A Pecking Order in Contingent Convertible Bond (CoCo) Financing *

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Abstract

Originally designed as an equity-diluting disciplinary mechanism, contingent convertible bonds (CoCos) have evolved to permit less punitive nondilutive triggers. Using a novel measure of CoCo dilution and a comprehensive hand-collected dataset covering 27 countries, our empirical findings suggest a pecking order in CoCo issuance, where banks generally prefer less information sensitive, nondilutive (debt-like) structures, but shift to incentive-compatible (equity-like) dilutive CoCos to address risk shifting agency conflicts during periods of aggregate uncertainty. Negative abnormal returns are found for dilutive CoCo announcements, but not for nondilutive CoCos. This negative market reaction reverses during periods of heightened aggregate uncertainty, with dilutive CoCos generating positive announcement returns. The equity and CoCo bonds of banks issuing dilutive CoCos perform more favorably when aggregate uncertainty is elevated.

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1 Introduction

Contingent convertible bonds (CoCos) were initially designed to punitively dilute existing bank shareholders by converting into equity when the bank's financial condition reached a predetermined low point (i.e., at conversion). The early academic literature was based on the assumption that the threat of dilution acted as a deterrent against excessive risk-taking by bank managers (Flannery, 2005; French et al., 2010).[1] Around 2013, banks developed nondilutive CoCo designs, such as principal write-down CoCos (PWDs) that were less punitive. Studies such as Flannery (2014) and Avdjiev, Bogdanova, Bolton, Jiang, and Kartasheva (2020) suggest that bank equity holders prefer nondilutive CoCos.[2]

This leads to the puzzle that is addressed in this paper. Why do banks continue to issue both dilutive CoCos and nondilutive CoCos? Bank regulators grant nondilutive CoCos full regulatory capital credit and have mandated mechanical trigger levels using minimum regulatory capital standards.[3] Thus, the only CoCo design feature subject to issuer discretion is the choice of dilution level. We offer empirical support for pecking order preferences for less information-sensitive, debt-like nondilutive CoCos. However, during periods of aggregate uncertainty, equity-like dilutive CoCos better control managerial risk-shifting incentives.

Therefore, while bank shareholders may exhibit a strong preference for nondilutive CoCos due to their non-punitive nature (as demonstrated during the 2023 Credit Suisse collapse that preserved some equity value while writing off the CoCo debt), dilutive CoCos retain important merits inherent in their original design. Specifically, when managers anticipate severe dilution in the event of a trigger, they have stronger incentives to reduce risk to avoid such outcomes. For instance, under conditions of heightened aggregate uncertainty, investors

[1] Academic literature largely focused on the design of the appropriate trigger mechanisms to incentive management to control risk (Flannery and Perotti, 2011; Calomiris and Herring, 2013), McDonald (2013); Sundaresan and Wang (2015); Glasserman and Nouri (2016); Pennacchi and Tchistyi (2018).

[2] For example, Flannery (2014) argues "a CoCo's Principal Write-Down increases the value of common equity to the detriment of bondholders. PWD also affects traditional notions of seniority by placing shareholders ahead of CoCo bondholders." Avdjiev et al. (2020) posit "bank equity holders have little incentive to issue such [dilutive] CoCos, because doing so mostly benefits outstanding unsecured creditors."

[3] With currently nonbinding regulatory triggers, the only relevant conversion mechanism is the discretionary declaration of a Point of Non-Viability (PONV) by bank regulators.

may come to value these managerial incentives, recognizing the potential of dilutive CoCos to mitigate risk through stronger *ex ante* discipline. Indeed, in September 2023, UBS stressed that it was replacing the nondilutive CoCos issued by Credit Suisse with dilutive CoCos.[4]

This paper empirically investigates whether a pecking order among CoCos is shaped by their contingent dilution design and managerial incentives. The core empirical challenge we face is twofold: (a) quantifying contingent dilution at the CoCo security level and (b) testing the pecking order within CoCos. To address the first challenge, we develop a novel measure of contingent dilution that captures deviations from a permanent write-down CoCo structure. This enables the comparison across CoCos with varying dilution features relative to a fully nondilutive benchmark. To address the second challenge, we analyze the reaction of the financial market to specific CoCo features by focusing on issuance announcement returns and secondary market pricing so as to evaluate investors' responses and infer their preferences across the single remaining CoCo design variable: contingent dilution. This approach aligns with the central empirical implication of the pecking order theory, as argued by Harris and Raviv (1991): *"What are the empirical implications of Myers' "pecking order" theory? Probably the most important implication is that, upon announcement of an equity issue, the market value of the firm's existing shares will fall."*

Our empirical results are consistent with this assertion, but suggest a more nuanced view. We find negative abnormal returns following the issuance of dilutive CoCos that have equity-like properties. We also find that during periods of elevated uncertainty, the negative announcement effects of dilutive CoCos are significantly mitigated, or even reversed, consistent with the view that such instruments align managerial incentives by discouraging risk-shifting to avoid conversion. Further, we show that both the equity and debt returns of banks with any outstanding dilutive CoCos outperform relative to banks that only issued nondilutive CoCos during uncertain periods. Collectively, our results suggest that while shareholders generally prefer nondilutive CoCos, they recognize that dilutive CoCos align

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

managerial incentives and mitigate trigger risk under conditions of uncertainty.

We begin our analysis by constructing our novel contingent dilution measure. Building on Berg and Kaserer (2015), our measure aims to quantify deviations from a full write-down in contingent dilution. To do so, we uniquely incorporate the *pari-passu* loss absorption feature of temporary write-downs alongside mechanisms like share conversion. We (a) hand-collect conversion prices for all equity-converting CoCos issued between 2009 and 2021 and (b) account for temporary write-downs by proportionally allocating residual losses across outstanding instruments at the same trigger levels. This approach enables us to define an indicator variable, *Dilutive*, that equals 1 for one-third of CoCos that are the farthest from a full write-down (i.e., highest tercile by contingent dilution) and 0 otherwise. Our analysis reveals significant variation in dilution across CoCo types, with 67.4% of equity conversion and 28.3% of temporary write-down CoCos classified as relatively dilutive. This shows that dilutiveness of CoCos depends not only on their loss absorption mechanism but also on features like conversion price and *pari-passu* structure, which shape the wealth transfer between bondholders and shareholders.

In the first part of our paper, we document evidence of the baseline pecking order properties among CoCos. Applying our contingent dilution measure, we find that the 10-day cumulative abnormal returns when issuing dilutive CoCos are -1.68% (statistically significant at the 1% level).[5] This finding resembles the vast evidence from seasoned equity offerings (Asquith and Mullins, 1986). Alternatively, upon issuing a nondilutive CoCo, there is a statistically insignificant positive stock price market reaction, resembling findings from bond issues or loans (Eckbo, 1986; James, 1987). The findings are robust to the definition of dilutive CoCos and changes to the assumptions of equity deterioration when constructing our contingent dilution measure. Further, our analysis includes coupon rates at issue to control for the possibility that dilutive CoCos are systematically mispriced upon issue and

[5]We use event windows extending up to a month post-announcement, as key information on the dilution level of CoCo design such as the conversion price often becomes available only very close to issuance, typically weeks after announcement. This delay affects the stock price on issuance day, which is then factored into the dilution measure.

may be more expensive than nondilutive CoCos.

We examine the cross-section of the announcement returns across the distance from the trigger to assess whether the negative market reaction to dilutive CoCo reflects information asymmetry (Myers, 1984). Since CoCo conversion into equity is imminent for banks close to the trigger, the significantly more negative announcement effects are consistent with pecking order concerns about "issuing" information sensitive equity. That is, the costs of information asymmetries are particularly salient for banks that issue dilutive CoCos close to trigger conversion.

To further isolate the market's response to contingent dilution from confounding factors such as credit risk and the cost of capital, we exploit plausibly exogenous variations in CoCo design as instruments in a two-stage least squares analysis. Ideally, one would compare both CoCo types issued by the same bank within a reasonably short period, but such cases are rare. Instead, we rely on the observation that banks incorporated in common law and French civil law countries, where the risk of contract repudiation is higher and legal enforcement is weaker (La Porta, Lopez-de-Silanes, Shleifer, and Vishny, 1998), are significantly more likely to issue dilutive CoCos. Using this instrumental variable in the second stage, we find results consistent with our baseline results that dilutive CoCos are associated with negative market reactions, particularly when banks are near the CoCo trigger. Thus, we find empirical evidence of a pecking order among CoCos, with nondilutive designs being more highly valued by the stock market.

In the second part of our paper, we assess the value of managerial incentives embedded in dilutive CoCos. To do so, we examine how the announcement effects of dilutive CoCo issuance vary during periods of elevated aggregate uncertainty. We find that announcements of dilutive CoCo issuance during periods of high Global Economic Policy Uncertainty (as measured by Baker, Bloom, and Davis, 2016) are associated with a positive cumulative abnormal return of 1.1% over a 10-trading-day window. We find consistent results when using CoCo market volatility as an alternative proxy for aggregate uncertainty, specifically capturing the perceived likelihood of CoCo trigger events. These findings suggest that, in times of heightened uncertainty, shareholders place greater value on the managerial incentives stemming from dilutive CoCos.

Next, we examine the long-term performance of bank equity and bond yields. If dilutive CoCos are generally viewed unfavorably by investors, then banks issuing dilutive CoCos should experience weaker long-term equity performance reflecting pecking order issuance costs. However, this underperformance should diminish or reverse when aggregate uncertainty is high due to the embedded managerial incentives. Similarly, in the secondary CoCo market, dilutive CoCos should have higher yields relative to nondilutive CoCos, ceteris paribus, reflecting their lower pecking order value. However, this gap should narrow during periods of heightened aggregate uncertainty, as the value of the managerial incentives embedded in dilutive CoCos becomes more salient.

Our results show that banks that issue dilutive CoCos exhibit weaker long-term equity performance, although this underperformance reverses during periods of elevated aggregate uncertainty. We construct a monthly long-short portfolio that involves buying equity in banks issuing more dilutive CoCos and selling equity in banks issuing less dilutive CoCos over a three year look-back window. During periods of low aggregate uncertainty associated with contingent trigger events, these portfolios yield a statistically significant (at the 5% level) negative alpha of over 94 basis points monthly, reflecting the higher adverse selection costs of issuing dilutive CoCos. Conversely, during periods of high aggregate uncertainty, the long-short portfolio achieves positive and statistically significant (at the 5% level) alpha exceeding 20 basis points monthly. During such times, banks issuing more dilutive CoCos generate positive equity alpha returns, aligning with the equity market's recognition of the benefits of managerial incentives to prevent the conversion of dilutive CoCos.

We find analogous patterns in the bond market. Specifically, dilutive CoCos trade at higher yields in the secondary market, consistent with the CoCo pecking order. However, this yield premium narrows during periods of elevated aggregate uncertainty. A complementary bond portfolio analysis, in which we take a long position in dilutive CoCos and a short position in nondilutive CoCos with monthly rebalancing, yields results similar to the equity portfolio analysis. That is, the portfolio delivers higher returns during periods of high Global Economic Policy Uncertainty (EPU) compared to periods of low EPU, suggesting that the embedded managerial incentives are also valued by CoCo investors.

Lastly, we examine the systemic risk implications of dilutive CoCos. Consistent with the incentive-alignment features embedded in their design, we find that issuance of dilutive CoCos is negatively associated with the $\Delta CoVaR$ systemic risk measure of Adrian and Brunnermeier (2016). That is, issuers of dilutive CoCos exhibit a lower marginal contribution to systemic risk, supporting the view that they mitigate managerial risk-taking incentives and, in turn, enhance macroprudential stability.

Our paper contributes to several strands of literature. First, we contribute to the debate over the market's understanding of the specific terms of CoCo bonds. For instance, Bolton, Jiang, and Kartasheva (2023) interpret the widespread disapproval of Credit Suisse's CoCo write-down in March 2023 as evidence that the stock market misunderstood CoCos' primary function as going-concern instruments that absorb losses ahead of equity, implying that the stock market is misinformed. However, our findings highlight that the single decision parameter left to the discretion of CoCo issuers, which is the degree of dilution, is indeed priced by shareholders, thereby suggesting a more nuanced view of market engagement with CoCo design specifics involving the interplay between adverse selection and agency costs. That is, our findings reveal a sophisticated market calculus in CoCo evaluation by shareholders, balancing the adverse selection pecking order against agency costs across the degree of contingent dilution.

Second, our paper contributes to empirical tests of pecking order theory (Myers and Shyam-Sunder, 1999), which has faced criticism for inconsistent support (Jung, Kim, and Stulz, 1996; Frank and Goyal, 2003), with some, like DeAngelo (2022), calling for its abandonment due to managers' lack of information to accurately determine the optimal capital structure. We propose that CoCos offer a unique opportunity to address this debate. CoCos inherently reflect pre-contractual adverse selection and post-contractual agency costs, key elements of the theory, making their contingent dilution decisions a simplified proxy for broader capital structure choices. While bank capital structure has traditionally been excluded from pecking order tests due to regulatory requirements that force banks to issue certain forms of capital, CoCos present an exception. Banks are required to issue Tier 1 common equity, violating pecking order predictions, but CoCos allow banks to issue securities at any point on the capital spectrum simply by adjusting the degree of contingent dilution in the security's design. Thus, within a single instrument, CoCos can be positioned anywhere along the pecking order hierarchy: the more dilutive (or equity-like) the CoCo, the lower it falls on the hierarchy, whereas the less dilutive (or more debt-like) CoCos rank higher. By examining CoCo issuance, we gain a clean empirical setting to explore adverse selection and agency costs while contributing valuable insights to the broader literature on capital structure.

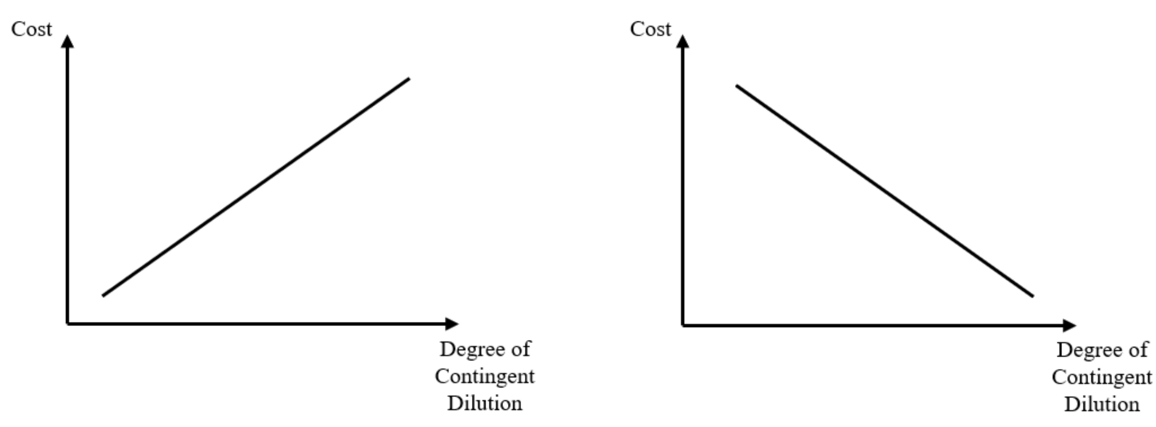
The rest of the paper is organized as follows. Section 2 outlines the testable hypotheses. Section 3 details the data sources, sample construction, and summary statistics. Section 4 presents the empirical analysis of the pecking order in CoCo issuances. Section 5 explores the value of managerial incentive alignment inherent in dilutive CoCos. Section 6 concludes the paper.

2 Hypothesis Development

The standard pecking order concept introduced by Steward Myers in his 1984 AFA Presidential address (Myers, 1984; Myers and Majluf, 1984) posits that firms will prioritize the issuance of less information sensitive securities to avoid the dilution of original stockholders' stakes. Knowing this, arms-length investors rationally infer that new equity issues are overpriced, and therefore, charge an adverse selection discount. Thus, adverse selection costs increase as dilution increases.

Myers (2003) later explains that Jensen and Meckling (1976)-type agency costs can also drive pecking order considerations by introducing conflicts of interest between debtholders and stockholders. This occurs because the costs of private benefits remain internalized with debt but are shared with outside shareholders when equity is issued. Consequently, agency costs are higher with equity, leading firms to favor debt issuance until they reach their debt capacity.

However, when agency costs are applied to dilutive and nondilutive CoCos, the hierarchy may differ due to two key conditions found in traditional external capital but not in CoCos: (a) debt is strictly senior to equity, and (b) common equity is dilutive upon issuance. First, dilutive CoCos only dilute shares upon a trigger event, deviating from the immediate dilutive impact of traditional equity. This creates conditional internalization of private benefits that incentivize managers to avoid trigger events and thereby reduce agency costs for dilutive CoCos. Second, nondilutive CoCos absorb losses before shareholders (first loss-absorbing provision). This conflicts with the seniority condition, which may increase agency costs for nondilutive CoCos, as bank managers may be incentivized to undertake riskier projects following an issuance of nondilutive CoCos (Goncharenko, Ongena, and Rauf, 2021).



Panel A: Adverse Selection Cost Panel B: Agency Cost

Figure 1: Information Asymmetry Costs Across the Degree of Contingent Dilution

We argue that two opposing forces shape the pecking order properties of CoCos, which we empirically investigate in our paper. The first is adverse selection: more dilutive CoCos are more information-sensitive, raising issuance costs and leading banks to prefer less dilutive instruments (Panel A, Figure 1). This is the standard pecking order. The second is agency cost: more dilutive CoCos strengthen managerial discipline by heightening the threat of dilution, thereby mitigating risk-taking incentives, while nondilutive CoCos may exacerbate moral hazard due to their lack of a dilution trigger (Panel B, Figure 1). These contrasting forces suggest that markets will react differentially to CoCo issuance, depending on whether adverse selection or agency concerns are more salient.

3 Data, Measures, and Sample Description

3.1 Background: CoCo Security Design

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 conversion stock price to determine 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 contingent wealth transfer depends on the idiosyncratic terms of conversion and the projected value of the equity upon CoCo trigger.

However, over time, the industry has progressively shifted away from equity conversion loss absorption mechanisms in favor of principal 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 in favor of shareholders and equal to their par value, denoted as a wealth transfer of +100%.[6]

As CoCo security design evolved further in 2014, the *temporary* write-down CoCo emerged as the dominant design, especially among European 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 (though no obligations) 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 (2023) are subject to ambiguity emanating from considering each CoCo debt instrument in isolation rather than within the bank's entire CoCo capital structure. To illustrate this challenge, consider an issuer with three outstanding instruments at a common 5.125% mechanical trigger level but with three different loss absorption mechanisms: equity conversion, 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 CoCo 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

[6] 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, 2014, 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 was 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 permanent or temporary prinicpal write-down) is only imperfectly correlated with shareholder wealth transfers.[7] 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.

3.2 Measuring Contingent Wealth Transfer

The goal of our measure is to gauge how far away the contingent wealth transfer (i.e., the contingent dilution) can deviate from a full write-off, which may be the most valued type of contingent dilution. This can occur broadly in two ways: share conversion and *pari-passu* partial write-down. To achieve this, our novel method estimates wealth transfers upon CoCo trigger using the specific terms of conversion for all loss absorption mechanisms, as well as each CoCo instrument's position within the issuer's entire outstanding CoCo capital structure. Specifically, we are the first to consider the impact of a trigger event on temporary write-down CoCos.

[7]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).

For each CoCo issuance announced at time t, we estimate the expected market capitalization at the trigger event T as follows:

$$MVE_T = \frac{Trigger\,Ratio}{Capital\,Ratio_t} \times MVE_t + Notional\,Value. \tag{1}$$

MVE_T is the bank's expected market capitalization at the date of the trigger event T. $Trigger\,Ratio$ is the contingent capital level of the trigger event. $Capital\,Ratio_t$ is the issuer's capital ratio at the time of issuance. The fraction captures the estimated market capitalization if the trigger were to occur ($Trigger\,Ratio$) relative to the current value ($Capital\,Ratio$). MVE_t is the market capitalization of the issuer at the announcement date. $Notional\,Value$ is the notional value of the CoCo (i.e., the amount issued). Following Berg and Kaserer (2015), this estimate relies on the assumption that the market price of equity would follow the movements in capital ratios one-to-one ($\frac{Trigger\,Ratio}{Capital\,Ratio_t}$).[8]

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

$$WT_t^0 = Notional\,Value - \frac{Shares\,CoCo_T}{Total\,Shares_T} \times MVE_T. \tag{2}$$

WT_t^0 is the expected wealth transfer to equity holders. $Shares\,CoCo_T$ is the number of shares CoCo holders receive in a trigger event. $Total\,Shares_T$ is the total outstanding shares after the trigger event. MVE_T is from Equation (1). 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, $Shares\,CoCo_T$ equals zero and the wealth transfer equals the CoCo's notional value ($Notional\,Value$). In other words, when the trigger level is reached, the instrument is entirely written down to zero and equity holders receive the full

[8]For instance, if a bank issued a CoCo when its CET1 Ratio was 20% and the CoCo trigger level is 6%, then $MVE_T = \frac{6}{20} MVE_t$. CoCo triggers have occurred twice to date: Banco Popular's market capitalization fell to 10%, and Credit Suisse's to 16% upon each bank's failure, respectively, compared to the latest dates of their CoCo issues. While not reported, our results are robust under an alternative assumption that the ratio ($\frac{Trigger\,Ratio}{Capital\,Ratio_t}$) is 10%.

notional value without share conversions.

While $Shares\,CoCo_T$ is also zero for temporary write-downs, CoCos with this loss absorption mechanism are designed to absorb losses *pari passu* with all other outstanding CoCo instruments positioned at an identical trigger level, and only up to the amount necessary to reestablish the issuer's capital ratios to compliance with the regulatory minima. Thus, it is necessary to take into consideration the entirety of the CoCo stack outstanding when their trigger level is breached. 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.[9] 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 values (i.e. amount issued) from the loss absorption capacity, as these CoCos will absorb losses in full before temporary write-downs are affected. Lastly, the residual loss is spread between all outstanding temporary write-down instruments positioned at the breached trigger level (*pari-passu*). This is measured by dividing the residual loss by the sum of the notional values 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 (3).

$$Wealth\ transfer_t = \begin{cases} WT_t^0 \times LossSharingRatio, & \text{if temporary write-down} \\ WT_t^0, & \text{otherwise.} \end{cases} \tag{3}$$

The resulting wealth transfer measure for each instrument, $Wealth\ transfer_t$, is scaled by the individual CoCo notional values.

Our wealth transfer measure is bounded above by 100 representing the full write-down of a 100%. Lower values reflect CoCos deviating from full write-down, either through (a)

[9]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.

share conversion (Equation (2)) or (b) *pari-passu* write-ups (Equation (3)). To capture the CoCos that are farther away from full write-down, we define *Dilutive*, which equals 1 if the CoCo falls in the lowest tercile of the wealth transfer measure from Equation (3), and 0 otherwise. Intuitively, a CoCo with $Dilutive = 1$ is farther from full write-down and thus more dilutive upon a trigger event. In contrast, a CoCo with $Dilutive = 0$ is closer to full write-down, being less dilutive and transferring more wealth to shareholders as part of its equity loss-absorbing capacity.

It should be noted that while trigger events of temporary write-down CoCos do not result in the immediate creation of new shares, they deviate significantly from permanent write-down instruments by virtue of their contingent write-up feature. That is, while for equity conversion and permanent write-down CoCos a trigger event terminates any relationship between CoCo holders and the issuing bank, with temporary write-down the issuer assumes a promise to write-up the CoCo once its financial conditions improve[10]. This implies that following a trigger event, temporary write-down CoCo holders acquire an implicit claim to a portion of the issuer's cash flows that could otherwise be support dividend payments, roll-over costs or new projects (Goncharenko, 2022).

[Figure 2 about here]

Figure 2 plots the distribution of our wealth transfer measure by CoCo type. The first box plot shows that the median value of wealth transfer for all CoCos is 100, reflecting the prevalence of full write-down CoCos. The wealth transfer measure is left-skewed, indicating significant variations in the degree of dilution. The second box plot shows that most equity conversion CoCos yield low values consistent with share dilutions. As shown in the third box plot, the *pari-passu* write-ups affect some temporary write-down CoCos to deviate from 100%. Due to varying terms of conversion or existing CoCo stacks that affect the *pari-passu* write-downs, not all equity conversion and temporary write-down CoCos are classified as

[10]Basel regulations prohibit this promise to be contractually binding, to avoid the possibility of enforceable write-ups deteriorating the financial conditions of a still fragile institution.

relatively dilutive.

In our sample, 67.4% of equity conversion CoCos and 28.3% of temporary write-down CoCos are classified as relatively dilutive. Importantly, we use the term *dilutive* in the context of our wealth transfer measure, rather than simply on the CoCo's loss absorption mechanism. This approach allows for consistent comparisons across CoCos with different contingent dilution features by benchmarking each instrument against a fully nondilutive alternative (i.e., any permanent write-downs). For example, while any triggered equity-converting CoCo will issue new shares and appear nominally dilutive, it may result in a net wealth transfer favoring equity holders only if the value of the equity received by CoCo holders is less than the bond's notional amount. Conversely, temporary write-down CoCos do not issue new shares, but if they are issued at the same trigger level as other CoCos (e.g., equity-converting or principal write-down instruments), they may absorb losses only after a deeper trigger breach, particularly if those other instruments are more junior. Thus, some temporary write-down CoCos fall into the lowest tercile of projected wealth transfer and are classified as dilutive, while certain equity-converting CoCos with very high conversion prices may not be. Our measure of contingent wealth transfer thus captures not only the loss absorption mechanism but also the dilution potential embedded in features such as the conversion price and *pari-passu* structure.

3.3 Data

We collect CoCo security level information from Bloomberg.[11] 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 and BankFocus by tracking

[11] As of October 1st 2022, there are 1,236 CoCos issued including those that were retired due to maturity or exercise of a call option by the issuer.

the issuer using ISINs and issuers' names. The stock price information is from Datastream matched using the bank's name and home country, and for equity converting CoCos we match to the equity security contractually specified by the prospectus. Our baseline sample consists of 757 CoCo issues between January 2009 to December 2021 from banks in 27 countries with balance sheets and stock price information. See Allen and Golfari (2023) for a more complete description of the database and its construction.

To calculate cumulative abnormal returns (CARs) upon CoCo issue announcements, we use the market model (CAPM) to determine daily excess returns.[12] Market beta is estimated over a 250-day window, with at least 50 valid returns, ending 30 days before the CoCo announcement. Using market returns from Wharton Research Data Services (WRDS), excess returns are accumulated to measure CARs over various windows. The pre-announcement CAR ends the day before the announcement, and the post-announcement CAR starts on the announcement date.

3.4 Descriptive Statistics

Panel A of Table 1 presents the descriptive statistics of the cumulative abnormal returns across different windows. On average, issuing CoCos does not generate abnormal returns, which is consistent with Avdjiev et al. (2020). Panel B presents the descriptive statistics of the baseline sample used in the analysis. The average market beta of CoCo issuers is 1.190, showing the banks that issue CoCos are marginally more volatile than the national stock market in which the bank is incorporated. Equity conversion, permanent write-down, and temporary write-down CoCos account for 29.2%, 24.7%, and 46.1% of the sample respectively. 32.8% of CoCos in our sample are classified as CoCos farther away from full write-down and with a more contingent dilutive effect on equity value ($Dilutive = 1$).

[Table 1 about here]

[12] Since our sample includes issuers from 27 countries, we use the market returns of each country to account for country-specific returns around announcement dates. Fama-French factors are unavailable for all countries in our sample.

Panel C 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 A Pecking Order in Contingent Convertible Bonds

4.1 Announcement Effects: Univariate Tests

Our first set of empirical tests investigates the pecking order among CoCos, as predicted in prior studies (Flannery, 2014; Avdjiev et al., 2020). To do so, we employ our contingent dilution measure (Section 3.2) to analyze both announcement returns and secondary market pricing. This approach is grounded in the broader literature on corporate capital structure, which emphasizes the interplay between market valuation and financing decisions (e.g., see Harris and Raviv, 1991; Frank and Goyal, 2008).[13]

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.[14] Panel A plots the CARs of the more dilutive CoCos in the sample ($Dilutive = 1$). Results show that issuance of the most dilutive tercile of CoCos lead 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 -2.22% over 29 trading days.

[13] Our empirical predictions relate to the well-established evidence that seasoned equity offerings (lower in the pecking order hierarchy) typically are associated with negative announcement returns (Asquith and Mullins, 1986), whereas the evidence for debt issuances (higher in the pecking order hierarchy), such as bonds or loans, is more mixed (Eckbo, 1986; James, 1987).

[14] Since not all relevant information is released upon announcement, but only closer to 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 parameters in the conversion terms or specify conversion terms based on the bank's closing stock price immediately before the issuance date. The median (mean) number of days from announcement to issuance is seven (eight).

[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. These findings support the interpretation that markets differentiate among CoCos based on their equity-like versus debt-like characteristics. More dilutive, equity-like CoCos elicit negative market reactions, whereas less dilutive, debt-like CoCos generate no significant response, consistent with the predicted pecking order among CoCos.

[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 findings suggest that the announcement effects primarily originate from the information that is made available after the announcement, such as specific conversion prices for equity converting CoCos.

4.2 Announcement Effects: Regression Analyses

In this section, we revisit the univariate findings presented in the previous section using multivariate regression analysis. We use our database consisting of all CoCos issued during the period from 2009 through 2021 to shed light on conflicting results in the literature, comprising studies using more restricted samples than ours that do not account for projected trigger point 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.

We estimate the following regression equation for a CoCo issue j in year t to evaluate the announcement effects on equity value:

$$CAR_{j,t} = \beta_1 Dilutive_{j,t} + Controls_{j,t} + \varepsilon_{j,t}. \tag{4}$$

The dependent variable is the cumulative abnormal return (CAR) as utilized in the univariate analysis presented 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 announcement ($Controls_{j,t}$). These variables are the natural log of market capitalization, profitability, the difference between the capital ratio and the CoCo trigger level (*Distance to trigger*), the sum of pre-existing and newly announced CoCos scaled by total liabilities, total liabilities, and coupon rate. We also include an indicator variable that equals 1 if the CoCo is a rollover, otherwise 0. Detailed variable descriptions are provided in Appendix A.1.

The regression results using Equation (4) are presented in Table 3. Across all columns, estimates suggest negative CARs for more dilutive CoCos. Specifically, we find a -1.68% CAR within the first 9 trading days after the CoCo issue announcement (Column 2). Column 4 indicates the negative impact reaches a statistically significant (at the 1% level) coefficient of -2.13% by the 29$^{\text{th}}$ trading day after the announcement. The increase in the magnitude of our estimates from Column 1 to Column 4 is consistent with Panel A of Figure 3.

[Table 3 about here]

While we control for the coupon yield at issuance, a potential concern remains regarding differences in the pricing terms of dilutive versus non-dilutive CoCos. Specifically, if nondilutive CoCos offer more favorable pricing for banks, the observed negative market reaction for dilutive CoCos could reflect investor concerns about cost rather than dilution risk. We address this issue in detail in Sections 4.4 and 5.2.

To assess the robustness of our findings, we conduct two additional tests. First, Appendix A.2 reports results using alternative definitions of the indicator variable *Dilutive*. The main findings remain unchanged, indicating that our results are not sensitive to how *Dilutive* is defined. Second, we use the methodology employed by Avdjiev et al. (2020).[15] As shown in Appendix A.4, the results are consistent with those based on CARs (Table 3).

4.3 Dilutive CoCos and the Distance To Trigger Levels

In this section, we examine how the announcement effect varies with a bank's distance from the CoCo conversion trigger. We hypothesize that if information costs (Myers, 1984) are driving the negative announcement returns of dilutive CoCos, then banks with CET1 ratios closer to the conversion trigger will experience more negative market reactions upon issuance. Consider a bank with a Common Equity Tier 1 (CET1) ratio just above the conversion threshold, indicating that a CoCo trigger event may be imminent. If dilutive CoCos are perceived to rank low in the pecking order among CoCo instruments, investors are likely to react more negatively to their issuance. Such reactions reflect heightened investor sensitivity to information about the issuing bank's underlying quality, particularly when the risk of CoCo trigger event is higher.

[Table 4 about here]

To test this, we include an interaction term between the distance from the trigger and the dilutive CoCo indicator variable in Equation (4). The results, reported in Table 4, support the pecking order among CoCos by showing that the negative announcement effect varies systematically with a bank's proximity to the trigger level. For example, in Column

[15] Avdjiev et al. (2020) also examine the impact of CoCo issuance on equity returns. They follow James (1987) and compute average cumulative prediction errors (ACPE) for a subsample of 170 CoCos in advanced economies that issued CoCos between January 2009 and December 2015. They find a statistically significant (at the 5% level) positive announcement effect for permanent write-down CoCos with mechanical triggers exceeding 5.125%.[16]

1, the baseline estimate for *Dilutive* is -2.98%. This effect becomes more pronounced as a bank's CET1 ratio closer to the trigger. Specifically, a hypothetical bank with a CET1 ratio exactly at the trigger level is estimated to experience a –2.98% announcement return over the five-day window. In contrast, a bank with a CET1 ratio 10 percentage points above the trigger level is estimated to experience a smaller –1.04% announcement return. These findings suggest that banks closer to the conversion trigger are more susceptible to adverse market reactions when issuing dilutive CoCos.

Notably, the heterogeneity across the distance from the trigger is unique to dilutive CoCos as evidenced by the insignificant estimate of *Distance to trigger* alone. This is explained by the fact that principal write-down CoCos pose no dilutive threat to shareholders.

4.4 The Hierarchy of CoCos and Legal Origins

In this section, we isolate the market's response to contingent dilution from potential confounding influences such as the issuer's credit risk and cost of capital. An ideal empirical design would observe instances in which the same issuer, within a relatively short period, issues both dilutive and non-dilutive CoCos. Such within-issuer comparisons would provide a clean test by holding constant issuer characteristics and isolating the market's reaction to each CoCo type.

Because such cases are rare, we leverage a plausibly exogenous variation in CoCo design: the legal origin of the issuing bank's home country. As shown in Figure 4, legal origin, which is largely predetermined for most banks, shapes persistent and distinct patterns in issuance choices. Panel A shows that banks incorporated in common law countries most frequently issue dilutive CoCos, whereas banks in French civil law countries (Panel B) predominantly issue non-dilutive CoCos. In other jurisdictions (Panel C), non-dilutive CoCos are likewise the most common.

[Figure 4 about here]

We formally test this by considering a regression with the dependent variable set to the dilution and wealth transfer measures from Equation (3), as follows for a CoCo issue j in year t:

$$\begin{aligned} \mathit{Wealth\ transfer}_{j,t} = &\beta_1 \mathit{Common\ law\ origin}_j + \beta_2 \mathit{French\ civil\ law\ origin}_j + \\ &\mathit{Controls}_{j,t} + \varepsilon_{j,t}. \end{aligned} \tag{5}$$

The regression model includes two indicator variables, namely *Common law origin* and *French civil law origin*, which are assigned a value of 1 if the issuer is incorporated in 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. Control variables are from Equation (4).

[Table 5 about here]

Results are reported in Table 5. Column 1 shows that banks that are incorporated in common law countries tend to issue more dilutive CoCos. In Columns 2 and 3, we replace the dependent variable with an indicator variable, *Dilutive*, and estimate both a linear probability model and a probit specification. Consistent with Column 1, We find that banks incorporated in common law (French-civil law) countries are 35.0% (15.3%) more likely to issue more dilutive CoCos (Column 2).

A plausible explanation for this robust pattern lies in the renegotiation environment associated with legal origin. La Porta et al. (1998) document higher risks of government contract repudiation and weaker legal enforcement in both common law and French civil law countries.[17] These conditions may lead shareholders to favor CoCos that allow greater contractual flexibility to anticipate possible renegotiations, such as adjustments to the conversion price or ratio, in the event of bankruptcy. In contrast, nondilutive CoCos, such as

[17] In La Porta et al. (1998), contract repudiation risk refers to the risk of a modification in a contract taking the form of a repudiation, postponement, or scaling down due to budget cutbacks, indigenization pressure, a change in government, or a change in government economic and social priorities. The quality of legal enforcement refers to a country having (i) an efficient judicial system, (ii) a rule of law, (iii) low corruption, (iv) less risk of expropriation, and (v) less risk of contract repudiation by the government.

write-down CoCos, are inherently less flexible, as a write-off would simply cancel the claim, leaving less room to renegotiate.

Next, using the findings on wealth transfer and legal origin, we re-estimate Equation (4) applying legal origins as instruments. That is, we estimate Equation (5) using the linear probability model as the first-stage regression (Column 2 of Table 5) and use the following equation as the second-stage regression:

$$CAR_{j,t} = \beta_1 \widehat{Dilutive}_{j,t} + Controls_{j,t} + \varepsilon_{j,t}. \tag{6}$$

We argue that while the legal origin indicators (*Common law origin* and *French civil law origin*) directly impact the CoCo design choices, they are not directly associated with the announcement abnormal returns, thereby satisfying the exclusion principle.

[Table 6 about here]

Panel A of Table 6 reports results from the second stage of this two-stage least square estimation (2SLS).[18] 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 -6.39% after 30 trading days (Column 4).

In Panel B of Table 6, we re-estimate our results on the heterogeneity across the distance from the trigger level (Table 4). Our findings show that the *Distance to trigger* generates larger variation across all columns compared to Table 4. Specifically, in Column 4, if a bank's capital ratio is exactly at the trigger level, the announcement effect is -17.3%. However, one

[18] 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 (6).

standard deviation above the average distance from the trigger (approximately 10%) results in an announcement effect of -1.4%.

5 Managerial Incentives of Dilutive CoCos

5.1 Announcement Effects Under Uncertainty

Our findings thus far suggest the existence of a pecking order within CoCos. In light of the agency costs and managerial incentive issues associated with CoCos (see Section 2), this indicates that shareholders generally exhibit limited concern about the agency costs stemming from CoCo issuance.

However, our results do not necessarily imply that more dilutive CoCos are unrelated to agency costs. For instance, shareholders may weigh adverse selection costs against agency conflicts based on the perceived likelihood of a trigger event. When the probability of a trigger increases, shareholders may place greater value on the stronger managerial discipline provided by dilutive CoCos, to the extent that agency cost mitigation outweighs adverse selection concerns. Since CoCo-related agency costs tend to rise with the likelihood of a trigger (e.g., first-loss absorbing features become more relevant as a bank's risk of distress increases), the value of CoCos designed to address these costs should increase correspondingly under such conditions.

We test this by focusing on periods of elevated aggregate uncertainty. Such macroeconomic conditions are largely exogenous to individual bank decisions, thereby mitigating endogeneity concerns while still affecting the perceived likelihood of CoCo trigger events. To capture uncertainty that is particularly relevant to the anticipation of such events, thereby amplifying the value of managerial incentive alignment embedded in dilutive CoCos, we employ two measures of uncertainty that are particularly relevant to the anticipation of trigger events.

First, we consider periods when regulatory uncertainty is high. Historical cases, such as

Banco Popular in 2017 and Credit Suisse in 2023, illustrate that rising regulatory uncertainty amplifies the perceived chances of a regulator-initiated Point of Non-Viability (PONV), thus elevating expected trigger risk even when the mechanical trigger remains non-binding. To measure regulatory uncertainty, we adopt the Global Economic Policy Uncertainty Index (EPU) by Baker et al. (2016) and define an indicator variable, *EPU High*, when the EPU index is in its highest tercile. In our regressions, we include the two indicator variables and their interaction terms with *Dilutive* and *Distance to trigger* in Equation (4).

Second, we analyze periods characterized by increased volatility in the secondary market for CoCo yields. Since CoCo yields incorporate information about trigger risk, heightened volatility reflects growing investor concern over the probability of a trigger event. We construct an indicator variable, *CoCo Index Volatility High*, which equals one if the CoCo issuance announcement occurs during a period of elevated CoCo market volatility, and zero otherwise. Specifically, we measure volatility as the 100-day rolling standard deviation of Bloomberg's Global CoCo Bond Index. High-volatility periods are defined as those falling in the top tercile of this distribution over the 2014 to 2019 sample period.

[Table 7 about here]

The results are reported in Table 7. Panel A reports estimates using the EPU as our measure of uncertainty. We find that the negative announcement returns associated with issuing more dilutive CoCos are significantly attenuated or even reversed during periods of elevated regulatory uncertainty. For example, Column 4 shows that while issuing dilutive CoCos generates a -3.95% return over the 30-day window, this effect reverses to a +1.99% return when the issuance occurs during high-EPU periods.

In Panel B, we find similar effects when replacing EPU with an indicator equal to one if the volatility of Bloomberg's Global CoCo Bond Index falls in the highest tercile. In this case, the negative effect is dampened when uncertainty is high. Specifically, issuing a dilutive CoCo results in a -4.07% return over 30 days under normal volatility conditions, but the effect is reduced to 0.26% when the issuance occurs during periods of elevated index volatility.

These findings are consistent with bank shareholders valuing the managerial incentive-alignment mechanism embedded in dilutive CoCos. When the likelihood of a trigger event increases, perhaps due to heightened regulatory uncertainty, investors react more favorably to dilutive CoCo bond issues because such instruments have the potential to better align managerial incentives with shareholder interests.

5.2 Bank Stock Performance After CoCo Issuance

Next, we examine the subsequent stock price performance after issuing CoCos. If our results thus far reflect the pecking order among CoCos, banks that issue dilutive CoCos should exhibit relatively weaker equity performance, compared to banks that issue nondilutive CoCos, reflecting their poorer quality. Further, if investors value the managerial incentive-alignment feature of dilutive CoCos, then this weaker performance should reverse or dampen during periods of elevated aggregate uncertainty since investors value managerial incentive alignment of dilutive CoCos.

To test this, we construct an equally weighted long-short portfolio of bank equity 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.[19] Then, we sort the CoCo issues by the wealth transfer measure from Equation (3). We take a long position in the stocks of banks that have issued at least one CoCo below the median wealth transfer measure (i.e., more dilutive) and a short position in the stocks of banks that have issued at least one CoCo above the median wealth transfer measure (i.e., less dilutive)[20]. The portfolio is rebalanced monthly. We construct the portfolios in October 2014 and continue until December 2021 because there are limited number of CoCo rollovers in the earlier part of our sample period

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

[20]Banks that have issued both types of CoCos within the three-year look-back period are included in the long portfolio

and CoCos were originally introduced in dilutive forms only.

We estimate the following time-series regression to evaluate the performance of our long-short portfolio:

$$\begin{aligned} Return_t = & \alpha + \beta_1 Market_t + \beta_2 Size_t + \beta_3 Value_t + \\ & \beta_4 Profit_t + \beta_5 Investment_t + \varepsilon_t. \end{aligned} \tag{7}$$

Monthly portfolio excess returns are regressed on the Fama-French five-factor model using developed market factors.[21] The regression assesses the relative performance of banks that issue dilutive CoCos (long leg) versus those that issue nondilutive CoCos (short leg), controlling for differential exposures to systematic risk factors. We hypothesize that $\alpha < 0$, indicating that banks that issued more dilutive CoCos subsequently underperform, consistent with the interpretation that such issuance indicates weaker bank fundamentals.

Column 1 of Table 8 presents the results applying Equation (7). In Column 1, we find an underperformance of the long portfolio relative to the short portfolio in the amount of 37.8 basis points per month (statistically insignificant). This is consistent with banks issuing dilutive CoCos being of lower quality.

[Table 8 about here]

Next, we investigate the performance of the long-short portfolio during periods of heightened aggregate uncertainty related to contingent trigger events. We hypothesize that the portfolio's performance reverses in such periods. This would suggest that, under elevated uncertainty, shareholders place greater value on the managerial incentive alignment features embedded in dilutive CoCos.

We test this by including an indicator variable in Equation (7), denoted as *EPU High*, which takes a value of 1 if the Global Economic Policy Uncertainty Index (Baker et al., 2016)

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

is above the median and 0 otherwise. The regression equation for this model is as follows.

$$\begin{aligned} Return_t = \alpha_0 + &\alpha_1 EPU_t + \beta_1 Market_t + \beta_2 Size_t + \\ &\beta_3 Value_t + \beta_4 Profit_t + \beta_5 Investment_t + \varepsilon_t. \end{aligned} \tag{8}$$

In this equation, α_0 captures the relative performance of banks issuing dilutive CoCos during periods of low policy uncertainty, while $\alpha_0 + \alpha_1$ reflects their relative performance during high uncertainty periods. To test the robustness of our findings and capture different dimensions of uncertainty, we replace EPU High with two alternative proxies. The first, *CoCo Index Volatility High*, equals 1 if the 100-day rolling volatility of Bloomberg's Global CoCo Bond Index (I30902US) exceeds its sample median (2014–2021), and 0 otherwise. The second, *VIX High*, takes a value of 1 when the VIX is above its sample median, and 0 otherwise.

The results are reported in Columns 2 through 4 of Table 8. Column 2 shows that the long portfolio underperforms by 98.2 basis points per month, statistically significant at the 5% level, during periods when CoCo Index Volatility High equals 0. In contrast, during high-volatility periods (*CoCo Index Volatility High*= 1), the portfolio yields a positive excess return of 14.8 basis points per month (=1.13% - 0.982%). This finding supports the interpretation that banks issuing dilutive CoCos are generally of lower quality, but that investors value the incentive-alignment features of dilutive CoCos under heightened uncertainty.

In Column 3, we replace *CoCo Index Volatility High* with *EPU High* as an alternative proxy for uncertainty and obtain similar results. Consistent with Table 7, these findings suggest that managerial incentive alignments are particularly salient when concerns over trigger events are elevated. Column 4 reports results using VIX High as a broad measure of equity markets uncertainty. Although the estimates remain qualitatively similar, the joint significance $p-$value increases to 0.085, suggesting that the uncertainty most relevant to CoCo-related agency costs is more closely tied to concerns surrounding contingent trigger events (captured by *EPU High* or *CoCo Index Volatility High*) rather than general market volatility (VIX).

5.3 CoCo Bond Yields After Issuance

Our results thus far suggest that bank shareholders recognize the managerial incentive alignment features embedded in dilutive CoCos, which may help banks avoid the capital deterioration that could lead to trigger events. In this section, we turn to the pricing of CoCo bonds themselves to assess whether CoCo investors, who are arguably more directly exposed to trigger risk, also incorporate these incentive mechanisms into their calculations. This analysis is essential, as the validity of the pecking order and the value of managerial incentives embedded in dilutive CoCos hinges on a shared understanding among all market participants regarding the valuation of CoCos.

We hypothesize that dilutive CoCos are associated with higher yields, reflecting the issuers' quality. Further, we predict that the yield differences between dilutive and nondilutive CoCos narrows during periods of heightened aggregate uncertainty. This convergence is consistent with investors placing greater value on the incentive-alignment features of dilutive CoCos, which may mitigate the likelihood of trigger events during uncertain times.

To test this, we analyze monthly CoCo bond yields using the following regression equation:

$$\begin{aligned} Yield_{c,t} =& \beta_1 Dilutive_{c,t} + \beta_2 Dilutive_{c,t} \times EPU\ High_t \\ &+ \beta_3 EPU\ High_t + \eta_{b,t} + \lambda_{f,t} + \gamma_{f,t} + \varepsilon_{i,t}. \end{aligned} \tag{9}$$

The dependent variable, *Yield*, is the monthly CoCo bond yields. For the aggregate uncertainty measure, we apply *EPU High* that equals 1 if the Global Economic Policy Uncertainty Index (Baker et al., 2016) is above the median and 0 otherwise.[22] To account for issuers' credit risks and currency risks associated with the CoCos, our most rigorous specification includes bank-month fixed effects, currency of the issuer's country of incorporation fixed effects, and CoCo currency fixed effects.

[Table 9 about here]

[22] In the CoCo bond yield analysis, we do not use *CoCo Index Volatility High* because of endogeneity issues.

Panel A of Table 9 reports the results. Each column applies Equation (9) but with different fixed effects. Across all columns, we find that dilutive CoCos trade at higher yields, but such difference dampens during periods of heightened uncertainty. For instance, in our most rigorous specification (Column 4), we find that dilutive CoCos trade at a 23.6 basis points higher yield, but this yield gap becomes economically insignificant (0.2 basis points) during periods when EPU is high.

We further examine the pricing implications of dilutive CoCos in a time-series setting by analyzing the monthly yield differential between dilutive and nondilutive CoCos. This allows us to rule out concerns that our yield results are driven by outliers. Specifically, we construct an equally weighted long position in dilutive CoCos and a short position in nondilutive CoCos, calculating the monthly change in average yield for each position. The resulting differential in yield changes increases when the long portfolio (dilutive CoCos) underperforms relative to the short portfolio (nondilutive CoCos), and vice versa.

We use this differential in yield changes as the dependent variable in the following time-series regression:

$$\begin{aligned}\textit{Differential in Yield Change}_t = {} & \alpha_0 + \alpha_1 EPU_t + \beta_0 \textit{10Y-2Y Spread} \\ & + \beta_1 Market_t + \beta_2 Size_t + \beta_3 Value_t + \beta_4 Profit_t + \beta_5 Investment_t + \varepsilon_t.\end{aligned} \tag{10}$$

We hypothesize that $\alpha_0 > 0$ and $\alpha_1 < 0$, indicating that the dilutive CoCo bond yield performance will be poorer on average ($\alpha_0 > 0$), but it will reverse during periods of aggregate uncertainty ($\alpha_1 < 0$).

Panel B of Table 9 presents the results, with each column incrementally adding time-series factors. Across all specifications, we find that the yield spread between dilutive and nondilutive CoCos tends to widen during periods of low aggregate uncertainty ($\alpha_0 > 0$), but tighten when uncertainty is elevated ($\alpha_1 < 0$). Notably, in Column 4, the estimated yield spread between dilutive and nondilutive CoCos is expected to narrow under high uncertainty. These findings suggest that CoCo bond investors, like shareholders, recognize and price the managerial incentive alignment features embedded in dilutive CoCos.

5.4 Dilutive CoCos and Systemic Risk

In this section, we explicitly examine the association between issues of dilutive CoCos and the level of systemic risk exhibited by banks. We focus on systemic risk for two reasons. First, CoCos were introduced to mitigate bank systemic risk exposure. Second, since systemic risk is external to the individual bank, it is not priced in equity returns. Similarly, while our findings thus far suggest that shareholders and CoCo bond investors price the managerial incentive alignment of dilutive CoCos at times, this does not inherently confirm that these instruments effectively reduce systemic risk.

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

$$Systemic\ Risk_{j,t+1} = \beta_1 Diluive_{j,t} + Controls_{j,t} + \varepsilon_{j,t+1} \tag{11}$$

where the disturbance term, $\varepsilon_{j,t+1}$, includes year-fixed effects. As dependent variables, we employ two measures that capture distinct dimensions of systemic risk. First, we use the 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 marginal expected shortfall (MES) to gauge the potential capital shortfall of the issuer in the event of market downturns that indicate systemic risk (i.e., the average loss a financial institution is expected to suffer when the overall market is in distress). The dependent variables are measured a year after the announcement. 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]

[Table 10 about here]

The results are presented in Table 10. Column 1 shows that, relative to nondilutive CoCos, dilutive CoCos are more negatively associated with the issuing bank's contribution

[23] We do not include the lag of ΔCoVaR in Column 1 of Table 10 because of its slow-moving property.

to systemic risk. This finding suggests that dilutive CoCos play a greater role in mitigating systemic risk, particularly through reduced interconnectedness. Columns 2 and 3 present results using the average post-announcement Marginal Expected Shortfall (MES), evaluated at the 95% and 99% thresholds, respectively. While we find that potential capital shortfall is more positively associated with dilutive CoCos than with nondilutive CoCos, the estimates are not statistically significant. Taken together, the results suggest that dilutive CoCos may contribute more effectively to reducing bank interconnectedness, thereby supporting financial stability.

6 Conclusion

This paper provides novel evidence on the existence of a pecking order in contingent convertible bonds (CoCos), demonstrating that market participants distinguish sharply between dilutive, equity-like CoCos and non-dilutive, debt-like CoCos. Using a comprehensive dataset, we show that dilutive CoCos are consistently associated with negative announcement returns, with effects that grow in magnitude over longer event windows. By contrast, non-dilutive CoCos elicit no significant equity market reaction. These results are robust to multiple empirical specifications, including regressions controlling for issuer characteristics, alternative definitions of dilutiveness, and an instrumental-variables approach exploiting variation in legal origin.

Our findings further highlight the role of managerial incentive alignment mechanisms embedded in dilutive CoCos. Specifically, while dilutive CoCos are generally penalized by markets under normal conditions, we show that investor reactions are significantly attenuated, and can even reverse, during periods of heightened regulatory or market uncertainty. In such environments, shareholders and bondholders appear to value the incentive-alignment features of dilutive CoCos, recognizing their potential to discipline management and mitigate agency costs when the probability of a trigger event is elevated. Consistent with this interpretation, banks issuing dilutive CoCos tend to underperform in normal times but show relative resilience during high-uncertainty periods, and CoCo bond yield spreads likewise narrow in such cases. Importantly, we find that dilutive CoCos are more strongly associated with reductions in systemic interconnectedness, suggesting that these instruments can play a stabilizing role for the broader financial system. These findings suggest that the valuation and effectiveness of CoCos are state-contingent: dilutive structures are costly when uncertainty is low but become valuable tools of incentive alignment and systemic risk mitigation when uncertainty is high.

Our analysis extends the literature on pecking order theory and capital structure by offering a unique lens through CoCos. Unlike traditional instruments, CoCos are related to diverging adverse selection and agency costs, providing a simplified yet insightful framework for studying security design. By positioning CoCos along the degree of contingent dilution, banks can navigate the costs inherent in financing decisions, offering a valuable laboratory for theoretical predictions.

Finally, the results underscore the evolving role of CoCos as a key instrument in bank financing. The evidence suggests that shareholders, far from being passive observers, actively price the contingent dilution parameter of CoCos. This insight contributes to a deeper understanding of capital markets' sophistication in evaluating complex financial instruments and the behavior of banks in response to regulatory and market pressures.

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Figure 2: The Distribution of the Wealth Transfer Measure by CoCo Type

This figure plots the box plots of the wealth transfer measure in percentage by CoCo type and how the variable *Dilutive* is defined. From the left, each boxplot represents the wealth transfer measure distribution of all CoCos, equity conversion, temporary write-down, and permanent write-down, respectively. The horizontal dashed line represents the threshold that defines the variable *Dilutive*. The bold line represents the median.

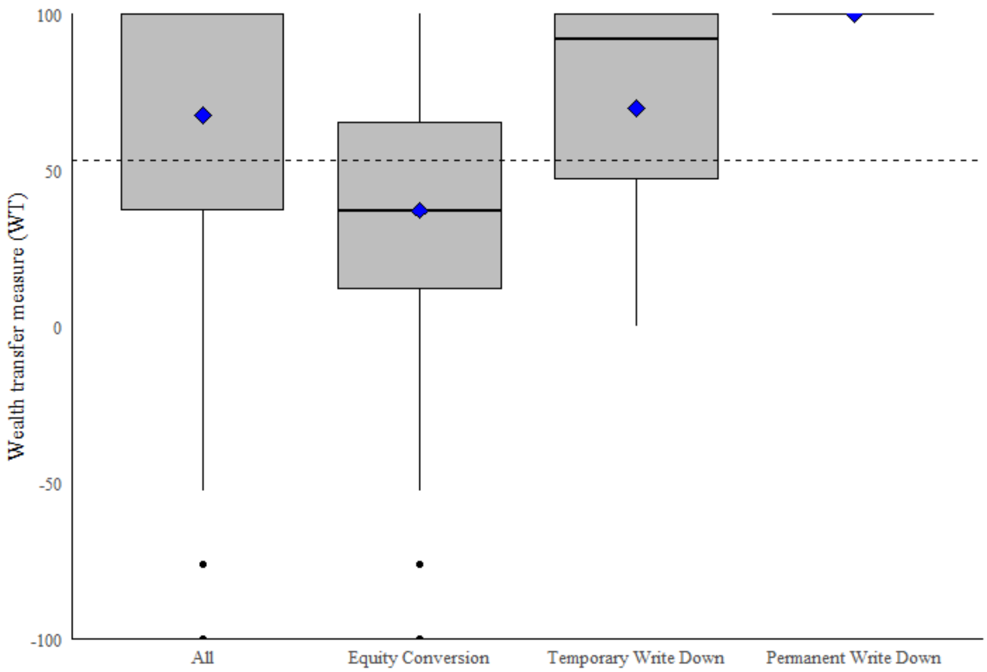
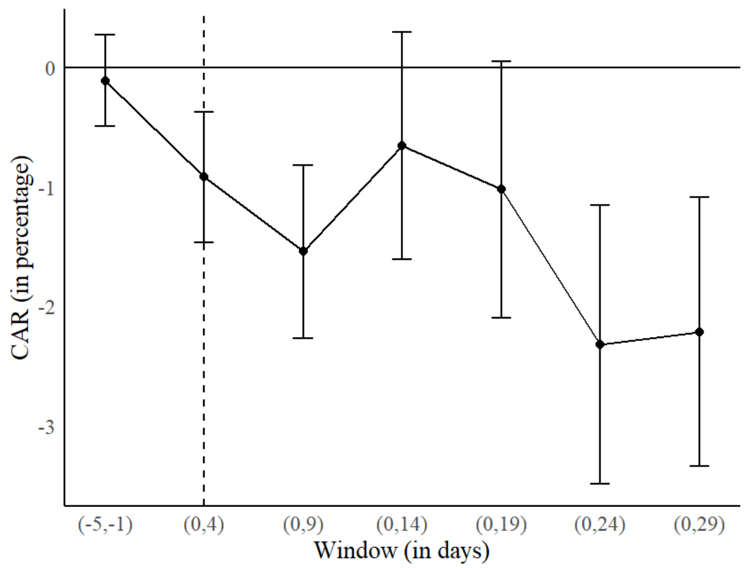
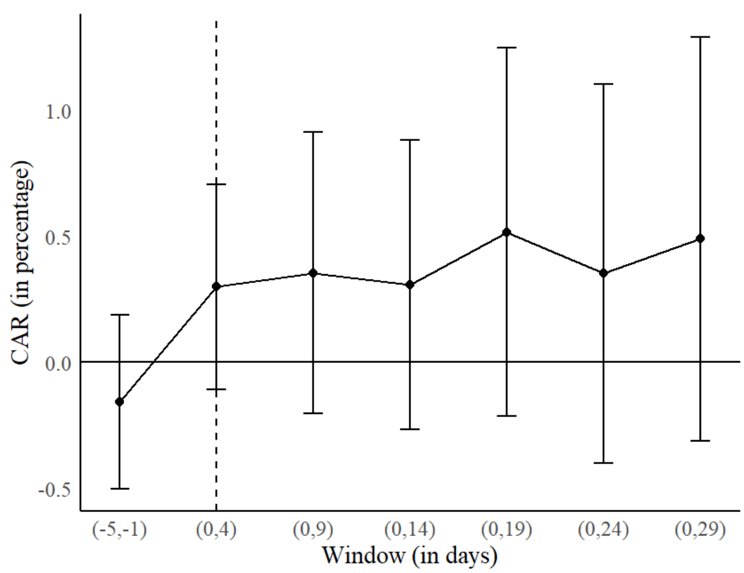


Figure 3: Cumulative Abnormal Returns: By *Dilutive*

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 error bars represent the 95% confidence intervals. The vertical axis represents cumulative abnormal return in percentage. The horizontal axis represents estimation windows with 5 trading day increments.



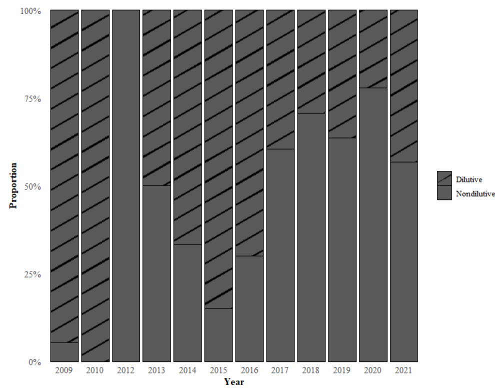
Panel A: *Dilutive* = 1



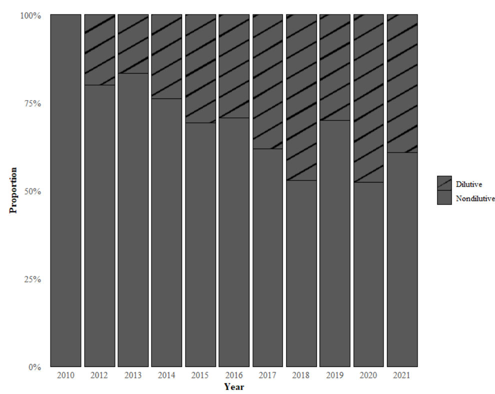
Panel B: *Dilutive* = 0

Figure 4: Porportion of Dilutive CoCo Issues: By Legal Origin

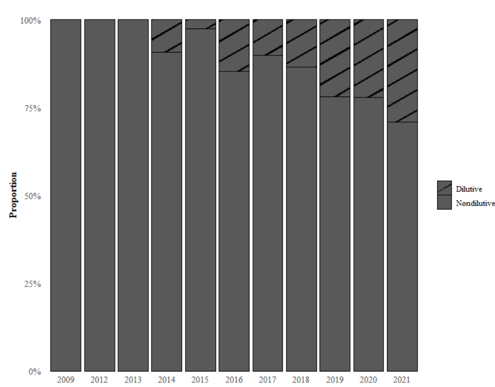
This figure plots the yearly proportion of dilutive and nondilutive CoCo issues by legal origin. The striped bars represent the proportion of dilutive CoCos ($Dilutive$ = 1) and the solid bars represent nondilutive CoCos ($Dilutive$ = 0). Panel A plots banks incorporated in common law origin countries. Panel B plots banks incorporated in French civil law origin countries. Panel C plots banks incorporated in German and Scandinavian civil law origin countries and China.



Panel A: Common law origin



Panel B: French civil law origin



Panel C: Others

Table 1: Descriptive Statistics

This table presents the descriptive statistics of the main variables used in the analysis. The baseline data consists of 757 CoCos issued between 2009 and 2021 in 27 countries. The level of observation is CoCo issues. Panel A reports the descriptive statistics. Panel B reports the top 10 countries and financial institutions by number of distinct CoCo issues. Detailed variable descriptions are provided in Table A.1.

Panel A. Descriptive Statistics (Cumulative Abnormal Returns in %)

Variable	Obs	Mean	Std. Dev.	Min	50%	Max	$p-$value (H_0: $\mu = 0$)
CAR(-2,2)	757	0.224	4.038	-15.86	0.0001	29.776	0.1269
CAR(0,9)	757	-0.267	6.299	-21.44	-0.338	75.967	0.2441
CAR(0,19)	757	0.013	8.518	-34.375	-0.687	95.039	0.9665
CAR(0,29)	757	-0.397	9.245	-37.198	-0.658	59.002	0.2384

Panel B. Descriptive Statistics (Other Variables)

Variable	Obs	Mean	Std. Dev.	Min	50%	Max
Announcement to issuance (days)	757	8.073	6.975	0	7	48
Beta	757	1.19	0.635	-0.358	1.234	2.963
Wealth transfer (%)	757	66.004	51.897	-374.433	100	100
Dilutive	757	0.328	0.47	0	0	1
Outstanding CoCos (%)	757	1.925	3.994	0	0.892	35.537
Coupon rate (%)	757	6.376	2.327	0.82	6.125	16.125
Equity conversion	757	0.292	0.455	0	0	1
Permanent write-down	757	0.247	0.432	0	0	1
Temporary write-down	757	0.461	0.499	0	0	1
Common law origin	757	0.341	0.474	0	0	1
French civil law origin	757	0.24	0.428	0	0	1
Market capitalization (%)	757	16.425	2.17	7.776	17.154	20.666
Profitability (%)	757	7.593	6.986	-24.735	7.64	37.308
Distance from trigger (%)	757	6.828	3.451	-3.95	6.635	22.775
Total liabilities (%)	757	92.945	2.849	73.478	93.56	98.145
Rollover	757	0.139	0.346	0	0	1
ΔCoVaR($t+1$)	671	-0.851	0.527	-2.242	-0.86	0.172
MES95($t+1$)	740	-1.565	1.545	-7.568	-1.115	0.958
MES99($t+1$)	740	-2.601	3.231	-16.707	-1.61	3.704

Panel C. Number of CoCo Issued by Country and Issuer (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	15
10	Mexico	27	Credit Agricole	15

Table 2: Cumulative Abnormal Returns and CoCo Dilutiveness

This table compares the announcement effects for dilutive and nondilutive CoCo issuance through mean-difference tests. Column 1 reports the cumulative abnormal returns of dilutive CoCos. Column 2 reports the cumulative abnormal returns of nondilutive CoCos. Column 3 reports the difference in mean between the cumulative abnormal returns of dilutive and nondilutive 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) ending 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 A.1. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Cumulative abnormal return (%)		Diff (1-2)	$p-$value
	Dilutive	Nondilutive		
CAR window	(1)	(2)	(3)	(4)
(-1,-5)	-0.109	-0.157	0.049	0.853
(0,4)	-0.918***	0.299	-1.217***	0
(0,9)	-1.543***	0.355	-1.898***	0
(0,14)	-0.656	0.307	-0.962*	0.091
(0,19)	-1.02*	0.516	-1.536**	0.021
(0,24)	-2.32***	0.352	-2.672***	0
(0,29)	-2.215***	0.49	-2.705***	0
Observations	248	509	757	757

Table 3: Cumulative Abnormal Returns and CoCo Dilutiveness: 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. *Distance to trigger* is the distance between the capital ratio and the trigger level. Control variables include the natural log of market capitalization, profitability, total liabilities, rollover indicator, outstanding CoCos, and the coupon rate at issue. Detailed variable descriptions are provided in Table A.1. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Heteroskedasticity-robust standard errors are reported in parentheses.

Dependent variables:	Cumulative abnormal returns (%)			
CAR window:	(-2,2)	(0,9)	(0,19)	(0,29)
	(1)	(2)	(3)	(4)
Dilutive	-0.862***	-1.68***	-1.26*	-2.13***
	(0.324)	(0.435)	(0.672)	(0.726)
Market capitalization	0.072	0.136	-0.186	-0.093
	(0.085)	(0.124)	(0.191)	(0.183)
Distance to trigger	-0.012	0.012	-0.013	0.143
	(0.055)	(0.100)	(0.115)	(0.128)
Profitability	-0.010	-0.086**	-0.049	-0.082
	(0.023)	(0.035)	(0.048)	(0.056)
Total liabilities	-0.092	-0.326*	-0.131	-0.147
	(0.089)	(0.186)	(0.180)	(0.192)
Rollover	0.363	0.432	0.105	0.598
	(0.429)	(0.627)	(1.02)	(1.14)
Outstanding CoCos	0.216***	0.228**	0.211*	0.325***
	(0.080)	(0.103)	(0.110)	(0.113)
Coupon rate	-0.090	-0.191**	-0.220*	-0.378***
	(0.065)	(0.083)	(0.115)	(0.140)
Adj. R2	0.074	0.106	0.047	0.092
Observations	757	757	757	757

Table 4: Cumulative Abnormal Returns and Distance to Trigger

This table examines the heterogeneous announcement effect of CoCos across the distance to trigger levels. Cumulative abnormal returns are estimated with the market model (CAPM) on an estimation window of 250 days (with at least 50 valid returns) ending 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. *Distance to trigger* is the distance between the capital ratio and the trigger level. Control variables include the natural log of market capitalization, profitability, total liabilities, rollover indicator, outstanding CoCos, and the coupon rate at issue. Conditional announcement effects report economic magnitudes based on *Distance to trigger*, *Dilutive*, and the interaction term when *Dilutive* equals 1. Detailed variable descriptions are provided in Table A.1. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Heteroskedasticity-robust standard errors are reported in parentheses.

Dependent variables:	Cumulative abnormal returns (%)			
CAR window:	(-2,2)	(0,9)	(0,19)	(0,29)
	(1)	(2)	(3)	(4)
Dilutive	-2.98***	-3.48***	-4.61***	-6.54***
	(0.616)	(1.03)	(1.47)	(1.49)
Distance to trigger × Dilutive	0.323***	0.274**	0.512***	0.671***
	(0.084)	(0.134)	(0.174)	(0.180)
Distance to trigger	-0.129**	-0.087	-0.198	-0.100
	(0.062)	(0.109)	(0.136)	(0.148)
Market capitalization	0.074	0.137	-0.182	-0.089
	(0.084)	(0.125)	(0.191)	(0.183)
Profitability	-0.009	-0.085**	-0.047	-0.079
	(0.023)	(0.036)	(0.049)	(0.056)
Total liabilities	-0.062	-0.301	-0.083	-0.085
	(0.090)	(0.185)	(0.181)	(0.191)
Rollover	0.132	0.236	-0.262	0.117
	(0.437)	(0.631)	(1.03)	(1.16)
Outstanding CoCos	0.218***	0.229**	0.213*	0.328***
	(0.081)	(0.103)	(0.109)	(0.112)
Coupon rate	-0.052	-0.159*	-0.160	-0.300**
	(0.065)	(0.082)	(0.119)	(0.140)
Conditional announcement effects of dilutive CoCos (*Dilutive* = 1):				
If Distance to trigger 0%:	-2.98%	-3.48%	-4.61%	-6.54%
If Distance to trigger 10%:	-1.04%	-1.61%	-1.47%	-0.83%
Adj. R2	0.074	0.106	0.047	0.092
Observations	757	757	757	757

Table 5: Determinants of Dilutive CoCo Issues and Legal Origins

This table examines the impact of legal origin on the banks' choice of CoCo loss absorption mechanisms. *Wealth transfer* is the estimated contingent wealth transfer from CoCo bondholders to stockholders, as a share of CoCo notional value. *Dilutive* is an indicator variable that equals 1 if the CoCo is in the lowest wealth transfer tercile and else 0. *Common law* is an indicator variable that equals 1 if the issuer is incorporated in a common law jurisdiction and else 0. *French civil law* is an indicator variable that equals 1 if the issuer is incorporated in a French civil-law jurisdiction and else 0. The legal origins across countries are classified following La Porta et al. (1998). Control variables include the natural log of market capitalization, profitability, distance between the capital ratio and the trigger level, total liabilities, rollover indicator, outstanding CoCos, and the coupon rate at issue. Detailed variable descriptions are provided in Table A.1. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Heteroskedasticity-robust standard errors are reported in parentheses.

Dependent variables:	Wealth transfer (1)	Dilutive (2)	Dilutive (3)
Common law origin	-25.7*** (5.55)	0.350*** (0.047)	1.06*** (0.158)
French civil law origin	-0.988 (5.95)	0.153*** (0.047)	0.516*** (0.154)
Market capitalization	-2.07 (1.65)	0.003 (0.009)	0.009 (0.033)
Profitability	0.461** (0.221)	-0.007** (0.003)	-0.021** (0.008)
Distance to trigger	-1.69 (1.03)	0.005 (0.006)	0.024 (0.022)
Total liabilities	-2.33*** (0.687)	0.020** (0.009)	0.062* (0.034)
Rollover	3.34 (6.45)	-0.069 (0.052)	-0.199 (0.170)
Outstanding CoCos	-0.183 (0.402)	-0.001 (0.004)	-0.003 (0.014)
Coupon rate	-2.19* (1.27)	0.009 (0.008)	0.028 (0.028)
Model	OLS	LPM (OLS)	Probit
Adj. R2	0.085	0.106	–
Pseudo R2	–	–	0.131
Observations	757	757	757

Table 6: Cumulative Abnormal Returns, CoCo Dilutiveness, and Legal Origins: 2SLS

This table examines the causal impact of CoCo dilutiveness 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) ending 30 days before the CoCo issue announcement date. Panel A reports the results of the second-stage estimates. Panel B reports the results of the second-stage estimates including an interaction term with *Distance to trigger*. *Dilutive* is an indicator variable that equals 1 if the CoCo is in the lowest wealth transfer tercile and else 0. Control variables include the natural log of market capitalization, profitability, distance between the capital ratio and the trigger level, total liabilities, rollover indicator, outstanding CoCos, and the coupon rate at issue. Conditional announcement effects report economic magnitudes based on *Distance to trigger*, *Dilutive*, and the interaction term when *Dilutive* equals 1. Detailed variable descriptions are provided in Table A.1. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Heteroskedasticity-robust standard errors are reported in parentheses.

Panel A. Second Stage Estimate				
Dependent Variables:	Cumulative abnormal returns (%)			
CAR Window:	(-2,2)	(0,9)	(0,19)	(0,29)
	(1)	(2)	(3)	(4)
$\widehat{\text{Dilutive}}$	-0.498	-1.15	-5.02*	-6.39**
	(1.27)	(1.84)	(2.75)	(3.07)
Controls	Yes	Yes	Yes	Yes
Observations	757	757	757	757
F-test (1st stage)	28.6	28.6	28.6	28.6
1st stage $F-$test $p-$value (weak inst.)	0.000	0.000	0.000	0.000
Sargan $p-$value (overid.)	0.994	0.016	0.388	0.366

Panel B. Second Stage Estimate: Heterogeneity Test				
Dependent variables:	Cumulative abnormal returns (%)			
Window:	(-2,2)	(0,9)	(0,19)	(0,29)
Model:	(1)	(2)	(3)	(4)
$\widehat{\text{Dilutive}}$ × Distance from trigger	1.11***	2.90***	1.89**	2.27**
	(0.421)	(0.987)	(0.797)	(1.01)
$\widehat{\text{Dilutive}}$	-6.58***	-15.5***	-13.9***	-17.3***
	(1.92)	(4.46)	(3.95)	(4.44)
Distance from trigger	-0.399**	-0.987**	-0.698**	-0.680*
	(0.174)	(0.423)	(0.309)	(0.357)
Conditional announcement effects of dilutive CoCos:				
If Distance to trigger 0%:	-6.58%	-15.5%	-13.9%	-17.3%
If Distance to trigger 10%:	0.53%	3.63%	-1.98%	-1.4%
Controls	Yes	Yes	Yes	Yes
F-test (1st stage)	28.6	28.6	28.6	28.6
1st stage $F-$test $p-$value (weak inst.)	0.000	0.000	0.000	0.000
Sargan $p-$value (overid.)	0.125	0.871	0.756	0.705
Observations	757	757	757	757

Table 7: Cumulative Abnormal Returns and Aggregate Uncertainty

This table examines the announcement effects of dilutive CoCos during periods of high uncertainty associated with CoCo trigger events. 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. Panel A reports results using *CoCo Index Volatility High* as the uncertainty measure. Panel B reports results using *EPU High* as the uncertainty measure. *CoCo Index Volatility High* is an indicator variable that equals 1 if the announcement date falls within periods when the 100-trading day volatility of the Bloomberg's Global CoCo Bond Index (I30902US) is in the highest tercile between 2014 and 2019 and else 0. *EPU High* is an indicator variable that equals 1 if the Global Economic Policy Uncertainty of Baker et al. (2016) is in the highest tercile and else 0. *Developed* is an indicator variable that equals 1 if the bank is incorporated in a developed country and else 0. *Dilutive* is an indicator variable that equals 1 if the CoCo is in the lowest wealth transfer tercile and else 0. *Distance to trigger* is the distance between the capital ratio and the trigger level. Control variables include legal origins, the natural log of market capitalization, profitability, distance between the capital ratio and the trigger level, total liabilities, rollover indicator, outstanding CoCos, and the coupon rate at issue. Conditional announcement effects report economic magnitudes based on *Developed*, *Dilutive*, *CoCo Index Volatility High*, and the interaction terms when *Dilutive* equals 1. Detailed variable descriptions are provided in Table A.1. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Heteroskedasticity-robust standard errors are reported in parentheses.

Panel A. Global Economic Policy Uncertainty				
Dependent Variables:	Cumulative abnormal returns (%)			
Window:	(-2,2)	(0,9)	(0,19)	(0,29)
Model:	(1)	(2)	(3)	(4)
Dilutive	-0.982**	-2.91***	-3.02***	-3.95***
	(0.384)	(0.538)	(0.817)	(0.889)
Dilutive × EPU high	0.375	4.01***	5.75***	5.94***
	(0.669)	(1.10)	(1.56)	(1.49)
EPU high	-0.507	-0.737	-1.48*	-1.61*
	(0.373)	(0.608)	(0.771)	(0.832)
Controls	Yes	Yes	Yes	Yes
Adj. R2	0.054	0.072	0.034	0.065
Observations	757	757	757	757

Panel B. CoCo Market Volatility				
Dependent Variables:	Cumulative abnormal returns (CAR)			
Window:	(-2,2)	(0,9)	(0,19)	(0,29)
Model:	(1)	(2)	(3)	(4)
Dilutive	-1.25**	-3.55***	-3.28***	-4.07***
	(0.550)	(0.770)	(0.880)	(1.05)
Dilutive × CoCo Index Volatility High	1.21*	4.15***	2.76**	4.33***
	(0.696)	(1.09)	(1.29)	(1.41)
CoCo Index Volatility High	-0.757*	-1.39**	0.055	-0.703
	(0.407)	(0.703)	(0.936)	(0.903)
Controls	Yes	Yes	Yes	Yes
Adj. R2	0.035	0.082	0.037	0.073
Observations	589	589	589	589

Table 8: Monthly Long-Short Portfolio Returns and Aggregate Uncertainty

This table examines the relationship between outstanding CoCo and stock returns. 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. The dependent variable is the monthly long-short portfolio returns. *CoCo Index Volatility High* is an indicator variable that equals 1 if the 100-trading day volatility of Bloomberg's Global CoCo Bond Index (I30902US) is higher than the sample median between 2014 and 2021 (using the values for each month-end) *EPU High* 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. *VIX High* 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. *COVID* is an indicator variable that equals 1 if the portfolio is constructed after January 2020 and else 0. Market, Size, Value, Profit, and Investment 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 A.1. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are provided in parentheses.

Dependent variables:	Monthly long-short portfolio return (%)			
	(1)	(2)	(3)	(4)
Alpha	-0.378	-0.982**	-0.940**	-0.995**
	(0.289)	(0.379)	(0.397)	(0.405)
EPU High		1.25**		
		(0.527)		
CoCo Index Volatility High			1.13**	
			(0.563)	
VIX High				1.23**
				(0.576)
Market	0.229***	0.215***	0.216***	0.278***
	(0.074)	(0.072)	(0.073)	(0.076)
Size	-0.119	-0.088	-0.164	-0.198
	(0.201)	(0.196)	(0.199)	(0.201)
Value	0.476**	0.487**	0.527***	0.429**
	(0.191)	(0.186)	(0.189)	(0.188)
Profit	0.088	0.079	0.191	-0.073
	(0.263)	(0.256)	(0.263)	(0.268)
Investment	-0.228	-0.273	-0.193	-0.230
	(0.320)	(0.311)	(0.314)	(0.313)
Joint significance p-value (Alpha & Uncertainty)	-	0.035	0.037	0.085
Adj. R2	0.223	0.265	0.251	0.255
Observations	87	87	87	87

Table 9: CoCo Bond Yields and Aggregate Uncertainty

This table examines the monthly bond yields, bond yield change differentials, and aggregate uncertainty. In Panel A, the dependent variable is monthly individual bond yields. In Panel B, the dependent variable is the monthly average yield differentials between dilutive and nondilutive CoCos. The variable *EPU High* is an indicator variable that equals 1 if the Economic Uncertainty Index is above the median. The variable *10Y-2Y Spread* is the difference between 10-year and 2-year treasury rates. The portfolio is formed from October 2014 to December 2021. Detailed variable descriptions are provided in Table A.1. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are provided in parentheses.

Panel A. Monthly Individual CoCo Bond Yields				
Dependent variables:	Monthly CoCo Bond Yield (%)			
	(1)	(2)	(3)	(4)
Dilutive	1.81***	2.09***	0.236***	0.236**
	(0.060)	(0.275)	(0.091)	(0.104)
Dilutive × EPU High	-0.176**	-1.79***	-0.234**	-0.234**
	(0.075)	(0.280)	(0.097)	(0.111)
EPU High	-0.648***			
	(0.058)			
Issuer × Time FE	–	Yes	Yes	Yes
Bank Currency × Time FE	–	–	Yes	Yes
CoCo Currency × Time FE	–	–	Yes	Yes
Bank Incorporated Country × Time FE	–	–	–	Yes
Adjusted R^2	0.106	0.842	0.897	0.866
Observations	21,291	21,291	21,291	21,291

Panel B. Monthly Changes in Yield Differentials Between Dilutive and Nondilutive CoCos				
Dependent variables:	Monthly Differentials in Yield Changes (%)			
	(1)	(2)	(3)	(4)
Intercept	0.072*	0.057*	0.055*	0.043
	(0.037)	(0.030)	(0.030)	(0.031)
EPU High	-0.087**	-0.082**	-0.078**	-0.078**
	(0.038)	(0.032)	(0.033)	(0.033)
10Y-2Y Spread		0.014	0.016	0.028
		(0.035)	(0.036)	(0.037)
Market			-0.003	-0.002
			(0.004)	(0.004)
Size				-0.014
				(0.014)
Value				-0.007
				(0.008)
Profit				-0.009
				(0.010)
Investment				0.004
				(0.011)
Adjusted R^2	0.073	0.064	0.061	0.041
Observations	87	87	87	87

Table 10: 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). MES95$(t+1)$ and MES99$(t+1)$ are the average post-announcement Marginal Expected Shortfall using a 5% and 1% negative tail of market return, respectively. *Dilutive* is an indicator variable that equals 1 if the CoCo is in the lowest wealth transfer tercile and else 0. *Outstanding CoCos* is the outstanding amount of CoCo bonds scaled by total liabilities. MES95 and MES99 are the average pre-announcement Marginal Expected Shortfall using a 5% and 1% negative tail of market return, respectively. ΔCoVaR is the average pre-announcement systemic risk measure from Adrian and Brunnermeier (2016). Control variables include profitability (ROE), market capitalization, distance from the trigger level, book leverage, and rollover indicator variable. Detailed variable descriptions are provided in Table A.1. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Heteroskedasticity-robust standard errors are reported in parentheses.

Dependent variables:	Measures of systemic risk		
Risk measures:	ΔCoVaR$(t+1)$ (1)	MES95$(t+1)$ (2)	MES99$(t+1)$ (3)
Dilutive	-0.186** (0.069)	0.014 (0.092)	0.177 (0.185)
Outstanding CoCos	-0.012 (0.009)	-0.024** (0.009)	-0.044* (0.021)
MES95		-0.031 (0.155)	
MES99			-0.204 (0.199)
ΔCoVaR		0.882*** (0.267)	1.51** (0.538)
Controls	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Adjusted R^2	0.361	0.493	0.411
Observations	671	671	671

Table A.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 full correction is available in an R code).

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
Equity conversion	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
Temporary write-down	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
Permanent write-down	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
Wealth transfer	Contingent wealth transfer measure of the CoCo issue estimated using Equation (3).	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
Outstanding CoCo	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
Distance to trigger	The difference between the trigger level of the CoCo and the corresponding capital ratio of the issuer.	Bloomberg, Capital IQ, Datastream
Market capitalization	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 *freecurrencyapi* package (Ho, Imai, King, and Stuart, 2022)	Datastream
Total liabilities	Total liabilities of banks measured as the total liabilities scaled by the total assets.	Capital IQ, Bankfocus
Profitability	Profitability of the banks measured by the return on equity (ROE) collected directly from the data sources.	Capital IQ, Bankfocus
Rollover	An indicator variable that equals 1 if the CoCo is issued within +/- 90 days of the first call date of an outstanding CoCo by the same issuer.	Bloomberg
Close to MDA	An indicator variable that equals 1 if the distance from the MDA trigger level of the issuer is in the lowest tercile and 0 otherwise.	Hand-collected
Shift	An indicator variable that equals 1 if the issue shiftes from dilutive to nondilutive (and vice versa) compared to the CoCo that is being retired and 0 otherwise (missing if the CoCo is not a rollover CoCo).	-
Retired CoCo is dilutive	An indicator variable that equals 1 if the CoCo being retired is dilutive, and 0 otherwise (missing if the CoCo is not a rollover).	-
CoCo Index Volatility High	For abnormal return analysis, it is an indicator variable that equals 1 if the announcement date falls within periods when the 100-trading day volatility of Global CoCo Bond Index from Bloomberg (ticker I30902US) is in the highest tercile between 2014 and 2019 and else 0. For portfolio analysis, it is an indicator variable that equals 1 if the 100-trading day volatility of I30902US is higher than the sample median between 2014 and 2021 (using the values for each month-end).	Bloomberg
EPU High	For abnormal return analysis, it is an indicator variable that equals 1 if the Global Economic Policy Uncertainty Index (Baker et al., 2016) is in the highest tercile and else 0. For portfolio analysis, it is an indicator variable that equals 1 if the index in the period when the portfolio is constructed is above the sample median.	EPU website
VIX High	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
COVID	An indicator variable that equals 1 if the monthly portfolio is constructed after January 2020 and else 0.	-

Table A.1: *(Continued)*

Variable	**Description**	**Source**
Common law origin	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 civil law origin	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)
Developed	An indicator variable that equals 1 if a bank is incorporated in a developed country and else 0. Developed countries include the United Kingdom, Norway, Switzerland, France, Spain, Japan, Denmark, Finland, Ireland, Sweden, Germany, Netherlands, Australia, Belgium, Austria, Italy, and Portugal. Countries that are classified as emerging countries are Brazil, Mexico, India, Malaysia, China, Indonesia, Turkey, Hungary, Thailand, and South Africa.	-
MES95	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
MES99	The average pre-announcement Marginal Expected Shortfall. Marginal Expected Shortfalls are measured daily as the mean equity return of the bank in the 1% negative tail of market returns (1% 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
MES95$(t+1)$	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
MES99$(t+1)$	The average post-announcement Marginal Expected Shortfall. Marginal Expected Shortfalls are measured daily as the mean equity return of the bank in the 1% negative tail of market returns (1% 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
Δ*CoVaR*	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, *SystemicR*, CRSP, FRED

Table A.2: Cumulative Abnormal Return and Dilutive CoCos: Robustness

This table examines the robustness of 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 quartile (Panel A) or quintile (Panel B) and else 0. *Wealth transfer* is the contingent wealth transfer measure from Equation (3). Control variables include the natural log of market capitalization, profitability, distance between the capital ratio and the trigger level, total liabilities, rollover indicator, outstanding CoCos, and the coupon rate at issue. Detailed variable descriptions are provided in Table A.1. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Heteroskedasticity-robust standard errors are reported in parentheses.

Panel A. *Dilutive* defined as the lowest quartile				
Dependent Variables:	Cumulative abnormal returns (CAR)			
Window:	(-2,2)	(0,9)	(0,19)	(0,29)
Model:	(1)	(2)	(3)	(4)
Dilutive	-1.19***	-2.12***	-1.58**	-2.03***
	(0.376)	(0.516)	(0.740)	(0.780)
Controls	Yes	Yes	Yes	Yes
Adjusted R^2	0.058	0.058	0.017	0.045
Observations	757	757	757	757
Panel B. *Dilutive* defined as lowest quintile				
Dependent Variables:	Cumulative abnormal returns (CAR)			
Window:	(-2,2)	(0,9)	(0,19)	(0,29)
Model:	(1)	(2)	(3)	(4)
Dilutive	-1.46***	-2.72***	-2.14**	-2.57***
	(0.447)	(0.601)	(0.909)	(0.914)
Controls	Yes	Yes	Yes	Yes
Adjusted R^2	0.062	0.065	0.020	0.048
Observations	757	757	757	757
Panel C. Applying the wealth transfer measure				
Dependent Variables:	Cumulative abnormal returns (CAR)			
Window:	(-2,2)	(0,9)	(0,19)	(0,29)
Model:	(1)	(2)	(3)	(4)
Wealth transfer	0.007**	0.018***	0.009	0.014**
	(0.003)	(0.004)	(0.006)	(0.006)
Controls	Yes	Yes	Yes	Yes
Adjusted R^2	0.062	0.065	0.020	0.048
Observations	757	757	757	757

Table A.3: Coupon Rate At Issue and Dilutive CoCos

This table examines the coupon rates at issues using OLS regressions. The dependent variable, *Coupon rate*, is the coupon rate at issue in percentages. *Dilutive* is an indicator variable that equals 1 if the CoCo is in the lowest wealth transfer tercile and else 0. Control variables include the natural log of market capitalization, profitability, distance between the capital ratio and the trigger level, total liabilities, rollover indicator, and outstanding CoCos. Detailed variable descriptions are provided in Table A.1. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Heteroskedasticity-robust standard errors are reported in parentheses.

Dependent Variables:	Coupon rate					
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Dilutive	1.04***	0.707***	0.686***	0.565***	0.111	0.080
	(0.183)	(0.163)	(0.158)	(0.148)	(0.144)	(0.128)
Market capitalization			-0.145***	-0.154***	-0.073*	-0.127***
			(0.036)	(0.037)	(0.043)	(0.042)
Profitability			-0.041***	-0.046***	-0.012	-0.016
			(0.011)	(0.010)	(0.012)	(0.010)
Distance from trigger			-0.311***	-0.223***	-0.196***	-0.030
			(0.027)	(0.027)	(0.029)	(0.026)
Total liabilities			-0.195***	-0.235***	-0.079*	-0.085***
			(0.036)	(0.032)	(0.042)	(0.033)
Rollover			-0.434**	0.290	-0.685***	0.204
			(0.188)	(0.212)	(0.145)	(0.161)
Outstanding CoCos			0.036**	0.050***	0.003	0.003
			(0.017)	(0.018)	(0.014)	(0.014)
Year fixed effects	-	Yes	-	Yes	-	Yes
Country fixed effects	-	-	-	-	Yes	Yes
Adj. R2	0.255	0.326	0.255	0.326	0.368	0.451
Observations	757	757	757	757	757	757

Table A.4: Average Cumulative Prediction Errors and Dilutive CoCos: Regression Analysis

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. Control variables include the natural log of market capitalization, profitability, distance between the capital ratio and the trigger level, total liabilities, rollover indicator, outstanding CoCos, and the coupon rate at issue. Detailed variable descriptions are provided in Table A.1. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Heteroskedasticity-robust standard errors are reported in parentheses.

Dependent Variables:	Average cumulative prediction error (ACPE)			
Window:	(-2,2)	(0,9)	(0,19)	(0,29)
Model:	(1)	(2)	(3)	(4)
Dilutive	-0.170***	-0.335***	-0.257**	-0.430***
	(0.063)	(0.085)	(0.130)	(0.148)
Market capitalization	0.014	0.024	-0.030	-0.017
	(0.017)	(0.023)	(0.034)	(0.036)
Profitability	-0.002	-0.017**	-0.010	-0.017
	(0.005)	(0.007)	(0.009)	(0.011)
Distance from trigger	-0.002	0.008	0.004	0.036
	(0.011)	(0.018)	(0.022)	(0.025)
Total liabilities	-0.017	-0.055*	-0.020	-0.019
	(0.017)	(0.031)	(0.033)	(0.037)
Rollover	0.068	0.097	-0.012	0.084
	(0.083)	(0.119)	(0.193)	(0.221)
Outstanding CoCos	0.040***	0.040**	0.038**	0.060***
	(0.015)	(0.017)	(0.019)	(0.020)
Coupon rate	-0.020	-0.041**	-0.048**	-0.082***
	(0.013)	(0.017)	(0.022)	(0.028)
Adjusted R^2	0.051	0.058	0.017	0.050
Observations	757	757	757	757

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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]:

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

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:

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

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 *AT1 Shortfall Size*$_{i,t}$ for bank i in year t as the difference between the maximum amount of CoCos permitted to meet AT1 requirements in year t minus the CoCos actually used in AT1 as of year-end $t-1$. A positive value indicates the portion of AT1 capital requirements that could have been met with CoCos that are instead met with common equity as of time t. In addition to the size of the AT1 shortfall, we define an indicator variable, *Has AT1 Shortfall*$_{i,t}$ that assumes a value of 1 for bank i in year t if the value of the variable *AT1 Shortfall Size* is positive and 0 otherwise. Further, in our analysis, the AT1 shortfall interacts with the Maximum Distributable Amount (MDA) threshold. We define a variable *Distance to MDA Trigger*$_{i,t}$: for bank i in year t as the difference between the bank's CET1 ratio reported at year-end t and its regulator's discretionary MDA threshold point computed for year $t+1$. 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:

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

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.

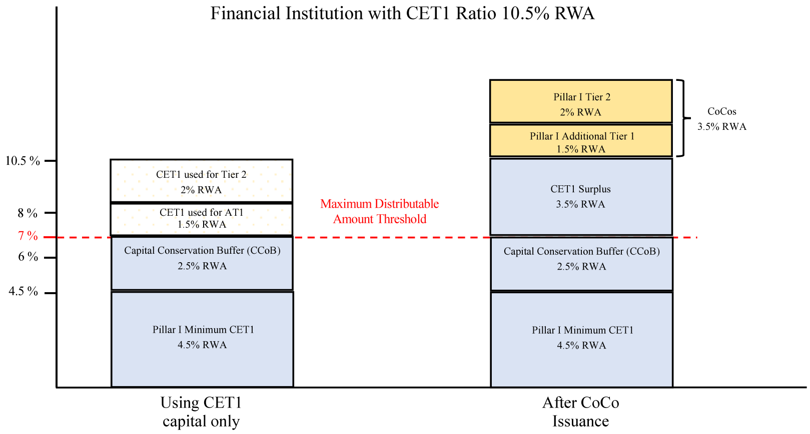

Fig. 1. Capital Conservation Constraint, effects of AT1 shortfall.
Light blue: capital layers filled with common equity capital. White: capital layers filled with common equity capital but not receiving regulatory credit in computing the MDA threshold. Yellow: capital layers filled with CoCos. (For interpretation 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.

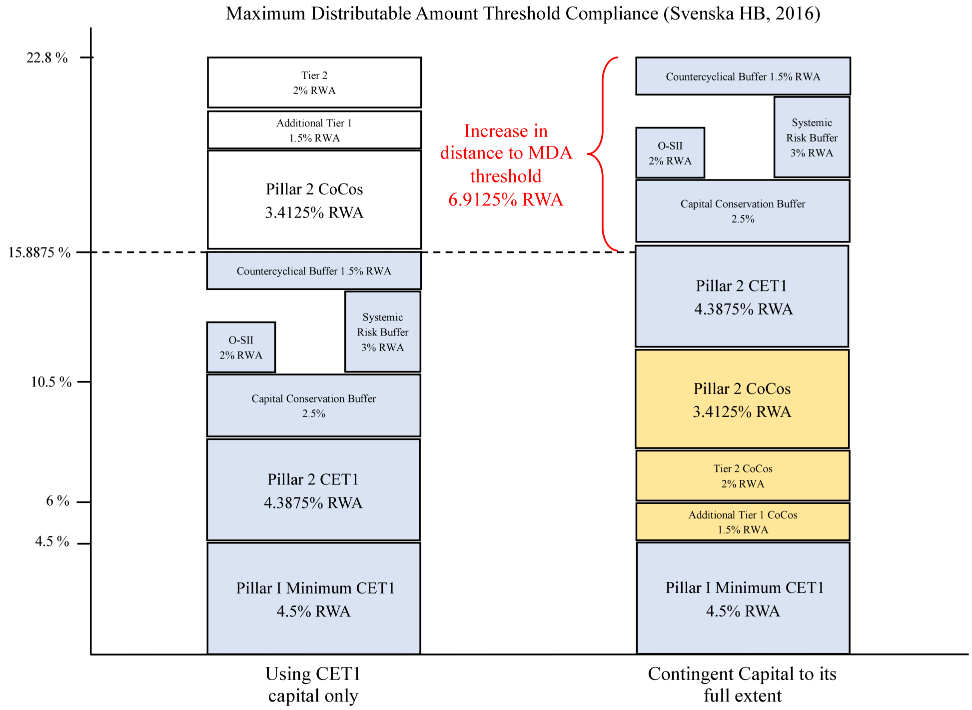

Fig. 2. Real World Example of the Effects of the AT1 Shortfall.
Light blue: capital layers filled with common equity capital. White: capital layers filled with common equity capital but not receiving regulatory credit towards meeting the MDA threshold. Yellow: capital layers filled with CoCos. (For interpretation 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

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