarkably different financial statement structure in compared to non-financial companies (Chen, 2004). In their pioneering study, Avdjiev et al. (2017) explore the factors affecting the propensity and hazards to issue CoCos using duration analysis. They define their dependent variable "Time to Issue" as the number of months from January 2009 to the time of first CoCo issuance for each bank. They find that larger banks are quicker in CoCo issuance. Their findings suggest that large banks (those with higher asset values) and higher long term funding are more likely to issue CoCos, whereas those with higher Tier 1 capital, gross loans and deposits are less likely to do so.

Following the study by Avdjiev et al. (2017) investing the likelihood of CoCo issuance and time to issue, Williams et al. (2018) find systemically riskier banks are more likely to issue CoCos and argue that riskier banks may find CoCo loss absorption mechanism an ideal solution to internalize the costs of losses. They believe that when a bank issues CoCo without facing regulatory pressure, it may need greater supervision. On the contrary, if the issuance is the result of regulatory prompting, the bank may be engaging in risk management strategies, minimizing their cost of equity issuance.

Goncharenko et al. (2019), based on their empirical analysis show that riskier banks are less likely to issue CoCos. They argue that "since under Basel III banks are expected to raise equity prior to CoCo conversion, riskier banks that anticipate future equity issuance are less likely to issue CoCos before." They find that CoCos issuance initiate debt overhang problem. Their findings show a statistical evidence that "bank asset volatility relates inversely to the likelihood of CoCo issuance but not to that of equity issuance."

In this paper we do not specifically look at systemic risk issue or agency problems such as debt overhang, but similar to Avdjiev et al. (2017), we simply investigate the effect of factors

which reflect financial health and characteristics of issuer banks on the likelihood and speed of CoCo issuance. Even though, we use different variables and proxies, slightly different methodology and time frame, our results still confirm the general results they obtained on the relation between the likelihood of issuance and size, capital adequacy, RWA and leverage.

### 2.3. Bankruptcy Literature

Bankruptcy prediction is of great interest to banking regulators, depositors and investors. Banking regulatory authorities require accurate assessments of a bank's future prospects, including the risk of bankruptcy to set regulatory capital level and take the measures to improve solvency and other prudential parameters. This has become particularly important after the recent financial crisis. However, there is no clear consensus in the literature on the choice of bankruptcy predictors. The relevant literature indicates the importance placed on bankruptcy cost in financing decision making. According to Shumway (2001) financial distress measures are profitability (proxied by Net Income/Total Assets), leverage (proxied by Total Liabilities/Total Assets), and liquidity (proxied by Cash and Short-Term Investments/Total Assets). In addition, Campbell et al. (2008) study the determinants of corporate failure and the pricing of financially distressed stocks and find firms with higher leverage, lower profitability, lower cash holdings are more likely to file for bankruptcy. Bharath and Shumway (2008) and Campbell et al. (2008) find that the Merton's measures of default namely the value of firm assets and its volatility have insignificant effect on improving the explanatory power of the variables defined in models proposed by Shumway (2001) and Chava and Jarrow (2004).

## 3. The Determinants of CoCo Issuance

The motives for banks to issue contingent convertibles are still not well investigated. Contingent convertible bonds are different to regular convertible bonds in that their conversion to common

equity is contingent on a pre-specified event, yet they are still the closest hybrids in terms of design and structure. In this chapter, we investigate the motives behind issuance of contingent convertibles based on convertible and bankruptcy literatures. The main determinants dictated by convertible literature are: asset value, tier1 capital, net loans, risk weighted assets and funding. These variables reflect the bank characteristics (see Avdjiev et al. 2017). The second set of variables with respect to bankruptcy literature are leverage, profitability and liquidity. These variables are considered to be an indicator of financial health of the bank. In addition, we control for macroeconomic condition proxied by growth rate of GDP per capita. We also capture the effect of being recognized as "Global Systemically Important Banks "(G-SIBs) on probability of CoCo issuance.

**Leverage**

Leverage is an investment strategy of using borrowed money (debt) to finance assets. Leverage is a double edged sword. While it magnifies profits when the returns from the asset offset the costs of borrowing, leverage may also magnify losses. Banks are known to be among the most leveraged institutions. Banks with higher leverage ratio use more debt to finance their assets relative to others. Banks with higher level of leverage may be expected to issue CoCo as a part of their regulatory capital an easier way to raise fund. However, a highly leveraged bank could face default or bankruptcy during financial crisis, while a less-leveraged bank could survive. As a proxy of bank leverage level, we consider debt to assets ratio.

It shows the percentage of total assets that were financed by creditors, liabilities, debt. The debt to total assets ratio is calculated by dividing a corporation's total liabilities by its total assets:

$$\text{Leverage} = \frac{\text{Total Liabilities}}{\text{Total Assets}}$$

**Profitability**

Profitability as an indicator of financial performance can be measured in a number of ways including return on assets, return on equity or profit margins. In analyzing how well any given bank is performing, it is often useful to contemplate on the Return on Equities. The Return on Equities (ROE) is an inflation invariant helpful measurement when comparing the profitability. Here, we consider ROE (the ratio of net income to total equities) as proxy of profitability[2]. ROE is calculated as:

$$\text{ROE} = \frac{\text{Net Income}}{\text{Average of Current and Prior Period (Common Equity} + \text{Preferred Equity))}} * 100$$

The higher ROE ratio, the better bank profits. We can expect that the improvement in profitability could increase the likelihood of issuing CoCos. Consequently, we can expect a positive sign for the coefficient of this variable in the determination of the bank probability of CoCo issuance.

**Liquidity**

Banking system successful performance can be affected by many factors. Among those determinants, liquidity plays a very crucial rule. A bank is liquid when it has the ability to settle obligations instantly. Liquidity is a bank's capacity to meet both anticipated and unanticipated obligations at reasonable cost and in a timely manner. Liquidity is often considered as a measure of bank's bargaining power and strength in the literature. Adequate liquidity enables a bank to



[2] We choose ROE as the key proxy for bank profitability instead of the alternative return on assets (ROA) because an analysis of ROE disregards financial leverage and the risks associated with it (Flamini, McDonald & Schumacher, 2009).

meet three risks namely: Time risk (which is the ability to compensate for non-repayment of funds. That is, if the borrower defaults their commitment at a specific time), funding risk (which signifies the ability to replace net out flows of funds, either via usual withdrawals of retail deposits or non-renewal of wholesale funds), lending risk (which denotes ability to meet occasional withdrawals of funds from cogent customers). Banks can mitigate the incidence of bankruptcy and liquidation by controlling the illiquidity risk.

As a proxy of bank liquidity level we use loan-to-deposit ratio. This ratio is often used to measure a bank's liquidity by dividing the bank's total loans by its total deposits. The higher the ratio, it means that the bank's liquidity level to cover any unforeseen fund requirements is lower. Based on the existing relevant studies, we can expect a positive sign for the coefficient of this variable in the determination of the bank probability to issue contingent convertibles.

**Net Loans**

Net Loans represents total loans to customers, reduced by possible default losses and unearned interest income. Net loans is usually calculated by taking total gross loans and subtracting loan loss allowances and unearned interest. "It is commonly believed that loans create deposits that means that lending to a customer simultaneously creates a new asset and a new liability for both the bank and the borrower." For banks, it includes but is not restricted to Lease Financing and Total non-performing assets

**Deposits**

Bank deposits are money kept in banking institutions in the form of savings accounts, checking accounts and money market accounts. The depositors have the right to withdraw their money considering the pre-agreed terms and conditions. These deposits can be counted as a part of

funding requirements. Banks strive to attract more deposits from their customers to have a higher liquidity and improved profitability.

**Total Assets**

Total assets is the sum of all short and long-term assets as reported on the Balance Sheet.

For a bank total asset is calculated as:

$$\text{Cash \& Bank Balances} + \text{Fed funds sold \& Resale agreements} + \text{Investments for Trade and Sale} + \text{Investments Held to Maturity} + \text{Net Fixed Assets} + \text{Other Assets.}$$

**Tier 1 capital**

As a proxy of bank capital adequacy, we use Tier 1 capital which is essentially the most perfect form of a bank's capital maintained for smooth functioning through all the risky transactions. A bank is considered to be more vulnerable when its capital structure is weaker compared with of its risky assets (Martin, 1977). Tier 1 capital is commonly known as core capital and describe the capital adequacy of a bank. It consists of shareholders' equity, disclosed reserves and retained earnings. It may also include non-redeemable non-cumulative preferred stock. "Tier 1 capital is the highest-quality component capital because it guarantees the depositors from any negative circumstances in which the bank could incur (occasional or persistent losses over time; "bankruptcy" with a subsequent liquidation of the bank capital)."

In this context, bank security buffer could be too weak to absorb losses from bad quality assets. According to the findings reported in similar studies, we can expect a positive sign for the coefficient of this variable in the determination of the CoCo bonds issuance likelihood.

**Size**

For regulators, investors and customers the size of the bank matters to different degrees and for different reasons. Size can be considered as an indicator of efficiency since it is a common believe that large means effective. The bigger the bank is, it plays a more important role in the financial system and its failure needs to be anticipated using an early warning system and regulatory supervisions for the government to be able to intervene and prevent the failure (Too Big To Fail Theory). The fact that the state will not allow the big banks to fail brings more confidence in the investors and customers.

Among different measures for bank size, total assets is the most frequent used indicator by regulators and academics. Here, we use the natural logarithm of total assets as a proxy of the bank size. Consistent with the literature we expect a positive relationship between size and bank' choice to issue CoCo.

**RWA**

Different types of assets have different risk profiles. While government debt is almost considered risk free and get a 0 % risk weighting assigned to it calculating the Capital Adequacy Ratio, other assets, such as debentures carry a higher risk. Hence, risk weighted assets or RWA is a bank's assets weighted according to risk. The main use of risk weighted assets is to calculate capital adequacy ratios. "Risk weighting adjusts the value of an asset for risk, simply by multiplying it be a factor that reflects its risk. Low risk assets are multiplied by a low number, high risk assets by 100%."

Risk Weighted Assets represents the total of the carrying value of each asset class multiplied by their assigned risk weighting, as defined by banking regulations.

$$\text{RWA} = \text{Value of Asset Class} * \text{Assigned Risk Weighting}$$

**Funding**

Commonly banks rely on deposits and wholesale funding to finance themselves. Wholesale funding mainly refers to federal funds, foreign deposits and brokered deposits. Wholesale funding is "more sensitive to changes in interest rates and more prone to 'runs' in response to negative information about bank profitability." Wholesale funding is known as one of the major sources of bank vulnerability during the financial crisis (Huang and Ratnovski, 2011).

**GDPP:**

Here GDPP stands for the annual percentage growth rate of GDP per capita based on constant local currency obtained from World Bank. Aggregates are based on constant 2010 U.S. Dollars. Where GDP per capita is gross domestic product divided by midyear population.

**4. Data and Variables**

We base our empirical analysis on a balanced panel of aggregate level data for 230 banks obtained from Bloomberg pertaining to the period 2008 to 2017, resulting in 28,760 bank-year observations for variables in our sample. We consider banks from European countries including Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Ireland, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and UK. Table 1 shows the number of banks and the frequency of issuance in each country.

**Table 1 - Number of banks issued CoCos per country in our sample**

| Country | No of the banks based of their country of origin our sample | No of the banks issued CoCos in our sample |
|---|---|---|
| Austria | 8 | 4 |
| Belgium | 5 | 1 |
| Denmark | 24 | 6 |
| Finland | 4 | 1 |
| France | 14 | 3 |
| Germany | 14 | 3 |
| Greece | 6 | - |
| Ireland | 1 | 1 |
| Italy | 32 | 2 |
| Norway | 7 | 3 |
| Netherlands | 37 | 24 |
| Portugal | 3 | 1 |
| Spain | 9 | 6 |
| Sweden | 7 | 4 |
| Switzerland | 46 | 8 |
| UK | 13 | 9 |
| **Total** | **230** | **76** |

Descriptive Statistics of the variables used in our regression analyses are shown in Tables 2 and 3.

**Table 2 - Descriptive Statistics**

This table presents the descriptive statistics for our sample of 230 European banks from 2008 to 2017.

| Variable | Mean | Stdv | Min | Max |
|---|---|---|---|---|
| Ln Assets | 9.97 | 2.25 | 1.42 | 15.08 |
| Tier 1 Capital | 0.07 | 0.05 | -0.04 | 1.00 |
| Net Loans | 0.64 | 0.23 | 0.0002 | 2.06 |
| RWA | 0.51 | 0.23 | 0.0000009 | 3.14 |
| Funding | 0.81 | 0.15 | 0 | 2.95 |
| ROE | 0.04 | 0.39 | -12.50 | 1.42 |
| Loan\Deposits | 0.67 | 0.68 | 0.00015 | 19.03 |
| Leverage | 0.90 | 0.10 | 0.04 | 3.10 |
| GDPP | 0.02 | 2.15 | -9.00 | 24.38 |

The descriptive Statistics of our explanatory variables over period 2008-2017 are reported. The data has been obtained from Bloomberg for 230 banks across Europe. Our explanatory variables are Ln Asset (natural logarithm of total assets), Tier 1 Capital, Net Loans, RWA (Risk Weighted Assets) and Funding (Whole sale funding). Similar to Avdjiev et al. 2017, the values of Tier 1 Capital, Net Loans, RWA and Funding are all scaled by dividing by total asset value. We also use three variables which are measures of financial health of the bank: Profitability, Liquidity and Leverage. ROE and Loan\Deposits are respectively measures of Profitability and Liquidity, where Leverage is obtained by dividing total liabilities to total assets. In our sample of 230 banks which related data is obtained from Bloomberg 76 banks have issued CoCos. This implies that about 33 percent of the banks in our sample have issued CoCos. Table 2 presents the descriptive statistics (for a sample of 184 banks) when we omit the Swiss Banks.

**Table 3 - Descriptive Statistics**

This table presents the descriptive statistics for our sample of 184 European banks (Swiss banks are excluded) from 2008 to 2017.

| Variable | Mean | Stdv | Min | Max |
|---|---|---|---|---|
| Ln Assets | 10.19 | 2.22 | 1.42 | 15.08 |
| Tier 1 Capital | 0.07 | 0.05 | -0.04 | 1 |
| Net Loans | 0.64 | 0.21 | 0.0012 | 2.06 |
| RWA | 0.53 | 0.23 | 0.0001 | 3.14 |
| Funding | 0.80 | 0.15 | 0 | 2.94 |
| ROE | 0.03 | 0.43 | -12.50 | 1.42 |
| Loan\Deposit | 0.71 | 0.74 | 0.0041 | 19.03 |
| Leverage | 0.90 | 0.12 | 0.45 | 3.10 |
| GDPP | -0.02 | 2.31 | -9.00 | 24.38 |

## 5. Empirical Setting

This paper aims to explore empirically the factors which play a role in issuance of Contingent Convertible Bonds. In the next step, we test how these factors affect the time gap (measured by years) between introducing the first CoCo to market by Lloyds (in 2009) and the first CoCo issued by other issuers across the Europe. We address these research questions by defining two dependent variables, namely; ISSUE and YEAR TO ISSUE and using Binary and Ordered Logistic models:

### 5.1. Issue

To study the elements known as determinants of CoCo issuance, we use a binary logistic model and define the dependent binary variable Y which takes value 1 if the bank issues CoCo and 0 otherwise.

$$Y=ISSUE=\begin{cases}1 & \text{if Bank has issued CoCo}\\ 0 & \text{otherwise}\end{cases}$$

According to the existing literature, the issuance of CoCo can be affected by bank characteristics and its financial health. We also consider macroeconomic indicators as determinants of CoCo issuance. Hence, the conditional probability of issuance can be shown as:

$$P(\mathbf{Y_{it}=1|X_{it}})=\beta(\lambda \text{ Bank Characteristics} +\delta \text{ Financial Health} +\gamma \text{ Macroeconomic Indicators})$$ [3]



[3] Fajardo and Mendes (2017) follow a similar methodology for BRICS.

The logistic model regresses the log of probability ratios on the explanatory variables and can mathematically be written as:

$$\log\left(\frac{\text{Prob}(y=1)}{1-\text{Prob}(y=1)}\right)=\sum_{i=1}^{n}\beta_i X_i \qquad (2)$$

which can be expressed as

$$\text{Prob}(y=1)=\frac{e^{\sum_{i=1}^{n}\beta_i X_i}}{1+e^{\sum_{i=1}^{n}\beta_i X_i}} \qquad (3)$$

On the other hand, the coefficients can be exponentiated in order to express the output as odds ratios:

$$\text{Odds}=\frac{\text{Prob}(y=1)}{1-\text{Prob}(y=1)}=e^{\sum_{i=1}^{n}\beta_i X_i} \qquad (4)$$

To identify the determinants which rule the CoCo issuance we logistically regress the binary outcome variable (Y) on various bank characteristics, financial health and macroeconomic indicators. To test our hypothesis we run two regression models. Equation (5) is based on the relationship defined in convertibles literature between CoCo issuance and bank characteristics.

$$Y=\beta_0+\beta_1\ \text{LnAssets}+\beta_2\ \text{Tier1 Capital}+\beta_3\ \text{Net Loans}+\beta_4\ \text{RWA}+\beta_5\ \text{Fundings}+\varepsilon_1 \qquad (5)$$

Equation (6) represents the regression model derived from bankruptcy literature. Banks consider issuing CoCos based on their financial health which can be mainly indicated by their level of leverage, profitability and liquidity.

$$Y=\beta_0+\beta_1\ \text{Profitabiliy}\ +\ \beta_2\ \text{Liquidity}\ +\beta_3\ \text{Leverage}+\varepsilon_2 \qquad (6)$$

Finally, we introduce two more explanatory variables to our regression model: GSIB and GDPP for two reasons. First, CoCos are also referred to as "regulatory hybrid securities" (Squam Lake Working Group, 2009 due to the promise that they have made to avoid future bail-outs and avoid collapses. The importance this quality of CoCo is magnified for «Global Systemically Important Banks"[4] known as G-SIB which their collapse would pose a serious hazard to the banking, financial system and the economy as a whole. These banks need extra regulatory supervision and government intervention to prevent the failure and bail-out in a timely manner. For this reason we create a dummy variable GSIB which takes value 1 if the bank in our sample is listed as one of G-SIBs and 0 otherwise. FSB (Financial Stability Board) has published a list of G-SIB presented in Table 4.



[4] These banks can also be labeled as "too big to fail".

**Table 4 - List of Global Systemically Important Banks (G-SIBs) in Europe 2016**

| | |
|---|---|
| **1** | Deutsche Bank |
| **2** | HSBC |
| **3** | Barclays |
| **4** | BNP Paribas |
| **5** | Credit Suisse |
| **6** | Groupe Crédit Agricole |
| **7** | ING Bank |
| **8** | Nordea |
| **9** | Royal Bank of Scotland |
| **10** | Santander |
| **11** | Société Générale |
| **12** | Standard Chartered |
| **13** | UBS |
| **14** | Unicredit |

Second, studies on banking crisis and financial soundness, suggest that macroeconomic indicators are associated with the inception of such crisis. Demirgüç-Kunt and Detragiache (1998) explore the relationship between macroeconomic indicators and occurrence of banking crises. Their findings indicate that crises are more likely to emerge in an environment of low growth. Bonfim (2009) studies credit risk and finds that macroeconomic conditions are important determinants of default probabilities over time. For this reason we include the annual growth rate of GDP per capita[5] in our regression model. We report the regression results for these two models in Table 3-3 for a sample of 230 banks located in Europe. Since Swiss regulators have been forcing the banks to issue CoCos, we eliminate Swiss banks from our sample and show the results in Table 3-4. Interestingly, comparing the results shows that the sign of the coefficients remain unchanged only some coefficients lose or gain significance.

### 5.2. Years to Issue

In order to study the effect of determinants of CoCo issuance on the time gap to issue on yearly basis[6], we define our dependent variable YEARS TO ISSUE which takes values 0 to 8. If the first CoCo by any issuer bank is issued in 2009, YEARS TO ISSUE variable takes value 0. If it is issued in 2010, YEARS TO ISSUE variable takes value 1, and so on. Here, bigger magnitude implies longer time (in term of numbers of years) to issue. In other words, this variable indicates how many years after issuing the first CoCo (ECN) by Lloyds, any bank in our sample has issued CoCos:



[5] GDP per capita annual growth rate reported by the World Bank.
[6] Similarly Avdjiev et al. 2017 considers the number of months during the period 2009-2015.

$$\mathrm{Y} = \text{YEARS TO ISSUE} = \begin{cases} 0 & if \quad \text{CoCo is issued in 2009} \\ 1 & \quad\quad\;\; \text{CoCo is issued in 2010} \\ 2 & \quad\quad\;\; \text{CoCo is issued in 2011} \\ 3 & \quad\quad\;\; \text{CoCo is issued in 2012} \\ 4 & \quad\quad\;\; \text{CoCo is issued in 2013} \\ 5 & \quad\quad\;\; \text{CoCo is issued in 2014} \\ 6 & \quad\quad\;\; \text{CoCo is issued in 2015} \\ 7 & \quad\quad\;\; \text{CoCo is issued in 2016} \\ 8 & \quad\quad\;\; \text{CoCo is issued in 2017} \end{cases}$$

We use an Ordered Probit regression to discover the effect of bank characteristics and its financial health on the YEAR TO ISSUE. Our right-hand side variables are the same as equations (5) and (6).

**6. Results**

This paper studies the effect of banks characteristics, their financial health and macro indicators on CoCo issuance. Here, the aim is not specifically investigating the effect of systemic risk or agency problems, similar to Avdjiev et al. (2017), we simply investigate the possible determinants reflecting the financial health and characteristics of banks on the likelihood and speed of CoCo issuance. Using different variables and proxies, slightly different methodology and time frame, our results are in line with previous findings. We also consider the effect of macroeconomics situation is proxied by GDP per capita. Our results also suggest that banks in countries with higher annual growth rate of GDP per capita are more likely to issue CoCo. We use a sample of 230 European banks and present the results based on a binary regression in Table 5. To interpret the probit regression results one should only consider the sign and not the magnitude of the coefficients. Hence, the positive coefficient means that CoCo issuance is more probable given the higher level of the explanatory variable. Column (1) of Table 5 is corresponding to Equation (5) and studies the relationship between CoCo issuance and bank characteristics based on convertibles literature. The results indicate that the sign of the

coefficients for Ln Asset, Tier 1 capital, Loans and Funding are positive for all specifications. The coefficient of Ln Assets is positive and significant for all specifications which means that bigger banks are more likely to issue CoCos. Our findings also imply positive and significant coefficients on Tier 1 capital and Loans, which means that adequately capitalized banks and those with higher net loans are more likely to issue contingent convertible bonds. The sign of the coefficient on Funding is positive everywhere but not significant in Column (1). The sign of the coefficient on RWA is negative which means that banks with higher RWA are less likely to issue CoCos.

## Table 5 - Probit Regression Model, CoCo Issuance (ISSUE)

This table analyses the likelihood of CoCo issuance using binary regression. The sample consists of 230 European banks from 2008 to 2017. Column (1)- Column (4) present results from regressions using a Probit regression where the dependent variable is the binary variable Issue (which it takes value 1 once the bank issue CoCo). Tier1 Cap, Loans, RWA and Funding are all adjusted by dividing by asset value. The variables are 1-year lagged.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | | | | |
| LnAssets | 0.127***<br>(4.43) | | 0.155***<br>(4.64) | 0.127***<br>(3.39) |
| Tier 1 Cap | 6.740***<br>(5.43) | | 5.332***<br>(3.79) | 4.183***<br>(2.81) |
| Loans | 1.319***<br>(3.71) | | 0.902*<br>(2.41) | 1.067**<br>(2.58) |
| RWA | -1.058***<br>(-3.31) | | -0.0841*<br>(-2.51) | -0.436<br>(-1.21) |
| Funding | 0.406<br>(0.96) | | 1.919**<br>(2.96) | 2.382***<br>(3.21) |
| Profitability (Return On Equities) | | 0.908*<br>(2.48) | 0.509<br>(1.24) | 0.987<br>(1.60) |
| Liquidity (Loans\Deposits) | | 0.178*<br>(2.23) | 0.111<br>(1.81) | 0.169*<br>(2.31) |
| Leverage (Liabilities/Assets) | | -0.257<br>(-0.54) | -2.062**<br>(-2.65) | -2.814***<br>(-3.36) |
| GSIB | | | | 1.193***<br>(7.54) |
| GDPP | | | | 0.248***<br>(6.38) |
| Constant | -3.596***<br>(-6.83) | -1.044*<br>(-2.35) | -3.048***<br>(-4.49) | -3.049***<br>(-4.33) |
| McFadden's Adj R2 | 0.043 | 0.006 | 0.048 | 0.174 |
| Observations | 1116 | 1558 | 1044 | 1044 |

The z-statistics are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Column (2) of Table 5 presents the regression results defined by Equation (6) where the right-hand side variables are indicators of the bank's financial health. Banks in our sample are less likely to issue CoCos if they have higher level of leverage, or in the other words banks with a lower level of leverage are more likely to issue CoCos. The more profitable banks (which are defined here as banks with higher ROE) and those with more liquidity level (higher loans to deposits ratio) are more likely to issue CoCos. In column (3), we consider the determinants of CoCo issuance suggested by both convertible and bankruptcy literatures. As a result, the significance status of some coefficients change but the signs remain unchanged. Finally, column (4) shows the results after introducing GSIB and GDPP to our regression model. The coefficients on GSIB and GDPP are positive and significant, meaning that if the bank is listed as one of G-SIBs and if it is from a country with better economic performance, it is more likely to issue CoCos. We use McFadden's adjusted $R^2$ ($R^2_{McF}$) to test and compare the goodness of fit for all models. The reason behind using different measure rather than the conventional adjusted R-squared is its inappropriateness in binary dependent variable models. Comparing adjusted $R^2_{McF}$ reported in column (1) to column (4) of Table 5 implies that including the banks' characteristics and financial health along with state of the economy improves the explanatory power. Using other measures of goodness of fit such as $R^2$ of McKelvey and Zavoinas or Akaike Information Criterion (AIC) leads to the same results.

## Table 6 - Probit Regression Model, CoCo Issuance (ISSUE) (Swiss banks are excluded)

This table analyses the likelihood of CoCo issuance using binary regression. The sample consists of 184 European banks (Swiss banks areexcluded) from 2008 to 2017. Column (1)- Column (4) present results from regressions using a Probit regression where the dependent variable is the binary variable Issue (which it takes value 1 once the bank issue CoCo). Tier1 Cap, Loans, RWA and Funding are all adjusted by dividing by asset value. The variables are 1-year lagged.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Ln.Assets | 0.124*** | | 0.144*** | 0.113** |
| | (4.07) | | (4.11) | (2.90) |
| Tier 1 Cap | 6.545*** | | 5.250*** | 3.875* |
| | (5.14) | | (3.58) | (2.51) |
| Loans | 1.415*** | | 1.051* | 1.127* |
| | (3.57) | | (2.53) | (2.47) |
| RWA | -1.201*** | | -0.996** | -0.534 |
| | (-3.33) | | (-2.62) | (-1.31) |
| Funding | 0.127 | | 1.334* | 1.976* |
| | (0.28) | | (1.99) | (2.52) |
| Profitability (Return On Equities) | | 0.982* | 0.489 | 0.852 |
| | | (2.53) | (1.19) | (1.38) |
| Liquidity (Loans\Deposits) | | 0.167* | 0.106 | 0.164* |
| | | (2.13) | (1.68) | (2.18) |
| Leverage (Liabilities/Assets) | | -0.231 | -1.647* | -2.524** |
| | | (-0.48) | (-1.99) | (-2.87) |
| GSIB | | | | 1.087*** |
| | | | | (6.11) |
| GDPP | | | | 0.254*** |
| | | | | (6.32) |
| Constant | -3.318*** | -1.041* | -2.857*** | -2.789*** |
| | (-6.02) | (-2.35) | (-3.89) | (-3.74) |
| McFadden's Adj R2 | 0.041 | 0.007 | 0.041 | 0.158 |
| Observations | 994 | 1235 | 930 | 930 |

The z-statistics are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

## Table 7 - Ordered Probit Regression Model, Time to Issue (YEARS TO ISSUE)

This table presents the regression results of ordered probit model where the dependent variable measures the number of the years that issuers took to issue their first CoCo. Column (1) shows the results for a sample of 76 European banks who issued CoCos from 2009 to 2017. Column (2) present results for a sample of 68 European banks who issued CoCos when the Swiss banks are excluded. Similarly, Tier1 Cap, Loans, RWA and Funding are all adjusted by dividing by asset value. The variables are 1-year lagged.

| | (1) | (2) |
|---|---|---|
| Ln.Assets | -0.189*** | -0.216*** |
| | (-4.15) | (-4.46) |
| Tier 1 Cap | -28.90*** | -25.71*** |
| | (-6.13) | (-4.45) |
| Loans | 0.177 | 1.170 |
| | (0.68) | (1.67) |
| RWA | 0.196 | 0.317 |
| | (0.46) | (0.71) |
| Funding | -0.793 | -2.115** |
| | (-1.16) | (-2.78) |
| Profitability (Return On Equities) | 0.0426 | 0.0517 |
| | (0.26) | (0.31) |
| Liquidity (Loans\Deposits) | 1.221*** | 0.631* |
| | (3.98) | (2.02) |
| Leverage (Liabilities/Assets) | -23.66*** | -19.97*** |
| | (-5.70) | (-3.90) |
| GSIB | -0.766*** | -0.747*** |
| | (-5.89) | (-5.48) |
| GDPP | -0.0148 | -0.0132 |
| | (-0.66) | (-0.57) |
| Constant | -24.87*** | -22.27*** |
| | (-5.87) | (-4.23) |
| Observations | 470 | 428 |

The z-statistics are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

To avoid the possible influence of mandatory issuance, in the next step, we eliminate Swiss banks from our sample. This is due to the fact that CoCo issuance in Switzerland was affected by regulatory intervention. We report the regression results based on a sample of 184 banks in Table 6. Similar to Avdjiev et al. 2017, our finding shows that exclusion of Swiss banks does not change the results. One reason behind this finding can be related to similarity of attitudes between banks and regulators towards risks and their choice of securities to eliminate or lessens such risks. To study the effect of our right-hand side variables on the speed of CoCo issuance, we define a dependent variable which indicates the time gap as the number of years between year 2009 and a bank's first CoCo issuance. Table 7 shows the results based on ordered Probit regression where the dependent variable is "Years to Issue". The results shown in Column (1) imply that banks with higher level of Total Assets, Tier1 Capital, Leverage and lower level liquidity are quicker in issuing CoCos. Our results also show that banks who are listed as GSIB are quicker in CoCo issuance. Excluding the Swiss banks only changes the results (shown in Column (2)) by eliminating the significance effect of liquidity.

## 7. Conclusion

CoCos were initially issued to avoid future bail-outs caused by financial crisis. The reason behind CoCo issuance may vary across banks depending on the country of issue's state of financial stability, regulatory system, banking policies. The issuance can be the choice of the bank over other financial instruments or encouraged and even in some cases forced by regulators. In any case the factors which will be taken into consideration will be related to the individual issuer's characteristics, its financial health and financial soundness of the economy. Our findings show that the banks with bigger size and those with higher Tier 1 capital, higher net loans, higher wholesale funding and lower level of leverage have a higher tendency to issue CoCos. Our results also suggest that banks in countries with higher annual growth rate of GDP

per capita and those listed as G-SIBs are more likely to be CoCo issuer. We also find that big and adequately capitalized banks with a higher level of leverage and lower level of liquidity are more prompt in issuing CoCos.

## References


Albul, B., Jaffee, D. M., and Tchistyi, A. (2010). Contingent convertible bonds and capital structure decisions. Coleman Fung Risk Management Research Center.

Avdjiev, S., Bogdanova, B., Bolton, P., Jiang, W., & Kartasheva, A. (2017). CoCo issuance and bank fragility (No. w23999). National Bureau of Economic Research.

Brennan, Michael J., and Eduardo S. Schwartz. "Analyzing convertible bonds." Journal of Financial and Quantitative analysis 15.4 (1980): 907-929.

Brigo, D., Garcia, J., and Pede, N. (2013). Coco bonds valuation with equity-and credit-calibrated first passage structural models. Available at SSRN 2225545.

Buergi, M. P. (2013). Pricing contingent convertibles: a general framework for application in practice. Financial Markets and Portfolio Management, 27(1):31–63.

Buergi, M. P. H. (2012). A tough nut to crack: On the pricing of capital ratio triggered contingent convertibles. Available at SSRN 2020571.

Essig, S., 1991. Convertible securities and capital structure determinants. Ph.D. Dissertation.

Graduate School of Business, University of Chicago, Chicago, IL.

Diamond, Douglas W., and Raghuram G. Rajan. "Liquidity shortages and banking crises." The Journal of finance 60.2 (2005): 615-647.

Demirgüç-Kunt, Asli, and Enrica Detragiache. "The determinants of banking crises in developing and developed countries." IMF Staff Papers 45.1 (1998): 81-109.

Elliott, Douglas J. "Bank liquidity requirements: An introduction and overview." The Brookings Institution (2014).

Fajardo, José and Mendes, Layla, On the Propensity to Issue Contingent Convertible (CoCo) Bonds (December 6, 2017). Available at SSRN: https://ssrn.com/abstract=2900496 or http://dx.doi.org/10.2139/ssrn.2900496

Goncharenko, R. and Ongena, S. and Rauf, A. (2017). The Agency of CoCo: Why Do Banks Issue Contingent Convertible Bonds? CFS Working Paper, No. 586, 2017. Available at SSRN: https://ssrn.com/abstract=3067909

Huang, Rocco, and Lev Ratnovski, 2011, The dark side of bank wholesale funding.

Journal of Financial Intermediation 20, 248-263.

List of global systemically important banks (G-SIBs). Available at: http://www.fsb.org/wp-content/uploads/P211117-1.pdf

Madan, D. B. and Schoutens, W. (2011). Conic coconuts: the pricing of contingent capital notes using conic finance. Mathematics and Financial Economics, 4(2):87–106.

Martynova, Natalya, and Enrico C. Perotti. "Convertible bonds and bank risk-taking." (2015).

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

Merton, R. C. (1974). On the pricing of corporate debt: The risk structure of interest rates. The Journal of Finance, 29(2):449–470.

Myers, Stewart C. "Determinants of corporate borrowing." Journal of Financial Economics 5.2 (1977): 147-175.

Mayers, D. (1998). Why firms issue convertible bonds: the matching of financial and real investment options. Journal of financial economics, 47(1), 83-102.

Navajas, Matias Costa, and Aaron Thegeya. Financial soundness indicators and banking crises. No. 13-263. International Monetary Fund, 2013.

Pennacchi, G., Vermaelen, T., and Wolff, C.C.P. (2014). Contingent capital: The case of COERCS. Journal of Financial and Quantitative Analysis, 49(03):541–574.

Stein, J. C. (1992). Convertible bonds as backdoor equity financing. Journal of Financial Economics, 32(1), 3-21.

Williams, Barry and Tan, Shao Lei and Fenech, Jean-Pierre, Why Do Banks Issue Contingent Convertible Bonds? (May 30, 2018). Available at SSRN: https://ssrn.com/abstract=3187667 or http://dx.doi.org/10.2139/ssrn.3187667