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Do CoCos Serve the Goals of Macroprudential Supervisors or Bank Managers?

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Do CoCos Serve the Goals of Macroprudential Supervisors or Bank Managers?

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Abstract

Using a hand-collected, comprehensive sample of contingent capital bonds (CoCos) issued by banks over the 2009-2019 period, we identify shifts in CoCo design features that nullify their putative salutary macroprudential benefits. Increasingly, CoCos are issued without punitive wealth transfers from shareholders to bondholders, thereby removing incentives for bank managers to take preemptive, risk-reducing action in order to prevent the CoCo from triggering. Further, CoCo issuance can be used to circumvent supervisory discretion over bonus and dividend payouts. Bank managers are aware of these loopholes and exploit them to the detriment of financial market stability and macroprudential objectives.

Keywords: CoCo, contingent capital, bank capital regulation

JEL Codes: G21, G23, G28

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1 Introduction

Contingent Capital bonds (CoCos) were introduced in the wake of the Great Financial Crisis for macroprudential policy purposes. The objective was that the CoCo conversion option would be automatically triggered when a bank approached insolvency, thereby recapitalizing troubled banks without necessitating moral hazard bailouts or destabilizing fire sales of assets. To serve as effective disincentives for banks to engage in moral hazard behavior that increases systemic risk, optimal CoCo design has long stressed the role of a punitive wealth transfer upon exercise that serves as a risk-reducing incentive mechanism for shareholders and bank managers (Flannery, 2005; Hilscher and Raviv, 2014). Wealth is transferred from risk-taking bank shareholders and managers to CoCo bond holders upon the trigger of the equity conversion loss absorption mechanism. That is, CoCo bond holders receive equity when the CoCo conversion option is exercised, thereby deleveraging the bank by diluting share value. The macroprudential benefits of CoCos include the potential to automatically recapitalize troubled banks, the reduction of systemic risk from fire sales of assets by over-leveraged financial institutions under duress (Flannery, 2013), the mitigation of risk-shifting incentives (Martynova and Perotti, 2018), and the reduced likelihood of regulatory bailouts (Dudley, 2013; Herring, 2010).

Indeed, Kashyap, Hanson, and Stein (2011) praise the capacity of contingent capital to "pre-wire" an ex post optimal policy action that could substitute for other proposed macroprudential instruments such as capital insurance. Similarly, Avdjiev, Bolton, and Jiang (2015) highlight CoCos' automatic recapitalization on contractually pre-agreed terms as "a simple way of bailing-in a bank and cutting through all institutional complexities ... hindering debt restructuring in the midst of a crisis." Kashyap, Rajan, and Stein (2008) advocate CoCo issuance requirements, noting that macroprudential mandates are required since bank shareholders would be reluctant to issue these potentially dilutive instruments. Thus, the BIS and many individual national bank regulators have mandated CoCo issuance to fulfill Total Loss Absorbing Capital (TLAC) and other capital requirements in order to

address systemic risk exposure and enhance macroprudential stability.

Unfortunately, specific features permitted by policy makers have tarnished the CoCo promise and undermined potential macroprudential benefits. Academic literature has focused on limitations in trigger design that undermine CoCos' deterrent power to restrict excessive bank risk taking.[1] In this paper, we identify alternative CoCo design problems, focusing on two critical CoCo features as yet unexamined in academic work. First, we document the pervasive shift from equity conversion to principal write-down CoCos that have no punitive impact on shareholders upon exercise.[2] Second, we document banks' use of CoCos to circumvent discretionary regulatory intervention that imposes limits on dividend and compensation payouts as punishment for banks that take on excessive risk. We hand collect a comprehensive sample of 720 CoCos issued worldwide from 2009 to 2019 to show the detrimental impact of these two design flaws from the perspective of macroprudential stability. We also find indications that bank managers are aware of these flaws and exploit them, thereby exacerbating systemic risk. This paper complements work by Fatouh, Neamto, and Wijnbergen, 2022 who use a sample of U.K. bank CoCos to show that CoCo issuance is positively correlated with bank risk taking behavior.

In this paper, we use our large sample to document these two crucial shifts in CoCo design over the period from 2009 to 2019. The first design shift has permitted CoCo issuers to change the loss absorption mechanism from equity conversion to principal write-down. This shift eliminates punitive wealth transfers from shareholders since upon the trigger of principal write-down CoCos, there is no dilution of share value. Instead, the CoCo debt is either partially or completely eliminated. Therefore, the principal write-down CoCo structure provides no deterrence on bank shareholder and managerial risk taking. Indeed, sharehold-

[1]For example, one way that CoCo trigger design has circumvented systemic risk protection is that regulations allow issuers to set the CoCo triggers at extremely low levels (e.g., 5.125% risk-adjusted capital ratios), thereby reducing the risk of conversion of CoCo debt to equity. Other studies investigating shortcomings in CoCo trigger design are Glasserman and Perotti (2017), Haldane (2011), Pennacchi, Vermaelen, and Wolff (2014), Calomiris and Herring (2013), and Allen and Tang (2016).

[2]Although other papers, such as Himmelberg and Tsyplakov, 2012, Hilscher and Raviv, 2014 and Chan and Wijnbergen, 2017 discuss the importance of punitive wealth transfers upon CoCo conversion, we are the first to comprehensively document the market shift from equity conversion to principal write-down structures.

ers may benefit from the trigger of CoCo principal write-down features if the bank's debt overhang is reduced. Despite its importance, the regulatory framework is completely silent on the structural details that determine CoCo wealth transfer upon exercise, and has allowed the proliferation of bank-friendly, principal write-down CoCos to crowd out equity converting issues that potentially enhance macroprudential stability.

We analyze 720 CoCos and find that the shift from equity converting to principal write-down CoCos has substantially undermined their macroprudential benefits and created perverse risk-seeking incentives . Indeed, 100% of CoCo issues in 2009 were equity converting as compared to only 13.5% in 2019. Even within the vanishing subsample of equity-converting CoCos, we find CoCos that are structured to have a positive wealth transfer for shareholders at the trigger point. Examining all equity-converting CoCos, we find that the median wealth transfer *in favor of shareholders* is equal to 22.17% of the instrument's notional value. Thus, shareholders are actually rewarded upon CoCo trigger, thereby violating the optimal contract design envisioned by CoCo proponents. Moreover, our analysis of CoCo issuance yield spreads indicates market awareness and sensitivity to the terms of conversion of CoCo issues. We find a reduction in yield spreads for the CoCos structured to be more friendly to bond holders at the expense of stockholders; i.e., with a projected negative wealth transfer at the trigger point in favor of CoCo holders. These CoCos are associated with yield spreads 123 basis points lower (171 basis points if accounting for country-level fixed effects) than comparable CoCos without macroprudentially beneficial negative wealth transfers upon exercise. Further, the estimated effect of changing the terms of conversion from the median observed wealth transfer in favor of shareholders to a wealth transfer substantially in favor of CoCo holders is a reduction in yield spreads of 152 basis points.[3]

The second major design flaw from a macroprudential supervisory perspective is that CoCos can be used by bank managers to avoid Maximum Distributable Amount (MDA)

[3]The 152 basis points reduction in yield spread is for a hypothetical instrument with the trigger level set at a 5.125% regulatory capital ratio if the wealth transfer were changed from 22.17% of CoCo principal in favor of shareholders to 50% in favor of CoCo holders.

limitations on dividend and compensation payouts. Regulators employ MDA limitations as additional policy tools (i.e., Pillar 2) to require a troubled bank to increase its common equity capital cushion. Upon breaching the regulator's designated MDA threshold, restrictions are imposed on dividend payouts, coupon payments on some debt instruments (including CoCo coupons) and variable remuneration and bonuses paid to bank managers and employees. The severity of these restrictions becomes progressively higher, the more serious the bank's breach of the MDA threshold. The limitations on total distributions may range from 60% of profits to total elimination of all payouts. Thus, this is a powerful regulatory tool that can be used to conserve capital and incentivize bank managers to reduce risk in order to avoid crossing the MDA threshold.

However, banks can relax the MDA threshold and reduce the likelihood of imposition of these capital-saving supervisory interventions by issuing CoCos as Additional Tier 1 (AT1) capital in place of common equity. Banks satisfy Tier 1 capital requirements by issuing common stock and other capital conserving instruments. The CET1 (Common Equity Tier 1) component of Tier 1 capital can only be fulfilled with stock. In addition to equity, however, regulations permit banks to issue other, less expensive instruments to act as Tier 1 capital and fulfill AT1 capital requirements. If structured properly, CoCos can be used to replace common equity in fulfilling required AT1 levels. If a bank underutilizes CoCos and instead uses common stock to fulfill its AT1 requirement, the market considers the bank as having an "AT1 shortfall." That is, the bank can reduce the cost of meeting its capital requirements if it substitutes CoCos for common stock in the AT1 component of its regulatory capital cushion. Any common equity released from the AT1 layer of regulatory capital becomes a CET1 surplus which is counted against the MDA threshold. By releasing common equity into a CET1 surplus, CoCo issuance reduces the likelihood that the MDA restriction will be imposed. This effect is particularly powerful for banks close to the MDA threshold. These banks can issue CoCos in order to relax the likelihood of a disciplinary imposition of restrictions on bonus and dividend payouts. Recognizing the permissive impact of this

use of CoCos to meet bank capital requirement, on March 12, 2020 the European Central Bank granted widespread approval for all banks to use more CoCos to meet AT1 and Tier 2 capital requirements (and thereby relax MDA thresholds) as part of their Covid capital relief program.[4] The import of these CoCo capital regulations, therefore, is to allow bank managers and shareholders to protect their cash payouts at the expense of macroprudential policies meant to limit systemic risk exposure.

In this paper, we show that CoCo issuance responds to these incentives. Banks are significantly more likely to issue CoCos if they are close to the MDA threshold and have an AT1 shortfall that can be exploited to relax the MDA's binding constraint. These effects are both statistically and economically significant. For banks having an AT1 shortfall, the likelihood of CoCo issuance increases by a marginal effect of 3.7 percentage points. Further, for banks within a 1% RWA (risk weighted asset value) distance from the MDA threshold, the likelihood of issuing CoCos increases by 1.28 percentage points for banks with an AT1 shortfall, but decreases by 1.68 percentage points for banks with no AT1 shortfall. Together with the absence of punitive wealth transfers, these two CoCo design features have eviscerated the macroprudential benefits that originally motivated their adoption by bank regulators.

The structure of the paper is as follows. Section 2 describes our hand-collected database consisting of 720 CoCo instruments. Section 3 estimates the projected wealth transfers at the trigger point from the vantage point of the date of CoCo origination. The impact of projected wealth transfers on CoCo yields at issuance is discussed in section 4. Section 5 analyzes the use of CoCos to circumvent regulatory intervention mechanisms such as MDA restrictions. Finally, section 6 concludes.

[4]The expanded use of CoCos was mandated to take effect throughout Europe even before the pandemic outbreak.

2 Data

2.1 Source of Data

A comprehensive database of 720 CoCo issues was hand-collected using Bloomberg as a starting point. Using the ISIN identification number of each CoCo security, a manual search for all available prospectuses was conducted. Specific details of each CoCo issue (such as trigger point, loss absorption mechanism, call features, conversion price, etc.) were obtained from each individual bond prospectus.[5] CoCo prices were obtained from Bloomberg on a daily and monthly basis over the sample period, as well as on the date of issuance. Sovereign bond yields and currency exchange rates on the issue date of each individual instrument were sourced from individual countries' central bank databases, Nasdaq Quandl database,[6] the St. Louis Federal Reserve FRED database, the OECD database, and Bloomberg. Accounting values pertaining to asset composition, sources of funding, impaired loans and size of loan-loss reserves, outstanding share count, as well as regulatory capital ratios are obtained from BankFocus. Whenever necessary, missing data was integrated by hand collecting financial statement from bank websites. Our sample contains 720 individual CoCo issues by 286 distinct banks in 31 countries.

To reconstruct the timing of the phase-in of Basel III capital requirements, as well as all national supplemental capital buffers, we relied on each national authority's body of regulations, public announcements and press releases, as well as on the periodic Regulatory Consistency Assessment Programme (RCAP) reports published by the Basel Committee on Banking Supervision (BCBS). For the additional components of the Combined Buffer Requirement imposed within European jurisdictions applying the CRD/CRR framework, we relied on the notification templates national regulators were required to submit to the Eu-

[5]The most common procedure used to extract individual CoCo prospectuses was via manual search of the issuing bank's investor relations webpages. Prospectuses of instruments with matching ISIN codes were downloaded. If the prospectus was not available, the information was found from other sources (usually from a rating agency report).

[6]https://data.nasdaq.com/publishers/QDL

ropean Banking Authority (EBA), the European Central Bank (ECB) and the European Systemic Risk Board (ESRB). For Pillar 2 MDA restrictions, national regulators submitted their institution-specific or exposure-specific add-on measures in the context of the Supervisory Review and Evaluation Process (SREP), and in the most complex cases (most notably the United Kingdom, Norway, Denmark and Sweden) published periodic reports with a detailed breakdown of the capital surcharges applied to each institution.[7]

2.2 Overview of CoCo Database

CoCo issuance took place during three distinct phases over time. The first phase, lasting from 2009 to 2012, occurred during the period of regulatory policy uncertainty that preceded the release of final Basel III guidelines. Because of the importance of regulatory mandates, this time period was characterized by heterogeneous designs as banks were unsure of the specific regulations that would apply to CoCos. The second phase consisted of CoCo issuance designed to comply with Basel III regulations. This time period, from 2013 to 2015, is characterized by the rapid adoption of CoCos with terms that technically complied with regulations, but exploited loopholes. In particular, this period coincides with the shift from equity conversion to principal write-down CoCos without negative shareholder wealth impacts upon conversion. Finally, global CoCo issuance marks the third phase starting from around 2016, characterized by more CoCo issuance activity by Chinese, Japanese and Australian banks. Figure 1 indicates this phased time trend of CoCo issuance around the world.[8]

[Figure 1 about here.]

Table 1 reports descriptive statistics for all 720 instruments. Norwegian banks are the

[7]For example, see Finansinspektionen (2014c) Finansinspektionen (2015b), Danmarks Nationalbank (2014).

[8]Contrary to other national venues, CoCo coupons are not tax deductible in the U.S. Thus, U.S. banks have not issued CoCos (see Calomiris and Herring, 2013).

top issuers overall, with 17.4% of all CoCo issues. In the entire sample, Table 1 shows that only 25.4% are equity-converting CoCos. Table 2 reports CoCo issues for each year, and documents the shift from equity-converting CoCos in the early years to principal write down (total and partial; temporary and permanent) loss absorption mechanisms. Starting from 2013, principal write-downs dominated the market, and temporary write-downs became a de-facto standard for European financial institutions.

CoCo terms are determined by regulatory capital requirements. Thus, almost all CoCos are perpetual in order to raise the issue's capital status to Tier 1.[9] Because of this, almost all CoCos are callable, with the market's expectation that the call option will be exercised at first opportunity. As reflected in Table 1, the time from issuance to first call is at least five years in order to achieve Tier 1 capital status. Thus, Additional Tier 1 (AT1) CoCos vastly outnumber Tier 2 instruments (591 vs. 79) while also accounting for 85% of the total dollar amount of instruments issued during the entire period ($454,196,000 on a total $538,406,000).[10] It is important to note that the issuance distribution by year is drastically different for AT1 and Tier 2 instruments, with Tier 2 comprising a large share of the total in earlier years, but AT1 instruments consistently representing more than 90% of the total number of CoCos issued starting from 2015. The adoption of Basel III and the consequent phasing-in of capital buffers created strong incentives to issue AT1 instruments. Thus, Tier 2 CoCo issuance precipitously falls after 2013, never representing more than 9% of the aggregate total in any year during the 2015 to 2019 period.

[Table 1 about here.]

In terms of trigger levels, two clusters can be observed in Table 1 at the 5.125% and 7% minimum risk-weighted asset capital requirement, with 72.9% of all CoCos issued with a 5.125% trigger level corresponding to the minimum trigger level permitted for treatment

[9]The one exception is a 2012 Macquarie AT1 instrument issued with a maturity of 45 years. It was designed as Basel III regulations were being finalized and received regulatory exemption from the perpetual maturity requirement.

[10]Only 50 were not classified as either AT1 or Tier 2 capital instruments; for example, the 37 CoCos issued by Lloyds in 2009.

as AT1 capital.[11] The 7% trigger level was employed by banks in jurisdictions that imposed a higher minimum trigger (e.g., Denmark, Great Britain), as well as Swiss CoCos issued to meet the nation's expanded Capital Conservation Buffer. A third group is dominated by Indian banks to meet national regulations specifying a minimum trigger level of 6.125%. Thus, overwhelmingly, issuers align their CoCos' trigger levels to the regulatory minima imposed in their jurisdictions.

[Table 2 about here.]

2.3 Variable Definitions and Summary Statistics

Using the CoCo design features obtained from manual inspection of prospectuses, we defined the variables used in our analysis. We describe each variable's construction in this section. Table 3 provides summary statistics for the variables. Appendix A1 provides a summary list of variables, including variable name, definition and source of data.

One of our major variables of interest is *Wealth Transfer* defined as the wealth transfer to shareholders conditional upon CoCo conversion calculated as of issuance date. Using the terms of CoCo trigger exercise, and following the methodology of Berg and Kaserer (2015), we express *Wealth Transfer* as a share of the CoCo's par value so that it is bounded between $-\infty$ and $+1$. A negative wealth transfer implies terms of conversion favorable to CoCo holders at the expense of equity holders. We define an indicator variable, *Negative Transfer*, that takes a value of one if *Wealth Transfer* is negative; zero otherwise. In contrast, a non-negative wealth transfer benefits equity holders at the expense of CoCo bond holders. In addition to this normalized variable, Table 3 expresses the wealth transfer as a share of bank market value in order to measure the potential dilutive effect of CoCo conversion on total market capitalization.

[Table 3 about here.]

[11] In this paper, we consider only mechanical triggers, although some CoCos have discretionary triggers that rely on supervisory entities to declare that a point of non viability (PONV) has been reached.

Another variable, the CoCo *Yield Spread* is computed as the difference between the *Yield at Issue* for each CoCo instrument and the same date's yield to maturity of the tenor-matched sovereign bond for the country in which the issuing bank is domiciled. For each CoCo bond, the effective *Yield at Issue* is computed using the issue price, the coupon rate and coupon frequency over a holding period that varies depending on the existence of a call option. For CoCos that are not callable, the holding period is computed as the time between the issue date and the maturity date, whereas if a call option exists, the holding period is the time difference between the issue date and the first available call date. Further, *Fixed Rate* and *Floating Rate* specify the CoCo coupon structure. The most common structure is fixed-to-float, which specifies a fixed coupon rate up to the first available call date, with a specified spread over LIBOR if the CoCo is not called.[12]

Although CoCos may be designed to meet Tier 1 capital requirements, our analysis shows that they must be considered in the context of the entire regulatory capital structure. The *Additional CoCo Layers*$_{i,t}$ indicator variable assumes a value of 1 for bank i in year t if the bank could use CoCo instruments to fulfill capital requirements other than the 1.5% RWA AT1 and 2% RWA Tier 2 baseline Basel III minima; and 0 otherwise. The *%RWA CoCo Layers*$_{i,t}$ variable measures the maximum amount of capital requirements that can be fulfilled with CoCos for bank i in year $t+1$. This is equal to the sum of AT1 and Tier 2 minimum capital requirements plus any portion of other capital layers that can be met with CoCos. Table 4 provides summary statistics for issuance variables.[13]

According to Basel III guidelines, banks can elect to meet all their capital requirements with equity capital, if they choose to do so. However, CoCos can satisfy up to 25% of AT1 and Tier 2 capital requirements, providing a substitute for more costly common equity. In

[12]The choice of fixed, floating or fixed-to-floating rate varies across the country of domicile of the issuer. Among European AT1 CoCos, fixed-to-floating rate CoCos overwhelmingly dominate, but Norwegian banks diverge drastically by using almost exclusively floating interest rate coupon payments. Further, 21 out of 22 Indian CoCos are fixed rate, while Russian issues are split almost equally between fixed and fixed-to-floating rate designs.

[13]The summary statistics are provided for 1,406 bank-year observations for the 141 banks included in section 5.

particular, use of common equity to satisfy its AT1 (or, even more so, Tier 2) capital requirements, while permissible would not be advantageous to banks seeking to minimize their cost of capital compliance, especially for banks with supplemental capital buffer requirements that can only be satisfied with common equity. That is, even if CoCos do not qualify for inclusion in these capital buffers, banks will face increased incentives to fully utilize the capital credit that CoCos can provide within the Tier 2 and AT1 capital layers in order to "free" equity capital. Indeed, market analysts negatively view banks that do not fully exploit the CoCo substitution for equity as having an AT1 shortfall.[14] We compute the variable *AT1 Shortfall Size*$_{i,t}$ for bank i in year t as the difference between the maximum amount of CoCos permitted to meet AT1 requirements in year t minus the CoCos actually used in AT1 as of year-end $t-1$. A positive value indicates the portion of AT1 capital requirements that could have been met with CoCos that are instead met with common equity as of time t. In addition to the size of the AT1 shortfall, we define an indicator variable, *Has AT1 Shortfall*$_{i,t}$ that assumes a value of 1 for bank i in year t if the value of the variable *AT1 Shortfall Size* is positive and 0 otherwise. Finally, in our analysis, the AT1 shortfall interacts with the Maximum Distributable Amount (MDA) threshold. We define a variable *Distance to MDA Trigger*$_{i,t}$*:* for bank i in year t as the difference between the bank's CET1 ratio reported at year-end t and its regulator's discretionary MDA threshold point computed for year $t+1$.

[Table 4 about here.]

Following previous literature, several balance sheet measures are included in our models as control variables. *Size* is the natural logarithm of total assets at time $t-1$, and *G-SIB* is an indicator variable that assumes value of 1 at time t if at time $t-1$ the financial institution had been included by the FSB in its annual list of global systemically important banks. *Net Interest Margin* proxies for profitability, although our results are robust to the alternative

[14] In theory, this issue is not exclusive to the AT1 capital layer as a bank could be facing a "Tier 2 shortfall" whenever it uses common equity to meet Tier 2 requirements. However, banks have access to a variety of alternative instruments in Tier 2, such as subordinated debt, while the only alternative to CoCos in AT1 requirements is equity capital.

inclusion of either the return on assets or the return on equity. In terms of asset composition, we control for *Loans*, *Cash*, *Derivatives*, securities accounted for as *Trading*, Available for Sale *(AFS)* or held to maturity *(HTM)*. The variable *Impaired Loans* is the share of gross loans that at time $t-1$ the bank declared as impaired. The variable *Loan Loss Reserves* (as a share of gross loans) indicates how well provisioned the financial institution is to absorb losses from defaults on loans in its loan portfolio. Finally, we control for bank funding sources with the variables *Deposits* and *Wholesale Funding*.

3 CoCo Design: Wealth Transfer Analysis

Given that our objective is to explore the market-determined yield spread relationship with each CoCo design feature over time, we exclude from our analysis all CoCo instruments issued in exchange for previously outstanding securities. The yields on such replacement CoCos are overwhelmingly determined by the predecessor bond, and therefore are not independent indicators of the relationship between yield spreads and CoCo design features upon issuance. Further, we remove all CoCos that are issued directly to a governmental entity since these typically serve as bail-out vehicles. Finally, all CoCo instruments issued by Georgian banks were dropped from the sample because of the absence of matching sovereign debt yield data. After these exclusions, we are left with 615 instruments issued between 2009 and 2019 by 248 financial institutions in 27 countries.

The academic literature on the wealth transfer mechanism mandated by the specific details of CoCo instruments has been quite sparse, although we follow the computational methodology of Berg and Kaserer (2015). Although many studies have examined conversion prices and ratios, few have taken the next step and examined the wealth transfer upon exercise and none have our comprehensive CoCo sample. Using our scale from $-\infty$ to $+1$, the variable *Wealth Transfer* measures the range of wealth transfer to CoCo bond holders (negative values) to wealth transfer to shareholders (positive values). A value of -1 implies

that the CoCo holders effectively receive equity equal to the CoCo par value. In contrast, a +1 value of the variable *Wealth Transfer* implies that shareholders reduce debt by the full CoCo par value. Equity converting (but not principal write-down) CoCos may have negative values of *Wealth Transfer*, with the size of the variable determined by the conversion price.[15] For example, an infinitely small conversion price implies that CoCo holders would receive effectively all equity upon conversion. The higher the conversion price, the closer the equity converting CoCo's negative wealth transfer mechanism is to zero. That is, the amount of equity transferred to CoCo holders declines as the wealth transfer ratio moves from -1 toward zero. At zero, there is no longer a wealth transfer from shareholders to CoCo holders. Indeed, as the market has evolved, we find that many equity converting CoCos have such high conversion prices that the wealth transfer is actually positive. These CoCos, therefore, offer no incentives for bank managers and shareholders to avoid punitive wealth transfers upon conversion.

By design, all principal write-down CoCos have positive wealth transfer ratios, since CoCo holders receive no equity at all following a trigger event. Indeed, Himmelberg and Tsyplakov (2012) find that principal write-down CoCos introduce a perverse incentive to "burn capital" when capital levels approach their trigger thresholds. From a manager's perspective being immediately above the trigger level is strictly worse than being immediately below, since the latter state removes the liability represented by the CoCos. Thus, as the bank approaches the CoCo trigger, bank managers may undertake risky transactions that cause the bank's financial condition to further deteriorate in a deliberate effort to trigger the write down, in contrast to macroprudential preferences that they reduce risk or raise new equity. Permanent principal write-downs can be thought as having an (implicit) conversion price of $+\infty$ and thereby a wealth transfer ratio of +1. That is, the CoCo exercise transfers from CoCo holders

[15]The conversion price can be either fixed in terms of share price or variable based on a formula involving a share price floor. For instruments with formula-based conversion prices using market prices, the conversion value in our analysis is calculated using share prices as of the day the CoCo started trading. For instruments specifying a conversion price floor, the wealth transfer calculated is an upper limit of the punitive wealth transfer from shareholders to CoCo holders.

to equity holders a value equal to the CoCo par value, thereby providing the most extreme example of "convert-to-steal" or "equity-friendly" design (see Hilscher and Raviv (2014)).

There are two types of partial permanent write-down CoCos. The first type includes CoCos that specify a fixed percentage of their notional amount that would be immediately written-down at the trigger point, with the residual value to be returned in cash to CoCo holders.[16] The second kind reduces leverage only up to the amount needed to increase the issuer's common equity Tier 1 (CET1) ratio to the regulatory minimum. These CoCos can be subject to further write downs if subsequently the issuer's capital ratio falls below the regulatory minimum. Depending on these terms, the wealth transfer ratios for partial write-down CoCos range from 0 toward +1. From the perspective of their terms of conversion, increasingly popular temporary write-down instruments are in fact identical to this second type of partial permanent write-downs.[17] The *Wealth Transfer* of partial permanent principal write-down CoCos is equal to the share of the notional value that is contractually written-down at a trigger event.

In summary, equity converting CoCos are the only type that have the potential to impose punitive wealth transfers on risk-taking bank equity holders. The question is whether empirically the issuers chose conversion prices that do so. Berg and Kaserer (2015) report that out of the ten equity converting CoCos in their sample, only one was expected to produce a net wealth transfer in favor of the CoCo holders based on the issuer's capital position and stock price in December 2013. In the next section, we expand this analysis beyond the small sample size used by Berg and Kaserer (2015).[18] It should be noted that Berg and

[16] An example of this design is the Rabobank CoCo issued in 2011, for which 75% of the notional value would be written off at the trigger point, thereby producing a wealth transfer value of +0.75.

[17] Note that when temporary write down CoCos suffer trigger events, their par value is reduced. This means that if the call option were to be exercised on an instrument of this type after a trigger event but before a write up to full par value, the write-down suffered at the trigger event would effectively be made permanent. In our analysis, we do not consider the potential for a subsequent write-up that would allow CoCo investors to recover (potentially in full) par value because there is no obligation for the issuer to ever perform a write-up that would reverse the temporary write-down.

[18] We adopt their assumption that the market price of equity would follow changes in the capital ratio on a one-to-one basis in order to estimate the bank's market capitalization upon CoCo exercise. The capital ratio distance from issuance to the trigger level can be used to proxy for the expected fall in the stock price that would accompany the deterioration of regulatory capital until a conversion event is declared.

Kaserer (2015) use capital ratios as they stood in December 2013 for all ten equity converting CoCos in their sample, irrespective of issue date. While that choice provides a snapshot of the expected wealth transfer at that particular point in time, it is not relevant to the information and incentives available upon the bond's issuance. Therefore, we instead use the capital ratio, shares outstanding and market capitalization of each individual institution *at the point of CoCo issuance*, with the objective of investigating the issuance and market pricing decisions associated with various dilution and wealth transfer terms.

3.1 Wealth Transfer and Equity Dilution at Conversion

In order to implement the methodology outlined in the previous section, we estimate the market capitalization at the conversion point as:

$$\text{MarketCap}_{\text{at Conversion}} = \frac{\text{Trigger Ratio}}{\text{Capital Ratio}_{\text{issue date}}} \times \text{MarketCap}_{\text{issue date}} + \text{CoCo} \qquad (1)$$

with *CoCo* representing the par value of the CoCo bond. Upon conversion the CoCo holders will be issued a number of shares equal to *CoCo/Conversion Price*. The wealth transfer between CoCo holders and share holders will be:

$$\text{Wealth Transfer} = \text{CoCo} - \frac{\text{Shares to CoCo Holders}}{\text{Total Shares after Conversion}} \times \text{MarketCap}_{\text{at Conversion}} \qquad (2)$$

where positive values indicate a net wealth transfer from CoCo holders to equity holders and negative values indicate a wealth transfer from shareholders to CoCo bond holders. The value of *Wealth Transfer* is then normalized by the CoCo principal. Thus, since all principal write-down CoCos have no shares transferred upon conversion, the value of the normalized *Wealth Transfer* is +1.

Table 5 indicates that CoCo design has strayed far from optimal contracting specifica-

tions. Aggregate wealth transfers for the financial institutions individually responsible for the largest issue amounts of equity converting CoCos are shown in Table 5. In the aggregate, only two banks have issued CoCos with negative wealth transfers at the trigger point.[19] In all other cases, the projected wealth transfer is on average comparable to that of a mild partial permanent write-down CoCos, with Chinese CoCos particularly shareholder friendly. Further, only 6 institutions out of the top 15 CoCo issuers *ever* issued an instrument with negative wealth transfers from shareholders to CoCo bondholders upon conversion. Examining all equity-converting CoCos in our sample, we find that the median wealth transfer *in favor of shareholders* is equal to 22.17% of the CoCo's notional value (or 0.833 of the firm's stock market value as shown in Table 3).

[Table 5 about here.]

4 Wealth Transfer and CoCo Yields at Issuance

The market quickly accepted the introduction of CoCos with principal write down loss absorption mechanisms that undermined CoCo holders' rights. Rating agencies and industry experts note that new CoCo issues are routinely oversubscribed. This might suggest that CoCo investors are oblivious to the details of CoCo design, especially if trigger events are perceived to be unlikely tail events, similar to the "unconvertible CoCos" discussed in Glasserman and Perotti, 2017. Our comprehensive CoCo database allows us to perform an analysis of CoCo yield spreads at issuance to determine whether they reflect different loss absorption mechanisms.

[19] One of them is Banco Popular whose terms of conversion were overly optimistic compared to the trajectory of its share price before its failure. That is, Banco Popular issued CoCos in 2012 that actually specified a conversion price floor substantially below the share price at issue time, providing one of the largest discounts in the dataset. However, by the end of its first year after CoCo issuance, the bank's shares were trading at prices below the conversion price.

4.1 Pricing Wealth Transfer CoCo Features

In this section, we use CoCo design characteristics as explanatory variables in OLS regressions with *Yield Spread* (at the time of issuance) as the dependent variable as follows:

$$\begin{aligned} Yield\,Spread = \alpha &+ \beta_1 Amount + \beta_2 \ln(Assets) + \beta_3 \text{CET1 } Ratio \\ &+ \beta_4 Trigger\ Level + \beta_5 Tenor + \gamma_1 Perpetual + \gamma_2 Callable \\ &+ \gamma_3 Coupon\ Type + \gamma_4 Loss\ Absorption \\ &+ \gamma_5 Negative\ Transfer \\ &+ \beta_6 Wealth\ Transfer + \beta_7 Wealth\ Transfer \times Trigger\ Level \\ &+ \beta_8 Wealth Transfer \times \text{CET1 } Ratio \\ &+ \lambda CountryFE + \tau IssueYearFE \end{aligned} \tag{3}$$

Table 6 presents the results of estimation of the model in equation 3. Models 1 and 2 include an indicator variable for instruments projecting a negative (CoCo bondholder-friendly) wealth transfer. Models 3 through 5 include the wealth transfer as share of notional amount as well as its interaction with the trigger and common equity (CET1) levels at issuance. Model 6 includes all fixed effects and estimates cluster-robust standard errors, clustering at the country level. All models control for the different loss absorption mechanisms with the baseline set to equity converting CoCos.

The main independent variable of interest in models 1 and 2 is *Negative Transfer*. If the punitive transfers from shareholders are priced in CoCo yield spreads, we expect a negative coefficient on this variable. As shown in Table 6, the coefficient is negative, statistically significant at the 1% level and robust to controlling for country fixed effects. The coefficient is also economically significant, such that an equity converting CoCo that transfers wealth from stockholders to CoCo holders upon conversion has a yield spread that is 123 (model 1) or 171 (model 2) basis points lower than an equivalent equity converting CoCo without a

negative wealth transfer, as compared to a sample mean yield spread of 4.2%.

Columns 3 through 6 of Table 6 use the independent variable *Wealth Transfer* to measure the size of the wealth transfer. As expected, the coefficient estimate is positive and statistically significant at the 1% level in all models. That is, using the coefficient estimate from model 6, the additional yield spread for a stockholder-friendly CoCo with an estimated wealth transfer equal to 0.5 of its notional value is 189 basis points, relative to one with a -0.5 wealth transfer (assuming a 5.125% trigger). The results on both the *Negative Transfer* and *Wealth Transfer* variables suggest that the yield spreads reflect CoCo conversion terms upon issuance. That is, the more benign (adverse) the terms of conversion are to CoCo holders, the tighter (wider) its yield spread.

Further, the coefficient on *Trigger Level* is positive and significant (at the 5% level or better) in all specifications in Table 6, consistent with higher yield spreads when conversion is more likely to occur (i.e., higher trigger levels). However, the coefficient on the interaction term between *Trigger Level* and *Wealth Transfer* is negative and statistically significant at the 5% level or better. This is consistent with either lower spreads for high trigger countries (such as Switzerland) and/or a muted impact of trigger levels on yield spreads when the wealth transfer is considered. Thus, the market takes into account the anticipated action of bank managers and shareholders at conversion when setting yield spreads. That is, no matter the trigger level, banks will induce conversion for positive wealth transfer (shareholder-friendly) CoCos. In contrast, banks will avoid conversion for negative wealth transfer (CoCo-friendly) bonds. However, at higher trigger levels, bank managers have more resources to avoid conversion since the bank's capital position is less impaired. Thus, at higher trigger levels, they are less (more) likely to convert if the wealth transfer is negative (positive), thereby offsetting the impact of the wealth transfer effect. To illustrate this, Table 6 shows that the predicted difference in yield spread between two equity converting CoCos with 5.125% trigger level and wealth transfers respectively of +0.5 and -0.5 would be 249 basis points (model 4) or 189 basis points (model 6), but if issued at the 7% trigger level this

difference would be reduced to 116 basis points (model 4) or 38 basis points (model 6). Our results, therefore, suggest market sophistication in setting yield spreads to reflect optimal bank policies to exploit and offset the wealth transfer incentives implicit in CoCo terms.

[Table 6 about here.]

Table 6 also controls for the *Loss Absorption* indicator variables with the omitted baseline level equal to *Equity Conversion*, and a value of one for each of the following variables: *Permanent Write Down*, *Partial Permanent Write Down* and *Temporary Write Down*. All coefficients in models 3 through 6 are negative and significant at the 5% level or better. These coefficient estimates represent the difference in yield spreads for principal write-down CoCos as compared to equity converting CoCos having the same wealth transfer. Since no principal write-down CoCos can have negative wealth transfers, this coefficient measures the difference in yield spreads for all shareholder-friendly CoCos (i.e., with positive wealth transfers that can become negative if stock prices fall enough). Thus, the finding of a negative coefficient suggests that the market assesses a higher yield spread on positive wealth transfer equity converting CoCos as compared to principal write-down CoCos with equivalent wealth transfers.

Results on the coefficient estimates on the control variables are also shown in Table 6. Focusing on models 2 to model 6, the coefficient on *Perpetual* is as expected positive and statistically significant at the 5% level or better. Given the presence in the models of *Comparable Tenor* and *Callable*, the economic interpretation of the coefficient is that yield spreads of perpetual CoCos are predicted to be 77 to 97 basis points higher than CoCos with identical time to first call but finite maturity, indicating the risk associated with the call option. However, the coefficient on *Callable* is negative, but not individually significant in any of the regressions controlling for country fixed effects, indicating the market expectation that call options are always exercised at first opportunity. Further, *Comparable Tenor* is negative and consistently significant at the 5% level or better across all model specifications, indicating that the yield curve of CoCo instruments is less steep than the

matching sovereign debt curve. For example, model 4 (which controls for both country and year fixed effects) predicts the yield spread of a 10 year to first call CoCo to be 50 basis points tighter than an identically designed CoCo with a first call date 5 years after issuance. A possible interpretation is that since all perpetual instruments are callable, and the most common time to first call is 5 years, high values of *Comparable Tenor* include many long maturity but nevertheless *finite* maturity CoCos which carry lower yields (as indicated by the positive coefficient on the *Perpetual* variable).

In any model that includes country fixed-effects (model 2 to model 5), the coefficient on *ln(Total Assets)* is negative and statistically significant at the 1% level, suggesting that larger, more visible banks can issue CoCos at lower yield spreads. This result however does not survive clustering errors at the country level (model 6). Similarly, the coefficient on *Amount Issued* is negative and statistically significant at the 5% level in model 1 (with no fixed effects), but loses significance when controlling for country-specific factors. Finally, both *Fixed Rate* and *Floating Rate* are associated with tighter yields spreads relative to an identically designed fixed-to-floating rate instrument, but only the coefficient on *Floating Rate* remains significant (at the 1% level of confidence) when country and/or year fixed effects are included.

5 CoCo Issuance Incentives

To date, the academic literature has omitted critical incentives when analyzing CoCo issuance decisions. For example, Avdjiev et al. (2017) conduct duration and hazard analysis on time to first CoCo issuance for large financial institutions during the period 2009-2016, focusing on Tier 1 capital levels, and find that CoCo issuance is negatively related to Tier 1 capital levels. However, by focusing only on Tier 1 capital levels, Avdjiev et al. (2017) neglect the importance of other components of bank capital structure and regulatory requirements.[20]

[20]Further, by focusing only on first issuance, they neglect changing incentives as the market and regulatory requirements developed.

To remedy this, Goncharenko and Rauf (2016) and Goncharenko, Rauf, and Ongena (2017) focus on AT1 capital instruments in their study of CoCo issuance by publicly traded EU banks between 2010 and 2015. They find that banks with lower asset volatility are more likely to issue CoCos, whereas riskier banks find CoCo issuance exceedingly expensive and prefer to issue common equity. However, their studies do not incorporate how CoCo issuance impacts incentives across all alternative sources of bank capital. In particular, these previous studies ignore the role of CoCo issuance in freeing common equity from the AT1 capital requirement.

The closest paper to ours is Fatouh, Neamto, and Wijnbergen (2022), which examines 15 U.K. banks, and carefully estimates the wealth transfer incentives in CoCo issuance. They find that CoCos with perverse incentives (i.e., positive wealth transfer terms) induce increases in bank risk taking after CoCo issuance. Although they reject regulation as an ex ante driving force motivating CoCo issuance, their conclusions on this question are undermined by their study's reliance on banks from a single regulatory jurisdiction (the U.K.). In contrast, we examine CoCo issuance incentives across the world, and identify incentives for bank managers and shareholders to issue CoCos in order to circumvent MDA limitations on dividend and bonus payments.

[Figure 2 about here.]

To exemplify these mechanics, the left bar in Figure 2 shows a financial institution with a CET1 ratio of 10.5% that uses only equity to meet all its capital requirements. Basel III regulations stipulate a 7% minimum common equity requirement (shown in blue in Figure 2 as the sum of the 4.5% Pillar 1 minimum CET1 and the 2.5% capital conservation buffer). In addition, Basel III requires a minimum 1.5% AT1 plus 2.5% Tier 2 capital. The AT1 and Tier 2 components of the capital structure can be met by common equity. Alternatively, however, the AT1 requirement can be met by CoCos and the Tier 2 requirement can be met by CoCos and subordinated debt (properly structured). However, the bank in the left bar of Figure 2 uses only equity capital. For the purposes of computing the MDA threshold, regulators deduct all common equity used to meet non-Tier 1 capital requirements. Thus,

the 3.5% of equity held by the bank to be AT1 and Tier 2 requirements is deducted from the 10.5% total, for a common equity level of 7%. Since 7% is the Basel III minimum CET1 requirement, then this bank is exactly at the threshold. Any slight deterioration in the bank's capital position (say, via an increase in risk-weighted assets) would subject the bank to MDA limitations. Thus, the MDA threshold is a binding constraint on bank activities, and a threat to managerial bonuses and dividend payouts.

In contrast, the capital structure to the right in Figure 2 demonstrates how CoCos can be used to relax the bank's MDA binding constraint. In this example, the bank issues CoCos to cover both the AT1 and Tier 2 capital requirements, for a total CoCo issuance of 3.5% of risk-weighted assets. The bank has not issued any additional common stock (still at 10.5% of risk-weighted assets), but now 3.5% of the bank's equity is considered an excess capital position that moves the bank away from the MDA threshold.

[Figure 3 about here.]

Figure 3 provides a comparison of the MDA thresholds for Swedish lender Svenska Handelsbanken (SHB) in 2016 under the assumptions that only equity capital is used to meet all requirements (i.e., the right bar). In contrast, the left bar in Figure 3 shows the bank's capital position if it uses CoCos in every capital layer permitted by the Swedish regulatory framework. Complying with capital requirements using common equity only implies a 22.8% minimum capital requirement, whereas full use of CoCos in the AT1 layer reduces capital requirements by almost 7% to 15.8875%. Thus, CoCos allow banks to meet their regulatory capital requirements with lower capital ratios. This incentive will increase the closer a financial institution is to its MDA threshold.

5.1 Empirical Analysis: Regulatory Drivers of CoCo Issuance

To examine these issuance incentives for banks, we estimate logit models with the dependent variable $Issue_{i,t}$ taking a value of 1 if bank i is a CoCo issuer in year t and 0 otherwise. The

probability of CoCo issuance in a given year is:

$$P(Issue = 1|X) = \lambda(\beta_0 + \beta X) \tag{4}$$

with λ the logistic function, X a vector of explanatory variables accounting for the effects of different regulatory environments as well as fundamental bank characteristics and accounting values used as control variables. We also control for country and year fixed effects and cluster standard errors at the country level.

Table 7 presents the estimation results for the logit estimation of equation 4.[21] Columns 1 through 4 provide results for all CoCo issuance, whereas columns 5 and 6 consider CoCo issuance to satisfy AT1 requirements only. The importance of regulatory requirements across all bank capital levels is shown by the positive and significant (at the 5% level or better) of the regulatory variables (e.g., *Additional CoCo Layers, Has AT1 Shortfall, Distance to MDA Trigger* and the interaction term between *Has AT1 Shortfall* and *Distance to MDA Trigger*). Banks having an AT1 shortfall are more likely to issue, with odds of issuing in any given year estimated to be 2.7 times (Table 7, model 2) those of banks with no AT1 shortfall, and these results are robust to controlling for country fixed effects (Table 7, model 3). This effect is, as expected, stronger when considering AT1 instruments only (i.e., comparing coefficient estimates of Table 7, model 5 vs. model 2).[22]

For banks without an AT1 shortfall, the odds of issuing CoCos increase for increasing values of *Distance to MDA Trigger*, although this result does not survive full fixed effects (Table 7, models 4 and 6). However, the interaction term between *Has AT1 Shortfall* and *Distance to MDA Trigger* is negative and larger (in absolute value) than the coefficient on *Distance to MDA Trigger* alone. Thus, banks with AT1 shortfalls are significantly more likely to issue CoCos the closer they are to the MDA threshold. These effects are economically

[21] Untabulated probit estimation yields similar results and are available upon request.

[22] The coefficient on *Tier 1 Ratio* is never statistically significant, indicating that studies limited to examining the relationship between CoCo issuance and Tier 1 capital requirements omit important explanatory variables.

significant: for banks facing an AT1 shortfall, a reduction of 1% RWA in the difference between their CET1 ratio and their MDA threshold is associated with a 11.6% *increase* in the odds of being an issuer (table 7, model 3), while for banks with no AT1 shortfall an identical 1% RWA movement towards the MDA threshold is associated with a 17.3% *decrease* in the odds of issuing. This divergence is maintained for the odds of being an issuer of AT1 instruments specifically (table 7, model 5), such that a 1% reduction in the distance to MDA threshold increasing (decreasing) by 9.4% (17.1%) the odds of being an issuer for banks with (without) an AT1 shortfall. Thus, banks close to the MDA threshold are more likely to issue CoCos only if they can use them to meet AT1 capital requirements (i.e., they have an AT1 shortfall).

Moreover, we find that financial institutions that can adopt CoCo securities to meet requirements other than those in the Basel III minimum capital requirements are more likely to issue, with their odds being 3.85 times those of banks for which CoCos can only fill baseline requirements (Table 7, model 1). Further, the likelihood of CoCo issuance in any given year increases as the total regulatory space (measured in %RWA) that CoCos can occupy increases; i.e., a change equal to 1% RWA in total regulatory capital requirements that a bank can fulfill with CoCos is associated with a 27.1% increase in the odds of issuing (Table 7, model 3). Finally, CoCo issuance is less likely when there is no tax shield, such that the odds of issuing CoCos are reduced by 88% (using the coefficient estimate in column 2 of Table 7) when CoCo coupons are not tax deductible.

[Table 7 about here.]

Columns 5 and 5 of Table 7 focus on the issuance of CoCos that serve as AT1 capital. Examining column 6 which incorporates country and year fixed effects, we note that the coefficients on the regulatory variable coefficients become statistically insignificant, thereby indicating the importance of country-specific, time varying regulatory requirements. The single exception is the the coefficient on the interaction term between *Has AT1 Shortfall* and *Distance to MDA Trigger* which is consistently negative and statistically significant at the

5% level or better. Therefore, banks with AT1 shortfalls are more likely to issue CoCos to satisfy AT1 requirements if they are closer to the MDA threshold. To further examine this and distinguish between CoCos issued as AT1 versus Tier 2, we estimate a multinomial logit model as follows:

$$P(Issue = k|X) = \frac{\exp\left(\beta_0^{(k)} + \beta_1^{(k)} x_1 + ... + \beta_n^{(k)} x_n\right)}{\sum_i^{K-1} \exp\left(\beta_0^{(i)} + \beta_1^{(i)} x_1 + ... + \beta_n^{(i)} x_n\right)} \tag{5}$$

where $K = 3$ possible levels of the dependent variable: a baseline level for financial institutions not issuing any CoCos in year t (baseline); and levels $AT1$ and $T2$ when the bank issues CoCos to satisfy AT1 or Tier 2 capital requirements, respectively, in year t. X is a vector of explanatory variables accounting for the effects of different regulatory environments, as well as fundamental bank characteristics and accounting values used as control variables.

Table 8 presents the results of the model estimation of equation 5. Most noteworthy in this table are the results on the interaction term between the variables *Has AT1 Shortfall* and *Distance to MDA Trigger*. The coefficient estimates are negative and statistically significant (at the 1% level) for CoCos issued to satisfy AT1 requirements only. Thus, CoCos issued to satisfy Tier 2 capital requirements do not respond to these incentives. This is consistent with our finding that banks close to the MDA threshold with an AT1 shortfall can issue AT1 CoCos to free up equity capital and release the MDA constraint. A 1% RWA decrease in the distance to the MDA threshold is associated with a 13.8% increase (20.9% decrease) in the odds of issuing AT1 Cocos for financial institutions with (without) an AT1 shortfall (Table 8, model 2). Indeed, the odds of issuing AT1 CoCos increase by 3.5 times, while the odds of issuing Tier 2 CoCos are reduced by 87% (Table 8, model 1) for banks with AT1 shortfalls that are close to the MDA threshold.

Finally, the absence of a tax-shield benefit reduces the odds of CoCo issuance severely for Tier 2, but not for AT1 (Table 8, model 3). Since Tier 2 CoCos can be replaced with

tax deductible debt, non-deductible CoCos have less value as Tier 2 capital. However, since AT1 capital requirements can be met only with common equity or CoCos, tax shields are less important. Thus, our analysis suggests that CoCo issuance is targeted very precisely by banks who issue CoCos designed to limit supervisory discretion over dividend and bonus payouts and to maximize bank returns. These objectives may undermine macroprudential objectives that seek highly capitalized banks resistant to systemic risk.

[Table 8 about here.]

6 Conclusion

We contribute to the literature on Contingent Capital (CoCo) bonds by hand-gathering and analyzing a comprehensive sample comprised of all bank CoCos issued world-wide over the 2009 through 2019 period. To the best of our knowledge, this study is the first to gather as complete a sample of CoCo bonds, incorporating 720 distinct bond issues covering 286 distinct banks in 31 countries. Using this comprehensive sample, we document the shift over time in CoCo issuance away from the equity conversion loss absorption mechanism designed to induce a punitive wealth transfer from stockholders to CoCo bond holders upon exercise. Instead, the market is currently dominated by principal write-down CoCos that may actually benefit managers and shareholders if the bank's condition deteriorates enough to trigger CoCo conversion.

This shift undermines the macroprudential objectives that led regulatory authorities to mandate CoCo issuance to meet capital requirements. CoCos were initially designed to automatically recapitalize troubled banks without inducing the moral hazard and regulatory frictions associated with traditional bail outs. Correctly designed, CoCos have the potential to stabilize financial systems and reduce systemic risk by inducing bank managers and shareholders to take pre-emptive action in order to forestall punitive exercise.

However, we find that bank regulators have allowed CoCo issuers to fundamentally alter

the CoCo conversion mechanism. Increasingly, CoCos are issued without any punitive wealth transfer from stockholders to CoCo holders. These principal write-down CoCos may actually benefit bank shareholders at the trigger point, thereby providing perverse risk taking incentives that may exacerbate systemic risk. Even equity converting CoCos are being designed with low enough conversion prices so that they offer positive benefits for bank shareholders in the event of conversion.

In this paper, we show that financial markets are aware of the specific terms of conversion and their implications. We find that yield spreads at issuance reflect the projected wealth transfers that would occur as a consequence of a trigger event. Indeed, yield spreads even reflect bank incentives to circumvent CoCo terms, thereby undermining the integrity of trigger levels in driving CoCo conversion. Thus, the focus in the academic literature on trigger levels overstates their importance by failing to consider perverse managerial incentives driven by positive wealth transfers upon conversion.

We also find evidence that CoCos can be used by bank shareholders and managers to avoid discretionary interventions by regulators that limit distributions of dividends, bonuses and certain coupon payments. These Maximum Distributable Amounts (MDA) thresholds are discretionary supervisory mechanisms designed to limit bank risk and increase capital. We find that banks are more likely to issue CoCos if they have an AT1 shortfall and are close to the MDA threshold. Under these circumstances, CoCos can free up equity capital to be used as a buffer against the imposition of MDA restrictions on dividend and bonus payouts. Rather than acting as a tool of macroprudential governance, CoCos issued under these circumstances prevent bank supervisors from using discretionary powers to force troubled banks to recapitalize themselves via profit retention or equity issuance. This increases systemic risk exposure and increases the likelihood of moral hazard bailouts and destabilizing fire sales of assets, thereby undermining CoCos' potential macroprudential benefits.

These permissive policies are becoming more widespread as the European Central Bank adopts policies to further replace common equity with CoCos in capital requirements. In-

deed, regulators appear to be aware that these regulations have the effect of relaxing capital constraints on banks. This is why on March 12, 2020 the European Central Bank announced (European Central Bank, 2020) a series of measures to permit CoCos to fulfill capital requirements in lieu of common equity with the objective of providing capital relief to European financial institutions during the Covid crisis. As our analysis demonstrates, these policies relax capital constraints on bank risk taking and moral hazard behavior. Their increasing prominence should exacerbate systemic risk.

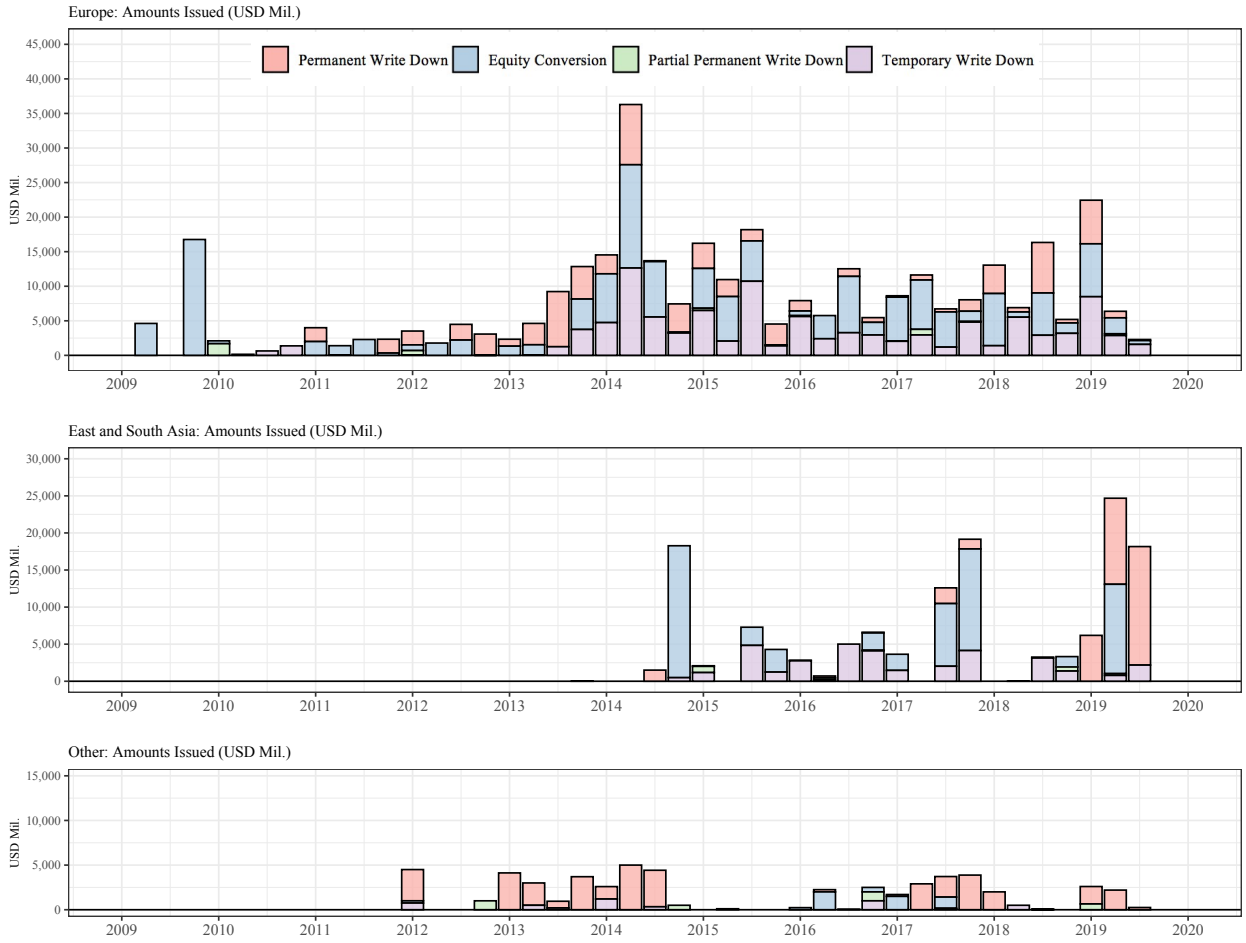

Figure 1: Contingent Convertible Capital Securities: Amounts Issued, by Geographic Area (USD Mil.)

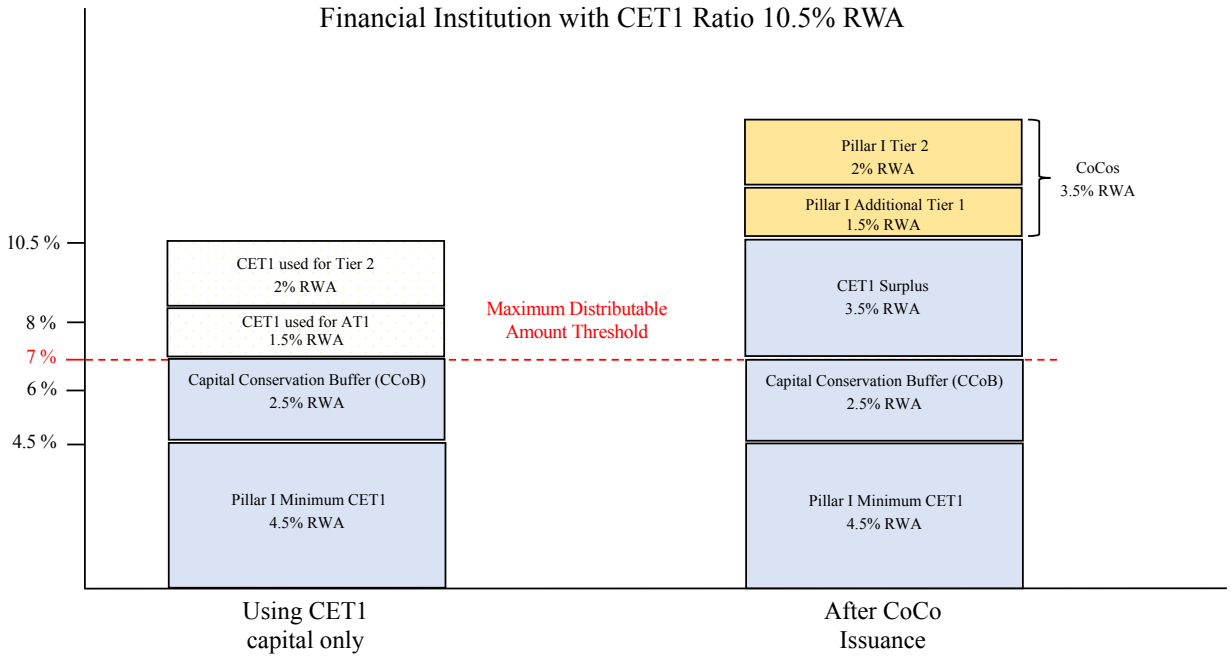

Figure 2: Capital Conservation Constraint, Effects of AT1 Shortfall

Light blue: capital layers filled with common equity capital. White: capital layers filled with common equity capital but not receiving regulatory credit in computing the MDA threshold. Yellow: capital layers filled with CoCos

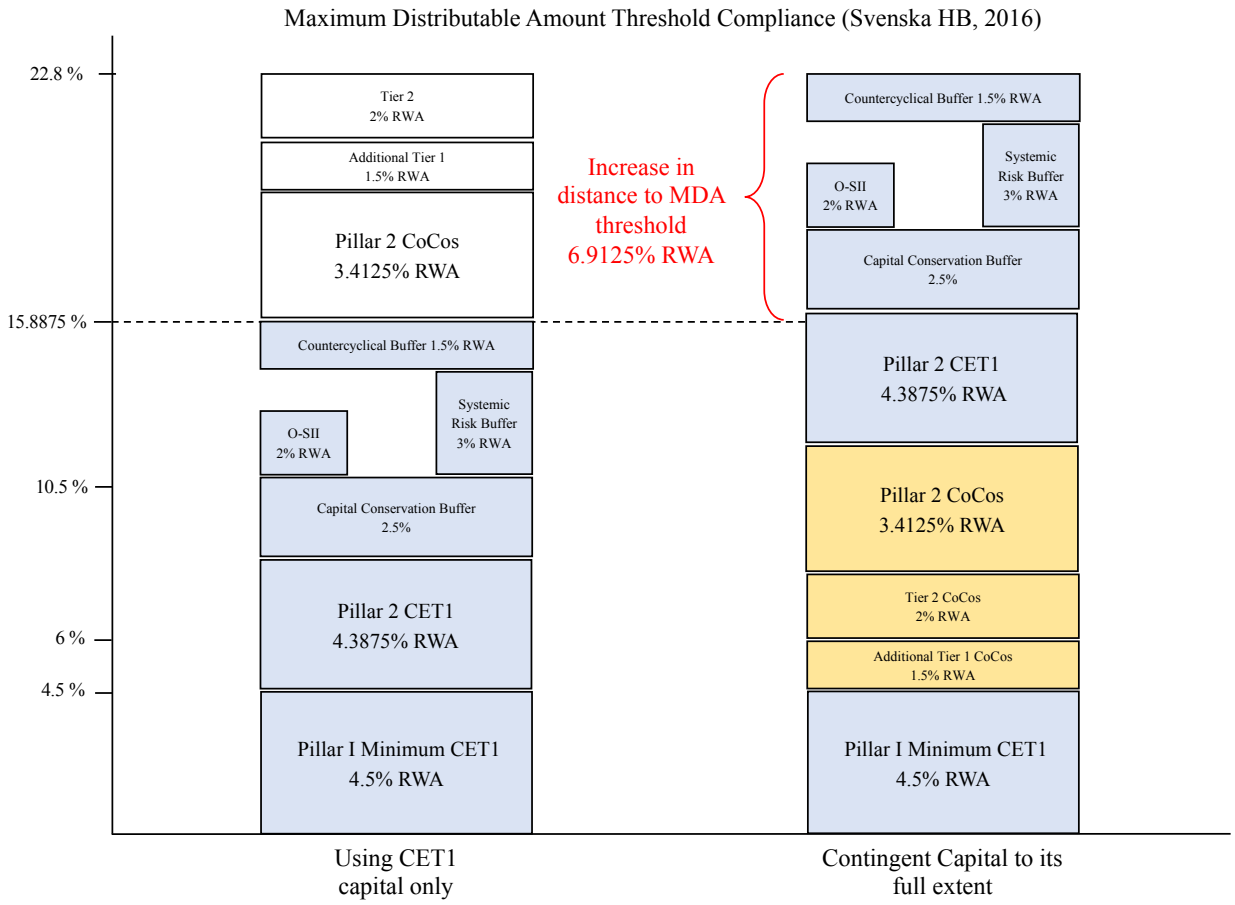

Figure 3: Real World Example of the Effects of the AT1 Shortfall

Light blue: capital layers filled with common equity capital. White: capital layers filled with common equity capital but not receiving regulatory credit towards meeting the MDA threshold. Yellow: capital layers filled with CoCos

Table 1: CoCo Issues 2009 - 2019, Descriptive Statistics (by Capital Tier)

	Additional Tier 1 (N=591)	Tier 2 (N=79)	Non-Basel III (N=50)	Total (N=720)
Amount Issued ($ Mil)				
Mean (SD)	769 (1139)	702 (738)	575 (736)	748 (1078)
Median	392	500	249	382
Range	1 - 11620	3 - 3000	4 - 4380	1 - 11620
Total Amount	454196	55471	28739	538406
Coupon Rate (%)				
Mean (SD)	6.22 (2.09)	6.45 (2.91)	9.00 (2.72)	6.44 (2.35)
Median	6.00	6.43	8.31	6.24
Range	0.98 - 13.88	1.00 - 13.50	2.70 - 16.12	0.98 - 16.12
Coupon Type				
Fixed	40 (6.8%)	32 (40.5%)	37 (74.0%)	109 (15.1%)
Fixed-To-Float	398 (67.3%)	44 (55.7%)	10 (20.0%)	452 (62.8%)
Floating	153 (25.9%)	3 (3.8%)	3 (6.0%)	159 (22.1%)
Perpetual				
Yes	590 (99.8%)	3 (3.8%)	13 (26.0%)	606 (84.2%)
No	1 (0.2%)	76 (96.2%)	37 (74.0%)	114 (15.8%)
Maturity (Years)				
Mean (SD)	45.00 (NA)	10.95 (4.21)	11.51 (3.63)	11.43 (5.11)
Range	45.00 - 45.00	3.00 - 30.00	2.00 - 23.00	2.00 - 45.00
Callable				
Yes	591 (100.0%)	53 (67.1%)	38 (76.0%)	682 (94.7%)
No	0 (0.0%)	26 (32.9%)	12 (24.0%)	38 (5.3%)
Years to First Call				
Mean (SD)	6 (2)	6 (2)	6 (2)	6 (2)
Median	5	5	6	5
Range	5 - 15	5 - 10	1 - 12	1 - 15
Loss Absorption Mechanism				
Equity Conversion	128 (21.7%)	11 (13.9%)	44 (88.0%)	183 (25.4%)
Permanent Write Down	128 (21.7%)	47 (59.5%)	0 (0.0%)	175 (24.3%)
Partial Permanent Write Down	21 (3.6%)	5 (6.3%)	1 (2.0%)	27 (3.8%)
Temporary Write Down	314 (53.1%)	16 (20.3%)	5 (10.0%)	335 (46.5%)
Trigger Parameter				
CET1 Ratio	591 (100.0%)	79 (100.0%)	45 (90.0%)	715 (99.3%)
Other	0 (0.0%)	0 (0.0%)	5 (10.0%)	5 (0.7%)
Trigger Level				
< 5	0 (0.0%)	37 (46.8%)	0 (0.0%)	37 (5.1%)
5	4 (0.7%)	25 (31.6%)	43 (86.0%)	72 (10.0%)
5.125	431 (72.9%)	2 (2.5%)	2 (4.0%)	435 (60.4%)
> 5.125, < 7	32 (5.4%)	0 (0.0%)	2 (4.0%)	34 (4.7%)
7	119 (20.1%)	12 (15.2%)	1 (2.0%)	132 (18.3%)
> 7	5 (0.8%)	3 (3.8%)	2 (4.0%)	10 (1.4%)
Issue Year (Row Percentages)				
2009	0 (0.0%)	0 (0.0%)	39 (100.0%)	39 (100.0%)
2010	0 (0.0%)	1 (20.0%)	4 (80.0%)	5 (100.0%)
2011	2 (25.0%)	3 (37.5%)	3 (37.5%)	8 (100.0%)
2012	8 (44.4%)	6 (33.3%)	4 (22.2%)	18 (100.0%)
2013	23 (50.0%)	23 (50.0%)	0 (0.0%)	46 (100.0%)
2014	78 (82.1%)	17 (17.9%)	0 (0.0%)	95 (100.0%)
2015	96 (97.0%)	3 (3.0%)	0 (0.0%)	99 (100.0%)
2016	82 (92.1%)	7 (7.9%)	0 (0.0%)	89 (100.0%)
2017	113 (93.4%)	8 (6.6%)	0 (0.0%)	121 (100.0%)
2018	95 (91.3%)	9 (8.7%)	0 (0.0%)	104 (100.0%)
2019	94 (97.9%)	2 (2.1%)	0 (0.0%)	96 (100.0%)
Currency				
USD	172 (29.1%)	47 (59.5%)	8 (16.0%)	227 (31.5%)
EUR	123 (20.8%)	10 (12.7%)	13 (26.0%)	146 (20.3%)
NOK	126 (21.3%)	2 (2.5%)	2 (4.0%)	130 (18.1%)
GBP	27 (4.6%)	1 (1.3%)	22 (44.0%)	50 (6.9%)
CHF	24 (4.1%)	4 (5.1%)	0 (0.0%)	28 (3.9%)
JPY	24 (4.1%)	0 (0.0%)	2 (4.0%)	26 (3.6%)
DKK	18 (3.0%)	1 (1.3%)	3 (6.0%)	22 (3.1%)
INR	22 (3.7%)	0 (0.0%)	0 (0.0%)	22 (3.1%)
MYR	20 (3.4%)	0 (0.0%)	0 (0.0%)	20 (2.8%)
CNY	10 (1.7%)	0 (0.0%)	0 (0.0%)	10 (1.4%)
Other	25 (4.2%)	14 (17.7%)	0 (0.0%)	39 (5.4%)
Country				
Norway	121 (20.5%)	2 (2.5%)	2 (4.0%)	125 (17.4%)
Great Britain	57 (9.6%)	3 (3.8%)	38 (76.0%)	98 (13.6%)
Switzerland	48 (8.1%)	12 (15.2%)	0 (0.0%)	60 (8.3%)
France	40 (6.8%)	2 (2.5%)	0 (0.0%)	42 (5.8%)
Spain	30 (5.1%)	5 (6.3%)	2 (4.0%)	37 (5.1%)
Denmark	28 (4.7%)	3 (3.8%)	3 (6.0%)	34 (4.7%)
Russia	11 (1.9%)	21 (26.6%)	0 (0.0%)	32 (4.4%)
China	27 (4.6%)	0 (0.0%)	0 (0.0%)	27 (3.8%)
Japan	24 (4.1%)	0 (0.0%)	0 (0.0%)	24 (3.3%)
Austria	23 (3.9%)	0 (0.0%)	0 (0.0%)	23 (3.2%)
India	23 (3.9%)	0 (0.0%)	0 (0.0%)	23 (3.2%)
Italy	20 (3.4%)	0 (0.0%)	2 (4.0%)	22 (3.1%)
Germany	20 (3.4%)	0 (0.0%)	0 (0.0%)	20 (2.8%)
Malaysia	20 (3.4%)	0 (0.0%)	0 (0.0%)	20 (2.8%)
Sweden	20 (3.4%)	0 (0.0%)	0 (0.0%)	20 (2.8%)
Brazil	15 (2.5%)	4 (5.1%)	0 (0.0%)	19 (2.6%)
Other	64 (10.8%)	27 (34.2%)	3 (6.0%)	94 (13.1%)

Table 2: CoCo Issues 2009 - 2019, Yearly Distribution by Loss-Absorption Mechanism

Yearly issuance of contingent convertible capital instruments by loss absorption mechanism. Percentages are calculated by year.

	Equity Conversion (N=183)	Permanent Write Down (N=175)	Partial Permanent Write Down (N=27)	Temporary Write Down (N=335)	Total (N=720)
Issue Year (Row %)					
2009	39 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	39 (100.0%)
2010	2 (40.0%)	0 (0.0%)	1 (20.0%)	2 (40.0%)	5 (100.0%)
2011	5 (62.5%)	2 (25.0%)	0 (0.0%)	1 (12.5%)	8 (100.0%)
2012	6 (33.3%)	7 (38.9%)	2 (11.1%)	3 (16.7%)	18 (100.0%)
2013	7 (15.2%)	28 (60.9%)	0 (0.0%)	11 (23.9%)	46 (100.0%)
2014	28 (29.5%)	25 (26.3%)	3 (3.2%)	39 (41.1%)	95 (100.0%)
2015	18 (18.2%)	17 (17.2%)	4 (4.0%)	60 (60.6%)	99 (100.0%)
2016	20 (22.5%)	11 (12.4%)	5 (5.6%)	53 (59.6%)	89 (100.0%)
2017	31 (25.6%)	36 (29.8%)	6 (5.0%)	48 (39.7%)	121 (100.0%)
2018	14 (13.5%)	20 (19.2%)	3 (2.9%)	67 (64.4%)	104 (100.0%)
2019	13 (13.5%)	29 (30.2%)	3 (3.1%)	51 (53.1%)	96 (100.0%)

Table 3: Wealth Transfer Effect on Yield Spread at Issuance, Summary Statistics

Amount Issued is the CoCo notional amount converted into U.S. dollars at the prevailing exchange rate on day of issuance, *ln(Total Assets)* is the natural logarithm of *Total Assets*. *Wealth Transfer* is the projected wealth transfer at the trigger point, expressed as a share of notional value and positive for transfers in favor of shareholders. *Callable* is an indicator variable signaling that an instrument features a call option for the issuer, *Perpetual* an indicator variable for instruments with no fixed maturity. *Years to Maturity* and *Years to First Call* measure the years from the day of issuance to maturity date (if present) and the first available call date, respectively. *Tenor* is equal to the time to the *Years to First Call* for *Callable* instruments and *Time to Maturity* otherwise. *Yield at Issue* is based on the CoCos' *Issue Price* and computed over a time period equal to the instrument's *Tenor*. *Matched Sovereign Yield* is the yield on the day of each CoCo issuance of the sovereign bond having the closest tenor. *Yield Spread to Sovereign* is *Yield at Issue - Matched Sovereign Yield*; *Loss Absorption Mechanism*, *Coupon Frequency*, *Coupon Type* are factor variables with levels as indicated below each variable. *Coupon Rate* is the instrument's coupon rate as indicated in the prospectus. *CET1 Ratio* for a CoCo issued at time t is the issuer's CET1 ratio as reported for year $t-1$, *Trigger Level* is the contractually defined *CET1 Ratio* at which the instrument loss absorption mechanism is engaged, *Distance to Trigger* is*CET1 Ratio - Trigger Level*.

Variable	Obs	Mean	Sd	Min	Median	Max
Issue Year	615	2016.12	1.99	2010	2016	2019
Amount Issued (USD mil.)	615	763.02	1,003.51	1.07	500.00	11,620.32
Total Assets (USD mil)	615	494,003	667,641	96	109,290	3,530,093
ln(Total Assets)	615	11.196	2.704	4.564	11.602	15.077
Issue Price	615	99.978	1.002	77	100	108.5
Coupon Rate	615	6.189	2.095	1	6	13.875
Yield at Issue	615	6.191	2.083	1	6	13.875
Matched Sovereign Yield	615	1.992	2.898	-0.944	0.994	17.22
Yield Spread to Sovereign	615	4.2	2.607	-4.1	4.434	10.686
Wealth Transfer (Share Notional)	615	0.833	0.394	-1.398	1	1
CET1 Ratio	615	13.056	3.485	5.5	12.61	41.49
Trigger Level	615	5.439	1.012	2	5.125	8.25
Distance to Trigger Level	615	7.617	3.555	0.25	7.065	36.365
Capital Tier = Tier 2	64	10.4%				
Years to Maturity	67	11.433	5.901	2	10	45
Years to First Call	593	6.11	1.921	1	5	15
Tenor	615	6.189	1.981	1	5	15
Perpetual = Yes	548	89.1%				
Callable = Yes	593	96.4%				
Loss Absorption Mechanism	615					
Equity Conversion	117	19%				
Permanent Write Down	161	26.2%				
Partial Permanent Write Down	26	4.2%				
Temporary Write Down	311	50.6%				
Coupon Frequency	615					
Annual	150	24.4%				
Semiannual	242	39.3%				
Quarterly	223	36.3%				
Coupon Rate Type	615					
Fixed	67	10.9%				
Floating	145	23.6%				
Fixed-to-Float	403	65.5%				

Table 4: Determinants of Issuance Variables, Summary Statistics

Issues and *Issues AT1* for a bank i in year t if the bank issued CoCo securities and AT1 CoCo securities, respectively. *Additional CoCo Layers* = 1 if a bank could at time t use CoCos outside of the Basel III Pillar 1 capital layer, *%RWA CoCo Layers* is the total amount of capital requirements that can be met with CoCo capital, *Distance to MDA Trigger* the difference between the issuer's *CET1 Ratio* at time t and the Capital Conservation Constraint or Maximum Distributable Amount threshold in year $t+1$; *AT1 Shortfall* is the size at time t of the financial institution's AT1 shortfall, *Has AT1 Shortfall* = 1 if *AT1 Shortfall* > 0; *No Tax Shield* = 1 if its regulatory jurisdiction did not grant debt tax treatment to CoCos. *Size* is the natural logarithm of Total Assets as reported end of year $t-1$, *G-SIB* = 1 if bank i at time t had been designated by the FSB as a G-SIB in year $t-1$. All control accounting values variables are observed as reported at the end of year $t-1$; all asset composition variables are defined as share of Total Assets, *AFS* are financial assets accounted for as Available for Sale, *HTM* financial assets accounted for as Held to Maturity. *Impaired Loans* and *Loan Loss Reserves* are, respectively, the share of gross loans reported at year end $t-1$ as impaired and the ratio between the provision for loan losses and gross loans. *Deposits* and *Wholesale Funding* are the share of total funding at end of year $t-1$ originating from customers deposits and wholesale sources, respectively.

Variable	Obs	Mean	Sd	Min	Median	Max
Year	1406	2014.26	3.082	2009	2014	2019
Issues	1406	0.1572	0.364	0	0	1
Issues AT1	1406	0.1422	0.349	0	0	1
Regulatory Environment						
Additional CoCo Layers	1406	0.111	0.315	0	0	1
%RWA CoCo Layers	1406	2.468	2.102	0	3.5	18.6
Distance to MDA Threshold	1406	3.252	3.959	-4.7	2.1	27.5
AT1 Shortfall	1406	0.287	1.051	-8.5	0	8.425
Has AT1 Shortfall	1406	0.418	0.493	0	0	1
No Tax Shield	1406	0.19	0.393	0	0	1
Control Variables						
Total Assets (USD mil.)	1406	500,937	577,011	1,171	273,457	3,530,092
Size	1406	12.465	1.267	7.066	12.519	15.077
G-SIB	1406	0.237	0.425	0	0	1
Tier 1 Ratio	1406	12.906	4.249	4.3	12.3	45.3
Net Interest Margin	1406	2.059	1.425	-0.13	1.705	10.5
Asset Composition						
Loans / Total Assets	1406	0.525	0.173	0.018	0.534	0.923
Derivatives / Total Assets	1406	0.046	0.069	0	0.023	0.917
Trading / Total Assets	1406	0.059	0.065	0	0.035	0.43
AFS / Total Assets	1406	0.085	0.075	0	0.072	0.571
HTM / Total Assets	1406	0.039	0.058	-0.004	0.013	0.37
Cash / Total Assets	1406	0.057	0.052	0	0.043	0.283
Loan Impairment (% Gross Loans)						
Impaired Loans	1406	4.026	5.646	0	2.02	49.75
Loan Loss Reserves	1406	2.683	3.086	0	1.88	26.32
Source of Funding (% Total Funding)						
Deposits	1406	62.383	19.036	1.5	64.66	99.18
Wholesale Funding	1406	35.846	18.519	0.82	33.755	99.63

Table 5: Aggregate Wealth Transfer for Largest Issuers of Equity Converting CoCos, 2009-2019

	Total Amount	Issue Period		Wealth Transfer Percent of Notional				Wealth Transfer Percent of MarketCap				Percent to CoCos		
Issuer	(USD Mil.)	First	Last	Mean	Median	Min	Max	Mean	Median	Min	Max	Mean	Min	Max
Lloyds Banking Group PLC	25,133	Dec 2009	Jun 2019	33.8	21.0	18.2	55.9	2.3	0.8	0.4	13.1	3.7	0.7	18.1
HSBC Holdings PLC	22,415	Sep 2014	Sep 2018	-23.2	-25.6	-39.2	3.8	-0.4	-0.4	-0.9	0.1	2.2	0.8	4.1
Barclays PLC	19,203	Nov 2013	Jun 2019	10.4	5.7	-22.2	48.4	1.2	0.5	-0.7	4.4	3.9	2.5	6.3
Industrial & Commercial Bank of China	11,257	Dec 2014	Dec 2014	51.8	52.8	49.5	53.0	1.2	1.3	0.5	1.9	1.1	0.5	1.7
Banco Santander SA	10,580	Mar 2014	Feb 2019	30.2	31.1	23.4	35.5	1.0	1.1	0.4	1.4	2.2	1.4	2.9
Standard Chartered PLC	10,553	Apr 2015	Jul 2019	30.8	37.1	11.7	43.4	2.4	2.2	0.9	4.4	5.3	2.0	7.3
Banco Bilbao Vizcaya Argentaria SA	10,248	May 2013	Mar 2019	8.9	7.9	-22.6	37.5	0.5	0.2	-1.2	2.3	4.3	2.0	6.5
Postal Savings Bank of China Co Ltd	7,250	Sep 2017	Sep 2017	38.4	38.4	38.4	38.4	7.9	7.9	7.9	7.9	12.6	12.6	12.6
Bank of China Ltd	6,528	Oct 2014	Oct 2014	46.3	46.3	46.3	46.3	6.0	6.0	6.0	6.0	7.0	7.0	7.0
Credit Suisse Group	6,045	Feb 2011	Jan 2017	16.7	26.6	-21.7	35.2	1.4	1.6	-1.3	3.9	5.5	2.9	7.1
Royal Bank of Scotland Group PLC	5,800	Aug 2015	Aug 2016	19.6	6.9	6.6	45.4	2.8	0.6	0.3	7.5	7.2	4.7	9.0
ING Groep NV	4,500	Apr 2015	Feb 2019	8.0	6.7	-11.7	30.2	0.4	0.3	-0.4	1.5	3.1	2.8	3.5
Banco Popular Espanol SA	3,312	Apr 2012	Feb 2015	-29.4	-17.4	-87.0	4.3	-8.1	-2.2	-28.7	0.5	25.8	12.2	61.7
China Construction Bank Corp	3,050	Dec 2015	Dec 2015	65.3	65.3	65.3	65.3	2.9	2.9	2.9	2.9	1.6	1.6	1.6
CaixaBank SA	2,665	Jun 2017	Mar 2018	34.9	34.9	32.5	37.2	3.5	3.5	3.3	3.6	6.6	5.6	7.5

Table 6: Analysis of CoCo Yield Spreads at Issuance

The dependent variable is the *Yield Spread to Sovereign* is the CoCo's yield at issuance minus the yield on sovereign bond of matching tenor; *Amount Issued* is the CoCo notional amount converted into U.S. dollars at the prevailing exchange rate on day of issuance, *ln(Total Assets)* at time t is the natural logarithm of total assets as reported at the end of year $t-1$. *Trigger Level* is the contractually defined CET1 ratio at which the instrument loss absorption mechanism is engaged, *CET1 Ratio* for a CoCo issued at time t is the issuer's CET1 ratio as reported at the end of year $t-1$, *Comparable Tenor* is equal to the years to first call for callable instruments or years to maturity otherwise, and it is the tenor used to find matching sovereign debt yields. *Perpetual* an indicator variable for instruments with no fixed maturity, *Callable* is an indicator variable signaling that an instrument features a call option for the issuer. *Fixed Rate* and *Floating Rate* are levels of a factor variable with indicating the type of coupon rate, with baseline level being the most common type *Fixed-to-Float*. The *Loss Absorption Mechanism* factor variable has baseline level equal to *Equity Conversion*, so the reported coefficients are for different forms of principal write down mechanisms. *Wealth Transfer* is the projected wealth transfer at the trigger point, expressed as a share of notional value and positive for transfers in favor of shareholders; the indicator variable *Negative Transfer* = 1 if *Wealth Transfer* < 0, and 0 otherwise. Fixed effects and standard error clustering indicated in the footer.

		Yield Spread to Sovereign of Matched Tenor					
	Exp.	(1)	(2)	(3)	(4)	(5)	(6)
Wealth Transfers							
Negative Transfer	−	−1.23***	−1.71***				
		(0.39)	(0.35)				
Wealth Transfer (% Notional)	+			5.09***	6.13***	4.94***	6.05***
				(1.64)	(1.50)	(1.69)	(1.40)
Wealth Transfer x Trigger Level	+/−			−0.58**	−0.71***	−0.78***	−0.81***
				(0.27)	(0.23)	(0.30)	(0.23)
Wealth Transfer x CET1 Ratio	+/−					0.14	0.08
						(0.09)	(0.11)
Loss Absorption							
Permanent Write Down	+	−1.75***	−0.74***	−1.51***	−1.66***	−1.76***	−1.80***
		(0.32)	(0.25)	(0.50)	(0.39)	(0.48)	(0.43)
Partial Permanent Write Down	+	−2.75***	−1.96***	−2.74***	−2.90***	−2.98***	−3.03***
		(0.47)	(0.41)	(0.57)	(0.49)	(0.55)	(0.86)
Temporary Write Down	+/−	0.11	−0.52*	−1.32**	−1.43***	−1.61***	−1.59***
		(0.27)	(0.31)	(0.54)	(0.43)	(0.52)	(0.56)
Amount Issued	+/−	−0.02**	0.02*	0.01	0.02*	0.02	0.02
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
ln(Total Assets)	−	−0.05	−0.12***	−0.13***	−0.15***	−0.13***	−0.15
		(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.09)
CET1 Ratio	−	0.04	−0.06**	−0.07***	−0.06***	−0.19**	−0.13
		(0.03)	(0.02)	(0.02)	(0.02)	(0.09)	(0.10)
Trigger Level	+	1.04***	0.24**	0.74***	0.86***	0.92***	0.96***
		(0.11)	(0.12)	(0.26)	(0.22)	(0.27)	(0.25)
Comparable Tenor	+/−	−0.13**	−0.12***	−0.12***	−0.10***	−0.12***	−0.10**
		(0.06)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)
Perpetual	+	0.54	0.77**	0.91***	0.97***	0.92***	0.97**
		(0.43)	(0.31)	(0.32)	(0.28)	(0.32)	(0.46)
Callable	−	−2.50***	−0.93	−0.82	−0.36	−0.81	−0.35
		(0.84)	(0.65)	(0.70)	(0.68)	(0.70)	(0.83)
Fixed Rate	−	−1.78***	−0.42	−0.33	−0.39	−0.28	−0.36
		(0.30)	(0.44)	(0.45)	(0.48)	(0.45)	(0.88)
Floating Rate	−	−1.02***	−1.11***	−1.09***	−1.09***	−1.11***	−1.10***
		(0.27)	(0.25)	(0.24)	(0.25)	(0.25)	(0.31)
Country Fixed Effects		No	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects		No	No	No	Yes	No	Yes
Clustered SE							Country
R^2		0.34	0.76	0.76	0.79	0.76	0.79
Adj. R^2		0.32	0.75	0.74	0.77	0.74	0.77
Num. obs.		615	615	615	615	615	615

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 7: Logit Analysis of the Determinants of CoCo Issuance

Logit models for determinants of CoCo issuance. The dependent variables *Issues* and *Issues AT1* for a bank i in year t if the bank issued CoCo securities and AT1 CoCo securities, respectively. *Additional CoCo Layers* = 1 if a bank could at time t use CoCos outside of the Basel III Pillar 1 capital layer, *%RWA CoCo Layers* is the total amount of capital requirements that can be met with CoCo capital, *Distance to MDA Trigger* the difference between the issuer's *CET1 Ratio* at time t and the Capital Conservation Constraint or Maximum Distributable Amount threshold in year $t+1$; *AT1 Shortfall* is the size at time t of the financial institution's AT1 shortfall, *Has AT1 Shortfall* = 1 if *AT1 Shortfall* > 0; *No Tax Shield* = 1 if its regulatory jurisdiction did not grant debt tax treatment to CoCos. *Size* is the natural logarithm of Total Assets as reported end of year $t-1$, *G-SIB* = 1 if bank i at time t had been designated by the FSB as a G-SIB in year $t-1$. All control accounting values variables are observed as reported at the end of year $t-1$; all asset composition variables are defined as share of Total Assets, *AFS* are financial assets accounted for as Available for Sale, *HTM* financial assets accounted for as Held to Maturity. *Impaired Loans* and *Loan Loss Reserves* are, respectively, the share of gross loans reported at year end $t-1$ as impaired and the ratio between the provision for loan losses and gross loans. *Deposits* and *Wholesale Funding* are the share of total funding at end of year $t-1$ originating from customers deposits and wholesale sources, respectively. Included fixed effects detailed in the footer.

	Issues				Issues AT1	
	(1)	(2)	(3)	(4)	(5)	(6)
Regulatory Variables						
Additional CoCo Layers	1.35***					
	(0.28)					
% RWA CoCo Layers		0.28***	0.24**	0.14	0.25***	0.08
		(0.09)	(0.11)	(0.11)	(0.09)	(0.11)
Distance to MDA Trigger	0.10***	0.16***	0.17***	0.05	0.16***	0.01
	(0.04)	(0.04)	(0.05)	(0.05)	(0.04)	(0.05)
Has AT1 Shortfall	1.03***	1.02***	1.52***	0.45	1.35***	0.67*
	(0.26)	(0.26)	(0.31)	(0.36)	(0.27)	(0.38)
Has AT1 Shortfall x Distance to MDA Trigger	−0.14***	−0.23***	−0.28***	−0.15**	−0.25***	−0.14**
	(0.04)	(0.05)	(0.06)	(0.06)	(0.05)	(0.06)
No Tax Shield	−2.01***	−2.20***	−0.55	−0.65	−2.00***	−0.74
	(0.50)	(0.50)	(0.69)	(0.76)	(0.51)	(0.78)
Size	0.29***	0.26**	0.49***	0.42***	0.32***	0.36***
	(0.11)	(0.10)	(0.12)	(0.12)	(0.11)	(0.13)
G-SIB	0.74***	0.85***	0.50*	0.61**	0.81***	0.66**
	(0.28)	(0.27)	(0.30)	(0.31)	(0.29)	(0.32)
Tier 1 Ratio	−0.02	0.03	0.03	0.03	0.04*	0.04
	(0.03)	(0.03)	(0.03)	(0.04)	(0.02)	(0.04)
Net Interest Margin	−0.08	−0.12	−0.07	0.05	−0.20**	0.03
	(0.08)	(0.08)	(0.16)	(0.17)	(0.10)	(0.20)
Assets Composition (Share of Total Assets)						
Loans	0.60	0.64	−1.21	−0.61	0.87	−0.48
	(0.91)	(0.90)	(1.14)	(1.15)	(0.97)	(1.24)
Derivatives	−0.45	−0.33	−0.99	−0.39	−1.11	−0.87
	(1.28)	(1.21)	(1.40)	(1.17)	(1.47)	(1.44)
Trading	4.60**	6.62***	4.00	5.17*	7.35***	4.01
	(2.07)	(1.96)	(2.61)	(2.74)	(2.07)	(2.85)
AFS	0.83	−0.36	0.94	1.61	0.87	2.10
	(1.53)	(1.52)	(1.94)	(2.02)	(1.58)	(2.07)
HTM	−2.98	−4.39**	−5.07*	−3.25	−3.09	−3.77
	(2.07)	(2.03)	(2.76)	(2.84)	(2.07)	(2.93)
Cash	5.39**	6.04***	5.33**	4.12	6.69***	4.65
	(2.11)	(2.06)	(2.58)	(2.80)	(2.15)	(2.93)
Loan Impairment (Share of Gross Loans)						
Impaired Loans	0.12***	0.11***	0.07	0.05	0.14***	0.06
	(0.04)	(0.04)	(0.05)	(0.05)	(0.04)	(0.06)
Loan Loss Reserves	0.10	0.05	−0.13	−0.16	0.02	−0.00
	(0.09)	(0.08)	(0.11)	(0.11)	(0.09)	(0.13)
Impaired Loans x Loan Loss Reserves	−0.01**	−0.01**	−0.00	−0.00	−0.01**	−0.01
	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
Funding (Share of Total Funding)						
Deposits	0.05*	0.07**	0.03	0.01	0.07**	−0.00
	(0.03)	(0.03)	(0.04)	(0.04)	(0.03)	(0.04)
Wholesale Funding	0.06**	0.08***	0.04	0.02	0.08***	0.01
	(0.03)	(0.03)	(0.04)	(0.04)	(0.03)	(0.04)
N	1406	1406	1406	1406	1406	1406
Country Fixed Effects	No	No	Yes	Yes	No	Yes
Year Fixed Effects	No	No	No	Yes	No	Yes
Nagelkerke Pseudo-R2	0.29	0.27	0.37	0.42	0.29	0.43
AIC	996.14	1011.80	963.99	934.62	936.34	864.93
BIC	1106.28	1121.94	1200.01	1223.10	1046.48	1153.41
Log Likelihood	−477.07	−484.90	−437.00	−412.31	−447.17	−377.47

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 8: Multinomial Logit Analysis of CoCo AT1 and Tier 2 Issuance

Multinomial logit for determinants of issuance of CoCos of different capital tier. The dependent variable has 3 levels, with baseline level *Nothing* if bank i in year t did not issue any CoCo instrument, and levels AT1 and T2 if the bank issued Additional Tier 1 and Tier 2 CoCo securities, respectively. *%RWA CoCo Layers* is the total amount of capital requirements that can be met with CoCo capital, *Distance to MDA Trigger* the difference between the issuer's *CET1 Ratio* at time t and the Capital Conservation Constraint or Maximum Distributable Amount threshold in year $t+1$; *AT1 Shortfall* is the size at time t of the financial institution's AT1 shortfall, *Has AT1 Shortfall* $= 1$ if *AT1 Shortfall* > 0; *No Tax Shield* $= 1$ if its regulatory jurisdiction did not grant debt tax treatment to CoCos. *Size* is the natural logarithm of Total Assets as reported end of year $t-1$, *G-SIB* $= 1$ if bank i at time t had been designated by the FSB as a G-SIB in year $t-1$. All control accounting values variables are observed as reported at the end of year $t-1$. Included fixed effects detailed in the footer.

	Multinomial Logit AT1 vs. T2 vs. Nothing		
	(1)	(2)	(3)
AT1: Has AT1 Shortfall x Distance to MDA Trigger	$-0.27\ (0.05)^{***}$	$-0.32\ (0.06)^{***}$	$-0.16\ (0.06)^{***}$
T2: Has AT1 Shortfall x Distance to MDA Trigger	$-0.05\ (0.15)$	$0.02\ (0.18)$	$-0.09\ (0.24)$
AT1: Has AT1 Shortfall	$1.27\ (0.26)^{***}$	$1.92\ (0.33)^{***}$	$0.68\ (0.37)^{*}$
T2: Has AT1 Shortfall	$-1.98\ (0.93)^{**}$	$-1.99\ (1.03)^{*}$	$-0.53\ (1.56)$
AT1: Distance to MDA Trigger	$0.18\ (0.04)^{***}$	$0.19\ (0.05)^{***}$	$0.04\ (0.05)$
T2: Distance to MDA Trigger	$0.21\ (0.12)^{*}$	$0.28\ (0.15)^{*}$	$0.15\ (0.17)$
AT1: No Tax Shield	$-2.13\ (0.50)^{***}$	$-0.48\ (0.70)$	$-0.72\ (0.78)$
T2: No Tax Shield	$-9.69\ (0.00)^{***}$	$-7.36\ (0.00)^{***}$	$-4.27\ (0.02)^{***}$
AT1: % RWA CoCo Layers	$0.32\ (0.09)^{***}$	$0.24\ (0.11)^{**}$	$0.12\ (0.12)$
T2: % RWA CoCo Layers	$0.55\ (0.23)^{**}$	$0.27\ (0.24)$	$0.37\ (0.29)$
AT1			
AT1: Size	$0.31\ (0.11)^{***}$	$0.41\ (0.13)^{***}$	$0.33\ (0.13)^{***}$
AT1: G-SIB	$0.96\ (0.27)^{***}$	$0.65\ (0.30)^{**}$	$0.79\ (0.32)^{**}$
AT1: Tier 1 Ratio	$0.03\ (0.02)^{*}$	$0.02\ (0.02)$	$0.03\ (0.03)$
AT1: Net Interest Margin	$-0.12\ (0.08)$	$-0.02\ (0.17)$	$0.11\ (0.19)$
AT1: Loans / Total Assets	$0.51\ (0.83)$	$-1.38\ (1.06)$	$-1.08\ (1.09)$
AT1: Securities / Total Assets	$0.39\ (1.19)$	$-0.19\ (1.52)$	$0.52\ (1.55)$
AT1: Cash / Total Assets	$4.50\ (1.94)^{**}$	$4.76\ (2.52)^{*}$	$2.75\ (2.83)$
AT1: Impaired Loans - Loan Loss Reserves	$0.05\ (0.03)^{*}$	$0.02\ (0.04)$	$-0.01\ (0.05)$
AT1: Deposits / Total Funding	$0.02\ (0.03)$	$0.01\ (0.04)$	$-0.01\ (0.04)$
AT1: Wholesale Funding / Total Funding	$0.04\ (0.03)$	$0.02\ (0.04)$	$-0.00\ (0.04)$
T2			
T2: Size	$-0.10\ (0.23)$	$0.52\ (0.32)$	$0.53\ (0.36)$
T2: G-SIB	$1.45\ (0.83)^{*}$	$0.07\ (1.54)$	$0.03\ (1.69)$
T2: Tier 1 Ratio	$-0.09\ (0.08)$	$-0.30\ (0.15)^{**}$	$-0.21\ (0.17)$
T2: Net Interest Margin	$0.27\ (0.13)^{**}$	$0.29\ (0.31)$	$-0.16\ (0.40)$
T2: Loans / Total Assets	$-2.71\ (2.00)$	$-1.50\ (3.35)$	$-1.00\ (4.17)$
T2: Securities / Total Assets	$-14.00\ (4.39)^{***}$	$-2.72\ (5.60)$	$-2.06\ (6.87)$
T2: Cash / Total Assets	$-3.54\ (5.89)$	$-0.03\ (9.13)$	$3.32\ (0.93)^{***}$
T2: Impaired Loans - Loan Loss Reserves	$-0.12\ (0.09)$	$-0.02\ (0.10)$	$-0.06\ (0.13)$
T2: Deposits / Total Funding	$-0.03\ (0.03)$	$0.03\ (0.06)$	$0.01\ (0.07)$
T2: Wholesale Funding / Total Funding	$-0.00\ (0.03)$	$0.08\ (0.06)$	$0.06\ (0.07)$
Num. Obs.	1406	1406	1406
Fixed Effects		Country	Country and Year
McFadden Pseudo-R2	0.19	0.31	0.38
Nagelkerke Pseudo-R2	0.27	0.41	0.49
AIC	1159.01	1094.44	1041.70
BIC	1326.85	1514.04	1566.20
Log Likelihood	-547.51	-467.22	-420.85

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

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A Appendix

Table A1: Variable Definitions and Sources of Data

Variable Name	**Variable Description**	**Sources of Data**
Amount Issued (USD mil.)	The notional amount of the CoCo converted into U.S. dollars if necessary at the prevailing currency exchange rate on the day of issuance.	CoCo prospectuses
Issue Year	Year of issuance	Bloomberg; CoCo prospectuses
Coupon Rate	The contractually specified coupon rate of the CoCo instrument.	Bloomberg; CoCo prospectuses
Coupon Type	*Fixed* if the coupon rate is to remain constant for the life of the instrument; *Floating* if the coupon rate is variable; *Fixed-to-Float* if the coupon rate is fixed during the initial period from issuance to the first scheduled call date, and reset to a variable rate thereafter.	CoCo prospectuses
Perpetual	Indicator Variable for instruments with no finite maturity.	CoCo prospectuses
Callable	Indicator Variable for instruments featuring a call option for the issuer.	Bloomberg; CoCo prospectuses
Maturity (Years)	Years from issue date to maturity date.	Bloomberg; CoCo prospectuses
Years to First Call	Years from issue date to the first available call option date.	Bloomberg; CoCo prospectuses
Loss Absorption Mechanism	Contractually specified method of loss absorption at the trigger point.	Bloomberg; CoCo prospectuses
Trigger Parameter	The measure used to define the trigger level at which the loss absorption mechanism is engaged.	CoCo prospectuses
Trigger Level	The capital level at which the loss absorption mechanism is engaged.	Bloomberg; CoCo prospectuses
Total Assets	Total Assets of the issuing institution, at end of year $t-1$ for CoCos issued in year t.	BankFocus; Issuer's financial statements
CET1 Ratio	Common Equity Tier 1 ratio of the issuing institution, as reported at end of year $t-1$ for CoCos issued in year t.	BankFocus; Issuer's financial statements
Issue Price	The instrument's opening price on issue date	Bloomberg
Tenor	The instrument's Years to First Call if callable, or Years to Maturity if non-callable	Computed
Yield at Issue	The instrument's yield computed on the basis of the Issue Price, Coupon Frequency and Tenor; for floating rate instruments the coupon rate is assumed constant at the rate on issue date	Computed

Table A1: Variable Definitions and Sources of Data (continues)

Variable Name	**Variable Description**	**Sources of Data**
Matched Sovereign Yield	The yield on a tenor-matched sovereign bond issued in the institution's country of domicile	Nasdaq Quandl; National central banks
Yield Spread to Sovereign	*Yield at Issue − Matched Sovereign Yield*	Computed
Wealth Transfer (Share Notional)	The projected wealth transfer at the trigger point, as a share of the instrument's notional value. It assumes the share price will follow one-to-one the fall in CET1 ratio to reach the trigger point, no change in the currency exchange rate between the CoCo currency of denomination and stock currency of denomination, and equity conversion price equal to the contractually specified fixed or floor conversion price.	Computed
Distance to Trigger Level	*CET1 Ratio − Trigger Level*	Computed
Coupon Frequency	Frequency of coupon payments: Annual, Semiannual or Quarterly	CoCo prospectuses
Coupon Frequency	Frequency of coupon payments: Annual, Semiannual or Quarterly	CoCo prospectuses
$\text{Issues}_{k,t}$	Indicator variable, set to 1 if bank k issues CoCos in year t and 0 otherwise.	Computed
$\text{Issues AT1}_{k,t}$	Indicator variable, set to 1 if bank k issues AT1 CoCos in year t and 0 otherwise.	Computed
$\text{Additional CoCo Layers}_{k,t}$	Indicator variable, set to 1 if bank k could in year t issue CoCos for capital layers other than baseline Basel III Pillar 1 capital requirements, and 0 otherwise.	National regulatory and supervisory documents
$\%\text{RWA CoCo Layers}_{k,t}$	The total %RWA of capital requirements that could be covered with CoCo capital instruments by bank k in year t.	Computed
$\text{Distance to MDA Threshold}_{k,t}$	For bank k in year t, the difference between the CCC or MDA threshold projected for year $t+1$ and the CET1 ratio reported at end of year $t-1$.	Computed
$\text{AT1 Shortfall}_{k,t}$	For bank k in year t, the difference between the maximum amount of %RWA regulatory capital layers that the bank can cover in year $t+1$ with CoCo securities and the outstanding AT1 capital securities, computed as the difference between Tier 1 ratio and CET1 ratio as reported at the end of year $t-1$.	Computed
$\text{Has AT1 Shortfall}_{k,t}$	Indicator variable, set to 1 if *AT1 Shortfall > 0* for bank k in year t, and 0 otherwise.	Computed

Table A1: Variable Definitions and Sources of Data (continues)

Variable Name	**Variable Description**	**Sources of Data**
No Tax Shield$_{k,t}$	Indicator variable, set to 1 if in the jurisdiction where bank k is domiciled the national tax authorities did not grant in year t debt tax treatment to coupon payments from CoCo securities, and 0 otherwise.	National regulatory and supervisory documents
Size	The natural logarithm of the issuer's *Total Assets* as reported for end of year $t-1$.	Computed; Total Assets from BankFocus
G-SIB	Indicator variable that assumes a value of 1 if bank k is included in year t in the FSB list of global systemically important financial institutions (announced in last quarter of year $t-1$).	Financial Stability Board
Net Interest Margin	Net interest margin as reported at end of year $t-1$	BankFocus; Banks' financial statements
Loans	Total Loans as a share of *Total Assets*, values reported at year end $t-1$	BankFocus; Banks' financial statements
Derivatives	Derivatives as a share of *Total Assets*, values reported at year end $t-1$	BankFocus; Banks' financial statements
Trading	Financial assets accounted for as trading assets as a share of *Total Assets*, values reported at year end $t-1$	BankFocus; Banks' financial statements
AFS	Financial assets accounted for as Available-for-Sale as a share of *Total Assets*, values reported at year end $t-1$	BankFocus; Banks' financial statements
HTM	Financial assets accounted for as Hold-to-Maturity as a share of *Total Assets*, values reported at year end $t-1$	BankFocus; Banks' financial statements
Cash	Cash and cash-like assets as a share of *Total Assets*, values reported at year end $t-1$	BankFocus; Banks' financial statements
Securities	All financial assets (regardless of accounting classification) as a share of *Total Assets*, values reported at year end $t-1$	BankFocus; Banks' financial statements
Impaired Loans	Impaired Loans / Gross Loans, values reported at year end $t-1$	BankFocus; Banks' financial statements
Loan Loss Reserves	Loan Loss Reserves / Gross Loans, values reported at year end $t-1$	BankFocus; Banks' financial statements
Deposits	Deposits / Total Funding, values reported at year end $t-1$	BankFocus; Banks' financial statements
Wholesale Funding	Wholesale Funding / Total Funding, values reported at year end $t-1$	BankFocus; Banks' financial statements