CoCo-Induced Collapse and Bank Equity Returns *

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Abstract

Using equity returns on all banks (across 28 countries) that ever issued contingent convertible capital securities (CoCos), we identify a "CoCo-induced collapse option," that apparently was exercised during the March 2023 failure of Credit Suisse. Reflecting this option's value, abnormal announcement returns for non-dilutive CoCos with positive wealth transfers to shareholders upon CoCo trigger are positive if banks have large amounts of CoCos. Systemic risk-reducing CoCos without this option have significantly negative announcement returns. Banks issuing dilutive CoCos overperform (exceeding 20 basis points monthly) during periods of high aggregate uncertainty. Dilutive CoCos are more prevalent in common and French-civil law countries.

JEL classification: G14, G21, G32

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1 Introduction

Contingent convertible capital instruments (hereafter, CoCos) were introduced to mitigate systemic risk by discouraging risk-shifting practices by bank managers and stockholders. In theory, CoCos achieve this by reducing bank leverage before insolvency and diluting existing shares. Notably, Chen, Glasserman, Nouri, and Pelger (2017) demonstrate how CoCos can maintain a failing bank's going concern value by recapitalizing it, preventing systemic fallout. However, recent events demonstrate that CoCos no longer offer these macroprudential benefits. The venerable Credit Suisse Bank's March 2023 failure, following a Point of Non-Viability (PONV) declaration by Swiss regulators, ended its status as an independent going concern and wiped out \$17 billion in outstanding CoCos.[1] This paper identifies an embedded option in CoCo designs explaining the Credit Suisse failure. CoCos now include incentives for distressed bank shareholders to trigger failure to obtain residual value (e.g., \$3 billion in Credit Suisse), despite losing the bank's going concern value.

Academic literature has touted CoCos' salubrious effects from both macroprudential and individual bank perspectives. CoCo benefits include (i) reductions in default risk obtained from CoCo conversion from debt into equity, thereby reducing systemic risk (ii) a possible resolution of the debt overhang problem in low asset valuation states, and (iii) savings in funding costs compared to straight debt. However, regulators have allowed shifts in the design of CoCos that have virtually eliminated the issuance of the equity-converting CoCos modeled in most of the theoretical literature. Instead, principal write-down CoCos now allow shareholders to eliminate CoCo debt without diluting equity, creating CoCo trigger events that lead to positive wealth transfers to stockholders from CoCo bondholders. Consequently, the purported funding benefits of CoCos have diminished, reflected in CoCo bond yields that

[1]Since the acquisition of Credit Suisse by UBS did not close until May 2023, both companies filed separate financial statements for the first quarter of 2023. Credit Suisse alone posted a 12.43 billion Swiss franc net profit, equivalent to \$13.9 billion, for the first three months of 2023. Further indications of Credit Suisse's going concern value upon exercise of its CoCo-induced collapse option is the \$29 billion accounting gain booked by UBS for buying Credit Suisse's assets for less than they were worth, and UBS' voluntary cancellation of its loss-protection agreement with the Swiss government.

consider potential wealth transfers.[2]

This paper documents a phenomenon that we call the "CoCo-induced collapse option," similar to the inefficient "debt-induced collapse option" identified by Chen et al. (2017).[3] In this scenario, bank stockholders are motivated to trigger CoCo conversion, transferring losses to CoCo bondholders and gaining wealth transfers at the PONV, thereby destroying any of the bank's going concern value. Chen et al. (2017) show that sufficiently high trigger levels eliminate the debt-induced collapse phenomenon. In reality, however, CoCo trigger levels have been set so low that they are no longer economically binding. Indeed, the only effective conversion mechanism is typically the PONV. There have been only two instances of CoCo conversions since 2009. In both cases, conversion was triggered by the declaration of a PONV when the bank's capital position was far above the CoCo mechanical trigger level; i.e., the CoCo mechanical trigger was not binding. Thus, shareholders are incentivized to precipitate the declaration of a PONV in order to trigger the wealth transfers from CoCo holders, thereby inefficiently accelerating bank failure.

Further, we show that the CoCo-induced collapse option with perverse incentives increases with the issuance of *non-dilutive* CoCos in the bank's capital structure. Indeed, by 2021, Credit Suisse replaced all of its equity-converting (dilutive) CoCos with principal write-downs (non-dilutive) that specified positive shareholder wealth transfers from CoCo holders upon the trigger.[4] This set the stage for the exercise of the shareholders' CoCo-induced collapse option in March 2023 in which the $17 billion in CoCos were written down and stockholders received approximately $3 billion in value.

We begin by analyzing the announcement returns of CoCo issues. Specifically, our sample that covers all CoCos issued from 2009 to 2021 shows a statistically significant (at the 1%

[2] Allen and Golfari (2022) find higher yield spreads for positive wealth transfer, non-dilutive CoCos.

[3] Both the debt- and CoCo-induced collapse options are inefficient since stockholders rationally declare bankruptcy before CoCo conversion, thereby destroying any bank going-concern value. The CoCo-induced collapse option has more perverse incentives, however, since stockholders actually receive positive wealth transfers upon option exercise, as compared to the post-conversion overhang of the CoCos as straight debt modeled in Chen et al. (2017).

[4] Credit Suisse had large amounts of non-dilutive CoCos in its capital structure. Its pre-failure holdings of CoCos as a proportion of all liabilities were above the 75^{th} percentile of the distribution for all CoCos.

level) cumulative abnormal return of -2.20% over the 29-day period following the announcement of CoCo issuance involving stockholder wealth transfers in the lowest tercile. Notably, these CoCos lack the CoCo-induced collapse option by design. Conversely, when banks with significant outstanding CoCos (ranking in the top decile of CoCo issuers) announce non-dilutive CoCo issuance with CoCo-induced collapse options, the market responds positively, showing an abnormal return of approximately 5% over the 29-day period following the announcement date. This outcome aligns with bank shareholders' recognition of the equity value associated with the option to trigger a CoCo-induced collapse, even in situations of low asset valuation.[5]

Since CoCo security design is endogenously determined, we analyze the decision to adopt more dilutive terms of conversion conditional on issuing CoCos. Following La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998), we use legal origin as an instrumental variable to estimate the stockholder wealth transfer specified in the CoCo's design. We find that CoCos with more dilutive terms of conversion (i.e., less shareholder-friendly) are more likely to be issued in common law and French-civil law countries with weak debtholder legal protections. That is, to attract CoCo bondholders in low creditor-rights countries, stockholders are more likely to issue more dilutive CoCos that voluntarily eschew the option to induce a CoCo-induced collapse. Controlling for endogeneity in CoCo security design increases the magnitude of the announcement effects. We find that bank equity returns are significantly negative, reaching -8.99% (at the 5% level), over the 29 days period following the announcement of dilutive CoCos that do not have the CoCo-induced collapse option.

Given the negative announcement effects for CoCos designed without the CoCo-induced collapse option, banks would only issue these CoCos because of regulatory capital requirements. However, all CoCos (both with and without the CoCo-induced collapse option) are treated equally in capital regulations. Therefore, omitting the CoCo-induced collapse option

[5] Bolton, Jiang, and Kartasheva (2023) interpret the widespread disapproval of Credit Suisse's CoCo write-down in March 2023 as a sign that the market misunderstood CoCos' original purpose as going concern instruments that absorb losses before equity. Our findings suggest that bank stockholders understand these effects and price them at the announcement.

sends a costly signal of shareholders' commitment to de-risking and maintaining the bank as a going concern.[6] In contrast, including this option suggests a willingness to use the regulatory put option rather than reducing the bank's risk exposure. Thus, CoCo design announcements reveal costly signals of managerial intent, aligning with the observation that banks in common law and French civil law countries are less inclined to issue CoCos with this option. By abstaining from it, bank managers in countries with weaker debtholder legal protections convey their intent to implement risk reduction policies to prevent bank failure. Indeed, UBS has explored sending a signal of managerial intent to investors by exploring the issuance of equity converting CoCos (without the CoCo-induced collapse option) to replace the written-down $17 billion of Credit Suisse CoCos.[7]

This information channel is further evident in our analysis of post-announcement monthly returns during periods of high and low aggregate uncertainty. We create an arbitrage portfolio that involves buying banks issuing more dilutive CoCos (without the CoCo-induced collapse option) and selling those issuing less dilutive CoCos (with the option). In non-stress periods, these portfolios yield a statistically significant (at the 5% level) negative alpha of over 50 basis points monthly, reflecting the loss of the CoCo-induced collapse option's value to stockholders. Conversely, during periods of market instability and uncertainty, indicated by the VIX, the COVID pandemic, and the Global Economic Policy Index of Baker, Bloom, and Davis (2016), the arbitrage portfolio achieves positive and statistically significant (at the 5% level) alphas exceeding 20 basis points monthly. In such times, dilutive CoCos (without the destabilizing CoCo-induced collapse option) generate positive equity alpha returns, aligning with the equity market's recognition of the managerial signal to reduce bank failure risk (particularly for banks without the CoCo-induced collapse option) when economic downturns are looming.

Finally, we show that non-dilutive CoCo issues do not reduce bank systemic risk-taking,

[6] Regulators declare the PONV when they judge the bank to be deficient in either liquidity or capital. By failing to cure these defects, management can precipitate the PONV.

[7] "UBS sounds out investors over first AT1 sale since Credit Suisse rescue." *Financial Times*, Sep. 2023.

thereby failing to provide the social benefits that motivated its inclusion in bank capital requirements. Specifically, bank-specific systemic risk, as measured by CoVaR (see Adrian and Brunnermeier, 2016), decreases by 22.16% compared to the unconditional sample average, but only for banks issuing dilutive CoCos with the lowest stockholder wealth transfer. Similar results are found using the MES systemic risk measure of Acharya, Pedersen, Philippon, and Richardson (2017). In essence, the systemic risk benefits intended by CoCo designers for their inclusion in bank regulatory capital requirements are realized, but solely for dilutive CoCos with negative wealth transfer, lacking a CoCo-induced collapse option. This suggests that the CoCo-induced collapse option (found in non-dilutive CoCos with positive wealth transfers upon conversion) has a destabilizing macroprudential impact. These destabilizing effects are of particular concern as Basel IV capital requirements foresee an increased regulatory role for CoCos in the near future.

Other studies have also raised concerns about the excessive risk-taking incentives associated with CoCos. For instance, Koziol and Lawrenz (2012) highlight the incomplete contract nature of CoCos, which can amplify managerial risk-taking incentives. While Pennacchi, Vermaelen, and Wolff (2014) and Flannery (2016) acknowledge the possibility of these adverse incentives, they downplay their practical significance. Additionally, Hilscher and Raviv (2014) propose an option-theoretic model to address risk-taking incentives in CoCos by determining conversion ratios and other terms. However, contemporary CoCos have been redesigned to exacerbate these incentives by specifying positive wealth transfers to stockholders upon CoCo trigger, as noted by Berg and Kaserer (2015). Our paper provides empirical evidence from our extensive CoCo sample that supports these risk-taking concerns.

In contrast, Avdjiev, Bogdanova, Bolton, Jiang, and Kartasheva (2020) find that CoCo-issuing banks in advanced countries between 2009 and 2015 reduced risk-taking, as evidenced by lower CDS spreads. This risk reduction was particularly notable for banks issuing CoCos with high triggers compared to those without mechanical triggers. However, it is worth noting that Basel III mandated all CoCos to have a mechanical trigger not lower than 5.125%

to qualify as AT1 (Alternative Tier 1) capital, eliminating the issuance of CoCos without mechanical triggers since 2014.[8] Thus, given these changes in CoCo design, we extend the analysis from Avdjiev et al. (2020) to our sample, encompassing all CoCos issued from 2009 to 2021.

An important shortcoming of many of the papers on this topic is the failure to account for shareholder wealth transfers upon CoCo conversion. Some exceptions include Hilscher and Raviv (2014), Allen and Golfari (2022), Goncharenko, Ongena, and Rauf (2021), Goncharenko (2022) and Fatouh, Neamt, and van Wijnbergen (2022), all of which control for dilution and wealth transfer in analyzing risk-taking incentives. Thus, our paper joins others that focus on possible risk-taking incentives by examining wealth transfers from CoCo holders to stockholders upon CoCo conversion. We extend this literature by being the first to identify a CoCo-induced collapse option.

We further contribute to this literature by addressing ambiguity in the measure of shareholder wealth transfer used in Berg and Kaserer (2015) and others. The CoCo conversion amount that drives shareholder wealth transfers for temporary write-down CoCos, which have emerged as the dominant CoCo design, depends on the amount required to absorb losses only to the point of re-establishing the bank's compliance with minimum capital levels. In this paper, we are the first to offer a new methodological approach to calculate the shareholder wealth transfer that fully accounts for each security's specific design features.

The rest of the paper is organized as follows. Section 2 discusses the theory behind the CoCo-induced collapse option, highlighting the March 2023 failure of Credit Suisse Bank. Section 3 introduces our novel wealth transfer measure and outlines our extensive CoCo database. Section 4 presents the key empirical findings and Section 5 concludes the paper.

[8] Avdjiev et al. (2020) specify triggers set at 7% CET1 ratio (common equity tier 1 divided by the bank's risk-weighted assets) as high and 5.125% CET1 ratio as low. However, these mechanical trigger levels are set by national bank regulators, with high triggers limited to banks in Switzerland and the United Kingdom. Further, Allen and Golfari (2022) show that 72.9% of all CoCos issued from 2009 to 2019 were issued at the 5.125% minimum level.

2 A Stylized Model of the CoCo-Induced Collapse Option: Understanding the Credit Suisse Failure

After years of scandals and deterioration in market value, Credit Suisse failed on March 19, 2023. At that time, $17 billion in CoCos were permanently written down. Yet, bank stockholders were not wiped out. Further, in 2021, before its failure, Credit Suisse replaced all of its remaining equity-converting (dilutive) CoCos with non-dilutive CoCos that had permanent write-down features. At the time Swiss regulators declared that a PONV had been reached, the $17 billion CoCo bonds written down accounted for approximately 2.5% of Credit Suisse's total liabilities. Consistent with the presence of a CoCo-induced collapse option, the value of Credit Suisse's CoCos dropped significantly five days before the failure announcement, whereas stock prices only fell after the announcement reflecting the loss of the bank's going concern value.

A simple way to understand how Credit Suisse's existing stockholders benefited from the large amounts of non-dilutive (as opposed to dilutive) CoCos outstanding is to view the value of equity at the point of non-viability as illustrated in Figure 1.[9] At the point where Credit Suisse became non-viable (i.e., Assets - CoCos = 0), the equity value under dilutive CoCos would have been worthless. That is, with a wealth transfer upon dilutive CoCo trigger of -1, existing stockholders would receive nothing as all assets would be transferred to CoCo holders (solid line). More simply, if Credit Suisse had issued dilutive CoCos, there would have been no equity value and no CoCo-induced collapse option. However, as of 2023, all of Credit Suisse's CoCos were non-dilutive. Assuming, for simplicity that the wealth transfer upon the trigger of all of the non-dilutive CoCos was set to +1, then Figure 1 shows that existing shareholders would receive the entire CoCo value (i.e., all remaining assets) since the CoCos would be written down in full (dashed line). Thus, as shown in Figure 1, equity

[9] For simplicity, Figure 1 assumes that there is no non-CoCo debt so that assets are defined as net assets after deducting all senior non-CoCo debt obligations. CoCo obligations outstanding are set at 12 for illustrative purposes in Figure 1.

value equals asset value when assets fall below CoCo value (i.e., the PONV is declared). In this way, Credit Suisse stockholders received some value for their shares based on the bank's asset value despite the bank's insolvency.

[Figure 1 about here]

Motivated by this recent event, we provide a simple stylized theoretical model for the valuation of the CoCo-induced collapse option to existing shareholders. As opposed to most of the literature in this area, we distinguish between dilutive and non-dilutive CoCos in our model of the value of distressed banks. We assume that the bank's log price of the real output follows a Brownian motion with drift in $\mathbb{Q}$ as follows

$$dp_t = \mu dt + \sigma dW_t \tag{1}$$

where μ, σ, and dW_t represent the drift, volatility, and standard Brownian motion under $\mathbb{Q}$. The bank pays c per unit of time which represents CoCo interest payments. For simplicity, we assume that the bank incurs no other costs. It follows that the going concern profit for shareholders is $e^{p_t} - c$ and the bank's equity value is given by

$$V(p_t) = \mathbf{E}^{\mathbb{Q}} \left[\int_0^{\tau_L} \overbrace{e^{-rs}(e^{p_{t+s}} - c)}^{\text{going concern profit}} \, ds + \underbrace{\eta e^{-r\tau_L}}_{\text{PONV recovery}} \right] \tag{2}$$

where r is the continuously compounded risk-free rate and $\tau_L = inf\{t : p_t = \underline{p}\}$ denotes the first time log price p_t reaches the threshold level $\underline{p}$ at which the bank's CoCos are triggered.

The key element in Equation (2) is the additive recovery rate η ($\eta \geq 0$), which is the value recovered by shareholders upon reaching $\underline{p}$. This recovery value depends upon whether the bank's CoCos are dilutive or not. If $\eta \leq 0$, the bank's CoCos are dilutive. That is, the bank's equity holders lose value since the bank's going concern value (as of the CoCo trigger date) is transferred via the issuance of dilutive stock to CoCo holders.[10] In this case, the value

[10] A negative η does not violate the participation constraint since banks are required to issue even negative net present value CoCos in order to comply with capital regulations.

of η is the net of the wealth transfer upon CoCo exercise minus the portion of the bank's going concern value transferred to CoCo holders in the form of equity that dilutes the value of original stockholders. These CoCos are the standard disciplinary instruments modeled in the literature; e.g., Calomiris and Herring (2013), Chen et al. (2017), and Flannery (2016). Note that η can be less than zero even if the bank's CoCos specify a positive wealth transfer to CoCo holders from stockholders upon the trigger, as long as the value of this wealth transfer is lower than the loss of going concern value to the original stockholders.[11] In the case of dilutive CoCos ($\eta \leq 0$), the CoCo-induced collapse option has no value, and CoCos are converted only when the bond's mechanical trigger (e.g., regulatory Tier 1 capital below 5.125%) is breached. Thus, $\underline{p}$ is the bank stock price when the bank's regulatory capital reaches the mechanical trigger level for dilutive CoCos.

If, however, the recovery value in Equation (2) is positive ($\eta > 0$), then equity holders receive a positive wealth transfer even after deducting the loss of the bank's going concern value. These CoCos are non-dilutive. Bank equity holders may realize this positive recovery value only by exercising their CoCo-induced collapse option via the declaration of the PONV prior to the breaching of the CoCo's non-binding mechanical trigger. Indeed, bank shareholders are incentivized to sacrifice any going concern value in order to receive the wealth transfer amount, such that the higher the wealth transfer amount, the greater stockholders' willingness to relinquish any bank going concern value through the exercise of the CoCo-induced collapse option. Thus, the bank's shareholders accelerate CoCo conversion via a PONV in order to exercise their CoCo-induced option. In the case of non-dilutive CoCos, $\underline{p}$ is the bank stock price at the PONV. Since the CoCo-induced collapse option only has value for non-dilutive CoCos with $\eta > 0$, we focus on these instruments in our stylized theoretical model.

Garlappi and Yan (2011) present an equity valuation model for distressed firms when resolution through debt restructuring and/or debt–equity exchanges allows equity holders to

[11]In empirical tests, therefore, some dilutive CoCos may specify a small positive wealth transfer to bank stockholders.

recover firm value. This model is applicable to our setting in which equity holders recover the firm's residual value ($\eta > 0$) via the exercise of their CoCo-induced collapse option that generates a positive wealth transfer from CoCo debtholders to stockholders. Thus, we use the Garlappi and Yan (2011) model to derive a closed-form solution for the equity value with non-dilutive CoCos at the PONV. Specifically, let $\delta \equiv r - \mu - \sigma^2/2 > 0$. Then, the analytical solution of equity value is given by

$$V(p_t) = \begin{cases} e^{p_t}/\delta - c/r - e^{\phi p_t + (1-\phi)\underline{p}}/(\phi\delta), & \text{if } p_t > \underline{p} \\ \\ \eta, & \text{if } p_t \leq \underline{p} \end{cases} \tag{3}$$

where

$$\phi = \frac{1}{2} - \frac{2(r-\delta) + \sqrt{(\sigma^2 - 2(r-\delta))^2 + 8\sigma^2 r}}{2\sigma^2} < 0$$

and

$$\underline{p} = log\left(\frac{\eta + c/r}{(1/\delta)(1-1/\phi)}\right) > 0. \tag{4}$$

Further details of our stylized model are provided in the Appendix A.

We focus on the relationship between equity value and η in Equation (3). As depicted in Figure 2, the equity value $V(p_t)$ in Equation (3) is an increasing function of η (i.e., $\frac{\partial V}{\partial \underline{p}} > 0$ and $\frac{\partial \underline{p}}{\partial \eta} > 0$ when $p_t > \underline{p}$). This is largely due to the recovery rate η being positively related to the endogenous default level in Equation (4) (i.e., $\frac{\partial \underline{p}}{\partial \eta} > 0$ when $p_t > \underline{p}$, illustrated by vertical lines in Figure 2).

[Figure 2 about here]

Empirically, for a given stochastic equity pricing function, Equation (4) shows that two factors increase $\underline{p}$, thereby increasing the value and the likelihood of exercise of the CoCo-induced collapse option. First, $\underline{p}$ increases when η increases, i.e., when banks issue non-dilutive CoCos that specify higher wealth transfers from CoCo holders to stockholders. Second, it increases when banks have larger proportions of CoCos on their balance sheets, i.e., when c increases. That is, our stylized model suggests these are the two conditions that enhance the option value of CoCo-induced collapse for shareholders. In our empirical analysis, we predict that shareholder value will reflect the option value of CoCo-induced collapse. Thus, for banks that issue dilutive CoCos, equity value will decrease (i.e., reflecting the loss of the CoCo-induced collapse option value). However, if banks issue large amounts of non-dilutive CoCos, equity value will increase (i.e., reflecting the option value). This forms the basis for our empirical tests.

3 Data, Measures, and Sample Description

3.1 A Novel Wealth Transfer Measure

At its inception, the history of CoCos was dominated by instruments with equity conversion loss absorption mechanisms. These CoCos' terms of conversion specify a predetermined conversion rate resulting from a contractually stipulated fixed or floor stock price to be used in determining the number of shares that CoCo holders receive when the conditions of a trigger event are reached. For CoCos of this type, the direction of the wealth transfer is always from stockholders to CoCo holders, although the amount depends on the idiosyncratic terms of conversion and the projected value of the equity upon CoCo trigger.

However, the industry has progressively shifted away from equity conversion loss absorption mechanisms in favor of write-down instruments. The earliest innovation was to issue permanent write-down CoCos, in which the CoCo principal is simply written down in full and permanently upon declaration of a trigger event. Thus, the wealth transfer of these CoCos' structures is unambiguously equal to their par value in favor of shareholders, denoted as a wealth transfer of +1.[12]

As CoCo security design evolved further in 2014, the *temporary* write-down CoCo emerged as the dominant design, especially among European bank issuers. The loss-absorption mechanism of these instruments differs from the others in multiple ways. First, upon reaching their trigger level, they absorb losses by writing down only the portion of their notional value necessary to reestablish their issuer's compliance with regulatory capital minima. Second, they stipulate that they will absorb losses *pari passu* with other CoCos issued at the same trigger level. Finally, as their name implies, their contracts include provisions for the issuer to gradually write up their notional value following a trigger event when the bank's financial position recovers, potentially making the write-down event temporary.

Because of these features, the wealth transfer measures used in Berg and Kaserer (2015), Goncharenko et al. (2021), and Allen and Golfari (2022) are subject to ambiguity emanating from the value of the embedded write-up option that impacts all debt instruments in the bank's capital structure. To illustrate this challenge, consider an issuer with three outstanding instruments at the common 5.125% mechanical trigger level but with three different loss absorption mechanisms: equity converting, permanent write-down, and temporary write-down. Upon a breach of the trigger level (regardless of the magnitude of the breach), any permanent write-down CoCos would be depleted completely, and any equity conversion would see its notional value converted to shares at the contractually predetermined price. However, for temporary write-down instruments, the results of the trigger event would be determined by considering the remaining need for recapitalization of the issuer. If the losses absorbed by equity conversion and permanent write-down instruments are sufficient to replenish the issuer's capital position, the temporary write-down CoCos would not need to be

[12] A small number of *partial* permanent write-down instruments were issued in the years preceding the introduction of Basel III regulations. Upon reaching their trigger level, these CoCos write down a predetermined percentage of their notional value and disburse to CoCo holders a cash payment equal to the balance. The potential of such a loss absorption mechanism to exacerbate a liquidity crisis, by requiring the issuer to deplete its cash position in a moment of financial distress, possibly triggering asset fire sales (Flannery, 2013, 2016), led the Basel Committee on Banking Supervision to explicitly prohibit this design starting from 2013 (Basel Committee on Banking Supervision, 2011).

written down at all. If further loss absorption capacity were indeed necessary, the loss would be spread among all the outstanding temporary write-down CoCos *pari passu*. Thus, calculating the shareholder wealth transfer on a temporary write-down CoCo entails evaluation of all securities in the capital structure at the point of conversion, and comparing the total to the bank's capital shortfall.

These CoCo design details impact inferences drawn from empirical analysis. For example, Avdjiev et al. (2020) find that CDS spreads are only significantly negative for the issuance of equity converting, AT1 CoCos. These CoCos are most likely to have dilutive wealth transfer mechanisms, consistent with the risk-reducing incentive effects we present in this paper. However, the loss absorption mechanism (equity converting versus principal write-down) is only imperfectly correlated with shareholder wealth transfers.[13] That is, upon conversion, whether equity converting CoCos transfer wealth from CoCo holders to shareholders or vice versa depends on the terms of the bond. Thus, we model and measure the shareholder wealth transfer in this paper because simply using their loss absorption mechanism is insufficient to differentiate between the economic impact of CoCo conversion on bank stockholders versus CoCo holders.

Our novel method carefully measures wealth transfers upon CoCo trigger using the specifics of all bond design details for all loss absorption mechanisms. We are the first to consider the impact of the trigger of temporary write-down CoCos on all debt instruments outstanding at the date of the CoCo trigger. For each CoCo issuance announced at time t, we estimate the expected market capitalization at the trigger event T as follows:

$$MVE_T = \frac{TriggerRatio}{CapitalRatio_t} \times MVE_t + NotionalValue. \tag{5}$$

MVE_T is the bank's expected market capitalization at the date of the trigger event T. $TriggerRatio$ is the contingent capital level of the trigger event. $CapitalRatio_t$ is the issuer's

[13]Failure to measure the shareholder wealth transfer amounts for each loss absorption mechanism may explain the insignificant results on equity returns presented in Avdjiev et al. (2020).

capital ratio at the time of issuance. The fraction captures the estimated market capitalization if the trigger were to occur ($TriggerRatio$) relative to the current value ($CapitalRatio$). MVE_t is the market capitalization of the issuer at the announcement date. $NotionalValue$ is the notional value of the CoCo (i.e., the amount issued). Following Berg and Kaserer (2015), this estimate relies on the conservative assumption that the market price of equity would follow the movements in capital ratios one-to-one.

For equity conversion CoCos, we then estimate the expected wealth transfer to equity holders at the announcement date t using the following equation.

$$WT_t^0 = NotionalValue - \frac{ShareCoCo_T}{TotalShares_T} \times MVE_T. \tag{6}$$

WT_t^0 is the expected wealth transfer to equity holders. $SharesCoCo_T$ is the number of shares CoCo holders receive in a trigger event. $TotalShares_T$ is the total outstanding shares after the trigger event. $MarketCap_T$ is from Equation (5). A positive value of WT_t^0 indicates a net wealth transfer in favor of equity holders and negative to CoCo holders in a trigger event.

For permanent write-down CoCos, $SharesCoCo_T$ equals 0 and the wealth transfer equals the CoCo's notional value ($NotionalValue$). In other words, when the trigger level is reached, the instrument is written down to zero and equity holders receive the full notional value without share conversions.

While $SharesCoCo_T$ is also 0 for temporary write-downs, we also consider the entirety of the trigger-level breaches. To do so, we model a trigger event declared with a CET1 ratio that is 1.5% RWA below the trigger level and compute the total loss that needs to be absorbed to re-establish the issuer in compliance with the regulatory minima.[14] We refer to this amount as loss absorption capacity. Then, we consider the presence of equity conversion or permanent write-down CoCos at a higher or equal trigger level and deduct the notional

[14] The 1.5% RWA magnitude is chosen because it equals the amount of contingent convertible capital that baseline Basel III regulation allows in the Additional Tier 1 capital layer. Unreported results modeling larger breaches yielded similar results.

values (i.e. amount issued) from the loss absorption capacity. Lastly, the remainder, the residual loss, is spread between all outstanding temporary write-down instruments at the same trigger level (*pari-passu*). This is measured by dividing the residual loss by the sum of all outstanding temporary write-down CoCos at the same trigger level, including the one being issued (i.e., Loss-Sharing Ratio = $\frac{\text{Residual loss}}{\sum_{\text{pari-passu}} \text{TWD}}$). The result is described in Equation (7).

$$WT_t = \begin{cases} WT_t^0 \times LossSharingRatio, & \text{if temporary write-down} \\ WT_t^0, & \text{otherwise.} \end{cases} \tag{7}$$

The resulting wealth transfer measure for each instrument, WT_t, is scaled by the individual CoCo notional values in our empirical analysis.

3.2 Data

We construct our baseline database by collecting security level information from Bloomberg.[15] For equity conversion CoCos, we hand-collect the structure of the contractually predetermined terms of conversion from each instrument's prospectus. This process provides us with the conversion price (fixed or floor) upon reaching the conditions for a trigger event, so we can determine the number of shares issued to CoCo holders upon the trigger event.

Issuers' balance sheet information is collected from Capital IQ by tracking the issuer using ISINs and issuers' names. The stock price information is from Datastream matched using the bank's name and home country. Exchange rates are obtained from the ECB API accessed through the *priceR* R package (Ho, Imai, King, and Stuart, 2022). Our baseline sample consists of 756 CoCo issues between January 2009 to December 2021 from banks in 28 countries with balance sheets and stock price information. See Allen and Golfari (2022) for a more complete description of the database and its construction.

[15] As of October 1$^{\text{st}}$ 2022, there are 1,236 CoCos issued including those that were retired due to maturity or exercise of a call option by the issuer.

3.3 Descriptive Statistics

Panel A of Table 1 presents the descriptive statistics of the baseline sample used in the analysis. The average market beta (BETA) of CoCo issuers is 1.196, showing the banks that issue CoCos are marginally more volatile than the national stock market in which the bank is incorporated. The average contingent wealth transfer between shareholders and CoCo holders (WT) is 65.31% so that in a trigger event, the average CoCo will transfer 65.31% of its notional value to shareholders, thereby reflecting the prevalence of less than fully dilutive (below 100%) CoCos. The sample mean of COCOOUT, measured as the current and pre-existing CoCos with trigger levels that are greater than or equal to the current issue scaled by total liabilities, is 1.933%. and the 75^{th} percentile is 1.428%. This demonstrates that the distribution is right-skewed. Equity conversion (EC), permanent write-down (PWD), and temporary write-down (TWD) CoCos account for 29.1%, 24.7%, and 46.2% of the sample respectively.

[Table 1 about here]

Following La Porta et al. (1998), we classify each issuer's country of incorporation based on its legal origin: 33.5% and 24.6% of the CoCos in the sample are issued by banks incorporated in common law (COMMON) or French-civil (FRENCH) law countries, respectively. The remaining 41.4% of banks that are not classified as either common or French-civil law are incorporated in German-civil law, Scandinavian-civil law, or in China. Panel B of Table 1 reports the top ten countries and banks by the number of CoCo issues. Our sample shows that financial institutions domiciled in the United Kingdom, India, Norway, Switzerland, and China issued the largest number of CoCos. More specifically, Lloyds Banking Group, Credit Suisse, Societe Generale, BNP Paribas, and UBS Group were particularly active.

4 The Relationship Between Equity Returns and CoCo Design Features

4.1 Announcement Effects of CoCo Issues: Univariate Tests

Our tests focus on the option value of CoCo-induced collapse as modeled in Section 2. Our key prediction is a positive relationship between the contingent wealth transfer measure and equity value. Specifically, we expect that more dilutive CoCos will lead to a decrease in equity value, whereas less dilutive CoCos will have the opposite effect. These effects are exacerbated by the presence of large amounts of CoCos in the bank's capital structure. That is, non-dilutive CoCos issued by banks with large amounts of CoCos outstanding hold a valuable CoCo-induced collapse option that generates positive abnormal returns upon announcement. In contrast, CoCo announcements by banks that eschew voluntary CoCo-induced collapse (by issuing dilutive CoCos) are expected to generate negative abnormal returns for bank stockholders.

To calculate cumulative abnormal returns (CARs) upon CoCo issue announcement, we apply the market model (i.e. CAPM) to calculate daily excess returns.[16] Market beta is estimated on an estimation window of 250 days (with at least 50 valid returns) that ends 30 days before the CoCo issue announcement date. As our sample spans 28 different countries, we use the market return for each country as provided by Wharton Research Data Services (WRDS). Excess returns are then accumulated to measure CARs across various windows. The pre-announcement CAR stops on the day before the announcement date, while the post-announcement CAR begins on the announcement date.

Throughout our analysis, we use the wealth transfer measure (WT) from Equation (7). Specifically, we create an indicator variable, DILUTIVE, that equals 1 if the CoCo is in the lowest tercile of the WT distribution and 0 otherwise. For instance, a CoCo with DILU-

[16]Because our sample of issuers comes from 28 countries, we use the market model to incorporate the market returns of individual countries. This allows us to account for country-specific returns around the announcement dates. Fama-French factors are not available for each of the 28 countries in our sample.

TIVE that equals 1 is interpreted as (comparatively) more dilutive, and thus more costly for shareholders upon a trigger event. A CoCo with DILUTIVE that equals 0 is (relatively) less dilutive and will transfer more wealth to shareholders upon a trigger event, thereby incorporating a CoCo-induced collapse option.

Figure 3 plots the univariate tests of CARs across various windows that lie between 5 days before the announcement date and 29 days after the announcement date.[17] Panel A plots the CARs of the more dilutive CoCos in the sample (DILUTIVE=1). Results show that issuing more dilutive CoCos leads to a persistent negative announcement effect. For instance, the negative abnormal return is estimated as roughly -1% for the first five trading days including the announcement date. The negative estimates increase in magnitude over time, reaching a CAR of -2.20% over 29 trading days. This result is consistent with the bank shareholders' loss of a CoCo-induced collapse option when dilutive CoCos are issued.

[Figure 3 about here]

Our results further indicate that the CARs for less dilutive CoCos are insignificantly different from zero. Panel B of Figure 3 plots the univariate tests for less dilutive CoCos (DILUTIVE=0). The CARs across various windows are estimated between -0.20% and 0.58% with no statistical significance.

[Table 2 about here]

We further investigate the significance of the results on wealth transfer in Figure 3 by conducting mean-difference tests, comparing the estimates between Panels A and B. Table 2 reports the mean-difference tests, consistent with negative CARs for more dilutive CoCo issues (Column 3). Additionally, the tests reveal that the differences are statistically significant for post-announcement windows, but not the pre-announcement window (-5,-1). These

[17] Since not all relevant information is released upon announcement, but only upon issuance, we incorporate an event window that includes issuance dates that often occur 20 days after the announcement. For example, some CoCo announcements leave blanks for certain terms or specify conversion terms based on the bank's closing stock price on the issuance date. The median (mean) number of days from announcement to issuance is six (eight).

findings suggest that the announcement effects primarily originate from the information that is made available after the announcement.

Next, we evaluate whether large proportions of outstanding CoCos affect equity value. This approach is motivated by the theoretical model presented in Section 2, which suggests that the value of the CoCo-induced collapse option increases with the proportion of outstanding CoCos. Thus, we examine the announcement effects focusing on the right tail of the distribution of COCOOUT, a measure of outstanding CoCos calculated as the sum of outstanding CoCos scaled by total liabilities. Specifically, we sort the sample by COCOOUT and retain the top decile (77 CoCos). The findings, presented in Panel A of Figure 4, show a positive but statistically insignificant announcement effect. In contrast, the announcement effects for non-dilutive CoCos that represent large components of the bank's debt structure (Panel B of Figure 4) are positive and significant (at the 5% level). Thus, the value of the CoCo-induced collapse option is shown to be larger when the bank has large amounts of CoCos outstanding.

[Figure 4 about here]

4.2 Announcement Effects of CoCo Issues: Regression Analyses

In this section, we revisit the findings presented in the previous section using multivariate regression analysis. We hope to shed light on conflicting results in the literature that is comprised of studies using more restricted samples than ours and that do not account for shareholder wealth transfers. For example, Liao, Mehdian, and Rezvanian (2017) report negative CARs for CoCos issued between 2010 to 2014, whereas Ammann, Blickle, and Ehmann (2017) document positive CARs for a small sample of CoCos issued between 2009 and 2014.

In this paper, we use the following regression equation for a CoCo issue j in year t to evaluate the announcement effects on equity value.

$$CAR_{j,t} = \beta_1 DILUTIVE_{j,t} + \beta_2 COCOOUT_{j,t} + CONTROLS_{j,t} + \epsilon_{j,t}. \quad (8)$$

We include year-fixed effects and cluster standard errors by calendar years throughout our regression analyses to account for potential unobservable year-specific effects and serial correlations within years. The dependent variable is the cumulative abnormal return (CAR) computed in Section 4.1. To control for potential differential effects of CoCo issues across issuers' characteristics (e.g., see Goncharenko, 2022), we include a vector of control variables that are observable at the time of issuance ($\text{CONTROLS}_{j,t}$). These variables are the natural log of market capitalization in USD (MKTCAP), return on equity (ROE), the difference between the capital ratio and the CoCo trigger level (DIST), and book leverage (BOOKLEV). We also include an indicator variable ROLLOVER that equals 1 if the CoCo is a rollover, otherwise 0.[18]

The regression results using Equation (8) are presented in Table 3. Across all columns, the coefficients of DILUTIVE are negative, indicating the negative CARs for more dilutive CoCos. The estimates show a -1.28% CAR within the first 9 trading days after the CoCo issue announcement (Column 2). Columns 3 and 4 indicate the negative impact reaches a statistically significant (at the 1% level) coefficient of -1.74% by the 29$^{\text{th}}$ trading day after the announcement. The increase in the magnitude of DILUTIVE from Column 1 to Column 4 is consistent with Panel A of Figure 3. Yet, the magnitudes overall are smaller than the univariate tests, which implies the announcement effects are influenced by unobserved year-specific effects and bank control variables.

[Table 3 about here]

The impact of large proportions of outstanding CoCos, as estimated by the coefficient of COCOOUT, is positive and consistent with the findings presented in Figure 4. We observe

[18] Detailed variable descriptions are provided in Appendix B.1.

a statistically significant (at the 5% level) increase in the CAR for the (-2,2) window around the announcement date as the proportion of outstanding CoCos increases (Column 1). Additionally, the magnitude of the effect persists and even increases over time. Interestingly, the distance to the CoCo trigger (variable $DIST$) is not statistically significant, suggesting that the trigger levels are not binding.

Avdjiev et al. (2020) also examine the impact of CoCo issuance on equity returns. Rather than measuring announcement effects using CARs, they follow James (1987) and compute average cumulative prediction errors (ACPE) for a subsample of 170 banks in advanced economies that issued CoCos between January 2009 and December 2015. They find no statistically significant results for their full sample. However, they find a statistically significant (at the 5% level) positive announcement effect for principal write-down CoCos with mechanical triggers exceeding 5.125%. However, these results are not generalizable since higher trigger CoCos are mandated by bank regulators in the U.K. and Switzerland. To compare our results to those of Avdjiev et al. (2020), we estimated CARs for the 626 banks from advanced economies in our comprehensive sample containing all CoCos issued between January 2009 and December 2021. Appendix Table B.2 shows that our results are qualitatively similar to our full sample results presented in Table 3. Abnormal returns over all post-issuance windows are significantly (at the 10% level or better) negative for dilutive CoCos without the CoCo-induced collapse option. Similarly, abnormal returns are positive for banks with large amounts of CoCos in their capital structure. Further, to establish the robustness of our results, we use the methodology employed by Avdjiev et al. (2020) and estimate CPEs for our full sample. The results presented in Appendix Table B.3 are consistent with our results using CARs presented in Table 3.

The findings suggest that the announcement effects of dilutive conversion terms and large proportions of outstanding CoCos are closely interrelated. Specifically, CARs are negative for more dilutive CoCos, while the CARs for less dilutive CoCos are positive if there are substantial amounts of outstanding CoCos. These joint effects are consistent with our model of the CoCo-induced collapse option presented in Section 2. We empirically confirm the existence of this joint effect by explicitly evaluating it in a regression model. To do so, we include an interaction term in Equation (8) as presented below:

$$\begin{aligned} CAR_{j,t} =& \beta_1 DILUTIVE_{j,t} \cdot COCOOUT_{j,t} + \beta_2 DILUTIVE_{j,t} + \\ & \beta_3 COCOOUT_{j,t} + CONTROLS_{j,t} + \epsilon_{j,t}. \end{aligned} \tag{9}$$

Intuitively, we seek to determine whether more dilutive CoCos and significant proportions of outstanding CoCos represent opposing sides of the same phenomenon. To this end, we evaluate the interaction (β_1) alongside the joint significance of all three variables (β_1, β_2, and β_3).

Table 4 reports the results obtained using Equation (9). In Column 1 for the (-2,2) event window, we find that around the announcement date, the proportion of outstanding CoCos is positively associated with abnormal returns ($\beta_3 > 0$). However, if the issue is more dilutive, the effect is reversed ($\beta_1 + \beta_3 < 0$).[19] The CoCo-induced collapse option derives its value from stockholders' ability to put a portion of the bank's losses to CoCo holders, which requires less dilutive CoCo instruments. In the longer horizons (Columns 2 to 4), the coefficient estimates of β_1 in Equation (9) are found to be statistically insignificant, while the estimates of β_2 and β_3 are consistent with Table 3. Moreover, the joint significance of the DILUTIVE, COCOOUT, and the interaction term lies within a range of 99% for all columns. These findings support the theoretical model showing that the negative effect of dilutive terms of conversion and the positive effect of large proportions of outstanding CoCos have opposite effects on equity value.

[Table 4 about here]

[19] Although not reported, we find that the variables COCOOUT and COCOOUT × DILUTIVE in Column 1 of Table 4 are jointly significant statistically at the 0.1% level.

4.3 The Impact of Legal Origins on CoCo Security Design

This section explores the endogeneity in CoCo security design.[20] Specifically, we investigate whether the legal origins of the countries where the issuing banks are incorporated impact the CoCo design features. To achieve this, we consider a regression with the dependent variable set to the wealth transfer measure embedded in CoCo design taken from Equation (7), as follows for a CoCo issue j in year t:

$$WT_{j,t} = \beta_1 COMMON_j + \beta_2 FRENCH_j + CONTROLS_{j,t} + \epsilon_{j,t} \tag{10}$$

where the disturbance term, ϵ_t, includes year-fixed effects. The model includes two indicator variables, namely COMMON and FRENCH, which are assigned a value of 1 if the issuer is incorporated in a common law or French-civil law country, respectively, and 0 otherwise (La Porta et al., 1998). The benchmark legal origins are German-civil law, Scandinavian-civil law, and China. In addition, we include our standard vector of control variables (CONTROLS) consisting of market capitalization (MKTCAP), profitability (ROE), distance from the trigger level (DIST), book leverage (BOOKLEV), rollover indicator (ROLLOVER), and the ratio of outstanding CoCos (COCOOUT) to total liabilities.

[Table 5 about here]

In Column 1 of Table 5, we find that banks that are incorporated in common law countries tend to issue CoCos with low shareholder wealth transfer, or relatively more dilutive CoCos. In Columns 2 and 3, we replace the dependent variable with an indicator variable, DILUTIVE, and apply the linear probability model and probit regression. We find that, consistent with the results in Column 1, banks incorporated in common law countries (and also French-civil law countries) are 31.0% more likely to issue CoCos that are dilutive.

There are several interpretations for these results. One plausible explanation relates

[20] Avdjiev et al. (2020) model the decision to issue CoCos. In this section, we model the design of CoCos conditional on their issuance, which is mostly driven by regulatory requirements.

to creditor rights. In certain legal systems, when a company undergoes a reorganization process, the existing management team is allowed to continue until the process is completed. According to La Porta et al. (1998), this is least frequent in common law and French-civil law countries, showing that management is penalized as a consequence of bankruptcy. Another way of penalizing incumbent managers is to issue dilutive CoCo that results in negative wealth transfers upon the trigger. This can reduce moral hazard risk-shifting incentives of management.

Moral hazard concerns are particularly problematic when the quality of legal enforcement is relatively lax. In La Porta et al. (1998), the quality of legal enforcement refers to a country having (i) an efficient judicial system, (ii) rule of law, (iii) low corruption, (iv) less risk of expropriation, and (v) less risk of contract repudiation by the government. La Porta et al. (1998) documents evidence of Scandinavian and German-civil law countries having a higher quality of legal enforcement relative to common law and French-civil origin countries. Strict legal enforcement may mitigate the likelihood that management undertakes risk-enhancing projects that increase the CoCo-induce collapse option value. Thus, we hypothesize that non-dilutive CoCos are more feasible in Scandinavian and German-civil law countries. Conversely, common law and French-civil law origin countries with weaker legal enforcement conditions are more likely to issue more dilutive CoCos in order to control managerial risk-taking incentives.

Using the findings on wealth transfer and legal origin, we re-estimate Equation (8) in order to establish a causal impact of wealth transfer on equity value. To do so, we estimate Equation (10) using the linear probability model as the first-stage regression and use the following equation in the second-stage regression:

$$CAR_{j,t} = \beta_1 DI\widehat{LUTI}VE_{j,t} + \beta_2 COCOOUT_{j,t} + CONTROLS_{j,t} + \epsilon_{j,t}. \qquad (11)$$

The variable $\mathrm{DI\widehat{LUTI}VE}$ is the fitted value from Equation (10) using DILUTIVE as the dependent variable (as reported in Column 2 of Table 5). The legal origin indicators, COMMON and FRENCH, serve as instruments to isolate the causal effect of wealth transfer on the announcement effects.

Table 6 reports results from the second stage of this two-stage least square estimation (2SLS). Across all columns, we find that the wealth transfer identified through the legal origins has a negative impact on the announcement returns. The effect is weaker than the previous results around the announcement date and in the first 10 trading days (Columns 1 and 2) but is larger in magnitude for the longer windows (Columns 3 and 4). The estimate reaches -8.99% after 30 trading days (Column 4). The coefficient estimates of COCOOUT are consistent with the results from Table 3 as to both magnitude and significance.

[Table 6 about here]

To ensure the validity of the legal origins as instruments for our wealth transfer measure, we report the statistics on the weak instrument test and the test of overidentifying restrictions. The first-stage F-statistics are statistically significant across all columns, thereby rejecting the null hypothesis that the legal origins are weak instruments. Additionally, the Sargan tests of overidentifying restrictions yield p-values exceeding 20%, which demonstrates the validity of the instruments and their correct exclusion from Equation (11). Based on these results, we conclude that the usage of legal origins as instruments for the wealth transfer measure is robust for our empirical tests on equity value.

4.4 CoCo Issues and Arbitrage Portfolio by Wealth Transfer

Our empirical findings suggest that the bank's CoCo-induced collapse option value is reflected in equity returns. That is, positive abnormal equity announcement returns are earned when banks issue large amounts of less dilutive CoCos. However, some banks continue to issue more dilutive CoCos, albeit at a cost to their shareholders. In the following sections, we focus on the wealth transfer measure and investigate the *ex post* issuance benefits associated with more dilutive CoCos. We gauge these effects by constructing an equally-weighted arbitrage equity portfolio based on the wealth transfer characteristics of all of the CoCos issued by each bank. Each month, we look back three years and collect all CoCo issues.[21] Then, we sort the CoCo issues by the wealth transfer measure from Equation (7). We take a long position on the stocks of banks that issued at least one CoCo that is below the median wealth transfer measure (i.e. relatively more dilutive, with a less valuable CoCo-induced collapse option) and take a short position on the stocks that issued at least one CoCo that is above the median of wealth transfer measure (i.e. relatively less dilutive, with a more valuable option). We assign a bank to the long portfolio if the bank issued both types of CoCos within the three-year look-back period. The long-short arbitrage portfolio is rebalanced each month. Due to the limited number of CoCo issues in the earlier period of our sample, we begin constructing arbitrage portfolios in October 2014 and continue until December 2021.

The monthly portfolio returns are regressed on the Fama-French monthly five factors using the following time-series regression equation.[22]

$$RET_t = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 RMW_t + \beta_5 CMA_t + \epsilon_t. \qquad (12)$$

The focus of our analysis is on the relative performance of the long portfolio against the short portfolio (estimate of α) after controlling for the differential exposures of the long and short portfolio to the Fama-French risk factors. The estimate of α will be negative if the issuance of more dilutive CoCos is associated with subsequent stock underperformance and vice versa.

Column 1 of Table 7 presents the results using Equation (12). We find a negative but insignificant underperformance of the long portfolio relative to the short portfolio by 32 basis points per month. Thus, the equity value of the CoCo-induced collapse option for the short

[21]The choice of three years comes from the fact that the CoCos are typically called back by the banks within five years.

[22]Due to the sample of bank equities from multiple countries within the portfolios, we use the Fama-French developed countries factors.

portfolio is greater than the equity value for those banks without the option, reflecting the value of the option during non-crisis periods. However, the contingent wealth transfer of CoCos does not have a significant impact, after controlling for Fama-French 5 factors, on future stock returns on average.

[Table 7 about here]

Next, we investigate the CoCo-induced collapse option value during crisis periods. Specifically, we expect that the option value of CoCo-induced collapse decreases for banks that issue more dilutive CoCos during crisis periods. That is, bank managers and stockholders have more incentives to precipitate bank failure (the PONV) the less dilutive their CoCos and, therefore the option is more likely to be exercised during crisis periods. This should reduce bank equity returns for banks issuing non-dilutive CoCos relative to banks issuing dilutive CoCos. Thus, we hypothesize that the stock performance of issuers of CoCos with different embedded CoCo-induced collapse options may diverge during periods characterized by elevated market volatility and uncertainty. To investigate this, we include an indicator variable in Equation (12), denoted as VIXH, which takes a value of 1 when the VIX is higher than the sample median and 0 otherwise. The regression equation for this model is as follows.

$$\begin{aligned} RET_t = \alpha_0 + &\alpha_1 VIXH_t + \beta_1 MKT_t + \beta_2 SMB_t + \\ &\beta_3 HML_t + \beta_4 RMW_t + \beta_5 CMA_t + \epsilon_t. \end{aligned} \tag{13}$$

In Equation (13), the sum of α_0 and α_1 estimates the relative performance of the long portfolio during periods of high aggregate uncertainty. In our analysis, we also substitute two alternative indicator variables for VIXH in order to measure different dimensions of aggregate uncertainty. The first is denoted as EPUH and takes a value of 1 when the Global Economic Policy Uncertainty Index (Baker et al., 2016) is above the sample median, and 0 otherwise. The second is denoted as COVID and takes a value of 1 when the portfolio is formed during and after the onset of the COVID pandemic period, and 0 otherwise.

The results are presented in Columns 2 through 4 in Table 7. In Column 2, we observe that the long portfolio underperforms by 93 basis points per month during periods of low aggregate uncertainty, but it outperforms by 27 basis points (= 1.19% − 0.918%) per month during high uncertainty periods. This result is consistent with banks that issue more dilutive CoCos having a lower probability of exercising the CoCo-induced collapse option that destroys the bank's going concern value during periods of high aggregate uncertainty. Furthermore, we observe a statistically significant joint impact of the two estimates at the 95% level (α_0 and α_1). Substituting VIXH with alternative indicator variables, EPUH and COVID, produces similar results (Columns 3 and 4). Thus, during crisis periods, the equity value of the banks without the CoCo-induced collapse option exceeds the equity value of banks in which incentives exist for shareholders to precipitate bank collapse.

The results in this section demonstrate that the issuance of CoCos has a discernible impact on future stock returns that varies by aggregate uncertainty. Specifically, banks that issue more dilutive CoCos (i.e., without a valuable CoCo-induced collapse option) exhibit weaker performance during periods of low aggregate uncertainty but perform better during periods of high aggregate uncertainty. These findings are most consistent with the destabilizing impact of the CoCo-induced collapse option. That is, the option is more likely to be exercised during high stress periods, thereby destroying bank's going concern value, exacerbating aggregate systemic risks, and undermining macroprudential objectives. Dilutive CoCos do not have the CoCo-induced collapse option, and thus, do not have the same incentives to increase risk, thereby earning positive alpha equity returns during high stress periods when the overall risk of collapse is high. Importantly, these results highlight the original motivation for CoCo inclusion in regulatory capital. That is, CoCos were originally designed to dilute shareholders, and thereby incentivize more prudent behavior as the bank approaches the CoCo trigger level. In the next section, we examine the impact of CoCo security design on systemic risk-taking.

4.5 The CoCo-Induced Collapse Option and Systemic Risk

In this section, we explicitly examine the association between CoCo issues and the level of systemic risk exhibited by banks. We focus on systemic risk for two reasons. First, CoCos were introduced in order to mitigate bank systemic risk exposure. Second, since systemic risk is external to the individual bank, it is not priced in equity returns.

To test this, we use the following regression equation for CoCo issues j announced in year t:

$$SYSRISK_{j,t+1} = \beta_1 DILUTIVE_{j,t} + \beta_2 COCOOUT_{j,t} + CONTROLS_{j,t} + \epsilon_{j,t+1} \quad (14)$$

where the disturbance term, $\epsilon_{j,t+1}$, includes year-fixed effects. As dependent variables, we employ two measures that capture distinct dimensions of systemic risk. First, we use the average ΔCoVaR, from Adrian and Brunnermeier (2016) to evaluate the issuer's contribution to systemic risk (i.e., the connectivity of the issuer). Second, we use the average marginal expected shortfall (MES) to gauge the potential capital shortfall of the issuer in the event of market downturns that indicate systemic risk. The control variables (CONTROLS) are the same as in Equation (3), except we further include the most recent estimate of the systemic risk measures.[23]

The results are presented in Table 8. In Column 1, the result indicates that issuing dilutive CoCos lowers the issuer's contribution to systemic risk. Columns 2 and 3 report results using the average post-announcement MES evaluated at 95% and 99% thresholds, respectively. In both columns, estimates show that the issuer's resiliency towards market-wide shock increases after controlling for the connectedness of the issuer within the financial system (ΔCoVaR). The findings suggest dilutive CoCos contribute to stabilizing systemic risks.

[Table 8 about here]

[23] We do not include the lag of ΔCoVaR in Column 1 of Table 8 because of its slow-moving property.

4.5.1 CoCo Issuance and Bank Idiosyncratic Risk-Taking

Although not the major focus of our paper, we examine the relationship between CoCo design features and bank risk exposure. In Appendix B.4 we examine bank idiosyncratic risk-taking by using bank-level idiosyncratic risk measures as the dependent variables in Equation (3). First, we use the banks' equity volatility measured using the standard deviation of daily returns one year after the CoCo issue announcement date (VOL) to gauge the bank's overall risk exposure. Second, we use the fifth percentile of the empirical distributions of the daily equity returns one year after the CoCo issue announcement date (R5PCT) to measure the post-announcement bank-level negative tail risks of issuers. We include the most recent bank-level risk measure at the announcement date in the set of control variables.

Column 1 of Appendix B.4 reports results using the post-announcement equity volatility (VOL) as the dependent variable. Estimates show that the overall risk level is positively associated with large proportions of outstanding CoCos (COCOOUT), consistent with the proportion of CoCos increasing the bank's risk-shifting incentives. Using the measure of bank-level tail risks of issuers further corroborates our findings on the risk-shifting incentives. Column 2 of Panel B reports the result using the fifth percentile of the empirical distribution of the post-announcement daily return (R5PCT) as the dependent variable. Consistent with Column 1, the coefficient estimate shows that larger proportions of outstanding CoCos increase the bank-level negative tail risks of issuers by lowering the left tail of the post-announcement daily return distribution. These results align with our theoretical model suggesting that the risk-shifting motives of banks exhibit a positive relationship with the proportion of outstanding CoCos.

In both columns, we do not observe a statistically significant reduction in *ex post* equity volatility or negative tail risk for banks announcing the issuance of relatively more dilutive CoCos (DILUTIVE). This is consistent with the role of the CoCo-induced collapse option on tail risk exposure rather than volatility. Indeed, this can explain why other studies have inconsistent results regarding the relationship between CoCo issuance and bank idiosyncratic risk-taking. For example, Avdjiev et al. (2020) analyze CDS spreads and find risk-reducing results only for CoCos that are specified as AT1. However, Allen and Golfari (2022) identify an important role of AT1 CoCos in restricting bank regulators' ability to control bank risk-taking using Maximum Distributable Amount (MDA) limitations. Regulators employ MDA limitations as additional (Pillar 2) policy tools 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 CoCos), and variable remuneration and bonuses paid to bank managers and employees. Allen and Golfari (2022) demonstrate how CoCos are used by management to circumvent these limitations with the full understanding of market participants. That is, bank equity analysts regularly refer to a bank's "AT1 shortfall" if it has underutilized CoCos in fulfilling its capital requirements, thereby incurring excessive costs of capital compliance.[24] Thus, the findings in Avdjiev et al. (2020) of negative CDS spreads upon issuance of CoCos for AT1 instruments may reflect the lowering of costs of capital for the bank rather than lower risk exposure. Thus, failure to consider the embedded options in CoCo design may explain inconsistent empirical findings in the literature.

5 Conclusion

We introduce the concept of CoCo-induced collapse. In low asset valuation states, bank shareholders may benefit from the regulatory declaration of bank non-viability (i.e., insolvency) in order to trigger CoCo conversion. This holds only if CoCos are designed to transfer wealth to stockholders upon CoCo conversion, and if there are substantial amounts of CoCos outstanding in the bank's capital structure. Thus, CoCos designed in this manner have an embedded CoCo-induced collapse option. Using our comprehensive sample of CoCo issues

[24]In their theoretical model, Avdjiev et al. (2020) assume that issuance of AT1-classified CoCos has no impact on the bank's CET1 capital levels. However, Allen and Golfari (2022) show that common equity can be released and designated as a CET1 surplus when CoCos fill AT1 capital requirements in place of more expensive common equity issuance.

from 2009 to 2021, we show that the evolution in the design of CoCos has increased the prevalence of CoCos with this embedded option. We provide evidence that this is destabilizing from a macroprudential perspective, and therefore CoCo design has eviscerated some of the original systemic risk reduction incentives envisioned when CoCos were introduced as regulatory capital components.

Indeed, Credit Suisse may have been the first case of exercise of the CoCo-induced collapse option when the bank wrote down $17 billion in CoCos upon its failure in March 2023 while still retaining equity value. We find evidence that equity markets were well aware of the details of CoCo design in the Credit Suisse case, as well as more generally. Thus, announcement effects on CoCo issues reflect the option value of CoCo-induced collapse based on the issue's specific design features. Further, legal origins impact the choice of these features. Finally, banks that issue CoCos that are designed to eschew the CoCo-induced collapse option outperform other banks' stock returns during periods of high aggregate uncertainty.

References

Acharya, Viral; Pedersen, Lasse; Philippon, Thomas, and Richardson, Matthew. Measuring systemic risk. *Review of Financial Studies*, 30(1):2–47, 2017.

Adrian, Tobias and Brunnermeier, Markus K. Coco issuance and bank fragility. *The American Economic Review*, 106(7):1705–1741, 2016.

Allen, Linda and Golfari, Andrea. Do cocos serve the goals of macroprudential supervisors or bank managers? *Available at SSRN 4218062*, 2022.

Ammann, Manuel; Blickle, Kristian, and Ehmann, Christian. Announcement effects of contingent convertible securities: Evidence from the global banking industry. *European Financial Management*, 23(1):127–152, 2017.

Avdjiev, Stefan; Bogdanova, Bilyana; Bolton, Patrick; Jiang, Wei, and Kartasheva, Anastasia. CoCo issuance and bank fragility. *Journal of Financial Economics*, 138(3):593–613, 2020.

Baker, Scott R.; Bloom, Nicholas, and Davis, Steven J. Measuring economic policy uncertainty. *The Quarterly Journal of Economics*, 131(4):1593–1636, 2016.

Basel Committee on Banking Supervision, . Basel III annex - Minimum requirements to ensure loss absorbency at the point of non-viability. https://www.bis.org/press/p110113.pdf, 2011.

Berg, Tobias and Kaserer, Christoph. Does contingent capital induce excessive risk-taking? *Journal of Financial Intermediation*, 24:884–904, 2015.

Bolton, Patrick; Jiang, Wei, and Kartasheva, Anastasia. The Credit Suisse CoCo Wipeout: Facts, Misperceptions, and Lessons for Financial Regulation. *Journal of Applied Corporate Finance*, Forthcoming, 2023.

Calomiris, Charles W. and Herring, Richard J. How to design a contingent convertible debt requirement that helps solve our too-big-to-fail problem. *Journal of Applied Corporate Finance*, 25:39–62, 2013.

Chen, Nan; Glasserman, Paul; Nouri, Behzad, and Pelger, Markus. Contingent capital, tail risk, and debt-induced collapse. *The Review of Financial Studies*, 30(11):3921–3969, 2017.

Fatouh, Mahmoud; Neamt, Ioana, and van Wijnbergen, Sweder. Risk-taking and uncertainty: Do contingent convertible (coco) bonds increase the risk appetite of banks? *Available at SSRN 3927198*, 2022.

Flannery, Mark J. Contingent capital instruments for large financial institutions: A review of the literature. *Working Paper*, 2013.

Flannery, Mark J. Stabilizing large financial institutions with contingent capital certificates. *Quarterly Journal of Finance*, 1:1–26, 2016.

Garlappi, Lorenzo and Yan, Hong. Financial distress and the cross-section of equity returns. *The Journal of Finance*, 66(3):789–822, 2011.

Goncharenko, Roman. Fighting fire with gasoline: Cocos in lieu of equity. *Journal of Money, Credit and Banking*, 54(2-3):493–517, 2022.

Goncharenko, Roman; Ongena, Steven, and Rauf, Asad. The agency of cocos: Why contingent convertible bonds are not for everyone. *Journal of Financial Intermediation*, 48, 2021.

Hasse, Jean-Baptiste. SystemicR: Monitoring systemic risk. 2020. URL https://CRAN.R-project.org/package=SystemicR.

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

Ho, Daniel E.; Imai, Kosuke; King, Gary, and Stuart, Elizabeth A. priceR: Economics and pricing tools. 2022. URL https://CRAN.R-project.org/package=priceR.

James, Christopher. Some evidence on the uniqueness of bank loans. *Journal of Financial Economics*, 19(3):217–235, 1987.

Koziol, Christian and Lawrenz, Jochen. Contingent convertibles. solving or seeding the next banking crisis? *Journal of Banking and Finance*, 36(1):90–104, 2012.

La Porta, Rafael; Lopez-de-Silanes, Florencio; Shleifer, Andrei, and Vishny, Robert W. Law and finance. *Journal of Political Economy*, 106(6):1113–1155, 1998.

Liao, Qunfeng; Mehdian, Seyed, and Rezvanian, Rasoul. An examination of investors' reaction to the announcement of coco bonds issuance: A global outlook. *Finance Research Letters*, 22:58–65, 2017.

Pennacchi, George; Vermaelen, T., and Wolff, C. Contingent capital: The case of coercs. *Journal of Financial and Quantitative Analysis*, 49(3):541–574, 2014.

Sankar, Priya and Feldberg, Greg. Countries Ease Bank Capital Buffers. *YPFS Systemic Risk Institute*, April 2020. URL https://som.yale.edu/blog/countries-ease-bank-capital-buffers.

Figure 1: Equity value: Dilutive versus non-dilutive CoCo

This figure plots the equity value of banks around the neighborhood of PONV with different types of CoCos outstanding. The horizontal axis represents the asset value of banks. The vertical axis represents the equity value of banks. The solid line represents the value of a bank with dilutive CoCos (-1 wealth transfer). The dashed line represents the value of a bank with non-dilutive CoCos (+1 wealth transfer). CoCo obligations outstanding are set at 12. The dotted vertical line represents the PONV.

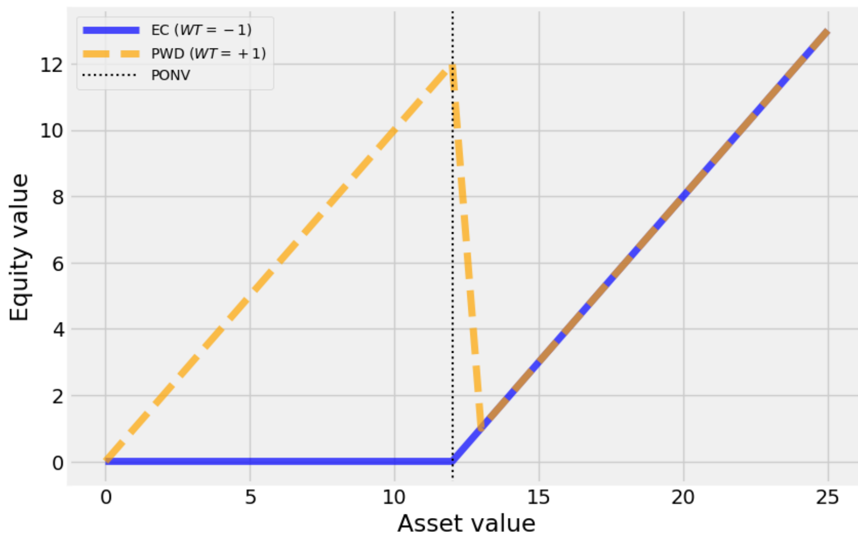


Figure 2: Visualization of the stylized model

This figure plots visualization of the stylized model in Equation (3). The horizontal axis plots the log price of real output in $\mathbb{Q}$. The vertical axis plots the natural log of equity value. All the exogenous parameters except η are fixed. The PONV recovery η takes the values 0, 0.5, 1, and 5. The vertical thin lines represent the endogenous PONV level $\underline{p}$ at different η values. The thick lines represent the equity values with different η values. Line styles paired with colors represent different η values (solid-blue: $\eta = 0$, dotted-magenta: $\eta = 0.5$, dashed-green: $\eta = 1$, and dashdot-orange: $\eta = 5$). We assume $r = 0.05$, $\sigma = 0.1$, $\mu = 0.01$, and $c = 5$.

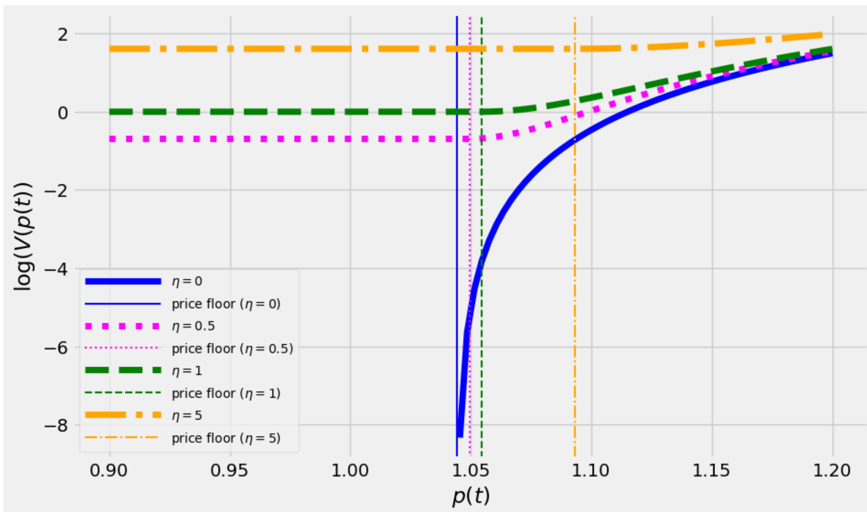
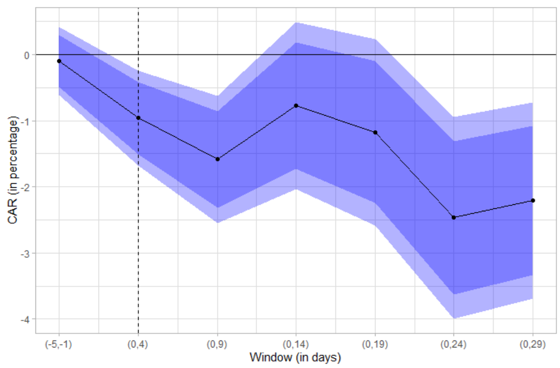


Figure 3: Cumulative Abnormal Returns: By DILUTIVE

This figure plots the announcement effect of CoCo issues on equity value. Cumulative abnormal returns are estimated with the market model (CAPM) on an estimation window of 250 days (with at least 50 valid returns) that ends 30 days before the CoCo issue announcement date. DILUTIVE is an indicator variable that equals 1 if the CoCo is in the lowest wealth transfer tercile and else 0. The solid lines represent the mean. The dark and light shaded areas represent the 95% and 99% confidence intervals respectively. Horizontal axis represents cumulative abnormal return in percentage. Vertical axis represents estimation windows with 5 trading day increments.



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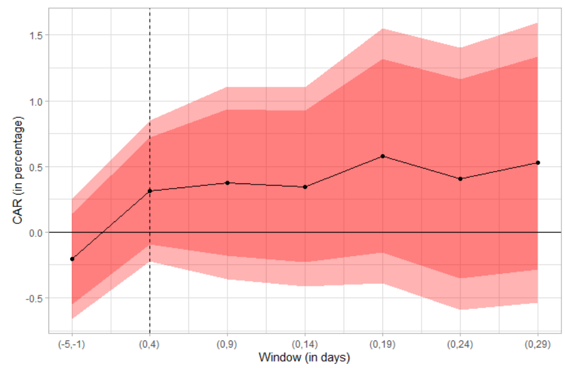
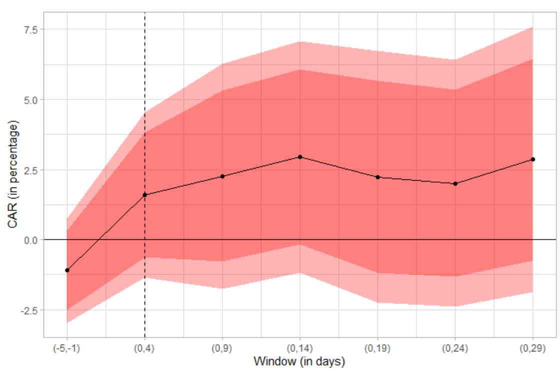


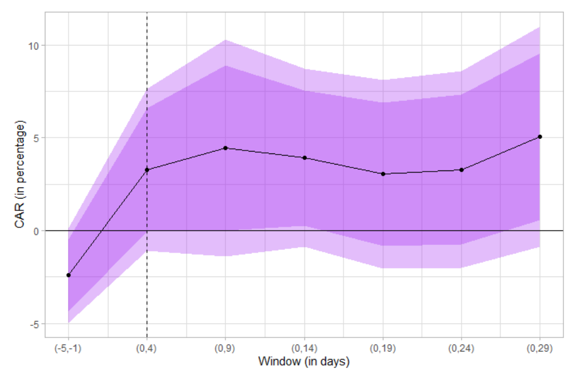
B. DILUTIVE=0

Figure 4: Cumulative Abnormal Returns: Top decile of COCOOUT

This figure plots the announcement effect of CoCo issues by banks with large amounts of outstanding CoCos on equity value. Cumulative abnormal returns are estimated with the market model (CAPM) on an estimation window of 250 days (with at least 50 valid returns) that ends 30 days before the CoCo issue announcement date. COCOOUT is the outstanding amount of CoCo bonds scaled by total liabilities. DILUTIVE is an indicator variable that equals 1 if the CoCo is in the lowest wealth transfer tercile and else 0. The solid lines represent the mean. The dark and light shaded areas represent the 95% and 99% confidence intervals respectively. Horizontal axis represents cumulative abnormal return in percentage. Vertical axis represents estimation windows with 5 trading day increments.



A. All



B. DILUTIVE=0

Table 1: Descriptive Statistics

This table presents the descriptive statistics of the main variables used in the analysis. The baseline data consist of 756 CoCo issues betwen 2009 and 2021 from 28 countries. Panel A reports the descriptive statistics. Panel B reports top 10 number of issues by countries and issuers. Detailed variable descriptions are provided in Table B.1.

Panel A. Descriptive statistics

Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**25%**	**75%**	**Max**
ANNTOISS	756	8.060	6.934	0	6	8	48
BETA	756	1.196	0.629	−0.358	0.801	1.583	2.963
DILUTIVE	756	0.325	0.469	0	0	1	1
COCOOUT	756	1.933	3.990	0.000	0.507	1.428	35.494
EC	756	0.291	0.455	0	0	1	1
PWD	756	0.247	0.432	0	0	0	1
TWD	756	0.462	0.499	0	0	1	1
COMMON	756	0.335	0.472	0	0	1	1
FRENCH	756	0.246	0.431	0	0	0	1
MKTCAP	756	16.440	2.159	7.783	15.178	17.885	20.667
ROE	756	7.574	6.997	−24.735	5.078	11.109	37.308
DIST	756	6.814	3.454	−3.950	4.675	8.575	22.775
BOOKLEV	756	92.955	2.841	73.478	92.114	94.817	98.145
ROLLOVER	756	0.139	0.346	0	0	0	1
VOL	756	34.995	24.028	1.391	21.969	39.932	125.997
VOL$(t+1)$	756	31.680	12.661	2.685	22.766	40.704	114.242
R5PCT	756	−3.285	2.187	−11.696	−3.659	−2.110	−0.101
R5PCT$(t+1)$	756	−2.971	1.118	−8.133	−3.758	−2.191	−0.195
ΔCoVaR	684	−0.370	0.245	−0.925	−0.530	−0.109	0.005
MES95	756	−1.725	1.615	−7.080	−2.286	−0.628	0.939
MES99	756	−2.811	2.718	−15.132	−4.422	−0.855	2.037
MES95$(t+1)$	756	−1.520	1.333	−6.495	−2.004	−0.637	0.609
MES99$(t+1)$	756	−2.677	2.618	−13.788	−3.688	−0.943	3.004

Panel B. Issues by countries and issuers (top 10)

Rank	Country	Issues	Issuer	Issues
1	United Kingdom	110	LBG Capital	38
2	India	97	Credit Suisse Group	22
3	Norway	75	Societe Generale	20
4	Switzerland	66	BNP Paribas	18
5	China	54	UBS Group	18
6	France	53	Banco Mercantil del Norte	16
7	Spain	38	Bank of Baroda	16
8	Japan	34	HSBC Holdings	16
9	Denmark	27	Barclays PLC	15
10	Mexico	27	Credit Agricole	15

Table 2: Cumulative abnormal returns and wealth transfer

This table compares the announcement effects between dilutive and non-dilutive CoCos through mean-difference tests. Column 1 reports the cumulative abnormal returns of dilutive CoCos. Column 2 reports the cumulative abnormal returns of non-dilutive CoCos. Column 3 reports the difference in mean between the cumulative abnormal returns of dilutive and non-dilutive CoCos. Column 4 reports the p-value of the mean differences. Cumulative abnormal returns are estimated with the market model (CAPM) on an estimation window of 250 days (with at least 50 valid returns) that ends 30 days before the CoCo issue announcement date. DILUTIVE is an indicator variable that equals 1 if the CoCo is in the lowest wealth transfer tercile and else 0. Detailed variable descriptions are provided in Table B.1. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Cumulative abnormal return (CAR)		Diff (1-2)	$p-$value
	DILUTIVE=1	DILUTIVE=0		
CAR window	(1)	(2)	(3)	(4)
(-5,-1)	-0.095	-0.203	0.108	0.684
(0,4)	-0.96***	0.316	-1.276***	0
(0,9)	-1.585***	0.376	-1.961***	0
(0,14)	-0.77	0.346	-1.117*	0.051
(0,19)	-1.172**	0.58	-1.752***	0.009
(0,24)	-2.468***	0.406	-2.874***	0
(0,29)	-2.204***	0.528	-2.732***	0
Observations	246	510	756	756

Table 3: Cumulative abnormal return and wealth transfer: Regression analysis

This table examines the announcement effect of CoCo issues using OLS regressions. Cumulative abnormal returns are estimated with the market model (CAPM) on an estimation window of 250 days (with at least 50 valid returns) that ends 30 days before the CoCo issue announcement date. DILUTIVE is an indicator variable that equals 1 if the CoCo is in the lowest wealth transfer tercile and else 0. COCOOUT is the outstanding amount of CoCo bonds scaled by total liabilities. ROE is the return on equity of the issuers. MKTCAP is the natural log of the market capitalization of the issuers in USD at the announcement date. DIST is the distance to the trigger level measured as the difference between the capital ratio and the trigger level of the CoCo. BOOKLEV is the book leverage of issuers measured as liabilities scaled by assets. ROLLOVER is an indicator variable that equals 1 if the CoCo is a rollover (issued within +/- 90 days of the first call date of an existing CoCo). Detailed variable descriptions are provided in Table B.1. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All standard errors are clustered at the calendar year level and provided in parentheses.

Dependent Variables:	Cumulative abnormal returns (CAR)			
Window:	(-2,2)	(0,9)	(0,19)	(0,29)
Model:	(1)	(2)	(3)	(4)
DILUTIVE	-0.687*	-1.28**	-1.23*	-1.74***
	(0.314)	(0.510)	(0.565)	(0.505)
COCOOUT	0.217**	0.208	0.205*	0.326**
	(0.090)	(0.147)	(0.106)	(0.129)
MKTCAP	0.045	0.136	-0.215	-0.136
	(0.102)	(0.088)	(0.124)	(0.161)
ROE	0.008	-0.061	-0.023	-0.033
	(0.042)	(0.044)	(0.087)	(0.095)
DIST	-0.050	-0.095	-0.080	0.087
	(0.084)	(0.168)	(0.157)	(0.202)
BOOKLEV	-0.037	-0.220	-0.012	-0.022
	(0.142)	(0.229)	(0.240)	(0.227)
ROLLOVER	0.296	0.057	-0.188	0.520
	(0.333)	(1.04)	(0.806)	(1.52)
Wald p-value (DILUTIVE & COCOOUT)	0.0309	0.0346	0.0076	0.0000
Year Fixed Effects	Yes	Yes	Yes	Yes
Adjusted R^2	0.07604	0.10717	0.04879	0.09157
Observations	756	756	756	756

Table 4: Cumulative abnormal return, wealth transfer, and outstanding CoCos

This table examines the joint significance of the wealth transfer measure and the proportion of outstanding CoCo on the announcement effects of CoCo issues. Cumulative abnormal returns are estimated with the market model (CAPM) on an estimation window of 250 days (with at least 50 valid returns) that ends 30 days before the CoCo issue announcement date. DILUTIVE is an indicator variable that equals 1 if the CoCo is in the lowest wealth transfer tercile and else 0. COCOOUT is the outstanding amount of CoCo bonds scaled by total liabilities. EC is an indicator variable that equals 1 if the CoCo is an equity convertible. ROE is the return on equity of the issuers. MKTCAP is the natural log of the market capitalization of the issuers in USD at the announcement date. DIST is the distance to the trigger level measured as the difference between the capital ratio and the trigger level of the CoCo. BOOKLEV is the book leverage of issuers measured as liabilities scaled by assets. ROLLOVER is an indicator variable that equals 1 if the CoCo is a rollover (issued within +/- 90 days of the first call date of an existing CoCo). Detailed variable descriptions are provided in Table B.1. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All standard errors are clustered at the calendar year level and provided in parentheses.

Dependent Variables:	Cumulative abnormal returns (CAR)			
Window:	(-2,2)	(0,9)	(0,19)	(0,29)
Model:	(1)	(2)	(3)	(4)
DILUTIVE	0.296	-0.809	-1.59*	-1.71*
	(0.318)	(0.673)	(0.761)	(0.841)
COCOOUT	0.320**	0.258	0.167	0.329*
	(0.129)	(0.184)	(0.139)	(0.158)
DILUTIVE × COCOOUT	-0.509***	-0.246	0.186	-0.017
	(0.139)	(0.202)	(0.415)	(0.294)
MKTCAP	-0.008	0.110	-0.196	-0.137
	(0.088)	(0.083)	(0.151)	(0.180)
ROE	0.003	-0.064	-0.021	-0.033
	(0.043)	(0.044)	(0.086)	(0.096)
DIST	-0.047	-0.094	-0.080	0.087
	(0.087)	(0.169)	(0.157)	(0.203)
BOOKLEV	-0.008	-0.206	-0.023	-0.021
	(0.132)	(0.221)	(0.249)	(0.236)
ROLLOVER	0.283	0.050	-0.183	0.520
	(0.344)	(1.07)	(0.785)	(1.52)
Wald p-value (DILUTIVE, COCOOUT)	0.0001	0.0120	0.0003	0.0001
Year Fixed Effects	Yes	Yes	Yes	Yes
Adjusted R^2	0.11598	0.10991	0.04873	0.09035
Observations	756	756	756	756

Table 5: Determinants of low wealth transfer CoCo issues and legal origins

This table examines the impact of legal origin on the loss absorption mechanisms of CoCo issues. WT is the estimated contingent wealth transfer from CoCo bondholders to stockholders. DILUTIVE is an indicator variable that equals 1 if the CoCo is in the lowest wealth transfer tercile and else 0. COMMON is an indicator variable that equals 1 if the issuer is incorporated in a common law country. FRENCH is an indicator variable that equals 1 if the issuer is incorporated in a French-civil-law country. The legal origins across countries are classified following La Porta et al. (1998). MKTCAP is the natural log of the market capitalization of the issuers in USD at the announcement date. ROE is the return on equity of the issuers. DIST is the distance to the trigger level measured as the difference between the capital ratio and the trigger level of the CoCo. BOOKLEV is the book leverage of issuers measured as liabilities scaled by assets. Detailed variable descriptions are provided in Table B.1. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All standard errors are clustered at the calendar year level and provided in parentheses.

Dependent Variables:	WT (1)	DILUTIVE (2)	DILUTIVE (3)
COMMON	-27.4*** (8.50)	0.310*** (0.078)	0.944*** (0.228)
FRENCH	-4.91 (5.63)	0.149*** (0.036)	0.496*** (0.119)
MKTCAP	-1.90 (1.24)	0.003 (0.011)	0.008 (0.041)
ROE	0.579 (0.330)	-0.008** (0.003)	-0.025*** (0.009)
DIST	-1.87 (1.74)	0.008 (0.010)	0.031 (0.035)
BOOKLEV	-1.54 (0.974)	0.012 (0.011)	0.041 (0.036)
ROLLOVER	2.35 (9.79)	-0.041 (0.034)	-0.116 (0.116)
COCOOUT	-0.172 (0.442)	-0.0008 (0.004)	-0.0009 (0.012)
Model	OLS	LPM (OLS)	Probit
Year Fixed Effects	Yes	Yes	Yes
Adjusted R^2	0.09794	0.17267	-
Pseudo R^2	-	-	0.15832
Observations	756	756	756

Table 6: Cumulative abnormal returns, wealth transfer, and legal origins: 2SLS

This table examines the causal impact of wealth transfer on equity value. 1^{st} stage estimates are provided in Column 2 of Table 5. Cumulative abnormal returns are estimated with the market model (CAPM) on an estimation window of 250 days (with at least 50 valid returns) that ends 30 days before the CoCo issue announcement date. DILUTIVE is an indicator variable that equals 1 if the CoCo is in the lowest wealth transfer tercile and else 0. COCOOUT is the outstanding amount of CoCo bonds scaled by total liabilities. ROE is the return on equity of the issuers. MKTCAP is the natural log of the market capitalization of the issuers in USD at the announcement date. DIST is the distance to the trigger level measured as the difference between the capital ratio and the trigger level of the CoCo. BOOKLEV is the book leverage of issuers measured as liabilities scaled by assets. ROLLOVER is an indicator variable that equals 1 if the CoCo is a rollover (issued within +/- 90 days of the first call date of an existing CoCo). Detailed variable descriptions are provided in Table B.1. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All standard errors are clustered at the calendar year level and provided in parentheses.

Dependent Variables:	Cumulative abnormal returns (CAR)			
Window:	(-2,2)	(0,9)	(0,19)	(0,29)
Model:	(1)	(2)	(3)	(4)
DILUTIVE	-0.666	-1.00	-6.57**	-8.99**
	(1.29)	(2.17)	(2.84)	(3.55)
COCOOUT	0.217**	0.208	0.213*	0.337**
	(0.089)	(0.147)	(0.114)	(0.141)
MKTCAP	0.044	0.131	-0.121	-0.008
	(0.094)	(0.103)	(0.165)	(0.229)
ROE	0.008	-0.058	-0.092	-0.126
	(0.030)	(0.041)	(0.091)	(0.094)
DIST	-0.050	-0.092	-0.136	0.010
	(0.090)	(0.179)	(0.165)	(0.224)
BOOKLEV	-0.036	-0.219	-0.031	-0.048
	(0.140)	(0.232)	(0.214)	(0.200)
ROLLOVER	0.297	0.072	-0.473	0.133
	(0.321)	(1.08)	(0.882)	(1.64)
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	756	756	756	756
F-test (1st stage)	23.657	23.657	23.657	23.657
1st stage $F-$test $p-$value (weak inst.)	0.000	0.000	0.000	0.000
Sargan $p-$value (overid.)	0.2468	0.2635	0.9886	0.9920

Table 7: Monthly arbitrage portolio returns by wealth transfer

This table examines the effect of CoCo issues on future stock return performance. Each month, we track the CoCo issue within the past 3 years and sort based on the wealth transfer measure. The equally weighted portfolio longs the issuers of the CoCos with below median wealth transfer and shorts CoCos with above median wealth transfer. VIXH is an indicator variable that equals 1 if the CBOE S&P 500 VIX in the period when the portfolio is constructed is above the sample median. EPUH is an indicator variable that equals 1 if the Global Economic Policy Uncertainty Index (Baker et al., 2016) in the period when the portfolio is constructed is above the sample median. COVID is an indicator variable that equals 1 if the portfolio is constructed after January 2020 and else 0. MKT, SMB, HML, RMW, and CMA are the Fama-French developed countries market, size, value, profitability, and investment factors respectively. The portfolio is rebalanced each month. The portfolio is formed from October 2014 to December 2021. Detailed variable descriptions are provided in Table B.1. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All standard errors are heteroskedasticity-consistent and provided in parentheses.

Dependent Variables:	Monthly arbitrage portfolio return			
Model:	(1)	(2)	(3)	(4)
ALPHA	-0.320	-0.918**	-0.819**	-0.586**
	(0.250)	(0.409)	(0.343)	(0.290)
VIXH		1.19**		
		(0.572)		
EPUH			1.03**	
			(0.476)	
COVID				1.07**
				(0.500)
MKT	0.164**	0.211***	0.152**	0.152**
	(0.078)	(0.080)	(0.073)	(0.072)
SMB	-0.116	-0.193	-0.090	-0.115
	(0.167)	(0.174)	(0.170)	(0.171)
HML	0.409**	0.363**	0.417**	0.411**
	(0.183)	(0.178)	(0.174)	(0.174)
RMW	0.077	-0.080	0.069	0.040
	(0.234)	(0.237)	(0.233)	(0.231)
CMA	-0.230	-0.232	-0.268	-0.222
	(0.279)	(0.274)	(0.269)	(0.272)
Wald p-value (ALPHA & Uncertainty)	-	0.0379	0.0502	0.0716
Adjusted R^2	0.16432	0.20588	0.20029	0.19316
Observations	87	87	87	87

Table 8: Systemic risk and CoCo Issues

This table examines the systemic risks of banks after the announcement of CoCo issues. ΔCoVaR$(t+1)$ is the average post-announcement systemic risk measure from Adrian and Brunnermeier (2016). MES$(t+1)$ is the average post-announcement Marginal Expected Shortfall. DILUTIVE is an indicator variable that equals 1 if the CoCo is in the lowest wealth transfer tercile and else 0. COCOOUT is the outstanding amount of CoCo bonds scaled by total liabilities. MES is the average pre-announcement Marginal Expected Shortfall. ΔCoVaR is the average pre-announcement systemic risk measure from Adrian and Brunnermeier (2016). Control variables include profitability (ROE), market capitalization (MKTCAP), distance from the trigger level (DIST), book leverage (BOOKLEV), and rollover indicator (ROLLOVER). Detailed variable descriptions are provided in Table B.1. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All standard errors are clustered at the calendar year level and provided in parentheses.

Dependent Variables:	Measures of systemic risk		
Risk measures: Model:	ΔCoVaR$(t+1)$ (1)	MES95$(t+1)$ (2)	MES99$(t+1)$ (3)
DILUTIVE	-0.081** (0.029)	0.180*** (0.049)	0.410*** (0.122)
COCOOUT	-0.007* (0.003)	-0.004 (0.008)	-0.012 (0.021)
MES95		0.137 (0.098)	
MES99			-0.025 (0.118)
ΔCoVaR		1.44** (0.473)	3.02** (0.975)
Controls	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Adjusted R^2	0.37583	0.41293	0.65837
Observations	684	684	684

Appendix A Derivation of the Stylized Model

Our model is a special case of Garlappi and Yan (2011) where we explore a simplified version of Corollary 1.1 assuming one cost dimension and fixed payout ($a = 1$, $b = 0$). Specifically, the equity value of a bank comprises (i) unlevered component, (ii) levered component, and (iii) a limited liability component. For simplicity, we assume there are only equity and CoCos in the bank's capital structure and the bank incurs no other costs. Under the log output price dynamics specified in Equation (1), the unlevered equity value $V^U(p_t)$ is

$$V^U(p_t) = \int_0^\infty \mathbf{E}^{\mathbb{Q}}\left[\exp(p_{t+s})\right] ds = e^{p(t)}/\delta$$

assuming $\mu + \sigma^2/2 - r < 0$ and $\delta \equiv r - \mu - \sigma^2/2$.[25] The levered equity value $V^L(p_t)$ is

$$V^L(p_t) = V^U(p_t) + c/r = e^{p(t)}/\delta + c/r.$$

where c is the CoCo interest payments. Lastly, equity value with the limited liability value $L(p_t)$ is

$$V(p(t)) = e^{p(t)}/\delta + c/r + L(p_t).$$

The limited liability value of the firm provided by the ODE is

$$\frac{\sigma^2}{2} L''(p) + \mu L'(p) - rU(p) = 0.$$

The solution for the ODE is $Ae^{\phi p(t)}$ where $\phi = \frac{-\mu + \sqrt{\mu^2 - 2\sigma^2 r}}{\sigma^2}$ ($\phi < 0$). Thus,

$$V(p(t)) = e^{p(t)}/\delta + c/r + Ae^{\phi p(t)}. \tag{A.1}$$

The value matching condition ($V(\underline{p}) = \eta$) and the smooth-pasting condition ($V'(\underline{p}) = 0$) results in $A = -\frac{1}{\delta\phi} e^{(1-\phi)\underline{p}}$ ($A > 0$). We then apply A to Equation (A.1) to obtain $\underline{p}$ ($\underline{p} > 0$).

[25] As in Garlappi and Yan (2011), the output pricing dynamics in $\mathbb{Q}$ are supported by the bank's real output price dynamics in $\mathbb{P}$ represented by $dp_t = \mu^p dt + \sigma dW_t^p$ assuming a pricing kernel of $dM_t/M_t = -rdt + \gamma dW_t^p$ (i.e., $dW_t = \gamma dt + dW_t^p$). Thus, $\mu = \mu^P - \sigma\gamma$.

Appendix B Tables and Figures

Table B.1: Variable Description

The below table provides the description and construction of variables used in the paper. Prospectus indicates hand-collected security level information that is collected directly from the prospectuses. We follow the information in the prospectus over what is recorded in Bloomberg (the correction is available in an R code). External sources indicate a hand-collected regulatory data from 28 different countries that record the country level and systemically important bank level capital requirements (available in an R code). We cross-validate the country level regulatory requirements of our hand-collected data with the data provided by Sankar and Feldberg (2020).

Variable	Description	Source
CAR (0,T)	Cumulative abnormal return around a daily window (0,T) measured using the decimal values of the daily stock price return of issuers and the market index of the country of incorporation. The market model (CAPM) is estimated on an estimation window of 250 days (with at least 50 valid returns) that ends 30 days before the CoCo issue announcement date. Country level market index is from WRDS World Indices. Risk-free rate is from Kenneth French's website (FF Factor Daily Developed Countries).	Datastream, WRDS
ANNTOISS	Number of calendar days between the announcement date and the issue date	Bloomberg
BETA	Market beta used to calculate the cumulative abnormal returns of CoCo issues.	Datastream, WRDS
EC	An indicator variable that equals 1 if the CoCo is an equtiy conversion CoCo. We hand collect the prospectuses and correct any errors made in Bloomberg.	Bloomberg, prospectus
TWD	An indicator variable that equals 1 if the CoCo is an temporary write-down CoCo. We hand collect the prospectuses and correct any errors made in Bloomberg.	Bloomberg, prospectus
PWD	An indicator variable that equals 1 if the CoCo is an permanent write-down CoCo (including partial permanent write down). We hand collect the prospectuses and correct any errors made in Bloomberg.	Bloomberg, prospectus
ROLLOVER	An indicator variable that equals 1 if the CoCo issued within +/- 90 days of the first call date of an outstanding CoCo by the same issuer.	Bloomberg
WT	Contingent wealth transfer measure of the CoCo issue estimated using Equation (7).	Bloomberg, Capital IQ, Datastream
DILUTIVE	An indicator variable that equals 1 if the wealth transfer measure (WT) is in the lowest tercile and else 0.	Bloomberg, Capital IQ, Datastream
COCOOUT	Outstanding CoCos of the issuer calculated as sum of the amount of the currently issuing and the pre-existing outstanding CoCos with trigger levels that are greater than or equal to the current issue scaled by total liabilities	Bloomberg, Capital IQ, Datastream
DIST	The difference between the trigger level of the CoCo and the corresponding capital ratio of the issuer.	Bloomberg, Capital IQ, Datastream
MKTCAP	The natural log of market capitalization (p $\times$ shout) of the issuer in USD at the announcement date. The daily exchange rate is from the *priceR* package (Ho et al., 2022)	Datastream, *priceR*
BOOKLEV	Book leverage of banks measured as the total liabilities scaled by the total assets.	Capital IQ, Bankfocus
ROE	Profitability of the banks collected directly from the data sources.	Capital IQ, Bankfocus
VIXH	An indicator variable that equals 1 if the CBOE S&P 500 VIX in the period when the portfolio is constructed is above the sample median and else 0.	WRDS
EPUH	an indicator variable that equals 1 if the Global Economic Policy Uncertainty Index (Baker et al., 2016) in the period when the portfolio is constructed is above the sample median.	EPU website
COVID	An indicator variable that equals 1 if the monthly portfolio is constructed after January 2020 and else 0.	-

Table B.1: *(Continued)*

Variable	Description	Source
COMMON	An indicator variable that equals 1 if the bank is incorporated in a common law country and else 0. The countries are: GB, IN, MY, IE, AU, TH, and ZA (in ISO Alpha-2 codes)	La Porta et al. (1998)
FRENCH	An indicator variable that equals 1 if the bank is incorporated in a French-civil law country and else 0. The countries are: FR, ES, MX, IT, BR, NL, BE, CO, TR, ID, and PT (in ISO Alpha-2 codes)	La Porta et al. (1998)
VOL	The pre-announcement equity volatility measured as the standard deviation of the daily stock returns one year before the announcement date. The standard deviation is then annualized by multiplying the square root of 255.	Datastream
VOL$(t+1)$	The post-announcement equity volatility measured as the standard deviation of the daily stock returns one year before the announcement date. The standard deviation is then annualized by multiplying the square root of 255.	Datastream
R5PCT	The pre-announcement negative tail risk of equity value measured as the fifth percentile of the daily stock return one year before the announcement date.	Datastream
R5PCT$(t+1)$	The post-announcement negative tail risk of equity value measured as the fifth percentile of the daily stock return one year after the announcement date.	Datastream
MES	The average pre-announcement Marginal Expected Shortfall. Marginal Expected Shortfalls are measured daily as the mean equity return of the bank in the 5% negative tail of market returns (5% worst days by market return) with a one year look back period. We take the average of the estimated Marginal Expected Shortfall one year before the announcement of the CoCo issues. We use S&P500 returns as the market returns.	Datastream
MES$(t+1)$	The average post-announcement Marginal Expected Shortfall. Marginal Expected Shortfalls are measured daily as the mean equity return of the bank in the 5% negative tail of market returns (5% worst days by market return) with a one year look back period. We take the average of the estimated Marginal Expected Shortfall one year after the announcement of the CoCo issues. We use S&P500 returns as the market returns.	Datastream
ΔCoVaR	The systemic risk measure from Adrian and Brunnermeier (2016). To estimate this, we use the R package *SystemicR* (Hasse, 2020). Daily equity returns of banks are collected from January 2008 to September 2022. We use weekly state variables, lagged by one period, known to capture time variation in the conditional moments of asset returns. These state variables include: (i) The change in the 3-Month T-bill yield rate, (ii) the change in the slope of the yield curve, measured as the change in the difference between the yields on 30-Year Treasury bonds and 3-Month T-bills, (iii) the change in the credit spread between Moody's Baa-rated bonds and 10-year Treasury rate, (iv) the real estate sector excess (weekly) return over the financial sector (v) The market return from the S&P 500 index, and (vi) the VIX index of equity volatility. The state variables are from Federal Reserve Bank of St. Louis (FRED). For CoCo issues, we measure the average of the daily ΔCoVaR a year after the announcement date.	Datastream, CRSP, FRED, *SystemicR*

Table B.2: Cumulative abnormal return and wealth transfer: Regression analysis (banks from developed countries or systemically important banks)

This table examines the announcement effect of CoCo issues using OLS regressions with a subsample consisted of banks that are either in developed countries or systemically important. Cumulative abnormal returns are estimated with the market model (CAPM) on an estimation window of 250 days (with at least 50 valid returns) that ends 30 days before the CoCo issue announcement date. DILUTIVE is an indicator variable that equals 1 if the CoCo is in the lowest wealth transfer tercile and else 0. COCOOUT is the outstanding amount of CoCo bonds scaled by total liabilities. ROE is the return on equity of the issuers. MKTCAP is the natural log of the market capitalization of the issuers in USD at the announcement date. DIST is the distance to the trigger level measured as the difference between the capital ratio and the trigger level of the CoCo. BOOKLEV is the book leverage of issuers measured as liabilities scaled by assets. ROLLOVER is an indicator variable that equals 1 if the CoCo is a rollover (issued within +/- 90 days of the first call date of an existing CoCo). Detailed variable descriptions are provided in Table B.1. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All standard errors are clustered at the calendar year level and provided in parentheses.

Dependent Variables:	Cumulative abnormal returns (CAR)			
Window:	(-2,2)	(0,9)	(0,19)	(0,29)
Model:	(1)	(2)	(3)	(4)
DILUTIVE	-0.240	-1.01**	-1.10**	-1.25*
	(0.274)	(0.404)	(0.475)	(0.627)
COCOOUT	-0.126*	0.116**	0.359	0.482**
	(0.070)	(0.047)	(0.233)	(0.184)
MKTCAP	-0.002	-0.005	-0.390**	-0.310
	(0.096)	(0.101)	(0.160)	(0.236)
ROE	0.016	-0.038	0.023	0.032
	(0.045)	(0.052)	(0.099)	(0.115)
dist	-0.065	-0.052	-0.108	0.127
	(0.065)	(0.103)	(0.109)	(0.172)
BOOKLEV	-0.043	0.006	0.214	0.268
	(0.086)	(0.086)	(0.156)	(0.232)
ROLLOVER	0.266	0.723	0.236	0.978
	(0.156)	(0.726)	(0.611)	(1.48)
Wald p-value (DILUTIVE & COCOOUT)	0.1058	0.0149	0.0211	0.0260
Year Fixed Effects	Yes	Yes	Yes	Yes
Adjusted R^2	0.06577	0.16003	0.05144	0.10021
Observations	626	626	626	626

Table B.3: Cumulative abnormal return and wealth transfer: Regression analysis (ACPE)

This table examines the announcement effect of CoCo issues using OLS regressions. Average cumulative prediction errors (ACPE) are estimated with the market model (CAPM) on an estimation window of 250 days (with at least 50 valid returns) that ends 30 days before the CoCo issue announcement date. DILUTIVE is an indicator variable that equals 1 if the CoCo is in the lowest wealth transfer tercile and else 0. COCOOUT is the outstanding amount of CoCo bonds scaled by total liabilities. ROE is the return on equity of the issuers. MKTCAP is the natural log of the market capitalization of the issuers in USD at the announcement date. DIST is the distance to the trigger level measured as the difference between the capital ratio and the trigger level of the CoCo. BOOKLEV is the book leverage of issuers measured as liabilities scaled by assets. ROLLOVER is an indicator variable that equals 1 if the CoCo is a rollover (issued within +/- 90 days of the first call date of an existing CoCo). Detailed variable descriptions are provided in Table B.1. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All standard errors are clustered at the calendar year level and provided in parentheses.

Dependent Variables:	Average cumulative prediction error (ACPE)			
Window:	(-2,2)	(0,9)	(0,19)	(0,29)
Model:	(1)	(2)	(3)	(4)
DILUTIVE	-0.134*	-0.128**	-0.067**	-0.062***
	(0.062)	(0.050)	(0.022)	(0.017)
COCOOUT	0.042**	0.020	0.012**	0.013**
	(0.017)	(0.013)	(0.005)	(0.004)
MKTCAP	0.011	0.015*	-0.007	-0.001
	(0.019)	(0.008)	(0.006)	(0.006)
ROE	-0.0010	-0.008	-0.004	-0.003
	(0.009)	(0.005)	(0.005)	(0.004)
DIST	-0.013	-0.010	-0.004	0.002
	(0.016)	(0.016)	(0.008)	(0.008)
BOOKLEV	-0.006	-0.015	0.0010	0.002
	(0.026)	(0.016)	(0.011)	(0.009)
ROLLOVER	0.082	0.046	0.018	0.046
	(0.077)	(0.109)	(0.049)	(0.069)
Wald p-value (DILUTIVE & COCOOUT)	0.0269	0.0206	0.0001	0.0001
Year Fixed Effects	Yes	Yes	Yes	Yes
Adjusted R^2	0.06858	0.11525	0.04208	0.07269
Observations	756	756	756	756

Table B.4: Bank-level risks and CoCo Issues

This table examines the bank-level risks of banks after the announcement of CoCo issues. VOL($t+1$) is the equity volatility measured using the standard deviation of daily returns one year after the CoCo issues. R5PCT($t+1$) is the post-announcement negative tail risk of equity value of the issuer. DILUTIVE is an indicator variable that equals 1 if the CoCo is in the lowest wealth transfer tercile and else 0. COCOOUT is the outstanding amount of CoCo bonds scaled by total liabilities. VOL is the pre-announcement equity volatility measured using daily returns one year before the CoCo issues. R5PCT is the pre-announcement negative tail risk of equity value of the issuer. Control variables include profitability (ROE), market capitalization (MKTCAP), distance from the trigger level (DIST), book leverage (BOOKLEV), and rollover indicator (ROLLOVER). Detailed variable descriptions are provided in Table B.1. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All standard errors are clustered at the calendar year level and provided in parentheses.

Dependent Variables:	Measures of bank-level risk	
Risk measures:	VOL($t+1$)	R5PCT($t+1$)
Model:	(1)	(2)
DILUTIVE	0.635	-0.096
	(0.769)	(0.067)
COCOOUT	0.208**	-0.021***
	(0.073)	(0.007)
VOL	0.432***	
	(0.119)	
R5PCT		0.366***
		(0.111)
Controls	Yes	Yes
Year fixed effects	Yes	Yes
Adjusted R^2	0.38537	0.40571
Observations	756	756

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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. That is, CoCos are overwhelmingly issued with conversion ratios of zero (principal writedowns) that do not mitigate bank risk taking. Further, CoCo issuance can be used to circumvent supervisory discretion over bonus and dividend payouts. That is, CoCos issued as Additional Tier 1 capital relax regulatory constraints, particularly for banks close to the Maximum Distributable Amount (MDA) threshold. Bank managers are aware of these loopholes and exploit them to the detriment of financial market stability and macroprudential objectives.

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 before the bank became insolvent, 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 and 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 et al. (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 et al. (2015) highlight

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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 et al. (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.[3] 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.[4] 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. Our comprehensive sample is unique in that it includes CoCos issued by private, as well as publicly-traded banks.

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 to bank shareholder and managerial risk taking. Indeed, shareholders may benefit from the trigger of CoCo principal write-down features since 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 expected wealth transfer for shareholders at the trigger point. Examining only 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 triggering, 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.[5]

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) limitations on dividend and compensation payouts. Regulators employ Maximum Distributable Amount limitations as additional policy tools 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 Additional Tier 1 capital requirements. If structured properly, CoCos can be used to replace common equity in fulfilling required AT1 capital levels. If a bank underutilizes CoCos and instead uses higher quality common stock to fulfill

[3] 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 et al. (2014), Calomiris and Herring (2013) and Allen and Tang (2016).

[4] Although other papers, such as Himmelberg and Tsyplakov (2012), Hilscher and Raviv (2014) and Chan and van Wijnbergen (2017) discuss the importance of punitive wealth transfers upon CoCo conversion, to our knowledge, we are the first to comprehensively document this market shift.

[5] 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.

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. Thus, although CoCo issuance reduces financial distress by increasing the bank's loss absorbing capital, the ability to issue CoCos in place of common equity may actually exacerbate risk taking, thereby exacerbating financial distress. This effect is particularly substantial for banks subject to the European Capital Requirements Regulation (CRR) and Capital Requirements Directive IV (CRD IV) framework, and especially in those jurisdictions where the national regulator has imposed additional capital surcharges meant to supplement the Basel III standard buffers. Recognizing the permissive impact of this use of CoCos to meet bank capital requirement, on March 12, 2020 the European Central Bank granted (European Central Bank, 2020) 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.[6] 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.

Recent theoretical papers have called into question the premise that CoCos must be dilutive to equity holders in order to combat the moral hazard risk shifting incentives of leveraged banks. For example, Martynova and Perotti (2018) compare risk shifting incentives for junior debt to CoCos with both positive and negative wealth transfers. They find that positive wealth transfer (non-dilutive) CoCos induce better risk controls than subordinated debt, but are inferior to common equity. Similarly, Gamba et al. (2022) contend that negative wealth transfers actually enhance the incentive for equity holders to engage in moral hazard risk shifting by "gambling for resurrection" because CoCo conversion reduces shareholders' equity stake. That is, negative wealth transfers encourage bank shareholders to undertake risky, negative net present value projects when CoCo conversion is imminent in order to gamble on a low-likelihood positive outcome; i.e., shareholders are playing with creditors' money as in the classic debt overhang problem. This "equity stakeholder effect" implies that CoCos that are designed to dilute equity upon conversion actually enhance risk taking incentives.

However, what is excluded from the modeling in these papers is that risk taking may either accelerate or delay CoCo triggering. That is, in these papers, the trigger is mechanically determined by exogenous signals of bank value. It has long been recognized (Sundaresan and Wang, 2015) that the bank's shareholders can engage in actions that impact the likelihood of CoCo trigger. For example, they can voluntarily recapitalize the bank either through equity issuance or shifts in the composition of assets away from higher risk-weighted assets to less risky assets, thereby reducing the likelihood of CoCo trigger. Alternatively, bank shareholders can induce CoCo triggers by enhancing risk and reducing bank capitalization. When the triggering of a CoCo generates positive wealth transfers, shareholders will be incentivized to accelerate conversion through risk enhancing activity. If, on the other hand, CoCo trigger induces a negative wealth transfer, equity holders would be incentivized to take on risk reducing policies to delay and prevent conversion. This "trigger incentive effect" provides the opposite risk taking incentives to the equity stakeholder effect identified in Martynova and Perotti (2018) and Gamba et al. (2022). The relative importance of each effect is an empirical question. For example, Fatouh et al. (2022) use a sample of 46 CoCos issued by 15 U.K. banks and show that positive wealth transfer CoCo issuance is positively correlated with bank risk taking behavior.

The structure of the paper is as follows. Section 2 describes our hand-collected database consisting of 720 CoCo instruments, including the methodology used to construct all variables. The impact of projected wealth transfers on CoCo yields at issuance is discussed in Section 3. Section 4 analyzes the use of CoCos to circumvent regulatory intervention mechanisms such as MDA restrictions. Finally, Section 5 concludes.

2. The hand-collected database of CoCo issues

A comprehensive database of 720 CoCo issues was hand-collected using Bloomberg and manual searches of issuing banks' investor relations webpages. Table 1 reports descriptive statistics for all 720 instruments. Norwegian banks are the top issuers overall, with 17.4% of all CoCo issues. In the entire sample, Table 1 shows that only 25.4% of CoCo issues are equity-converting. 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.

Using the CoCo design features obtained from manual inspection of prospectuses, we define the variables used in our analysis. We describe each variable's construction in this section. Appendix A.1 provides a summary list of variables, including variable name, definition and source of data.

[6] The expanded use of CoCos was scheduled to take effect throughout Europe starting from 2021, the pandemic outbreak accelerated the introduction of this measure.

Table 1
CoCo Issues 2009–2019, Summary Statistics by Capital Tier.

	Additional Tier 1 (N = 591)	Tier 2 (N = 79)	Non-Basel III (N = 50)	Total (N = 720)
Amount Issued (USD Mil)				
Mean (SD)	769 (1,139)	702 (738)	575 (736)	748 (1,078)
Median	392	500	249	382
Range	1–11,620	3–3,000	4–4,380	1–11,620
Total Amount	454,196	55,471	28,739	538,406
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)	–	10.95 (4.21)	11.51 (3.63)	11.43 (5.11)
Range	45–Perpetual	3–30	2–23	2–45
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%)

(*continued on next page*)

Table 1 (*continued*).

	Additional Tier 1 (N = 591)	Tier 2 (N = 79)	Non-Basel III (N = 50)	Total (N = 720)
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%)
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%)

Table 2
CoCo Issues 2009–2019, yearly distribution by loss-absorption mechanism.

	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%)

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

Our major variable 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 $+1$.[7] 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. To calculate the normalized value of the expected *Wealth Transfer*

[7] Other papers that have examined the wealth transfer upon CoCo conversion are Hilscher and Raviv (2014), Himmelberg and Tsyplakov (2012) and Himmelberg and Tsyplakov (2014).

upon conversion as a percent of CoCo par value we first estimate the bank's expected market capitalization at the conversion point as[8]:

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

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 upon conversion is then calculated as:

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

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.[9]

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. 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. Therefore, permanent principal write-downs essentially have an (implicit) conversion price of $+\infty$, and thereby a wealth transfer ratio of +1. That is, the CoCo exercise transfers from 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).

2.1. Variable definitions

The dependent variable in our regression analysis, 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.[10]

According to Basel III guidelines, banks can elect to meet all their capital requirements with equity capital, if they choose to do so. Appropriately designed CoCos, however, can satisfy Additional Tier 1 (AT1) and Tier 2 capital requirements, providing a substitute for more costly common equity. In 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 exclusively be satisfied with common equity (i.e. Capital Conservation Buffer, Countercyclical Buffer, buffers for systemically important institutions). 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.[11]

We compute the variable $\textit{AT1 Shortfall Size}_{i,t}$ 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, $\textit{Has AT1 Shortfall}_{i,t}$ 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. Further, in our analysis, the AT1 shortfall interacts with the Maximum Distributable Amount (MDA) threshold. We define a variable $\textit{Distance to MDA Trigger}_{i,t}$: 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 $t+1$. Finally, additional variables are defined in Appendix A.1.

[8] To estimate the bank's market capitalization at conversion, we adopt the Berg and Kaserer (2015) assumption that the market price of equity would follow changes in the capital ratio on a one-to-one basis. 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.

[9] We calculate the wealth transfer conditional on CoCo trigger. Although a full analysis of the out-of-the-money wealth transfer properties is beyond the scope of this paper, we offer some intuition in our discussion of the distance to the MDA threshold. That is, as the bank's capital declines towards the trigger point, both the stock price and the distance to the MDA decline, thereby incentivizing bank risk taking through CoCo issuance.

[10] 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.

[11] In theory, this issue is not exclusive to the Additional Tier 1 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 for AT1 requirements is equity capital.

Table 3
Wealth transfer effect on yield spread at issuance, summary statistics.

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%				

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*.

3. Wealth transfer and CoCo yields at issuance

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. Table 3 reports the summary statistics for the CoCo issuing banks used in the yield spread regression analysis. The wealth transfer is expressed as a share of the CoCo notional amount. The mean value of 0.833 illustrates that the average wealth transfer on CoCos in our sample is very close to the maximum value of +1, with the median value equal to +1 emerging from the prevalence of write-down loss-absorption mechanisms.

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.

3.1. 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:

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

Table 4 presents the results of estimation of the model in Eq. (3).

The main independent variable of interest in models 1 and 2 is *Negative Transfer*. If the punitive transfers from shareholders upon CoCo trigger are priced in CoCo yield spreads, we expect a negative coefficient on this variable. As shown in Table 4, 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 4 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 4, 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. This may suggest that the market takes into account the anticipated action of bank managers and shareholders at conversion when setting yield spreads. That is, at higher trigger levels, bank managers have more resources to avoid conversion on negative wealth transfer CoCos 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 4 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 both optimal bank policies and stricter monitoring by bank regulators in jurisdictions with higher trigger levels.

Table 4 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 4. 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.[12]

[12] 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).

Table 4
Analysis of CoCo Yield Spreads at Issuance.

	Exp.	Yield Spread to Sovereign of Matched Tenor					
		(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

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.
***$p < 0.01$.
**$p < 0.05$.
*$p < 0.1$.

In any model that includes country fixed-effects (model 2 to model 5), the coefficient on *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.

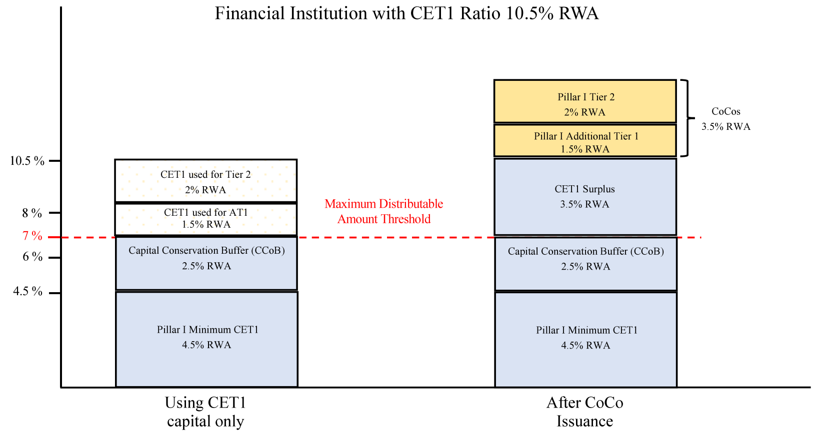

Fig. 1. Capital Conservation Constraint, effects of AT1 shortfall.
Light blue: capital layers filled with common equity capital. White: capital layers filled with common equity capital but not receiving regulatory credit in computing the MDA threshold. Yellow: capital layers filled with CoCos. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

4. CoCo issuance incentives

To date, the academic literature has omitted critical incentives when analyzing CoCo issuance decisions. For example, Avdjiev et al. (2020) only investigated the timing of the *first* CoCo issuance for large financial institutions, finding that CoCo issuance is negatively related to Tier 1 capital levels. This, however, neglects the importance of other components of bank capital structure and regulatory requirements and cannot account for the effects of evolving regulatory environments.

To remedy this, Goncharenko and Rauf (2016), Goncharenko et al. (2021) focus on Additional Tier 1 capital instruments in their studies 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 Additional Tier 1 capital layer.

To exemplify these mechanics, the left bar in Fig. 1 shows a financial institution with a Common Equity Tier 1 (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 Fig. 1 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% Additional Tier 1 (AT1) plus 2.5% Tier 2 capital. The AT1 and Tier 2 components of the capital structure can always 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 Fig. 1 uses only equity capital. For the purposes of computing the Maximum Distributable Amount (MDA) threshold, regulators deduct all common equity used to meet Additional Tier 1 and Tier 2 capital requirements. Thus, the 3.5% of equity held by the bank to in the AT1 and Tier 2 capital layers is deducted from the 10.5% total. Since 7% is the Basel III minimum Common Equity Tier 1 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 Fig. 1 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.

Fig. 2 provides an actual 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 Fig. 2 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.

4.1. Empirical analysis: Regulatory drivers of CoCo issuance

In order to analyze the incentives that drive CoCo issuance, we construct a sample comprised of issuing and non-issuing banks. The sample is comprised of 1,406 bank-year observations for 141 individual banks. This sample includes 57 banks that never issued CoCos. Summary statistics for this sample are provided in Table 5.

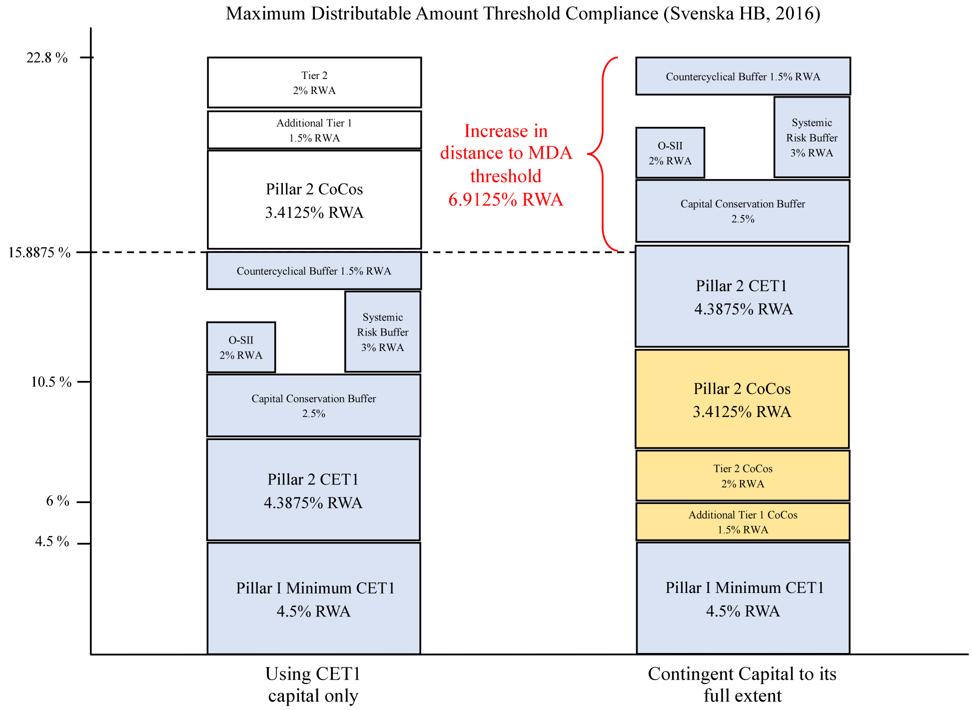

Fig. 2. Real World Example of the Effects of the AT1 Shortfall.
Light blue: capital layers filled with common equity capital. White: capital layers filled with common equity capital but not receiving regulatory credit towards meeting the MDA threshold. Yellow: capital layers filled with CoCos. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

To examine CoCo issuance incentives, 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. Table 6 presents the estimation results for the logit analysis.[13] 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 6, model 2) those of banks with no AT1 shortfall, and these results are robust to controlling for country fixed effects (Table 6, model 3). This effect is, as expected, stronger when considering AT1 instruments only (i.e., comparing coefficient estimates of Table 6, model 5 vs. model 2).[14]

For banks with 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 6, 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 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 6, 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 6, 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 6, 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 6, model 3).

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

[14] 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.

Table 5
Determinants of issuance variables, summary statistics.

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

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.

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 6) when CoCo coupons are not tax deductible.

Columns 5 and 6 of Table 6 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 notable exception is 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 with three 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.

Table 7 presents the results of this multinomial model estimation. 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 Additional Tier 1 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 7, 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 7, model 1) for banks with AT1 shortfalls that are close to the MDA threshold.

Table 6
Logit analysis of the determinants of CoCo issuance.

	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

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.

***$p < 0.01$.

**$p < 0.05$.

*$p < 0.1$.

Table 7
Multinomial logit analysis of CoCo AT1 and tier 2 issuance.

	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

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.

***$p < 0.01$.

**$p < 0.05$.

*$p < 0.1$.

Finally, the absence of a tax-shield benefit reduces the odds of CoCo issuance severely for Tier 2, but not for AT1 (Table 7, 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 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.

5. 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 by forgiving debt if the bank's condition deteriorates enough to trigger CoCo 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. 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 Amount (MDA) thresholds are discretionary supervisory mechanisms designed to limit bank risk and increase capital by forcing banks to retain earnings. We find that banks are more likely to issue CoCos if they have an Additional Tier 1 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, thereby protecting distributions to bank managers and shareholders. 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.

CRediT authorship contribution statement

Linda Allen: Conceptualization, Methodology, Formal Analysis, Investigation,Writing – original draft, Writing – review & editing, Supervision. **Andrea Golfari:** Conceptualization, Methodology, Software, Validation, Formal Analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Visualization.

Data availability

Data will be made available on request

Appendix

See Table A.1.

Table A.1
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

(*continued on next page*)

Table A.1 (*continued*).

Variable name	Variable description	Sources of data
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
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

(*continued on next page*)

Table A.1 (*continued*).

Variable name	Variable description	Sources of data
AT1 $\text{Shortfall}_{k,t}$	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
Has AT1 $\text{Shortfall}_{k,t}$	Indicator variable, set to 1 if *AT1 Shortfall* > *0* for bank k in year t, and 0 otherwise.	Computed
No Tax $\text{Shield}_{k,t}$	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

References

Allen, L., Tang, Y., 2016. What's the contingency? A proposal for bank contingent capital triggered by systemic risk. J. Financial Stab. 26, 1–14.

Avdjiev, S., Bogdanova, B., Bolton, P., Jiang, W., Kartasheva, A., 2020. CoCo issuance and bank fragility. J. Financ. Econ. 138 (3), 593–613.

Avdjiev, S., Bolton, P., Jiang, W., 2015. CoCo Bond Issuance and Bank Funding Costs, Vol. 678. Bank for International Settlements Working Paper Series, pp. 1–57.

Berg, T., Kaserer, C., 2015. Does contingent capital induce excessive risk-taking? J. Financial Intermediation 24, 356–385.

Calomiris, C.W., Herring, R.J., 2013. How to design a contingent convertible debt requirement that helps solve our too-big-to-fail problem. J. Appl. Corp. Finance 25, 39–62.

Chan, S., van Wijnbergen, S., 2017. CoCo Design, Risk shifting and Capital Regulation. Tinbergen Institute Discussion Paper TI 2016-007/VI.

Dudley, W.C., 2013. Ending too big to fail. URL: https://www.newyorkfed.org/newsevents/speeches/2013/dud131107.html.

European Central Bank, 2020. ECB Banking Supervision Provides Temporary Capital and Operational Relief in Reaction to Coronavirus. Tech. Rep.

Fatouh, M., Neamto, I., Wijnbergen, S., 2022. Do CoCo Bonds Increase the Risk Appetite of Banks? Working Paper.

Flannery, M.J., 2005. No pain, no gain? Effecting market discipline via "reverse convertible debentures". In: Capital Adequacy beyond Basel.

Flannery, M.J., 2013. Contingent Capital Instruments for Large Financial Institutions: A Review of the Literature. Working Paper.

Gamba, A., Gong, Y., Ma, K., 2022. Non-Dilutive Coco Bonds: A Necessary Evil? Working Paper.

Glasserman, P., Perotti, E., 2017. The Unconvertible CoCo Bonds. In: Achieving Financial Stability - Challenges to Prudential Regulation. World Scientific Publishing Co., pp. 317–329.

Goncharenko, R., Ongena, S., Rauf, A., 2021. The agency of CoCos: Why contingent convertible bonds are not for everyone. J. Financial Intermediation 48, 100882.

Goncharenko, R., Rauf, A., 2016. Bank Capital Structure with Contingent Capital. Working Paper.

Haldane, A.G., 2011. Capital discipline. Speech given at the American Economic Association, Denver.

Herring, R.J., 2010. How financial oversight failed and what it may portend for the future of regulation. Atl. Econ. J. 38 (3), 265–282.

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

Himmelberg, C.P., Tsyplakov, S., 2012. Pricing Contingent Capital Bonds: Incentives Matter. Working Paper.

Himmelberg, C.P., Tsyplakov, S., 2014. Incentive Effects and Pricing of Contingent Capital. Working Paper.

Kashyap, A.K., Hanson, S.G., Stein, J.C., 2011. A macroprudential approach to financial regulation. J. Econ. Perspect. 25 (1), 3–28.

Kashyap, A.K., Rajan, R., Stein, J.C., 2008. Rethinking capital regulation. In: Maintaining Stability in a Changing Financial System. Federal Reserve Bank of Kansas City, pp. 431–471.

Martynova, N., Perotti, E., 2018. Convertible bonds and bank risk-taking. J. Financial Intermediation 35, 61–80.

Pennacchi, G., Vermaelen, T., Wolff, C., 2014. Contingent capital: the case of CO-ERCs. J. Financ. Quant. Anal. 49 (3), 541–574.

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