UNIVERSITY OF LJUBLJANA
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MASTER'S THESIS

THE IMPACT OF CREDIT SUISSE COLLAPSE ON THE EUROPEAN CONTINGENT CONVERTIBLE BOND MARKET

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ABSTRACT

The financial crisis of 2007–2008 revealed numerous shortcomings in global banking regulation and capital adequacy, prompting the introduction of Basel III. As part of this reform, Contingent Convertible Bonds (CoCos) were introduced as hybrid instruments designed to absorb losses and strengthen bank capital during periods of financial stress. This thesis explores the development, structure, and regulatory role of CoCos, particularly Additional Tier 1 (AT1) bonds, in the European banking system.

The collapse of Credit Suisse in March 2023 marked a pivotal moment for the AT1 CoCo market. In an unprecedented move, Swiss regulators fully wrote down $17 billion in AT1 CoCo bonds while preserving shareholder value, reversing the conventional capital hierarchy. This decision raised concerns around legal consistency, investor protection, and regulatory credibility, and has since led to ongoing litigation.

Through empirical analysis, the thesis examines how this event affected the broader European AT1 bond market. Using a difference-in-differences methodology, it compares the Z-spreads of AT1 bonds with Tier 2 instruments over both short- and long-term event windows. The analysis also separates AT1 bonds into equity-converting and principal write-down structures, revealing that write-down CoCos experienced a more pronounced and persistent repricing of risk in the long term compared to equity-converting CoCos. These results suggest heightened investor sensitivity to bond structure and regulatory discretion.

Findings from this study provide insight into how financial markets react to regulatory actions involving complex instruments like CoCos. These findings underscore the importance of transparency, consistency, and clear contractual terms in maintaining investor confidence. More broadly, the thesis highlights the delicate balance regulators must strike between systemic stability and market expectations in times of crisis.

KEY WORDS: CoCos, Basel III, Additional Tier 1 capital, Contingent Convertible Bonds, Credit Suisse, financial crisis, empirical analysis, European bond market, market risk, systemic risk, financial stability

SUSTAINABLE DEVELOPMENT GOALS

POVZETEK

Finančna kriza v letih 2007–2008 je razkrila številne pomanjkljivosti v regulaciji bančnega sektorja in kapitalski ustreznosti, kar je spodbudilo sprejetje reforme Basel III. Ena ključnih novosti reform Basel III so bile pogojno zamenljive obveznice (CoCo obveznice), hibridna finančna sredstva, namenjena absorpciji izgub in krepitvi kapitalske strukture bank v času finančnih pretresov. Magistrsko delo obravnava razvoj, strukturo in regulatorno vlogo CoCo obveznic, s poudarkom na obveznicah dodatnega temeljnega kapitala (AT1) v evropskem bančnem prostoru.

Propad Credit Suisse marca 2023 je predstavljal prelomnico za trg AT1 CoCo obveznic. Švicarski regulator je v izrednem ukrepu izničil za 17 milijard ameriških dolarjev vrednih AT1 CoCo obveznic, pri čemer so delničarji ohranili del vrednosti, kar je v nasprotju s tradicionalno hierarhijo kapitalskih terjatev. Odločitev je sprožila burne odzive, odprla pravne spore ter spodbudila vprašanja o predvidljivosti in enotnosti regulatornih ukrepov.

Empirični del raziskave preučuje vpliv tega dogodka na širši evropski AT1 trg. Z metodo razlik v razlikah (difference-in-differences) se primerjajo Z-spredi AT1 obveznic s tistimi pri Tier 2 instrumentih, tako v kratkoročnem (3-mesečnem) kot dolgoročnem (1-letnem) obdobju. Analiza dodatno loči AT1 obveznice glede na mehanizem absorpcije izgub (pretvorba v lastniški kapital ali popolni odpis), pri čemer se je pokazalo, da so bile CoCo obveznice s funkcijo odpisa občutneje prizadete na dolgi rok.

Rezultati raziskave nudijo vpogled v odzive finančnih trgov na regulatorne ukrepe ter poudarjajo pomen preglednosti, pravne jasnosti in doslednosti pri oblikovanju tovrstnih instrumentov. Delo izpostavlja, da morajo regulatorji v času kriznih situacij najti ravnotežje med sistemsko stabilnostjo in zaupanjem trga.

KLJUČNE BESEDE: CoCo obveznice, Basel III, AT1 dodatni temeljni kapital, pogojno zamenljive obveznice, Credit Suisse, finančna kriza, empirična analiza, evropski trg obveznic, tržno tveganje, sistemsko tveganje, finančna stabilnost

CILJI TRAJNOSTNGA RAZVOJA

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LIST OF ABBREVIATIONS

AT1 Additional Tier 1
BPS Basis Points
BRRD Bank Recovery and Resolution Directive
CDS Credit Default Swap
CRD IV Capital Requirements Directive IV
CoCo Contingent Convertible
CSG Credit Suisse Group
EBA European Banking Authority
EC Equity Conversion
ECB European Central Bank

ECJ European Court of Justice
ELA Emergency Liquidity Assistance
ELA+ Supplementary Emergency Liquidity Assistance
ELACs Equity-Protecting Loss Absorbing Capacity
FINMA Financial Market Supervisory Authority
GFC Global Financial Crisis
GSIBs Global Systemically Important Banks
IMF International Monetary Fund
OLS Ordinary Least Squares
PONV Point of Non-Viability
PLB Public Liquidity Backstop
RWA Risk-weighted assets
TLAC Total Loss-Absorbing Capacity
SEC Securities and Exchange Commission
SIFIs Systemically important financial institutions
SNB Swiss National Bank
SOFR Secured Overnight Financing Rate
SPV Special purpose vehicle
SRB Single Resolution Board
WD Write Down

1 INTRODUCTION

The 2007-08 financial crisis exposed the vulnerability of banking systems and the need to increase the quantity and improve the quality of bank capital. In 2009, the Squam Lake Group, comprised of Anglo-American economists, proposed contingent convertible bonds as a possible instrument for strengthening banks' capital base (Squam Lake Working Group on Financial Regulation, 2009). Following this, in 2010, the Basel Committee on Banking Supervision adopted a new set of rules for capital adequacy in credit institutions. Under these new regulations, today better known as Basel III accords, financial institutions were required to increase their common equity with Additional Tier 1 capital (AT1 capital) and Tier 2 capital, consequently improving the quality of their equity capital.

The changed capital requirements under Basel III prompted the issuance of new financial instruments with distinct characteristics in the term and repayment structures. As these instruments are subordinate to senior debt, they typically offer higher interest rates to compensate for their risk. An example of such an instrument introduced in Basel III is the contingent convertible bond, or CoCo bond, a hybrid financial instrument that pays regular coupons to investors, but if a trigger event occurs, either when a bank's capital ratio falls below a specified threshold or when the regulator discretionally activates the trigger due to financial distress, they convert into equity or are written down entirely. This structure allows banks to recapitalize themselves automatically during times of financial distress, helping them stay solvent while reducing the chances of government intervention. CoCos can be classified as either Additional Tier 1 (AT1) or Tier 2 capital, depending on their specific structure (Shan et al., 2023).

In particular, AT1 bonds, often referred to synonymously as CoCos, play a critical role alongside Common Equity Tier 1 (CET1) capital as a first line of defence in absorbing losses. Developed in the aftermath of the 2008 financial crisis to transfer financial risk from taxpayers to private investors, AT1 bonds are designed to be converted or written down when a bank's capital weakens. While they offer attractive yields, investors accept the risk of losing interest payments, their entire principal, or ending up with equity of a distressed institution. Through this structure, CoCos aim to stabilize the financial system by strengthening banks' capital positions without direct public support.

In typical bank resolutions, a hierarchy of claims determines the order in which different stakeholders endure losses. In general, senior debtholders are more protected, followed by subordinated debtholders and finally equity holders, who are usually first to absorb losses. This structure ensures that creditors with higher claims on the bank's assets are compensated before lower-ranking claims. This creates a predictable framework of losses in time of financial uncertainty. CoCos, which qualify as either AT1 capital or Tier 2 capital, may complicate the traditional claims resolution hierarchy due to their hybrid structure (Basel Committee on Banking Supervision, 2011).

Since their introduction after the global financial crisis, CoCos have played a growing role in European bank funding structures. However, full write-downs of these instruments have been rare. Before 2023 only one major instance occurred in Europe: the 2017 resolution of Banco Popular in Spain, where a depositor run on the bank triggered the European Union's Single Resolution Mechanism. The Single Resolution Board arranged the sale of Banco Popular to Santander which resulted in losses for common shareholders, CoCo bondholders and subordinated debt investors. Only senior creditors and depositors remained unaffected (Mott, 2024).

The second significant write-down of CoCo bonds in Europe occurred in 2023 during the collapse of Credit Suisse. On 19th of March 2023, the Swiss Financial Market Supervisory Authority (FINMA) issued a statement in response to a crisis in market confidence and significant withdrawals from Credit Suisse. FINMA declared that the contingent convertible bonds classified under Credit Suisse's Additional Tier 1 capital would be fully written down. This move by FINMA surprised many and sparked widespread negative commentary with many arguing that it violated the traditional hierarchy of claims during bank resolutions, as equity holders were compensated while AT1 bondholders lost their entire investment. Notably, Credit Suisse shareholders received approximately $3 billion in equity for their shares, while CoCo bondholders were completely wiped out and faced a total loss of $17 billion. This decision, which compensated Credit Suisse equity holders while wiping out the more senior AT1 CoCo bondholders, had a significant impact on the market, which I aim to explore further in this thesis (Bolton et al., 2023).

In order for this thesis to have a clear direction, the following research questions have been formulated:

1.Why did the AT1 CoCo bondholders at Credit Suisse suffer losses before shareholders, and why did the Swiss regulatory authorities choose such an outcome?

2.Do negative contingent bond events, like CoCo bond write downs, impact the broader AT1 bond market?

To answer the first research question, I will examine Basel III's definitions of CoCos and analyse the specific terms of Credit Suisse's CoCos, which together should be able to insight into FINMA's rationale and the legal mechanisms that enabled the bondholder wipeout. Other regulators, such as the European Central Bank (ECB) and the Bank of England made statements that they would not adopt FINMA's approach and would instead uphold the standard priority of claims during resolutions (SRB, 2023).

The second research question is approached empirically. The central hypothesis is that the Credit Suisse CoCo write-down negatively affected the broader European AT1 market. This will be tested by assessing whether there was a repricing of risk, reflected in changes in zero volatility spreads (Z-spreads), following the announcement. The analysis compares the performance of AT1 bonds before and after the collapse with Tier 2 capital bonds from the

same issuing institutions used as a control group. A difference-in-differences methodology is employed, focusing on changes in Z-spreads as a direct measure of investor risk perception. The study also examines whether market reactions varied between CoCos with different loss-absorption mechanisms, specifically comparing write-down CoCos to equity-conversion CoCos.

2 THEORETICAL BACKGROUND

2.1 Contingent convertible bonds

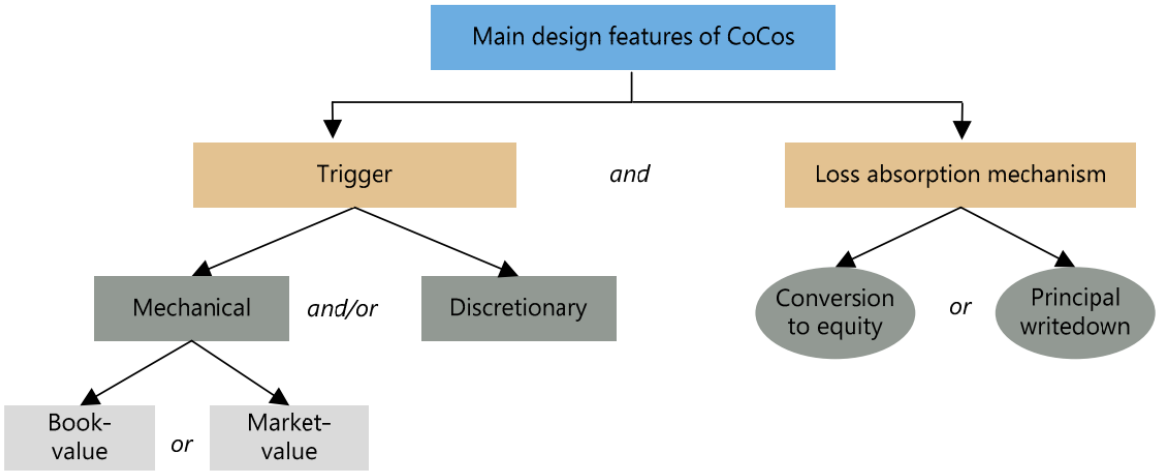
Contingent Convertible or “CoCo” bonds are a type of debt issued by banks that can either be converted into equity (stock) or written down under certain conditions, such as when the bank's financial health deteriorates. These bonds typically start as loans where investors receive interest payments, but if the bank’s capital falls below a specified level, the bonds may either convert into shares, helping the bank strengthen its capital and reduce debt, or be "written down", meaning the amount owed to bondholders is reduced or completely wiped out, further alleviating the bank’s debt burden. Their main objective of CoCo bonds is to reduce the need for government bailouts during crises, when no other external investors are willing to provide fresh capital. By either converting debt into equity or writing down the bonds, CoCo bonds increase the bank’s capital and help survive without relying on taxpayer-funded assistance, which can be costly and increases the risk of moral hazard, where banks take on excessive risk expecting to be bailed out. In this way CoCo bonds provide a self-sustaining mechanism for banks to manage crises while minimizing the burden on taxpayers (Avdjiev et al., 2013).

The theoretical benefit of CoCo bonds lies in their ability to stabilize banks in distress, ensuring that they can continue operating and avoiding the need for government bailouts. These bonds are particularly important for systemically significant banks, as they enhance the loss-absorbing capacity of the institution in times of financial distress. As such, CoCos are viewed as essential in managing the risks that could otherwise destabilize the entire banking system.

Empirical research further supports the role of CoCos in mitigating systemic risk. A study by Kund and Petras (2021) finds that CoCo bonds, when appropriately incorporated into systemic risk measures like SRISK (a metric that quantifies how much a financial institution might add to systemic risk, particularly the likelihood of requiring a government bailout during financial turmoil), effectively reduce systemic risk by enhancing banks' capital buffers. They show that the loss-absorbing capacity of CoCo bonds, irrespective of whether they are accounted for as debt or equity, decreases systemic risk. Their adjusted SRISK formula provides a more accurate measure by assuming the immediate conversion of CoCo bonds into equity, ensuring that the true stability benefits are captured (Kund & Petras, 2021).

CoCos are structured with two primary contractual elements, as illustrated in Figure 1. On the right side of the figure is the mechanism for absorbing losses, and on the left side is the trigger that sets this mechanism in motion. Losses are absorbed either by conversion into common equity or by a principal write-down, either partial or full. The trigger itself can be discretionary, meaning it is subject to the judgement of the supervisors, or mechanical, typically defined as a capital ratio.

Figure 1: Main design features of CoCos



Source: Avdjiev et al. (2013)

2.1.1 Triggers

The CoCo bond trigger determines the point when the loss absorption mechanism is initiated. A discretionary trigger, also known as the Point of Non-Viability (PONV) trigger, is activated at the discretion of regulatory authorities when they judge that the issuing bank may be nearing insolvency. If the regulator determines that the issuer is at risk of insolvency, the regulator has the authority to initiate the conversion. Since it is challenging to identify the PONV in advance, PONV triggers create ambiguity regarding when and under what conditions the regulator will activate the loss absorption mechanism (Avdjiev et al., 2020).

Alternatively, the mechanical trigger is set off when the issuing bank's capital falls below a predetermined percentage relative to risk-weighted assets (RWA). The measure of equity capital used for this trigger can be based on either market or book value. Triggers that rely on book value, often referred to as accounting-value triggers, are usually defined in terms of the ratio of CET1 capital to RWA. However, the reliability of book-value triggers may vary depending on factors such as the frequency the above ratios are calculated, the consistency of internal risk models across banks and over time, and the potential for balance sheet manipulation. These issues can lead to delays in activating book-value triggers. On the other hand, market-value triggers are set as a minimum ratio of the bank's stock market

capitalization to its RWA. Due to their structure, market-value triggers may create incentives for stock price manipulation. For instance, holders of CoCos that convert to equity with a market-value trigger are incentivised to short sell common stock in order to depress the share price to the point which the market-value trigger is activated (Avdjiev et al., 2013).

CoCos usually feature more than one type of trigger. When there are multiple triggers are present, the loss absorption mechanism can be triggered if any one of them is breached. According to Basel III regulations, all CoCos classified as regulatory capital are required to include a discretionary trigger (PONV) trigger. This discretionary trigger, included in all CoCos issued by Credit Suisse, was the mechanism FINMA used to write down Credit Suisse's AT1 capital instruments on March 19th, 2023.

2.1.2 Loss absorption mechanism

The loss absorption mechanism is the second key feature of CoCos. When triggered, CoCos may either convert into equity at a pre-determined conversion rate or undergo a principal write-down. Both scenarios aim to strengthen the bank's capital position by reducing leverage or enhancing its equity ratio. For CoCos that convert into equity, the conversion rate might be based on the stock's market price at the point of conversion or set in advance, such as the issue price. In some cases, a hybrid approach can be used, combining a market-based rate with a minimum threshold to prevent excessive dilution and protect existing shareholders. The different methods for setting the conversion price result in varying levels of dilution risk for current shareholders, influencing their motivation to avoid conversion. For CoCos with a principal write-down feature, the reduction can be either partial or complete. Partial meaning that a certain percentage gets written down while the rest gets paid back in cash. On the other hand, the complete write down of CoCo bonds can be either permanent or temporary, in the latter case, if the bank's financial health improves, investors may see their investment reinstated, offering a potential recovery if the institution stabilizes. Most of Credit Suisse's principal write-down CoCos were structured as full permanent write-down instruments. This type of CoCo may incentivize risk-taking by managers who prioritize the interests of shareholders (Bolton et al., 2023).

As noted by Hesse (2016), the write-down feature in CoCo bonds creates strong incentives for banks to take on excessive risks, particularly during periods of financial distress. When a trigger event occurs, CoCo bondholders lose their investment, and the losses are transferred to the bank's equity holders. This shift benefits shareholders, as they are protected from the loss while CoCo investors bear the full brunt. This creates a conflict of interest, as shareholders may gain from the write-down even in the event of a bank's failure. As a result, management may be incentivized to engage in risky behaviour, prioritizing shareholder interests over the long-term stability of the bank. Such dynamics are especially pronounced in write-down CoCo bonds, which increase the likelihood of risk-taking as the bank nears a trigger event (Hesse, 2016).

Non-dilutive CoCos allow banks to raise capital without diluting shareholder value, which can be advantageous for highly leveraged banks that may be reluctant to issue equity, fearing a reduction in their ownership stake or signalling financial weakness. However, this design also has limitations, as it does not fully discourage the risk-taking behaviour of shareholders during times of financial distress. By avoiding equity dilution, non-dilutive CoCos reduce some of the incentives for shareholders to gamble for recovery, but they do not entirely eliminate the risk of excessive risk-taking. This makes them a necessary tool for banks in need of additional capital but comes at the cost of allowing a certain level of moral hazard (Gamba et al., 2021).

Hau & Hrasko (2018) offer valuable insights into the comparative effectiveness of different CoCo bond designs as loss-absorbing instruments. They find that CoCo bonds with a permanent write-down feature achieve a risk reduction effect similar to common equity, since they provide immediate and irreversible debt relief without diluting shareholders. In contrast, equity converting CoCo bonds are less effective in mitigating default risk due to misaligned incentives, which may delay conversion and prolong bank distress. Moreover, equity-converting CoCos are associated with reduced asset volatility, most likely driven by shareholder aversion to dilution. The authors, however, did not find a connection between CoCo bond issuances and an increase in asset return risk (Hau & Hrasko, 2018).

Additionally, as Allen et al, (2023) conclude, Credit Suisse's principal write-down CoCos, structured as full write-down instruments, may have incentivized risk-taking by managers prioritizing shareholder interests. These CoCos, by embedding "Equity-Protecting Loss Absorbing Capacity" (ELACs), truncate shareholder losses in scenarios of extreme financial distress, particularly when regulators declare a PONV. This structure effectively transfers losses to CoCo bondholders, insulating equity holders and mitigating their financial burden during crises. The Credit Suisse's CoCos in that included ELACs had a significant impact during the bank's collapse in 2023. Swiss regulators wrote down $17 billion in CoCos, yet equity holders retained over $3 billion in residual value. While this design shields equity holders, it undermines systemic stability by reducing shareholder and managerial incentives to recapitalize or de-risk the bank as failure becomes imminent (Allen et al., 2023).

2.2 Basel III

The financial crisis of 2007–2008 highlighted significant gaps in risk management across banking institutions and showcased weaknesses in the global regulatory framework. In response, the Basel Committee on Banking Supervision released the initial version of Basel III in December 2010, aiming to improve global capital and liquidity standards to enhance financial system resilience. This framework was further revised in June 2011. The primary goals of Basel III included improving the quality and transparency of bank capital by increasing the required proportion of high-quality capital that could absorb losses in times of financial stress.

During the financial crisis, banks primarily covered losses using Core Tier 1 (CT1) capital, consisting of retained earnings and equity capital. However, many banks lacked sufficient Tier II and Tier III capital to absorb sudden losses effectively. Recognizing the need for higher levels of "core" capital for stability, Basel III introduced standards to boost the quantity and quality of Tier 1 capital, streamlined and reduced reliance on Tier 2 capital instruments, eliminated Tier 3 capital, and established a clear hierarchy for capital claims during bank resolutions (Shang, 2013).

Under the Basel III standards, regulatory capital is classified into three distinct tiers, each with specific criteria that financial instruments must meet to be eligible for inclusion (Basel Committee on Banking Supervision, 2019):

1) Common Equity Tier 1 (CET1)
2) Additional Tier 1 (AT1)
3) Tier 2 Capital

Regulatory capital is calculated by summing CET1, AT1, and Tier 2 capital, after applying regulatory adjustments outlined in CAP30[1]. Tier 1 capital specifically includes CET1 and AT1, adjusted for applicable deductions specified in CAP30. To ensure the robustness of a bank's capital base, most Tier 1 capital must consist of common equity, such as ordinary shares and retained earnings (Basel Committee on Banking Supervision, 2019).

Tier 1 capital is known as "going concern" capital because it absorbs losses with the intention that a troubled bank keeps going. On the other hand, Tier 2 capital is called "gone concern" capital because it might not be able absorb the bank's loss and prevent failure, but it may contribute to a bank resolution that has minimal effects on the wider economic system and reduces the burden on taxpayers (Vickers, 2017).

One of the significant changes introduced by Basel III compared to Basel II was the increase in minimum capital requirements for banks. Under Basel III, the following limits were applied (Basel Committee on Banking Supervision, 2011):

• CET1: Banks are required to hold at least 4.5% of their risk-weighted assets (RWA) in CET1 capital.

• Tier 1: This must represent no less than 6.0% of RWA.

• Total Capital: The combined amount of Tier 1 and Tier 2 capital must total at least 8.0% of RWA.

[1] https://www.bis.org/basel_framework/chapter/CAP/30.htm?inforce=20191215&published=20191215 for more information on CAP30.

In addition to these requirements, Basel III introduced the Capital Conservation Buffer of 2.5%. This means (Basel Committee on Banking Supervision, 2011):

• Minimum CET1: 7.0% of RWA with the buffer accounted for.

• Minimum Tier 1: 8.5% of RWA with the buffer accounted for.

• Minimum Total Capital: 10.5% of RWA with the buffer accounted for.

Together, these requirements represent a substantial increase in reserve capital obligations compared to Basel II, aiming to enhance the resilience of banks in periods of financial stress (Basel Committee on Banking Supervision, 2011).

2.2.1 Common Equity Tier 1 (CET1)

CET1 capital is composed of the following elements (Basel Committee on Banking Supervision, 2019):

1) Common shares issued by the bank that comply with regulatory classification criteria for common shares (or equivalent for non-joint stock companies).
2) Share premium from the issuance of CET1 instruments.
3) Retained earnings.
4) Accumulated other comprehensive income and other disclosed reserves.
5) Common shares issued by consolidated subsidiaries held by third parties (i.e., minority interest) that qualify for CET1, as specified in CAP10.20[2] to CAP10.26[3].
6) Regulatory adjustments applicable to CET1.

Retained earnings and other comprehensive income also contain temporary profit and loss. To be included in CET1 capital, an instrument must satisfy these criteria (Basel Committee on Banking Supervision, 2019):

1) Subordinated: Holds the most junior claim in the event of bank liquidation.
2) Residual Claim: It gives the holder a proportional claim on residual assets after all senior claims are settled.
3) Perpetual Nature: Principal is only repayable during liquidation.
4) No Buyback Expectation: The terms create no expectation for repurchase, redemption, or cancellation.

[2] https://www.bis.org/basel_framework/chapter/CAP/10.htm?inforce=20191215&published=20200605#paragraph_CAP_10_20191215_10_20 for more information on CAP10.20.

[3] https://www.bis.org/basel_framework/chapter/CAP/10.htm?inforce=20191215&published=20200605#paragraph_CAP_10_20191215_10_26 for more information on CAP10.26.

5) Distribution Source and Limits: Distributions come from distributable items, are not tied to the amount initially paid.
6) Non-Payment without Default: Distributions can be cancelled without a default happening.
7) Seniority in Distributions: Payments are made only after fulfilling all senior obligations.
8) Loss Absorption: CET1 instruments bear losses first and on a proportional basis[4].
9) Equity Treatment: The paid-in amount is accounted for as equity, not as a liability, when evaluating the institution's insolvency.
10) Direct Issue and Funding: Must be directly issued and fully paid-in, with no direct or indirect funding by the bank.
11) Unsecured and Non-Guaranteed: The amount paid-in is not secured or guaranteed.
12) Issuance Approval: Issuance requires authorization from shareholders or delegated representatives.
13) Balance Sheet Disclosure: Clearly identified on the bank's balance sheet.

These criteria ensure that CET1 capital can absorb losses effectively, maintain its equity standing, and provide robust support to the bank's financial stability. In exceptional cases where non-voting common shares are issued, they must be identical to voting shares in every respect except for the lack of voting rights. Additionally, dividends are removed from CET1 (Basel Committee on Banking Supervision, 2019).

2.2.2 Additional Tier 1 (AT1)

AT1 capital is comprised of the following components (Basel Committee on Banking Supervision, 2011):

1) Instruments issued by the bank that qualify for AT1 capital and are not classified as CET1.
2) Share premium from the issuance of AT1 instruments.
3) Instruments issued by the bank's consolidated subsidiaries, held by third parties, that qualify for AT1 capital and are not included in CET1.
4) Regulatory adjustments applicable to AT1 capital.

For specific criteria, refer to the CAP10.20 to CAP10.26. To qualify as AT1 capital, an instrument must meet the following key criteria (Basel Committee on Banking Supervision, 2019):

1) Issued and Paid-in: The instrument must be fully issued and paid-in.
2) Subordinated: It must be subordinated to deposits, general creditors, and subordinated debt. If issued by a holding company, it must be subordinated to all general creditors.

[4] When there are capital instruments with a permanent write down feature, common shares still meet this requirement because they continue to serve as the first in line to absorb losses (Basel Committee on Banking Supervision, 2019)

3) Unsecured: The instrument cannot be secured or covered by guarantees that enhance the seniority of the claim.
4) Perpetual: It must be perpetual, with no maturity date or incentives for redemption.
5) Callable: Callable only after a minimum of five years, with prior supervisory approval required for any call exercise.
6) Discretion on Payments: The bank must have discretion to cancel distributions without it being an event of default.
7) Distributable Items: Dividends/coupons must be paid from distributable items.
8) No Credit-Sensitive Features: The instrument cannot have a credit-sensitive dividend/coupon feature based on the bank's credit rating.
9) Loss-Absorption Mechanism: If classified as a liability, it must include a principal loss-absorption mechanism that generates CET1, which must operate through either conversion to common shares or a write down mechanism at specified trigger points.
10) Non-Purchase by Bank: Bank or affiliates cannot repurchase the instrument.
11) Recapitalization Features: Should not include features that obstruct issuing new equity, such as requiring compensation of investors when issuing new instruments at a lower price.
12) Trigger Event Provision: The terms must require that the instrument converts into common equity or is written off upon a trigger event, with immediate compensation to holders of these instruments in the form of common stock, if a conversion took place, prior to any public sector capital injection.

These criteria ensure that AT1 instruments are robust and can effectively absorb losses while supporting the bank's capital structure. The terms of AT1 instruments have to include a provision for write-off or conversion that can be activated by the relevant authority upon a trigger event. This requirement also generally applies to Tier 2 instruments. This structure ensures that AT1 and Tier 2 instruments absorb losses before public funds are utilized (Basel Committee on Banking Supervision, 2019).

2.2.3 Tier 2

Tier 2 capital is composed of (Basel Committee on Banking Supervision, 2019):

1) Instruments issued by the bank that qualify for Tier 2 capital, excluding any already included in Tier 1.
2) Share premium from the issuance of Tier 2 instruments.
3) Instruments issued by the bank's consolidated subsidiaries, held by third parties, that qualify for Tier 2 but are not included in Tier 1.

4) Certain loan-loss provisions as outlined in CAP10.18[5] and CAP10.19[6].
5) Regulatory adjustments applicable to Tier 2 capital.

These elements together form Tier 2 capital, providing additional loss-absorbing capacity beyond Tier 1. Tier 2 capital instruments, meant to absorb losses when a bank is no longer viable, must meet these core criteria (Basel Committee on Banking Supervision, 2019):

1) Issued and Paid-In: Instruments must be fully issued and paid-in by investors.
2) Subordinated: Tier 2 instruments are subordinate to depositors and general creditors, ensuring losses hit these instruments first before other debts.
3) Unsecured: The instrument cannot be secured or covered by guarantees that enhance the seniority of the claim.
4) Maturity Requirements: Instruments have a minimum maturity of five years, with amortization starting five years before maturity, and with no incentives to redeem.
5) Callable Provisions: Issuer can only call the instrument after five years, with regulatory approval and no expectation of a call. Any capital replacement upon call must match or exceed the quality of the original.
6) No Accelerated Repayment Rights: Investors cannot demand early repayment unless the issuer is undergoing bankruptcy or liquidation.
7) No Credit-Sensitive Features: The coupon or dividend rate must not be tied to changes in the issuer's credit rating.
8) Non-Purchase by Bank: Bank or affiliates cannot repurchase the instrument.
9) Immediate Availability of Proceeds: If issued through a special purpose vehicle (SPV), proceeds must be made available immediately to the operating entity or holding company.
10) Trigger Event Provision: The terms must require that the instrument converts into common equity or is written off upon a trigger event, with immediate compensation to holders of these instruments in the form of common stock, if a conversion took place, prior to any public sector capital injection.

As mentioned beforehand, the terms of Tier 2 instruments must also contain a provision for write-off or conversion that can be activated by the relevant authority upon a trigger event. These conditions ensure that Tier 2 capital can effectively support the bank's stability and loss absorption at the PONV, helping to safeguard public funds (Basel Committee on Banking Supervision, 2019).

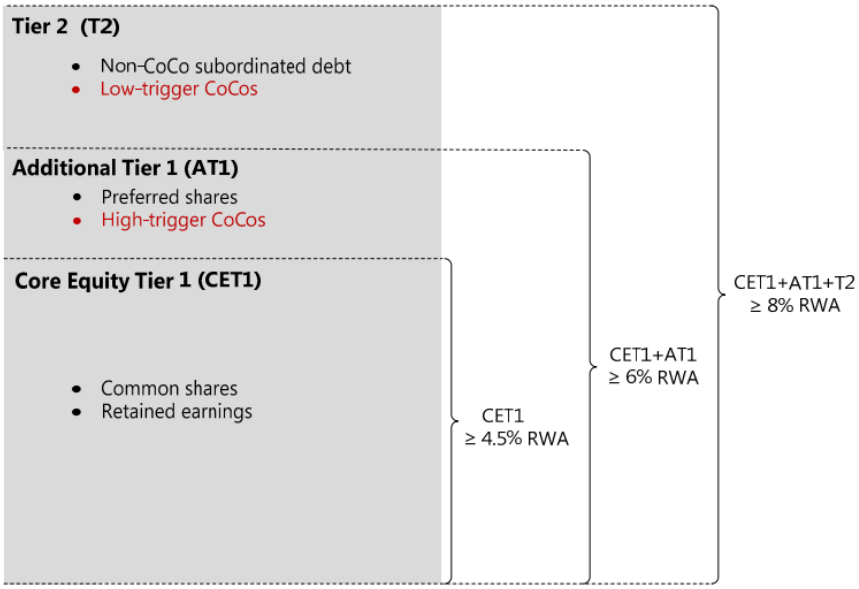
[5] https://www.bis.org/basel_framework/chapter/CAP/10.htm?inforce=20191215&published=20200605#paragraph_CAP_10_20191215_10_18 for more information on CAP CAP10.18.

[6] https://www.bis.org/basel_framework/chapter/CAP/10.htm?inforce=20191215&published=20200605#paragraph_CAP_10_20191215_10_19 for more information on CAP10.19.

2.2.4 CoCos in Basel III

Under Basel III, CoCos may be categorized as either AT1 or Tier 2 capital, depending on their design and features, as illustrated in Figure 2. The regulatory treatment of CoCos, along with additional requirements from national regulators, influences their contractual structure. To be recognized as eligible regulatory capital under Basel III, CoCos must meet two key conditions. First, applicable to both AT1 and Tier 2 instruments, is to have the PONV trigger. Second, for instruments to qualify as AT1, they must satisfy the going-concern requirement, which mandates a minimum CET1 to RWA trigger ratio of 5.125%. Additionally, AT1 instruments are required to be perpetual, which is why a lot of CoCos do not have a maturity date. Instruments that are dated can therefore only be classified as Tier 2 capital status under Basel III (Avdjiev et al., 2020).

Figure 2: Classification of CoCos within Basel III capital requirements[7]



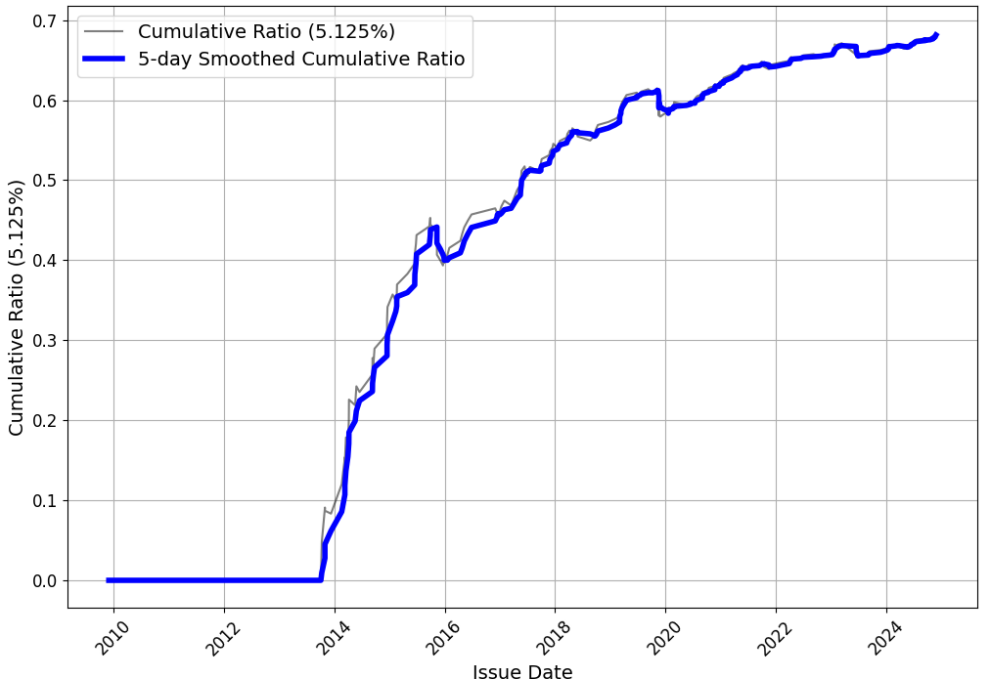
Source: Avdjiev et al. (2013)

The trigger level for CoCos is primarily chosen by balancing regulatory qualification criteria and issuance costs. Low-trigger CoCos, while offering reduced loss-absorbing capacity, are generally less expensive to issue. However, they typically do not qualify as AT1 capital. Despite this limitation, low-trigger CoCos enable banks to efficiently strengthen their Tier 2 capital (Avdjiev et al., 2013).

[7] The instruments shown in this graph are not comprehensive and are provided for illustration only. For a full list of instruments and the criteria for inclusion in each of the three capital categories, refer to (Basel Committee on Banking Supervision, 2011). The RWA percentages displayed represent the minimum capital requirements and do not include additional components, such as the capital conservation buffer, countercyclical buffer, or the SIFI surcharge.

Since a CoCo must have a minimum trigger level of 5.125% (measured as CET1 relative to RWA) to qualify as AT1 capital, there has been a large trend of issuing CoCos with a trigger set exactly at that level. As we can see in Figure 3, the share of CoCos issued at this trigger level compared to total CoCo issuance is increasing over the years. Banks prefer issuing CoCos with such triggers since they satisfy the criteria for AT1 capital recognition under Basel III and are generally more cost-effective to issue than CoCos with higher trigger levels (Avdjiev et al., 2013).

Figure 3: Cumulative Ratio of CoCos with 5.125% Trigger Level



Source: Own work based on Bloomberg[8] (2024)

The regulatory purpose of CoCos is to enhance banks' ability to absorb financial shocks by bolstering their capital reserves during crises. At the same time, they offer investors a unique alternative to conventional debt and equity instruments. CoCos allow banks to raise funds without significantly diluting the shares of existing shareholders at the time of issuance and help reduce the risk of insolvency or needing a public sector bailout. CoCos enable institutions to recapitalize smoothly in periods of financial instability. When a conversion or write-down is triggered, losses are transferred to CoCo holders rather than taxpayers, shifting the burden of bank failures to private investors. Beyond lowering distress-related costs, the conversion feature of CoCos can incentivize bank managers to act prudently and avoid financial trouble. For investors who are knowledgeable about the risks and can tolerate potential losses in a downturn, CoCos may represent an appealing investment option. They often provide higher returns than standard bonds, reflecting their contingent nature, lower

[8] As of 23/12/2024

priority ranking (equal to or below that of equity investors), and strong exposure to systemic risk (Bolton et al., 2023).

Banks issue CoCo bonds primarily to enhance their regulatory capital, often in response to Basel III requirements. However, the design of CoCo bonds also attracts specific preferences from investors. For instance, buyers generally favour CoCo bonds with lower conversion triggers, higher coupon rates, and smaller issuance sizes, reflecting their desire for bonds with more favourable risk-return profiles. In contrast, issuers, typically banks, are more interested in using CoCo bonds to avoid bankruptcy, often issuing larger amounts with lower coupon rates, especially when they are financially distressed (Caporale & Kang, 2021).

2.2.5 Differences between Additional Tier 1 capital and Tier 2 capital

In previous chapters we defined the characteristics and design features of different levels of debt capital. Since AT1 and Tier 2 capital differ from each other in multiple ways, a short overview of the most significant differences is presented in Table 1.

Table 1: Differences between Additional Tier 1 and Tier 2 capital

	Additional Tier 1	**Tier 2**
Duration	Perpetual (Callable)	Minimum 5 years
Coupon obligation	Can be suspended	Needs to be paid
Subordination	Yes	Yes
Call right	Always	Possible
Write down option	Yes	Yes
Equity conversion option	Yes	No
Seniority	After Subordinated Tier 2	After Senior not preferred

Source: Basel Committee on Banking Supervision (2011)

2.3 Seniority

The seniority of capital structure is the order in which an issuer's creditors and/or investors are paid back in the event of insolvency or liquidation. It determines the order in which the remaining assets of a company are distributed. Each security, either debt or equity, that a company issues, has a certain seniority or ranking. As a rule, creditors with higher seniority get paid back before lower seniority creditors.

In essence, seniority of claims from most senior to least senior goes as follows: covered bonds, senior preferred, senior not preferred, Tier 2 Capital bonds, AT1 Capital bonds, CET1 Capital bonds, preferred stocks and at the bottom ordinary stocks, that are the first to endure losses in the event of crisis.

The ranking of creditors in the event of bankruptcy is an important factor for investors as it directly affects the risk and return of an investment. The return is immediately known at

issue through the coupon, the true risk can usually only be assessed ex post. For instance, a senior bond with very high seniority usually offers a lower interest rate than a bond that is from the AT1 segment. However, a reduced return is accompanied with a lower risk of default and vice-versa.

In Table 2, a comparison between the achievable returns depending on capital structure was made. The remaining maturity of the bonds under consideration is around 5 years. Interest rates were calculated using market data from Bloomberg on 31/01/2025.

Table 2: Return comparison based on different capital structure level

	Deutsche Bank AG	**Banco Santander S.A.**	**BNP Paribas**
Covered	2.72%	2.73%	2.76%
Senior preferred	3.18%	3.12%	3.08%
Senior not preferred	3.78%	3.10%	3.10%
Tier 2 capital bonds	4.91%	3.33%	3.49%
AT1 CoCo bonds	7.12%	6.37%	6.44%

Source: Own work based on Bloomberg[9] (2025)

The following securities with the ISINs, listed in order of capital structure, were used for the calculation: Deutsche Bank (DE000A30V5F6, DE000A3826R6, DE000A30VT06, DE000DL19WN3, DE000A383S52), Banco Santander (ES0413900913, XS2743029766, XS2806471368, XS2247936342, XS2817323749) and BNP Paribas (FR001400FIG8, FR001400F0V4, FR001400CFW8, FR0013431277, FR001400F2H9). For these bonds, the return was calculated using the mid-yield (midpoint between the bid and ask yields) until maturity.

As we can see in the Table 2, investors demand a consistently higher risk premium for investing into bonds with lower seniority. The first noticeable gap arises between covered bonds and senior preferred bonds. Covered bonds are bonds that are secured by specific assets that serve as cover, usually mortgages. Senior bonds, however, have no special collateral and so the repayment of these bonds relies solely on the creditworthiness of the issuer. The biggest observable jump in the dataset is the change from Tier 2 capital bonds to AT1 capital CoCos. As discussed, AT1 CoCos are perpetual and can be converted into equity or written down upon activating the trigger. Consequently, AT1 CoCos have a much higher yield to maturity compared to Tier 2 capital bonds, which are not CoCo in this sample. Out of the 3 selected banks in the sample, bonds issued Deutsche Bank have a consistently higher yield to maturity compared to comparable bonds issued by Banco Santander and BNP Paribas, which may hint that the market views debt issued by Deutsche Bank as riskier.

Additionally, we can make this comparison, since as seen in Table 3, these three issuers have similar ratings and creditworthiness according to the three largest rating agencies: Fitch,

[9] As of 31/01/2025

Moody's, and S&P. Again, it can be observed that Deutsche Bank has slightly lower ratings compared to Banco Santander and BNP Paribas, hinting that it is perceived as riskier.

Table 3: Ratings of banks in comparison

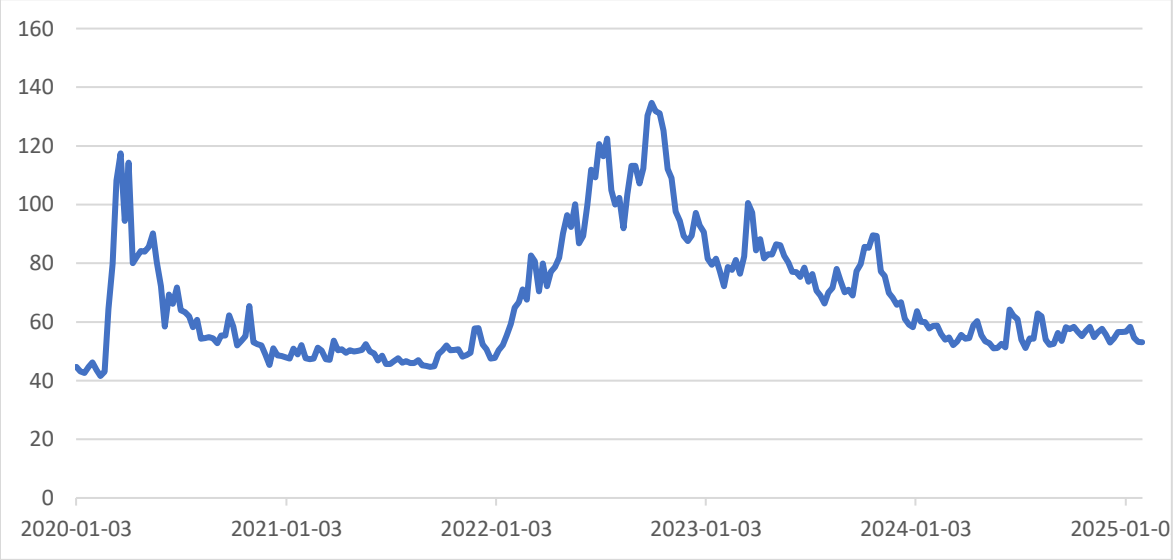
	Deutsche Bank AG	**Banco Santander S.A.**	**BNP Paribas**
Fitch	A-	A-	A+
Moody's	A1	A2	A1
Standard & Poor's	A	A+	A+

Source: FitchRatings (2025); Moody's (2025); S&P Global Ratings (2025)[10]

2.4 Bond credit spreads

Credit spreads are a basic measure in fixed-income markets. They showcase the extra return investors demand to as compensation for the credit risk relative to a risk-free benchmark. The main task of a credit spread is to quantify the creditworthiness of a particular bond. In practice, companies with poorer credit profile trade with a significantly higher spread than companies with more stability. Credit spreads are typically expressed in basis points (bps), where 100 bps corresponds to one percentage point (FasterCapital, 2025).

Figure 4: Markit iTraxx 5-year Europe index



Source: Own work based on Bloomberg[11] *(2024)*

Credit premium does not remain constant, but changes depending on how investors view the market. Figure 4 shows the history of the iTraxx Europe Index with a term of 5 years. The index includes 125 credit default swaps, all equally weighted, referencing investment-grade

[10] As of 26/01/2025
[11] As of 31/01/2025

corporate issuers based in Europe. It is rebalanced every 6 months to account for market changes (S&P Global, 2016).

Credit default swaps are used to hedge credit risk, the cost of which is expressed in bps. During times of uncertainty, the prices of credit default swaps go up and consequently so does the index, meaning investors are demanding a higher premium (credit spread) from the market. It is very clear to see how strongly the index reacts to significant macroeconomic developments. The first big increase happened due to the corona pandemic at the beginning of 2020. The second big increase in 2022, was due to multiple factors, mostly the Russian invasion into Ukraine with its consequences on the global markets, and a restrictive central bank policy due to high inflation in the past calendar year. The banking uncertainty in the beginning of 2023 can also be observed. The index spikes in March 2023, during the collapse and subsequent takeover of Credit Suisse by UBS (S&P Global, 2016).

Various types of spreads exist, each with different applications and limitations. In this thesis, I will be using Z-spreads due to their relevance for my analysis. Reasons why I chose the Z-spread, and not for example the I-spread or G-spread, are described below.

2.4.1 I-spread

I-spread, or Interpolated spread, represents the most significant spread in the bond market. In general, it refers to the spread between a respective bond and the risk-free benchmark, usually a treasury spot rate curves or a reference rate like the Secured Overnight Financing Rate (SOFR), with the same term. Because a treasury curve with the exact remaining term of a bond is not always available, the term is interpolated between two treasuries with different maturities. Every bond in the primary market is priced using the I-spread between two swaps, making it the most common markup in the bond market. However, the I-spread primarily accounts for credit risk and ignores liquidity risk. Since CoCo bonds are typically traded in less liquid markets and have complex structures with embedded options, using the I-spread in the empirical analysis of this thesis is not suitable (Fabozzi, 2005).

2.4.2 G-spread

G-spread, or Government bond spread, is typically used to assess the difference in yield between a corporate bond and a government bond with a similar maturity. As seen in Equation 1, it measures the additional return investors demand to compensate for the increased default risk associated with non-government bonds, assuming that government bonds are default-free or have a significantly lower default risk compared to corporate bonds. However, several issues arise when applying the G-spread to CoCo bonds. First, the G-spread uses the yield of a government bond with the same maturity as the corporate bond as a benchmark, which doesn't account for the complexity of CoCo bonds. CoCo bonds often have embedded options and triggers that affect their risk across different time horizons,

making the G-spread's use of a single maturity unsuitable. Moreover, the G-spread doesn't account for how different maturities react to interest rate changes, which is crucial for CoCo bonds. These bonds are sensitive to interest rates and liquidity conditions over time, so the G-spread's single maturity comparison overlooks these factors. And finally, CoCo bonds are often traded in less liquid markets. The G-spread ignores liquidity risk, which is especially relevant for such bonds and makes this measure less suitable (Fabozzi, 2005):

$$\mathrm{G} = Y_c - Y_g \tag{1}$$

G = *G-spread*

Y_c = *Yield of the non-treasury bond or corporate bond*

Y_g = *Yield of the government bond with the same maturity*

2.4.3 Z-spread

The Zero volatility spread, or Z-spread, represents the additional return a bond provides over a risk-free benchmark, typically a treasury spot curve. This spread is calculated as a constant amount added to the yield at every point on the spot rate curve so that the present value of a bond's future cash flows equals its current market price. In practical terms, to compute the Z-spread, we take a bond's cash flows (coupons and principal) for certain future dates and discount them using spot rates from the risk-free yield curve. Each treasury spot rate is increased by a fixed amount (the Z-spread), so that the sum of the discounted cash flows equals the bond's observed market value. This method ensures the adjusted rate curve accounts for risk across all maturities. In essence, the Z-spread refers to the premium above the risk-free interest rate that investors charge for a bond to compensate for the credit risk they take on. Equation 2 depicts how the Z-spread is calculated (Fabozzi, 2005):

$$\mathrm{P} = \sum_{x=1}^{n} \frac{C_x}{\left(1+\frac{r_x+Z}{2}\right)^{2x}} \tag{2}$$

P = *Bond current market value, including any accrued interest*

C_x = *Bond coupon payment at each period*

r_x = *Spot interest corresponding to maturity at time x*

Z = *Z-spread, the uniform premium added across all maturities*

n = *Total number of time periods relevant to the maturity*

$2x$ = *Treasury yields are compounded semi-annually, so we adjust our discounting by multiplying the exponent x, which represents years, by 2*

3 CONVERSION OF COCO BONDS: BANCO POPULAR & CREDIT SUISSE

Since their introduction after the global financial crisis of 2008, CoCos have only been entirely written down twice in Europe. The first was Banco Popular in Spain in 2017, the second one was Credit Suisse in 2023. I will now briefly introduce both.

3.1 Banco Popular

Banco Popular Español, S.A. began facing liquidity problems in October 2016 due to widespread customer withdrawals. By early 2017, an aggressive investment policy, a weak capital position, poor performing real estate loans and associated massive write-offs all contributed to a higher-than-expected loss of €3.5 billion in the first quarter of that year (Kozińska, 2019).

In April of 2017, Banco Popular's CEO resigned due to poor financial reports from the previous year. In an attempt to save the institution, the bank's leadership, with the help of Deutsche Bank, tried to find bidders to help save the bank. However, there were no offers, and the deterioration quickened. It is said that due to the depositor run, Banco Popular lost €18 billion in deposits over its last ten days (García-Abadillo, 2017).

On the morning of Friday, June the 2nd, reports emerged that Deloitte had assessed its economic value to range from negative €1.3 billion in the most favourable case to negative €8.2 billion in the worst, with the best estimate being negative €2 billion. As a result, Banco Popular experienced a significant depositor run (SRB, 2017).

On Monday, June the 5th 2017, the withdrawals continued. Consequently, the bank requested €1.6 billion in Emergency Liquidity Assistance (ELA) from Spain's central bank, the Banco de España, which granted it three hours later. On Tuesday, June 6th, further depositor withdrawals led to another ELA request, this time for €7.6 billion. As ELA support above €2 billion required ECB approval, the ECB authorized the request. However, Banco de España limited its approval to an additional tranche of €1.6 to €1.9 billion (Mott, 2024).

On June 6th Banco Popular communicated to the ECB that its liquidity had run dry, putting it at an imminent risk of failure. The ECB Governing Council determined that Banco Popular was "failing or likely to fail" known as the "FOLTF" assessment. This assessment triggers the resolution stage of the Single resolution Mechanism. The ECB subsequently sent this assessment to the Single Resolution Board (SRB), which concluded that no viable private sector or supervisory solutions existed. The SRB then instructed the Fund for Orderly Bank Restructuring (Fondo de Reestructuración Ordenada Bancaria, or FROB) to begin marketing Banco Popular to potential buyers. The SRB invited Santander and BBVA to submit binding offers for Banco Popular. Only Santander submitted a bid, with the condition that all shareholders (CET1) and Additional Tier 1 (AT1) capital holders, including CoCo

bondholders, would be fully written down, while Tier 2 capital instruments would be converted to equity and transferred to Santander at a symbolic €1. The SRB accepted this bid with the requirement that Santander raise an additional €7 billion in capital to ensure the acquisition would not compromise Santander's regulatory capital requirements. This sale marked the SRB's first completed resolution (Mott, 2024).

The SRB opted for a "sale-of-business" resolution strategy in combination with the write down or conversion of capital instruments, despite Banco Popular having an already existing resolution plan from 2016. As part of this process, CET1, AT1, and Tier 2 instruments were either converted or written down, and the full ownership of Banco Popular was transferred to Santander. This action resulted in total losses for common shareholders and holders of AT1 and Tier 2 instruments, valued at €4.2 billion, while senior creditors and depositors were protected. However, the SRB did not decide to use the "bail-in" resolution tool, that imposes losses on larger range of investors, which would have taken longer and consequently wouldn't solve the liquidity problems the bank was facing (Mott, 2024).

In May 2022, the European Court of Justice (ECJ) concluded that the shareholders who participated in Banco Popular's capital increase in 2016 are not eligible for compensation for the losses they incurred during the bank's resolution. The ECJ based its ruling on the European Union's Bank Recovery and Resolution Directive (BRRD). The ECJ stated that the directive establishes the principle that, in resolution proceedings, losses should be absorbed primarily by the shareholders, followed by the creditors, of the credit institution. The ECJ also noted that investor protection cannot override the broader goal of preserving financial stability within the EU. Nevertheless, many major shareholders and junior bondholders impacted by Popular's resolution filed lawsuits against the Single Resolution Board (SRB), responsible for overseeing the bank's wind-down, contending that the bank was not necessarily on the brink of collapse (Reuters, 2022).

Banco Popular's resolution marked the first case managed by the SRB. The sale of business approach achieved the objectives of the BRRD. Specifically, losses were absorbed by shareholders and holders of convertible capital instruments, Banco Popular continued operations without interruption, no taxpayer money was used in the resolution, and contagion effects were minimal. The European Court of Justice further upheld the treatment of shareholders and creditors. The Court concluded that these stakeholders would not have been better off in a normal insolvency scenario, thus solidifying the SRB's approach that no compensation was due. The rulings are final and not subject to appeal, providing a clear legal precedent for future bank resolution cases within the EU.[12] Consequently, policymakers and the media largely regarded the SRB's resolution of Banco Popular as a success (Mott, 2024).

[12] https://www.srb.europa.eu/en/content/srb-statement-general-court-judgment-banco-popular-decision-not-compensate-affected for more details.

3.2 Credit Suisse

3.2.1 Credit Suisse recent history

Unlike most bank runs, such as those during the 2007/08 financial crisis, the Credit Suisse bank run was triggered by poor-decision making and scandals rather than a change in macroeconomic conditions. Prior to the bailout and merger with UBS, there were several events that damaged Credit Suisse's reputation:

1) There was a spying scandal in February 2020 where Credit Suisse hired private investigators to follow its former head of wealth management who had joined UBS. This in turn resulted in the resignation of Credit Suisse's CEO Tidjane Thiam (Reuters, 2022).
2) Credit Suisse invested about $10 billion in Greensill Capital's debt, claiming it was low risk due to insurance from Tokio Marine. However, the bank did not directly confirm the insurance's validity and relied on updates from Greensill's broker, Marsh. In March 2021, after Greensill collapsed, some bonds were found to be improperly insured, leading to investor losses and reputational damage for the bank (Bergin, 2021).
3) Also in March 2021, Credit Suisse suffered a loss of $5.5 billion because of its involvement with US hedge fund Archegos Capital Management, which went bankrupt. The fund's aggressive use of leverage in concentrated positions in technology-related stocks ultimately led to significant losses when the strategy failed. As a result, Credit Suisse saw the value of its exposure to Archegos decline sharply. The bank's actions were criticized by an independent report into the incident, which claimed that the bank's attention was on maximizing short-term profits and, in spite of multiple warning signs, Archegos' risk-taking was not restrained, raising doubts about the competence of Credit Suisse's risk management staff (Reuters, 2022).
4) In October 2021, Credit Suisse admitted to defrauding investors in an $850 million loan intended for a tuna fishing project in Mozambique, with $200 million diverted to bankers and Mozambican government officials. The bank also facilitated $1.4 billion in undisclosed loans, which Mozambique later revealed, leading to the withdrawal of IMF support and triggering a severe economic crisis in the African country. As a result, British and U.S. regulators imposed a $547 million penalty on Credit Suisse (O'Donnell & Revill, 2021).
5) In January 2022, Credit Suisse Chairman Antonio Horta-Osorio, appointed to address the fallout from Greensill Capital and Archegos, resigned after breaching COVID-19 quarantine regulations (Reuters, 2022).
6) In February 2022, Credit Suisse faced allegations of managing accounts for human rights abusers, sanctioned businessmen, and other questionable clients, based on a data leak involving over 18,000 accounts collectively holding more than $100 billion. The accounts, dating from the 1940s to the 2010s, were leaked to Germany's Sueddeutsche Zeitung, which coordinated a Panama Papers-style investigation with media outlets worldwide. Credit Suisse denied the allegations, describing them as "predominantly

historical" and noting that most accounts had been closed prior to 2015. While the bank maintained compliance with regulations, the scandal reignited concerns about Switzerland's banking practices, drawing scrutiny from European lawmakers and further damaging Credit Suisse's reputation amidst ongoing efforts to recover from financial losses and governance failures (Shields & Murphy, 2022).

7) In March 2022, the Supreme Court of Bermuda determined that former prime minister of Georgia Bidzina Ivanishvili and his family were entitled to damages exceeding $500 million from Credit Suisse Bermuda, Credit Suisse's life insurance subsidiary, due to mismanagement. The reason for this decision was due to fraudulent activity by a former Credit Suisse adviser, Patrice Lescaudron, who forged client signatures on documents to falsify transfer orders and mismanaged funds (Böni et al., 2023).
8) In June 2022, the Swiss Federal Criminal Court ruled that Credit Suisse and a former employee were guilty of involvement in money laundering in connection with a Bulgarian cocaine trafficking organization. The court imposed a fine of CHF 2 million on Credit Suisse and ordered the confiscation of over CHF 12 million in assets held by the drug gang in accounts at the bank. Additionally, an amount of CHF 19 million was ordered to be relinquished, since this amount could not be recovered due to internal deficiencies within Credit Suisse. The former employee received a suspended prison sentence of 20 months and a monetary fine (Carrel, 2022).
9) In October 2022, Credit Suisse announced a $4.3 billion capital increase alongside a strategic overhaul that included 9,000 job cuts. The funding was achieved through a fully underwritten rights issue, allowing existing shareholders to buy new shares at a reduced price to offset dilution, and a $1.76 billion private capital placement, involving the sale of shares to a select group of investors. The private placement resulted in the Saudi National Bank becoming the largest shareholder of Credit Suisse (Bloomberg, 2022).
10) Also in October 2022, Credit Suisse unveiled plans to restructure the investment banking division, including the spin-off of the revived First Boston unit, a U.S.-based investment bank that Credit Suisse acquired in 1990 (Böni et al., 2023).[13]
11) During the fourth quarter of 2022, Credit Suisse experienced substantial customer outflows exceeding CHF 100 billion, resulting in a historic annual loss of CHF 7.29 billion, which represented about 50% of the bank's net revenues.[14] In response to this downturn, longtime shareholder Harris Associates sold its entire position in the bank (Morris & Walker, 2023).

Despite all of this, the events surrounding Credit Suisse reached their peak only in March 2023:

1) On March 8th, 2023, Credit Suisse postponed its annual report after receiving a request from the U.S. Securities and Exchange Commission (SEC), which raised concerns about

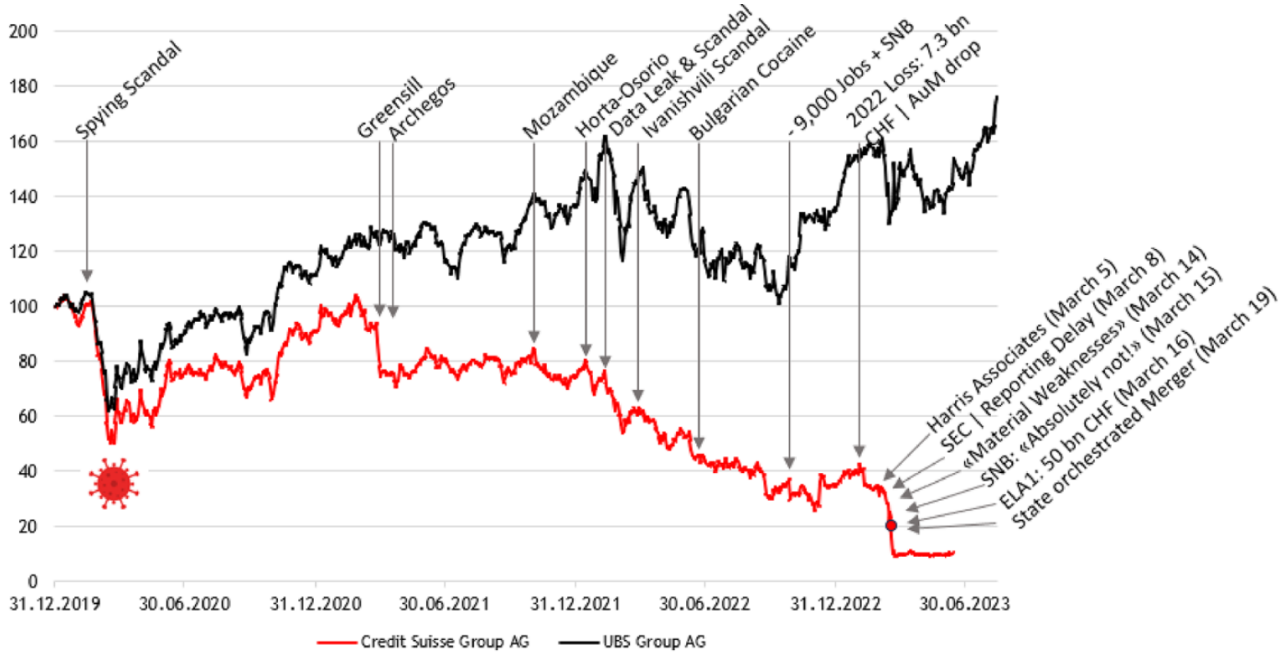
[13] https://www.credit-suisse.com/media/assets/corporate/docs/about-us/media/media-release/2022/10/strategy-update-press-release-en.pdf for more details.
[14] https://www.credit-suisse.com/media/assets/corporate/docs/about-us/media/media-release/2023/02/q4-22-press-release-en.pdf for the 4th quarter 2022 results and CS 4Q22 and Full Year 2022 Results.

revisions to the cash flow statements for 2019 and 2020, along with related internal controls (Böni et al., 2023).

2) On March 14th, Credit Suisse released its annual report, acknowledging "material weaknesses" in its internal financial controls and announcing the cancellation of board bonuses (Böni et al., 2023).
3) On March 15th, the chairman of Saudi National Bank sharply replied "absolutely not" when questioned by a journalist about the possibility of providing additional financial assistance to Credit Suisse if necessary. His response intensified the growing worries surrounding the bank's future (Böni et al., 2023).
4) On March 16th, in accordance with its legal mandate, the Swiss National Bank (SNB) provided emergency liquidity assistance of CHF 50 billion to Credit Suisse (Böni et al., 2023).
5) On the weekend of March 18th and 19th, the SNB, the Swiss Financial Market Supervisory Authority (FINMA), and the Federal Council met to respond to the unfolding crisis. They facilitated an agreement for UBS to acquire Credit Suisse, with the goal of stabilizing Switzerland's financial system. On March 18th, the Financial Times reported that BlackRock had explored a competing bid, possibly for parts of Credit Suisse's business, given their longstanding relationship with its investment banking division. Larry Fink, CEO of BlackRock, was reportedly driving the bid but ultimately abandoned the idea. BlackRock's decision was influenced by significant regulatory hurdles and the SNB and FINMA's preference for a Swiss-led solution (Morris et at., 2023).
6) On the evening of March 19th, 2023, a press conference was held in which the SNB, FINMA, and the Federal Council announced UBS's acquisition of Credit Suisse for $3.23 billion in stock and agreeing to absorb potential losses of up to $5.4 billion. As part of the deal, AT1 bonds with a nominal value of $17 billion were written down (Böni et al., 2023).

All these events that contributed to damaging Credit Suisse's reputation are summarized within a timeline below in Figure 5. The graphs show market capitalizations of Credit Suisse (in red) and its Swiss competitor UBS (in black), with both metrics indexed to January 1, 2020. As expected, the bank's market value declined an estimated $30 billion or 90% of its value between early 2020 and the eventual bailout and merger with UBS (Böni et al., 2023).

Figure 5: A Timeline of Events Market Capitalization of Credit Suisse Group and UBS

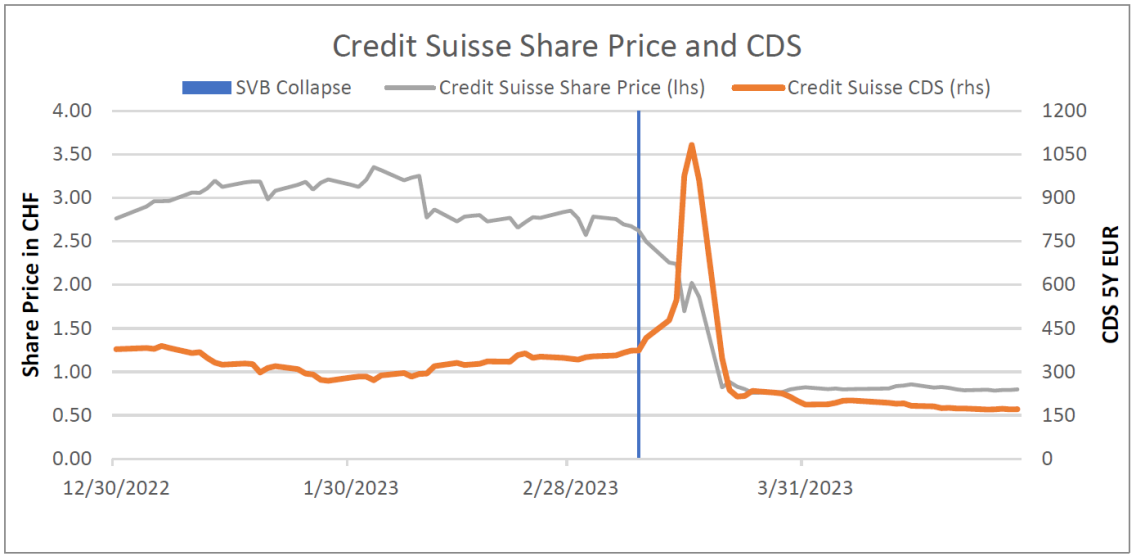


Source: Böni & Zimmerman (2024)

3.2.2 The collapse and bailout-merger in more detail

The collapse of Silicon Valley Bank (SVB) on March 10th, 2023, triggered widespread panic in the banking sector, with significant ripple effects felt across global financial markets. European listed banks experienced a sharp decline in stock prices, as investors feared further systemic contagion. The immediate market response was driven by a combination of uncertainty, information asymmetry, and panic, which led to a domino effect, severely impacting investor confidence in the stability of other financial institutions. As SVB's failure unfolded, it highlighted vulnerabilities in liquidity and capitalization, which were subsequently magnified as Credit Suisse faced its own crisis. The market reaction to Credit Suisse's eventual collapse was even more pronounced, as seen in Figure 6 with its stock price dropping and its Credit Default Swap (CDS) spread rising significantly as investors reacted to the potential broader implications for the global banking system. This negative market sentiment was exacerbated by concerns about interconnectedness among large financial institutions and the uncertainty regarding the ability of central banks and regulators to prevent further collapses (Martins, 2023).

Figure 6: Credit Suisse Share Price and CDS



Source: Bolton et al. (2023)

On March 16th, 2023, Credit Suisse received CHF 50 billion in ELA from the SNB. The latter was provided under an established legal framework and backed by high-quality collateral, in accordance with the SNB's Guidelines on Monetary Policy Instruments[15] (Böni & Zimmermann, 2024). This was insufficient to dispel speculation or impede the withdrawal of deposits. Consequently, two days later, the SNB and FINMA announced UBS would acquire control of Credit Suisse in a government-backed deal. Swiss financial regulators concluded that merging Credit Suisse with a strong financial institution was the most effective way to avoid a broader financial crisis (Bolton et al., 2023).

To enable the bailout and merger, the Federal Council invoked emergency measures under Articles 184 and 185 of the Federal Constitution.[16] Although these articles mainly focus on diplomatic relations and national security, the Federal Council has used them as a foundation for its actions in the financial sector. Article 184 grants the Federal Council the authority to engage in foreign policy, including protecting Switzerland's foreign policy interests, while Article 185 gives the Federal Council the authority to take measures to protect Switzerland's external and internal security, including issuing temporary ordinances to address imminent threats to public order or security (Kummer, 2023). The measures established a legal framework allowing the SNB to extend liquidity assistance beyond standard provisions and included a federal default guarantee. The Finance Delegation, representing the federal government, authorized a CHF 9 billion guarantee to cover potential losses from specific Credit Suisse assets that UBS acquired, with UBS taking the first CHF 5 billion of realised losses on non-core or incompatible assets. Non-core assets refer to holdings outside UBS's

[15] Richtlinien der Schweizerischen Nationalbank über das geldpolitische Instrumentarium, March 25th, 2004 (as of June 17, 2024).
[16] https://www.fedlex.admin.ch/eli/cc/1999/404/en for more details.

primary strategic focus or business model, while incompatible assets include those conflicting with its risk tolerance, regulatory requirements, or ethical standards, such as high-risk loans or underperforming portfolios. Losses exceeding this threshold would trigger federal coverage up to CHF 9 billion, while UBS was required to minimize losses and maximize proceeds, with federal oversight through extensive audit rights (Swiss Federal Council ordinance, 2023). Additionally, UBS and Credit Suisse were granted CHF 200 billion in supplementary emergency liquidity assistance (ELA+) loans from the SNB, comprising a CHF 100 billion loan with no collateral needed, but with privileged creditor status in bankruptcy, meaning the SNB would get repaid first in the event of bankruptcy and liquidation of assets of any of the two banks, demonstrating confidence in the bank's restructuring while safeguarding public funds for the bailout. The additional CHF 100 billion loan was a public liquidity backstop (PLB), also based on an emergency ordinance by the Swiss Federal Council, which again had privileged creditor rights and was additionally backed by a federal default guarantee (Swiss National Bank, 2023). The extraordinary financial assistance totalled CHF 209 billion, which can be compared to Credit Suisse's total outstanding deposits of around CHF 233 billion[17] (Böni & Zimmermann, 2024).

By May 2023, Credit Suisse had fully repaid its outstanding liquidity to the SNB. On the 16th of May UBS revealed that the costs and benefits of its Credit Suisse acquisition could amount to tens of billions of dollars, with a projected $13 billion negative impact from fair value adjustments, that change the value of assets and liabilities to reflect their market value, as well as $4 billion in estimated litigation and regulatory expenses. Additionally, the change in accounting standards increased the total estimated cost to $28.3 billion. UBS expected to mitigate some of these losses with the write-down of $17 billion from Credit Suisse's AT1 bonds and a one-time gain of $34.8 billion from acquiring Credit Suisse at a fraction of its book value. While the accounting gain was lower than anticipated, it provided UBS a cushion to absorb merger-related losses. UBS imposed restrictions on Credit Suisse, including limits on lending and spending, to manage the risks from Credit Suisse's prior lapses in risk control, which could lead to client losses. On June 12th, 2023, UBS completed the acquisition, forming a $1.6 trillion banking entity, with Credit Suisse operating as a separate subsidiary under stricter compliance measures (Böni et al., 2023).

This approach was like the one used by the Federal Reserve and US Treasury in 2008, when they rescued Bear Stearns through a merger with JPMorgan. These two deals are instructive because of their different contexts and constraints on the regulatory authorities. Unlike the Swiss authorities, which relied in the Swiss emergency law, the Federal Reserve and US Treasury lacked the legal framework to directly oversee or enforce a merger. In order to claim authority to provide liquidity support "under unusual and exigent circumstances" to a broker-dealer, the Federal Reserve was obliged to invoke section 13(3) of the Federal Reserve Act. Beyond the authority to provide liquidity support, the Federal Reserve and US Treasury could only try to convince Bear Stearns and JPMorgan to agree to a merger at a

[17] As at the end of 2022

price of $2 per share. The Federal Reserve and the US Treasury couldn't get around the shareholder agreements at Bear Stearns and JPMorgan. Furthermore, they lacked the authority to reduce Bear Stearns' liabilities outside of bankruptcy. The only viable structure was a purchase-and-assumption agreement, whereby JPMorgan would take on Bear Stearns' liabilities. Despite the low share price, the deal was considered highly risky. To address this, the Federal Reserve backed the agreement with a collateralised special purpose vehicle (SPV), Maiden Lane LLC. The SPV was to be financed with $1 billion in junior debt from JPMorgan and $29 billion in senior funding from the Federal Reserve. Its role was to purchase up to $30 billion troubled assets of Bear Stearns, thereby derisking its balance sheet. The transaction was completed in May 2008 and brought temporary stability to the financial markets, but a similar attempt between Lehman Brothers and Barclays failed, triggering the global financial crisis (Sorkin, 2009).

The Swiss regulators were in a comparatively stronger position to negotiate a merger between Credit Suisse and UBS. They were able to quickly resolve the uncertainty by circumventing the necessity for shareholder approval. Furthermore, public funds were not at risk since there was no need of establish a special purpose vehicle to stabilize Credit Suisse's balance sheet. Triggering the write-down of the Credit Suisse's CoCo bonds was the sole action required, as they were designed and issued exactly for this kind of contingency. FINMA was the one to announce the write-down of all AT1 bonds of Credit Suisse, whose nominal value was around CHF 16 billion. The write-down of the AT1 instruments permitted a fast reduction of the Credit Suisse's leverage. One criticism of the Bear Stearns rescue and subsequent interventions was the risk of moral hazard namely, the idea that investors might expect perpetual bailouts. In contrast, writing down the AT1 bonds in the Credit Suisse case was intended to restore balance sheet strength and avoid setting a precedent for repeated rescues of systemically important institutions (Walker et al., 2023).

While the write-down of Credit Suisse's CoCos was anticipated, it nevertheless triggered alarm in financial markets and sparked a short-lived crisis in the AT1 bond sector. Investors were taken aback to discover that their holdings had been wiped out, especially given that common shareholders were not similarly affected. This marked the first such instance in the history of CoCos.

3.2.3 Credit Suisse Cocos

Many investors and regulators saw the Credit Suisse CoCos write down as a violation of the hierarchy for capital claims. For example, the SRB together with the European Banking Authority (EBA) and ECB Banking Supervision, issued statements that CET1 should be the

first to absorb losses, only after CET1 is exhausted should AT1 instruments be written down.[18] Statements like these only further confused the situation.

But was FINMA in the wrong and did they breach the terms of the AT1 bond ontracts? The majority of CoCos issued by Credit Suisse, including those with principal write-down clauses, had similar provisions. For instance, the $1,500,000,000 issued in Zurich on 12th of September 2018, contains the following terms: "Write-down: If a Contingency Event, or prior to a Statutory Loss Absorption Date (if any), a Viability Event occurs, the full principal amount of the notes will be mandatorily and permanently written down. The notes are not convertible into shares of the Issuer upon the occurrence of a Contingency Event or a Viability Event or at the option of the Holders at any time…. CET1 Write-down Trigger: 7.00%, based on Credit Suisse Group AG consolidated CET1 ratio" (Credit Suisse Group AG, 2018).

The terms further state that: "A "Contingency Event" will occur if (i) Credit Suisse Group's consolidated Common Equity Tier 1 ("CET1") divided by its consolidated risk weighted assets ("RWA") as of any quarterly balance sheet date (or, in the case of certain of these instruments, such other date specified by FINMA) is below 7%, and (ii) FINMA has not agreed in writing prior to publication of such CET1/RWA ratio that a full conversion or write-off, as applicable, shall not occur because it is satisfied that actions, circumstances or events have had, or imminently will have, the effect of restoring the CET1/RWA ratio to a level above 7% that it deems to be adequate" (Credit Suisse Group AG, 2018).

In addition, the following provision clarifies PONV: "A 'Viability Event' will occur if either (i) FINMA notifies Credit Suisse Group (CSG) that it has determined that a conversion or write-off of the relevant instrument, together with the conversion or write-off of holders' claims in respect of all other regulatory capital instruments issued by a member of the Credit Suisse Group that, pursuant to their terms or by operation of law, are capable of being converted into equity or written-off at that time, is, because customary measures to improve CSG's capital adequacy are at the time inadequate or unfeasible, an essential requirement to prevent CSG from becoming insolvent, bankrupt or unable to pay a material part of its debts as they fall due, or from ceasing to carry on its business, or (ii) customary measures to improve CSG's capital adequacy being at the time inadequate or unfeasible, CSG receives an irrevocable commitment of extraordinary support from the public sector (beyond customary transactions and arrangements in the ordinary course) that has, or imminently will have, the effect of improving CSG's capital adequacy and without which, in the determination of FINMA, CSG would have become insolvent, bankrupt, unable to pay a material part of its debts as they fall due or unable to carry on its business. The occurrence of either or both of these two events is also referred to as the 'Point of Non-Viability' or the 'PONV'" (Credit Suisse Group AG, 2018).

[18] https://www.srb.europa.eu/en/content/srb-eba-and-ecb-banking-supervision-statement-announcement-19-march-2023-swiss-authorities for more details.

The additional Credit Suisse documentation on AT1 bonds further states that: "under certain circumstances, FINMA has the power to open restructuring proceedings with respect to CSG under Swiss banking laws (see "—CSG is subject to the resolution regime under Swiss banking laws and regulations" below), and, if the Notes have not already been subject to a write-down, could convert the Notes into equity or cancel the Notes, in each case, in whole or in part. Holders should be aware that, in the case of any such conversion into equity, FINMA would follow the order of priority set out under Swiss banking laws, which means, among other things, that the Notes would have to be converted prior to the conversion of any of CSG's subordinated debt that does not qualify as regulatory capital with a contractual write-down or conversion feature. Furthermore, in the case of any such cancellation, FINMA may not be required to follow any order of priority, which means, among other things, that the Notes could be cancelled in whole or in part prior to the cancellation of any or all of CSG's equity capital" (Credit Suisse Group AG, 2018).

Given these terms and provisions, FINMA exercised its authority initiating the conversion, having concluded that Credit Suisse had reached the PONV. It is important to note that Credit Suisse CoCos were primarily intended to support the recapitalization of a distressed but ongoing ("going concern") institution, rather than to lower resolution costs in the event of total failure ("gone concern"). In this context, FINMA's activation of the AT1 instruments aligned with their main purpose, enabling a rapid capital injection to stabilize Credit Suisse after it approached the brink of insolvency (Bolton et al., 2023).

To clarify the status of Credit Suisse's AT1 bonds, the Swiss Federal Council enacted an emergency ordinance on March 19th, 2023, authorizing FINMA to instruct both the bank and its parent financial group to carry out the write-down of AT1 bonds (Swiss Federal Council ordinance, 2023).[19] The AT1 bond contracts stipulated a complete write-down if extraordinary government support was granted. FINMA determined that this threshold had been met when Credit Suisse obtained emergency liquidity funding backed by a federal guarantee on March 19th, 2023 (Böni et at., 2023).

Subsequently, several Credit Suisse investors filed lawsuits against the Swiss regulator, alleging that FINMA's decision to write off the AT1 bonds was disproportionate and executed in bad faith (Böni et at., 2023).

The collapse of Credit Suisse in 2023 provided a stark example of the challenges associated with CoCos. The decision to fully write down $17 billion in AT1 CoCos while preserving shareholder value raised questions about the fairness and effectiveness of CoCo mechanisms in crisis scenarios. This event mirrors the concerns raised by Goncharenko et al. (2020), who argue that CoCos, while designed to absorb losses and bolster capital, can also exacerbate the 'debt overhang' issue. Debt overhang occurs when a bank's existing debt burden is so high that it becomes difficult to raise new capital, especially through equity. This problem

[19] https://www.newsd.admin.ch/newsd/message/attachments/76290.pdf for more details.

is especially problematic for banks with volatile assets, where the conversion process may disproportionately benefit equity holders, discouraging new equity issuance during financial distress. As a result, the bank has less incentive to raise fresh equity to stabilize itself. The CoCo mechanism can unintentionally exacerbate this issue, as it may prioritize preserving equity value rather than strengthening the bank's capital base. Consequently, this leads to a vicious cycle where the bank remains unable to raise capital, increasing its vulnerability during a crisis (Goncharenko et al., 2020).

3.2.4 Aftermath and lessons

CoCo bonds, classified as AT1 or Tier 2 capital under Basel III, play a crucial role in absorbing losses during financial distress, thus enhancing banks' resilience without requiring government intervention. AT1 bonds, as part of the "going concern" capital, help maintain the stability of the bank during times of crisis, focusing on ensuring that the bank remains operational and solvent. In contrast, Tier 2 bonds primarily contribute to the "gone concern" capital and Total Loss-Absorbing Capacity (TLAC), ensuring that banks can survive resolution processes without relying on taxpayer funds (Kund et al., 2023).

Apart from the 2017 Banco Popular CoCo write-down, there was no previous CoCo conversion we could have learnt from until Credit Suisse. The event has taught many lessons. First, CoCos have a complicated structure. Many investors were confused about the distinction between going-concern and gone-concern. Going concern CoCos, which were the type of Credit Suisse, are designed to help the bank remain operational by triggering a write-down before equity holders are affected. Additionally, multiple triggers induced a lot of uncertainty during the event itself. While mechanical triggers are linked to measurable thresholds like the CET1 capital ratio, discretionary triggers give regulators the authority to act when they determine the issuer has reached the PONV, as was seen in the Credit Suisse case. Determining the PONV is one of the main difficulties with the discretionary trigger and this lack of defined criteria raises uncertainty. This complexity makes it difficult to accurately predict the probability of CoCos being triggered (Macey-Dare, 2023).

The decision to write down the AT1 bonds of Credit Suisse, along with contradictory interpretations by the SRB and the ECB, disrupted investor confidence in this key funding instrument for banks. Nevertheless, they have served their purpose. They have allowed a swift recapitalisation, supported the UBS takeover, and helped shield taxpayers from bearing the losses tied to Credit Suisse. Through its action, FINMA reinforced accountability in the AT1 market, sending a clear message to investors about the first-loss nature of these instruments and the importance of conducting thorough due diligence (Bolton et al., 2023).

The collapse of Credit Suisse highlights a key lesson for regulators. Despite significant efforts to create resolution regimes for GSIBs following the global financial crisis, the complexity and lack of clarity in these procedures have actually heightened the risks of handling a major bank like Credit Suisse. As a result, Swiss authorities opted for a purchase

and assumption deal with UBS, supported by the Swiss National Bank (SNB), viewing it as a safer alternative. According to the Financial Times, at a crucial meeting on the 15th of March 2023, when the SNB approved a CHF 50 billion backstop for Credit Suisse, regulators also delivered a non-negotiable directive: the bank would merge with UBS, with the announcement made before Asian markets opened the following Sunday. A UBS executive present at the meeting explained that a formal resolution process could have destabilized the global financial system and sparked contagion. UBS had a vested interest in preventing a collapse, as it would have damaged the Swiss wealth management industry (Morris et al., 2023).

Later, Swiss finance minister Karin Keller-Sutter explained that winding down Credit Suisse might have been legally feasible, but in practice, it would have caused significant economic harm and dragged other banks down as well, potentially triggering an international financial crisis (Jones, 2023).

This assessment is largely undisputed, underscoring the need for regulators to reassess their approach to the too-big-to-fail problem and the resolution of systemically important financial institutions (SIFIs). The crisis raises doubts if regulators will ultimately choose bailouts over resolutions when under pressure. Nevertheless, a positive takeaway from the Credit Suisse debacle is that $17 billion worth of CoCos were written down without causing widespread instability in the banking system. This efficient debt reduction has helped address some aspects of the too-big-to-fail problem, while also reducing the financial burden on Swiss taxpayers for rescuing Credit Suisse, as no public funds were ultimately needed for the resolution (Bolton et al., 2023).

4 COCO BOND MARKET OVERVIEW

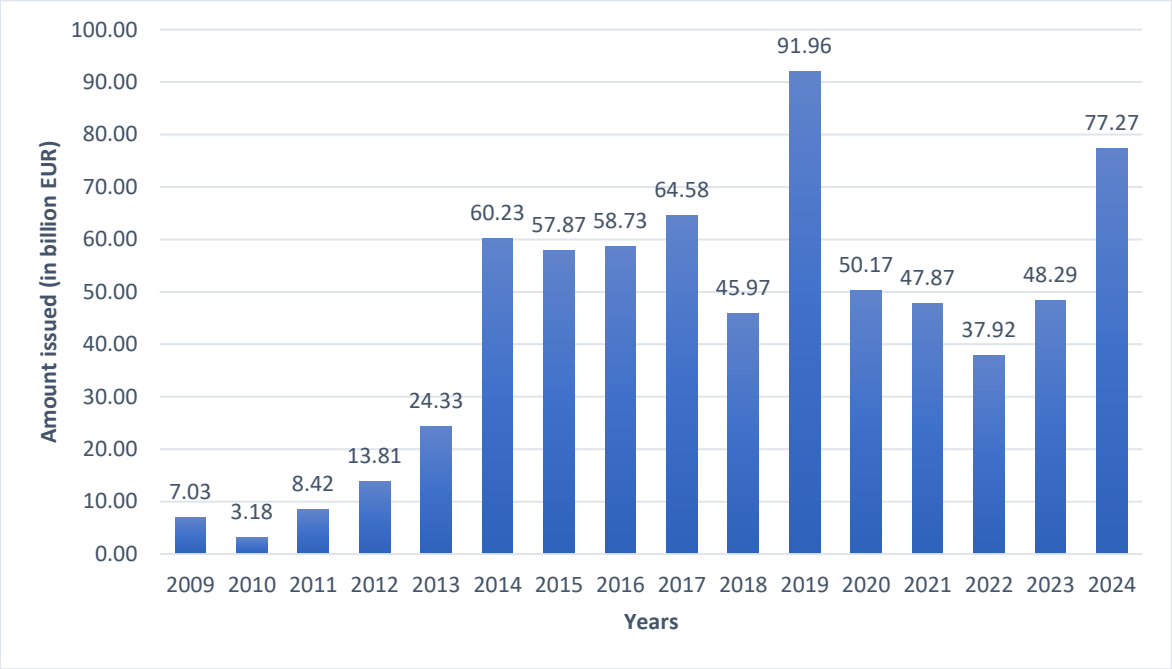
This chapter presents a comprehensive overview of the Global and European CoCo bond markets, with a focus on aspects such as its historical development and key issuers. To ensure consistency and clarity, only CoCo bonds issued by banking institutions[20] are sampled.

4.1 Global Market overview

The first CoCo bonds issued by banks started in the second half of 2009. Accordingly, bank data from summer 2009 to the end of 2024 is collected. The data on CoCo bonds and issuances are sourced from Bloomberg. While daily Z-spread data is fetched from Refinitiv Eikon. Figure 7 shows the value of the CoCo bond issued globally, converted into EUR (€) at the rate at issue, by year.

[20] Institutions that are described as "Banking" by the Bloomberg Barclays Classification System (BCLASS Classification) in Blomberg. Institutions like insurance companies are excluded.

Figure 7: Global CoCo bond issuance (in billion EUR)



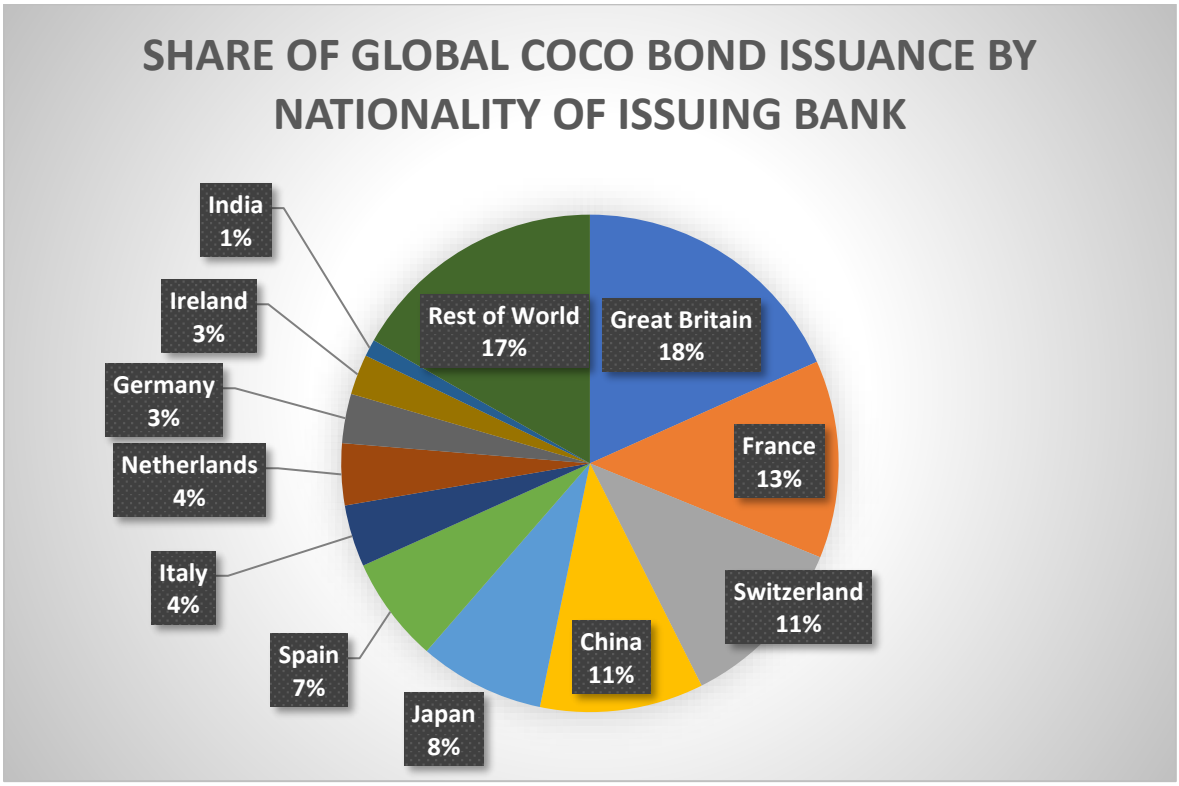
Source: Own work based on Bloomberg[21] (2025)

The issuance of CoCo bonds is largely influenced by how Basel III regulations are applied in different regions. As a result, the global distribution of issuers is primarily shaped by how various jurisdictions regulate these instruments. European banks are by far the most important issuers of CoCo bonds. However, in recent years banks in China are slowly catching up regarding annual issue volume. This trend reflects China's evolving regulatory framework and growing appetite for loss-absorbing capital instruments.

Only focusing on European banks for our later analysis represents a sensible sample choice, for the reason being that all European banks share similar relationships with their governments, whereas semi-state-owned banks in China might receive a significantly different treatment and government assurances. Such guarantees can be expected to change the market's perception of a bank's riskiness and consequently obscure meaningful inference. As seen in Figure 8, approximately 75% of CoCo bond issuance originates from European banks, while China and Japan together contribute another 20% of the global total.

[21] As of 09/03/2025

Figure 8: Share of global CoCo bond issuance by nationality of issuing bank



Source: Own work based on Bloomberg[22] (2025)

Banks in the United Kingdom have led the way, having issued €127.69 billion worth of CoCos until the end of 2024. This activity is largely driven by the requirement to meet the UK's loss-absorbing capital standards. Similarly, Swiss banks have issued a notable volume (€79.7 billion) of CoCos during the sample period. This is likely influenced by Switzerland's regulatory framework, which mandates that banks hold 9% of risk-weighted assets in instruments designed to absorb losses, meaning they are incentivised to issue more CoCo instruments. Finally, the implementation of the as the Capital Requirements Directive IV (CRD IV) in July 2013, which transposed Basel III into EU law, played a pivotal role in stimulating a new wave of CoCo issuances by EU banks. Among the member states, France emerged as the leading issuer, with a total issuance amounting to €89.71 billion up until the end of 2024 (Avdjiev et al., 2013).

Additionally, empirical evidence suggests that banks that maintain higher dividend payouts are more likely to issue CoCos, which in turn helps them maintain regulatory capital levels while avoiding potential government intervention. This relationship is especially pronounced in countries where regulatory oversight is more stringent. By issuing CoCos, these banks can strengthen their capital positions and continue paying dividends without facing restrictions from regulators (Shan et al., 2023).

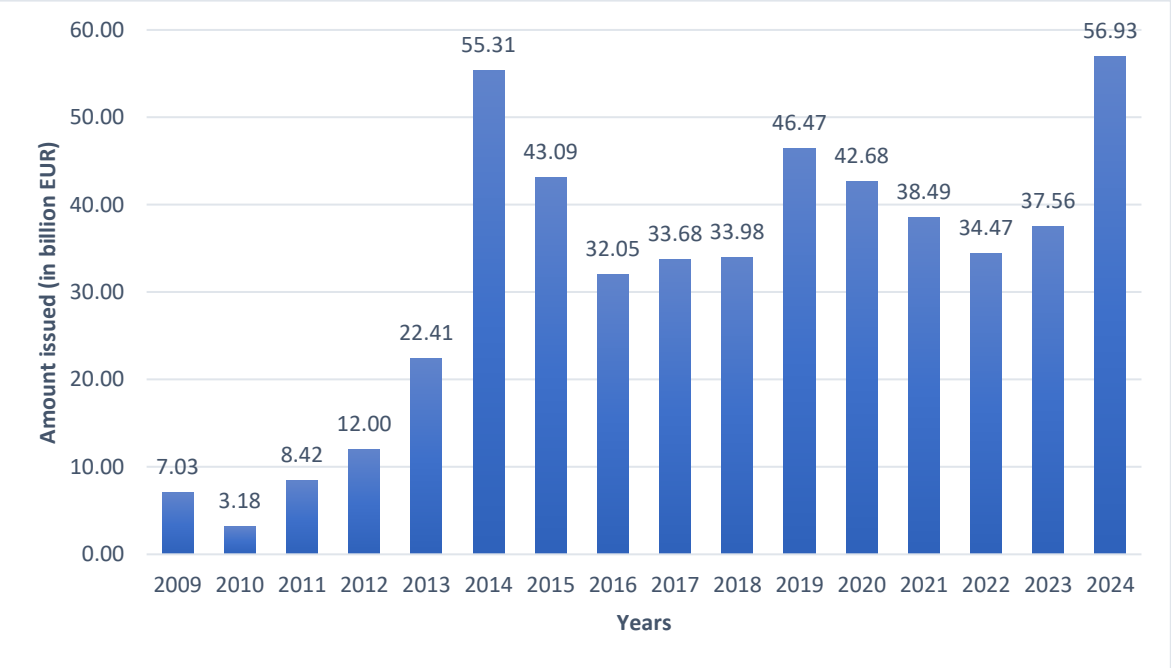
[22] As of 09/03/2025

4.2 European market overview

4.2.1 Historical growth and issues per year

CoCo bonds came into existence after the 2007/08 Global Financial Crisis. The first issuance was made by Lloyds Banking Group in November 2009, under the label Enhanced Capital Notes or ECNs. This inaugural issue amounted to £8.5 billion and was structured to convert into equity if the bank's core capital fell below a 5% threshold (Giri, 2021). In Figure 9 we can see the issue growth development over the years.

Figure 9: CoCo bond issuance in Europe (in billion EUR)[23]



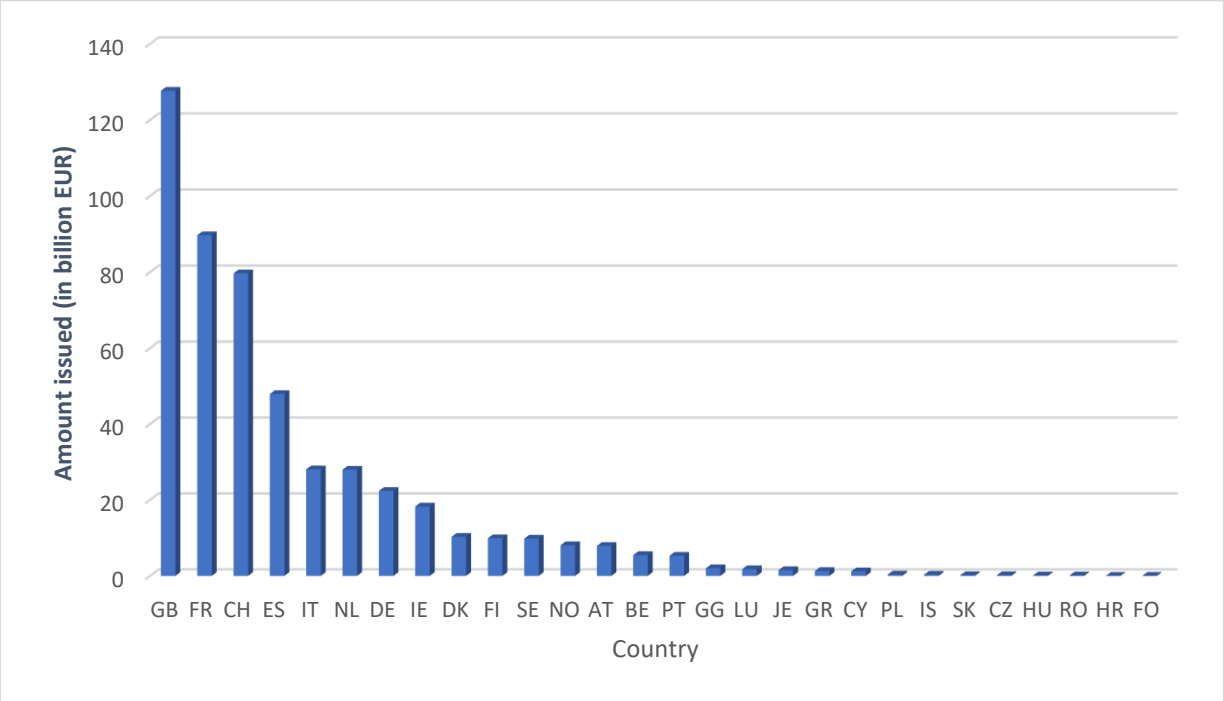
Source: Own work based on Bloomberg[24] *(2025)*

As can be observed in Figure 9, the first big year for CoCo issuances was 2014, this is when large European credit institutions became active in this market. Companies like Banco Bilbao Vizcaya Argentaria SA, Banco Santander SA, Credit Agricole SA, Deutsche Bank AG, HSBC Holdings PLC, and Société Générale SA all issued CoCo bonds for the first time in 2014.

In total, 243 European banks issued CoCo bonds with an aggregate value of €507.76 billion. Figure 10 shows the aggregate CoCo bond issuance value by country.

[23] Small side note here is to keep in mind that CoCo bonds must be perpetual in nature, as defined in Basel III, however they are still callable, that is why growth in Amount Outstanding is not linear according to new issues, but some CoCo bonds get and were called.
[24] As of 09/03/2025

Figure 10: Issuance Volume by European Country (in billion EUR)



Source: Own work based on Bloomberg[25] (2025)

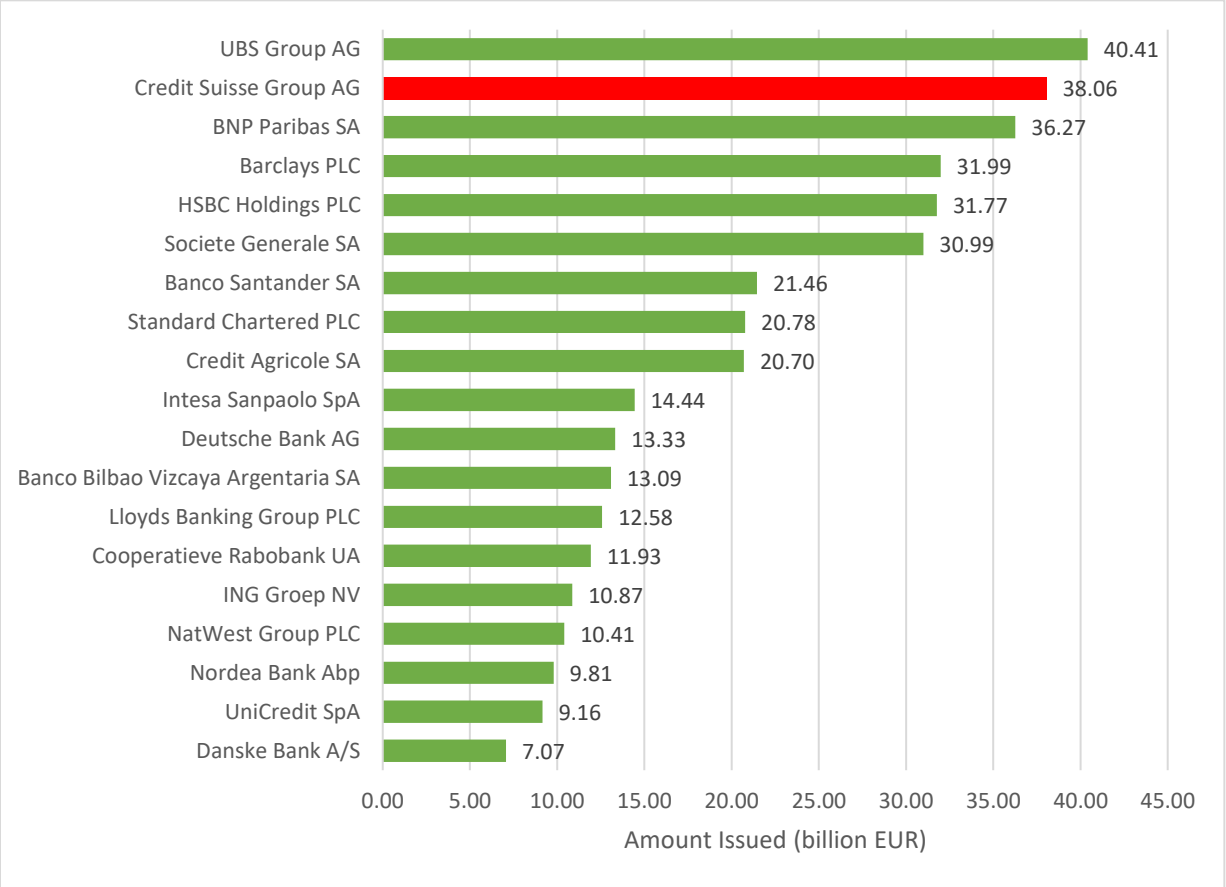
Great Britain is the largest issuer of CoCo bonds in Europe, representing 25% of the total issuance value. France follows with 18%, Switzerland with 16%, and Spain with 9%. Among countries with issuance shares exceeding 5%, both Italy and the Netherlands contribute 6% each. The issuing banks are typically large institutions that fall under the G-SIB classification by the Bank for International Settlements. Of the 15 European G-SIB banks[26], 14 have issued CoCo bonds, with Group BPCE being the only exception. These G-SIB banks are responsible for 71% of all CoCo bond issuances in Europe.

4.2.2 Largest issuers on the European AT1 market

As already mentioned, most of the bigger CoCo bonds issued in Europe are issued by G-SIBs. Figure 11 shows the top 20 CoCo bond issuers in Europe.

[25] As of 09/03/2025.
[26] Interactive BIS dashboard showing global G-SIBs https://www.bis.org/bcbs/gsib/index.htm.

Figure 11: Biggest CoCo Bond Issuers on European Market (in billion EUR)



Source: Own work based on Bloomberg[27] (2025)

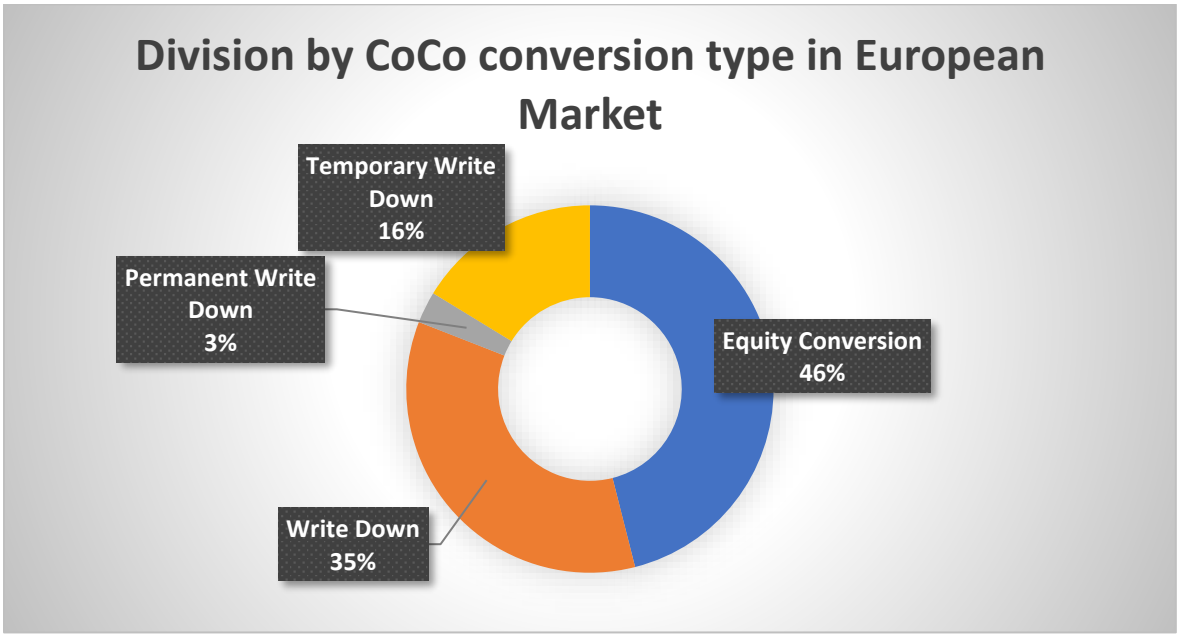
In first place by amount issued converted into EUR (€) at rate at issue are the UBS Group (€40.41 billion) and the late Credit Suisse Group (€38.06 billion). The two Swiss banks are followed by BNP Paribas (€36.27 billion), Barclays PLC (€31.99 billion), HSCB Holdings PLC (€31.77 billion) and Société Générale (€30.99 billion). These banks all issued over €30 billion worth of CoCo bonds over the reference period and could be placed into a group of their own, since the next issuers barely break the €20 billion mark.

4.2.3 Loss absorption mechanism

Broadly speaking, CoCo bonds can be categorized based on their loss absorption mechanism into two types: write down and equity converting. As seen in Figure 12, CoCos that are written down upon conversion constitute a slightly larger share of the market, accounting for approximately 54% of the market, compared to 46% represented by equity converting CoCos.

[27] As of 09/03/2025

Figure 12: Conversion type division in European market



Source: Own work based on Bloomberg[28] (2025)

In the case of temporary write-downs, investors may recover their investments once the bank regains financial stability. However, this recovery is contingent on the bank's survival. It is important to note that most write-down CoCos are simply labelled as "write-down" in financial databases such as Bloomberg and Reuters, without distinguishing between permanent and temporary write-down mechanisms.

The loss absorption mechanism, along with the trigger level, are the two primary factors influencing investor pricing and decision-making regarding CoCos. The yields on CoCos align with their subordinated position within the bank's capital structure. Consequently, CoCo bonds offer higher yields compared to senior debt instruments. Table 4 presents pricing data for different CoCo categories, segmented by trigger type and the method of absorbing losses when triggered.

Table 4: Weighted average of CoCo bond coupons

	All	Equity Conversion	Write Down
All	6.77	6.96	6.61
Low trigger[29]	6.74	6.91	6.68
High trigger	6.78	6.98	6.44

Source: Own work based on Bloomberg[30] (2025)

[28] As of 09/03/2025
[29] Mechanical trigger level less or equal to 5.125% CET1/RWA
[30] As of 09/03/2025

CoCo bonds with an equity conversion clause generally offer higher coupon rates than those subject to a write-down mechanism. At first glance, this appears counterintuitive, as equity conversion provides investors with residual value in the form of shares, whereas a write-down CoCo may result in a total loss. However, this discrepancy can likely be explained by investors perceiving equity-converting CoCos as riskier. In the event of a trigger event, these bonds convert into the equity of a distressed bank, which may be highly volatile and difficult to liquidate. In contrast, a significant portion of write-down CoCos are structured as temporary write-downs, allowing for the potential re-instatement of debt once financial stability is restored.

Furthermore, Table 4 also shows that CoCos with lower trigger levels tend to exhibit lower yields than high-trigger CoCos. This aligns with theoretical expectations, as high-trigger CoCos convert earlier in times of financial distress, increasing the likelihood of investor losses. However, one pricing anomaly stands out: high-trigger write-down CoCos appear to be the cheapest to issue. A plausible explanation for this trend is that most low-trigger write-down bonds have been issued more recently, reflecting the growing prevalence of CoCos issued at the 5.125% CET1 to RWA threshold. Consequently, the high-trigger write-down sample could primarily consist of older issuances, potentially distorting the observed pricing patterns.

4.2.4 European CoCo bonds classified under Basel III

It is important to note that most European CoCo bonds qualify as AT1 capital. In fact, approximately 90% of the total issuance consists of AT capital CoCo bonds, the rest is from CoCos that qualify as Tier 2 capital, which make up about 5 %, and older CoCo bond equivalents issued under Basel II. Furthermore, most Tier 2 CoCos and Basel II-era CoCos exhibit data inconsistencies. For these reasons, the subsequent difference-in-differences analysis, Tier 2 and Basel II CoCo bonds are excluded from the CoCo treatment group, as they represent a small and statistically insignificant segment of the market and introduce unnecessary noise into the analysis.

5 EMPIRICAL STUDY

This chapter contains empirical analyses aimed at validating or refuting the initial hypothesis and addressing the research question. For consistency, the subsequent empirical analysis is limited to CoCo bonds issued in Europe and denominated in EUR (€).

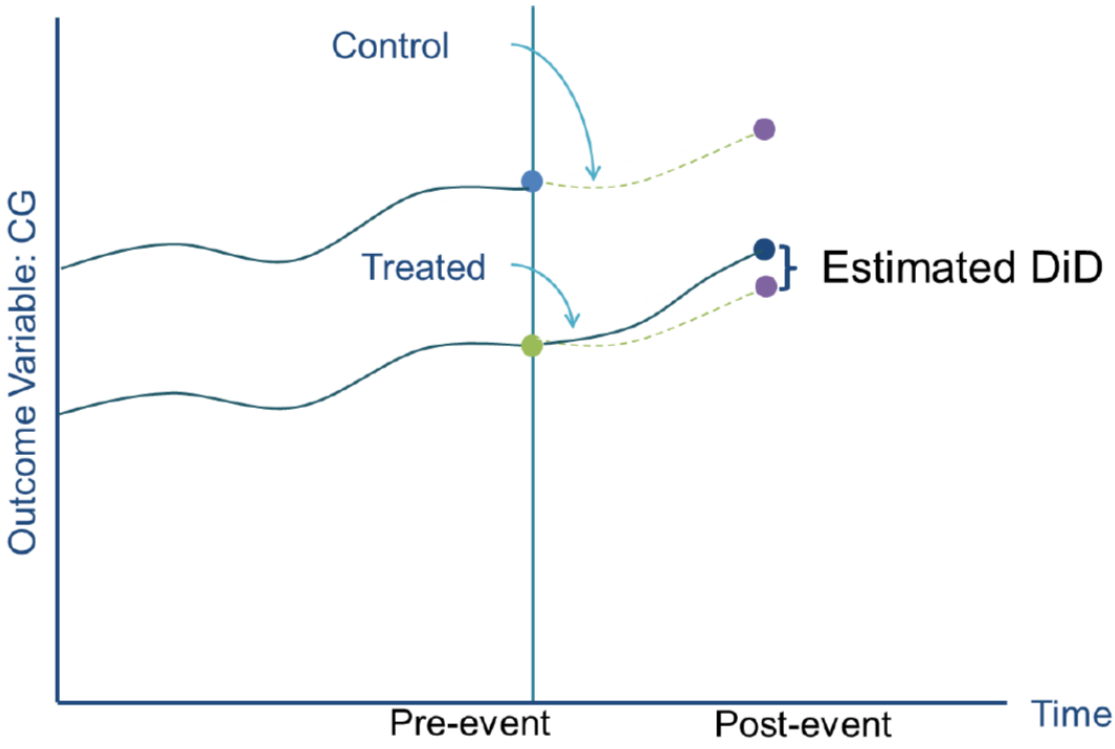
5.1 Methodology

The Difference-in-Differences, or DiD method, is a statistical analysis methodology that is used in empirical research to examine the possibly causal effects of certain treatments and events. Two different groups are considered here, with the first group being exposed to the

influence of an external factor and the second group remaining largely unaffected by this influence. Therefore, the first group is called the treatment group, and the second group is called the control group.

Before treatment, the initial values of the two groups can differ. As long as this difference remains constant over time, it can be differentiated. This is done by subtracting the group averages from each other. The remaining difference between the group mean values in the second stage shows the possible causal effect of the treatment. The main assumption of the DiD methodology is that the trends of the two groups would have been parallel without the external influencing factor. This is illustrated by the dashed green lines in the Figure 13, which run parallel to each other, representing the expected performance of the comparison and treatment groups over time. If the endpoint of the treatment group (blue line) is significantly above or below the expected endpoint of this group (dashed green line), the event or intervention can be said to have a causal effect (Armstrong et al., 2022).

Figure 13: Difference-in-differences



Source: Park et al. (2019)

Technically, the DiD analysis is just an ordinary least squares (OLS) regression estimated on panel data. There are various forms of DiD specifications, each suited to different empirical settings. The core idea in all cases is to leverage panel data to approximate an experimental setup in which units are assigned to treatment and control groups, while acknowledging that this assignment is not necessarily random in a strict sense. In our case, since all observations receive treatment simultaneously (i.e., the collapse of Credit Suisse),

we will use the "generalized DiD" design. The generalized DiD design is characterized by the fact that all observations in the treatment group receive the treatment at the same point in time, ensuring that the post-treatment period is identical for all observations. This design assumes that, in the absence of the treatment, the treatment and control groups would have followed parallel trends over time. Therefore, the difference in pre- and post-treatment outcomes between these groups can be attributed to the treatment itself. Additionally, the distinguishing property of the generalized DiD design is that it includes issuer fixed effects, which account for unobserved heterogeneity on the bank level. This regression can be expressed using the following formula (Armstrong et al., 2022):

$$y_{i,t} = \alpha_1 + \alpha_2 D_t + \beta_1 x_i + \beta_2 (D_t * x_i) + \text{Issuer}_i + \varepsilon_{i,t}. \quad (3)$$

$y_{i,t} =$ *dependent variable*

$\alpha_{1,2} =$ *regression constant*

$\beta_{1,2} =$ *regression parameters*

$D_t =$ *post dummy, which takes either the value of 0 or 1, depending on whether time t is before (D = 0) or after (D = 1) the treatment*

$x_i =$ *treatment dummy, which takes either the value of 0 or 1, depending on whether object i was not treated (D = 0) or was treated (D = 1).*

$Issuer_i$ *= variable, which controls for unobserved, time-invariant differences between banks*

$\varepsilon_{i,t} =$ *error term*

This design can be best explained by a two-by-two grid, as seen in Table 5, where each cell presents a conditional expectation of $y_{i,t}$:

Table 5: Classical Difference-in-differences

	$x_i = 0$ **Control**	$x_i = 1$ **Treatment**	**Difference**
$D_t = 0$ **Pre**	α_1	$\alpha_1 + \beta_1$	β_1
$D_t = 1$ **Post**	$\alpha_1 + \alpha_2$	$\alpha_1 + \alpha_2 + \beta_1 + \beta_2$	$\beta_1 + \beta_2$

Source: Armstrong et al. (2022)

This table shows that β_1 represents the difference in outcomes between the treatment and control groups before treatment. If the groups were randomly assigned, this difference would be zero on average. However, in practice, assignment is rarely random, and pre-treatment differences often exist (Armstrong et al., 2022).

To address these pre-existing differences, the pre-treatment period serves as a placebo to adjust for biases caused by non-random assignment. The key focus of the Difference-in-Differences design is not the baseline difference between groups (captured by x_i) but how this difference changes after treatment. This change is captured by the β_2 term, which gives the method its name: "difference-in-differences" (Armstrong et al., 2022).

The most important step after applying the DiD regression is the interpretation of the β_2 coefficient. If this coefficient has a statistically significant influence on the dependent variable and is different from zero, this suggests that the treatment has influenced the dependent variable (Armstrong et al., 2022).

5.2 Objective of the analysis and the description of the data

The objective of the DiD analysis is to test whether the collapse of Credit Suisse on March 19th, 2023, and the subsequent write down of its AT1 CoCo bonds had a measurable impact on AT1 CoCos issued by other European banks.

To investigate this, Z-spread data of all euro-denominated AT1 CoCos issued by European credit institutions was downloaded. The sample includes AT1 CoCos that were either outstanding or issued during the period from19th of March 2022 to the 19th of March 2024, thereby capturing a full year before and after the UBS takeover of Credit Suisse.

The analysis compares the treatment and control groups following the event to assess whether a significant divergence in spreads occurred, potentially signalling a market-wide repricing of risk. Specifically, both long-term effects (over the full two-year window) and short-term effects (within a three-month window around the event) are examined to evaluate shifts in investor sentiment toward AT1 CoCos.

The treatment group consists of euro-denominated AT1 CoCo bonds issued by European credit institutions. In contrast, the control group comprises Tier 2 capital bonds that closely resemble the AT1 CoCo bonds in terms of issuer, issuance volume, and maturity profile, differing only in capital structure and the absence of a CoCo feature. The dependent variable in the analysis are the daily Z-spreads of the selected securities.

To obtain a data set that is as free of random outliers as possible, various restrictions were imposed. The time until maturity (for Tier 2 bonds) or the time until the next possible call date (for AT1 CoCo bonds) must be at least 1 year. Bonds that are approaching maturity or have an upcoming call date within the next few months tend to experience significant increases in their spreads, leading to heightened volatility that is undesirable for this analysis. Therefore, Z-spreads of bonds which mature or have a call date in less than a year will not be retrieved or included in the study. The minimum issue volume of the respective bond was set at €200 million. This ensures that the bonds have a certain level of liquidity for a valid calculation of the Z-spread using daily prices.

To construct a control group for the DiD analysis, Tier 2 bonds from the same credit institutions that issued the AT1 CoCos were selected. For each AT1 bond, a corresponding Tier 2 bond was chosen such that the two securities differ in as few characteristics as possible. Ideally, the only distinctions between the two are their capital seniority and the presence of a CoCo mechanism in the AT1 security. Special attention was given to ensuring that the remaining maturity or time until the next call date was similar and that the issue volume did not vary significantly, thereby enhancing the validity of the treatment control comparison. Since some banks had multiple outstanding AT1 tranches but only a single Tier 2 bond issued in euros, or vice versa, these bonds were duplicated for later comparison.

The following three tables provide detailed descriptive statistics on the properties of the sampled CoCo bonds. Table 6 categorizes CoCo bonds by their conversion features, Table 7 by their trigger levels and Table 8 by their coupon rates. The 77 CoCo bonds issued have different conversion features: 57 CoCo bond issuances involve a temporary write-down, 14 have an equity conversion, 4 a permanent write down feature, and 1 has a partial permanent write down, with an additional one having none specified. The temporary write down allows the bank to fully or partially write down the principal of the CoCo bond when the trigger is breached. However, unlike the permanent write-down CoCo bonds, the amount temporarily written down can be reinstated if the bank's capital ratio recovers above the trigger threshold. The equity conversion feature refers to CoCo bonds that are converted into equity at a pre-defined price and resulting number of shares when the trigger level is breached. This mechanism effectively dilutes existing shareholders and recapitalizes the bank by transforming debt into equity.

Table 6: CoCo bonds by conversion features

Category	Observations (n)	Avg. Issued (€)	Freq (%)
Equity Conversion	14	850,000,000.00	18.18
Non-Specified	1	600,000,000.00	1.30
Partial Permanent Write Down	1	1,000,000,000.00	1.30
Permanent Write Down	4	400,000,000.00	5.19
Temporary Write Down	57	765,263,157.90	74.03

Source: Own work based on Bloomberg[31] (2025)

CoCo bonds also vary in terms of their trigger level, as shown in Table 7. We define low-trigger CoCo bonds as those for which conversion is activated below or equal the CET1/RWA ratio of 5.125%. This condition is fulfilled for 66 of the 77 CoCo bond

[31] As of 09/03/2025

issuances, which signals the trend that issuers mostly set low triggers. However, CoCo bonds can also be triggered by the regulators before the accounting trigger is reached, a case referred to as a discretionary or "point of non-viability" trigger. Most of the CoCo bonds in the dataset feature such additional regulatory triggers.

Table 7: CoCo bonds by conversion trigger levels

Category	Observations (n)	Avg. Issued (€)	Freq (%)
High Trigger[32]	11	654,545,454.55	14.29
Low Trigger	66	780,606,060.61	85.71

Source: Own work based on Bloomberg[33] *(2025)*

Finally, Table 8 distinguishes CoCo bonds by their coupon rate, where low coupon CoCos tend to have a higher amount issued, compared to high coupon CoCo bonds.

Table 8: CoCo bonds by coupon levels

Category	Observations (n)	Avg. Issued (€)	Freq (%)
High Coupon[34]	33	676,363,636.36	42.86
Low Coupon	44	827,272,727.27	57.14

Source: Own work based on Bloomberg[35] *(2025)*

Table 9 presents the distribution of CoCo bonds by trigger level and then provides the frequency of their respective conversion mechanisms. Approximately three-fourths of the CoCo bonds in both trigger-level categories are structured with a temporary write-down feature. However, notable differences emerge in the second and third most common conversion types across the two groups. Among high-trigger CoCos, the second most frequent structure is a permanent write-down (accounting for 18.18%), followed by equity conversion (9.09%). In contrast, for low-trigger CoCos, the second most common feature is equity conversion, present in 19.70% of cases.

Additionally, each of the non-specified and partial permanent write-down categories is represented by a single CoCo bond in the sample.

[32] High trigger is defined as more than 5.125% CET1/RWA
[33] As of 09/03/2025
[34] High coupon is defined as more than 5.5%
[35] As of 09/03/2025

Table 9: Frequency of CoCo bond design

Category	Equity Conversion	Non-Specified	Partial Permanent Write Down	Permanent Write Down	Temporary Write Down
High Trigger	9.09%	0.00%	0.00%	18.18%	72.73%
Low Trigger	19.70%	1.52%	1.52%	3.03%	74.24%

Source: Own work based on Bloomberg[36] (2025)

The dataset used in this analysis comprises 77 unique Additional Tier 1 CoCo bonds and 81 Tier 2 capital bonds, observed over a total for 522 trading days (260 trading days before and 262 trading days after the Credit Suisse event). The event occurred on Sunday 19.03.2023, placing the starting point of the pre-event window on Monday, March 21, 2022, as Saturday, March 19, 2022, was a non-trading day. Accordingly, the post-event period concludes on Tuesday, March 19, 2024, exactly one calendar year after the event. Table 10 present descriptive statistics for the bonds in the sample across this two-year window.

Table 10: Descriptive statistics of group averages

Category	Mean	Std. Dev	Median	Min	Max	Skew	Kurtosis	SE
AT1	757.05	405.92	653.32	211.49	3871.02	3.14	14.50	2.27
Tier 2	317.16	125.41	299.77	114.51	584.83	0.33	-0.81	5.50

Source: Own work based on Bloomberg[37] (2025)

The average Z-spread values are closely aligned with the corresponding median values, particularly for Tier 2 bonds, indicating relatively symmetric distributions. As expected, both the minimum and maximum Z-spread values, as well as the overall range, are significantly greater for AT1 CoCo bonds than for Tier 2 bonds, reflecting the higher risk and volatility typically associated with AT1 instruments. The kurtosis value of 14.50 for AT1 bonds indicates a distribution with heavy tails and a pronounced peak, suggesting the presence of extreme outliers. This implies that Z-spreads for AT1 bonds during the observed period exhibited significant volatility. In contrast, the negative kurtosis of –0.81 for Tier 2 bonds reflects a flatter distribution with lighter tails, indicating fewer extreme values and a more homogeneous risk profile. Both groups exhibit positive skewness, although to differing degrees. AT1 bonds display a pronounced right skew of 3.14, meaning most Z-spread values are concentrated at the lower end of the distribution, with a long right tail representing a smaller number of high-spread observations. This suggests a lot of low values and a few

[36] As of 09/03/2025
[37] As of 09/03/2025

extreme high values on the right. This further supports the presence of infrequent but substantial spread increases. Tier 2 bonds, by contrast, show a mild positive skew of 0.33, suggesting a near-normal distribution with only slight asymmetry.

The list of all CoCo and Tier 2 bonds included in the final analysis is provided in the Annex. As previously discussed, these selected bonds form the basis for the subsequent difference-in-differences analyses, which aim to test the hypothesis that a repricing of risk occurred in the European AT1 market following the collapse of Credit Suisse.

5.3 Results

The previous chapter provided an overview of the complete dataset, segmented into two categories: AT1 CoCo bonds and Tier 2 capital bonds. To properly assess whether Credit Suisse's rescue influenced a repricing of risk in the European AT1 CoCo market, the data was further divided into pre-event and post-event periods. This segmentation results in four analytical groups: AT1–before, AT1–after, Tier 2–before, and Tier 2–after, forming the basis for the difference-in-differences framework presented in Table 11:

Table 11: Basic Difference-in-differences table

	Before CS event	After CS event	Difference (after-before)
AT1 (treatment group)	A	B	B – A
Tier 2 (control group)	C	D	D – C
Difference (treatment – control)	A – C	B – C	**DiD = (B – A) – (D – C)**

Source: Nguyen et al. (2023)

Z-spread data for the selected securities was structured accordingly, and visualizations of the daily Z-spread movements used in the analysis are shown below; the majority of the remaining charts can be found in Annex 3.

5.3.1 Long term window (1 year)

We begin with the Difference-in-Differences analysis of the long-term window, covering one year before and after the Credit Suisse event. Table 12 reports the regression results, first without and then with issuer fixed effects, to test the robustness of the findings. The coefficient of primary interest is the DiD interaction term (did_interaction), which captures the difference in outcomes between the treatment and control groups after the event.

The did_interaction coefficient is statistically significant, with a t-value of 25.801, indicating that the interaction between the post-event period and the treatment group had a significant impact on the Z-spreads. This result supports the hypothesis that the collapse of Credit Suisse

led to a repricing of risk in the AT1 market, particularly when compared to the control group of Tier 2 bonds.

Table 12: DiD analysis (1 year before and 1 year after event)

Variables	**z_spread (1)**	**z_spread (2)**
intercept	307.5048*** (146.426)	404.7899*** (45.739)
post_event	-58.9818*** (-20.203)	-49.3520*** (-20.842)
treatment	419.1809*** (129.687)	410.6329*** (152.924)
did_interaction	113.5846*** (25.801)	114.2004*** (32.196)
Observations	72000	70427
R-Squared	0.403	0.631
Issuer fixed effects	No	Yes
Durbin-Watson	1.822	1.668
Skew	3.732	2.769
Kurtosis	28.111	24.648
Cond. No.	6.80	113.0
Pre-event average Z-Spread (AT1):	726.69 bps	726.69 bps
Post-event average Z-Spread (AT1):	781.29 bps	781.29 bps
Pre-event average Z-Spread (Tier 2):	307.50 bps	299.36 bps
Post-event average Z-Spread (Tier 2):	248.52 bps	240.51 bps

Source: Own work based on Bloomberg[38] (2025)

The R-squared value of 0.403 indicates that about 40.3% of the variation in the dependent variable (z_spread) is explained by the model. While not exceptionally high, this is relatively typical for financial models, where external factors, not captured in the model, may still influence bond spreads.

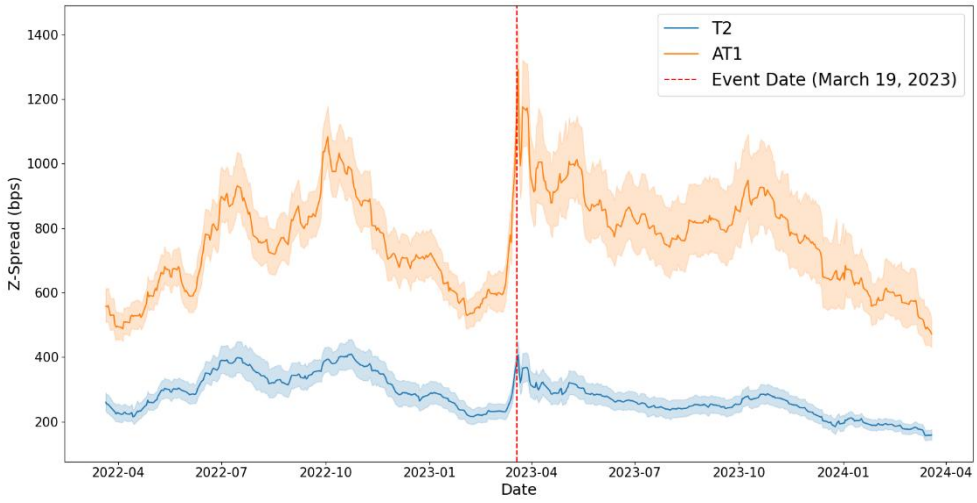
The Durbin-Watson statistic of 1.822 suggests that there is no significant autocorrelation in the residuals, which is a positive outcome indicating that the model's errors are not systematically correlated.

The post_event coefficient of -58.9818 indicates that, within the control group (Tier 2 bonds), Z-spreads decreased in the post-event period relative to the pre-event period. This suggests a reduction in perceived risk or uncertainty in the market for Tier 2 bonds following the Credit Suisse event, which can be due to the long period of 1 year after the event taken into account. In contrast, the treatment coefficient of 419.1809 shows that AT1 bonds had significantly higher Z-spreads than Tier 2 bonds even before the event, consistent with their subordinated position and higher risk profile, confirming that the treatment group had higher risk premiums before the Credit Suisse event.

[38] As of 09/03/2025

The table also shows the pre-event and post-event average Z-spreads for both AT1 and Tier 2 bonds: pre-event average Z-Spread (AT1): 726.69 bps, post-event average Z-Spread (AT1): 781.29 bps, showing a market increase in the risk premium for AT1 bonds following the event. Pre-event Z-Spread (Tier 2) is 307.50 bps, while the Post-event Z-Spread (Tier 2) increased to 248.52 bps, indicating a slight downward shift in the risk premium for Tier 2 bonds, which can be clearly observed in Figure 14. This drop suggests that after the Credit Suisse collapse, market participants perceived a lower level of risk or volatility for these instruments, potentially due to the stabilizing effect of regulatory interventions.

Figure 14: Daily Z-Spread for AT1 and T2 Bonds (Long term)



Source: Own work based on Bloomberg[39] (2025)

The second regression model, which includes fixed effects, yields similar results, confirming the robustness of the analysis. While the model shows significant results, the liquidity issues in the CoCo market and the non-standardized contracts among different issuers can complicate the interpretation of Z-spread movements. The lack of market liquidity, particularly in volatile periods, can lead to more extreme price movements, which may not necessarily reflect the underlying financial health of the issuers.

5.3.2 Short term (i.e. 3 month) window

To further explore the analysis, we now examine a shorter time frame of three months before and after the event. Specifically, we include securities from 1.1.2023 to 31.5.2023, covering approximately 50 trading days before and 50 trading days after the collapse. This narrower window is more appropriate given the low liquidity in the market, where inaccurate or missing Z-spread values were more common. The results for this period are presented in Table 13.

[39] As of 09/03/2025

As shown in the analysis, the did_interaction variable is even more statistically significant, with a t-value of 30.692. This reflects a stronger statistical significance effect compared to the longer two-year window, suggesting that the Credit Suisse event may have had a more pronounced immediate impact on the treatment group during this shorter timeframe.

Table 13: DiD analysis (3 months before and 3 months after event)

Variables	**z_spread (1)**	**z_spread (2)**
intercept	249.2094*** (60.076)	446.2742*** (22.466)
post_event	60.728*** (10.2)	63.4783*** (14.021)
treatment	378.7838*** (59.931)	379.4170*** (77.059)
did_interaction	277.1799*** (30.692)	279.5936*** (41.129)
Observations	15117	14788
R-Squared	0.509	0.732
Issuer fixed effects	No	Yes
Durbin-Watson	1.955	1.852
Skew	3.425	2.912
Kurtosis	26.622	26.529
Cond. No.	6.47	96.1
Pre-event average Z-Spread (AT1):	627.99 bps	627.99 bps
Post-event average Z-Spread (AT1):	965.90 bps	965.90 bps
Pre-event average Z-Spread (Tier 2):	249.21 bps	241.31 bps
Post-event average Z-Spread (Tier 2):	309.94bps	299.63 bps

Source: Own work based on Bloomberg[40] (2025)

The R-squared value rises to 0.509, indicating that the model explains approximately 50.9% of the variation in the Z-spread, which is a higher explanatory power compared to the longer two-year window (0.403). This implies that a shorter time frame may capture more relevant and accurate data, especially in periods of high market volatility.

The post_event coefficient is 60.7280, suggesting a moderate increase the Z-spread for the Tier 2 bond group after the event. This contrasts with the negative coefficient (-58.9818) observed in the one-year window, indicating a more immediate market reaction to the event within this shorter time frame. The treatment coefficient of 378.7838, implies that, prior to the event, the treatment group exhibited Z-spreads roughly 378.8 basis points higher than the control group.

Pre-event Z-Spread (AT1) is reported at 627.99 bps and post-event Z-Spread (AT1) is 965.90 bps, showing a sharp market increase in the risk premium for AT1 CoCos following the event. This sharp increase is notably larger compared to the slight increase observed in the

[40] As of 09/03/2025

2-year window, suggesting that the market's perception of risk was heightened in the immediate aftermath of the Credit Suisse event. Pre-event Z-Spread (Tier 2) is 249.21 bps, while the Post-event Z-Spread (Tier 2) increased to 309.94 bps, indicating a similar upward shift in the risk premium for Tier 2 bonds.

5.3.3 DiD analysis of AT1 bonds grouped based on their conversion type

To further enhance the comprehensiveness of the analysis, I conduct a Difference-in-differences analysis of AT1 bonds based on their conversion type, distinguishing between either write-down or equity conversion structures. This approach allows for an assessment of whether the repricing of risk in the market was specific to the write-down CoCos, since the Credit Suisse AT1 capital bonds had that type of conversion, or if both types of CoCos were affected. Again, there will be 2 regressions in each analysis, one without controlling for issuer specific fixed effects, and the other regression with controlling for them.

5.3.3.1 Equity Conversion AT1 CoCos with a 1 year before and after window

Table 14 presents the results of running the DiD analysis when the treatment group is only made of equity conversion CoCos.

Table 14: DiD analysis of Equity Conversion AT1 CoCos (Long term)

Variables	**z_spread (1)**	**z_spread (2)**
intercept	307.5048*** (257.626)	484.1696*** (92.496)
post_event	-58.9818*** (-35.546)	-55.0464*** (-45.212)
treatment	399.3521*** (109.662)	477.6134*** (157.810)
did_interaction	82.5566*** (17.291)	79.6632*** (23.052)
Observations	45828	44255
R-Squared	0.446	0.728
Issuer fixed effects	No	Yes
Durbin-Watson	1.749	1.400
Skew	1.304	0.990
Kurtosis	5.910	8.581
Pre-event average Z-Spread (AT1-Equity Conversion):	706.86 bps	706.86 bps
Post-event average Z-Spread (AT1-Equity Conversion):	730.43 bps	730.43 bps
Pre-event average Z-Spread (Tier 2):	307.50 bps	299.36 bps
Post-event average Z-Spread (Tier 2):	248.52 bps	240.51 bps

Source: Own work based on Bloomberg[41] (2025)

[41] As of 09/03/2025

The did_interaction variable is statistically significant, with a t-value of 17.291, indicating that equity conversion AT1 CoCos were significantly affected by the Credit Suisse event, consistent with the findings from the broader sample analyses. The coefficient of -58.9818 for the post_event variable again suggests that the Tier 2 bond market saw a decrease in Z-spread after the Credit Suisse collapse, likely influenced by the longer observation period. The treatment coefficient of 399.3521 for equity conversion CoCos suggests that this group's risk premium was higher by 399.35 basis compared to Tier 2 bonds before the event.

Pre-event Z-Spread (AT1) is reported at 706.86 bps and Post-event Z-Spread (AT1) at 730.43 bps, showing a modest increase in the Z-spread for equity conversion CoCos. Pre-event Z-Spread (Tier 2) is 307.59 bps, and the Post-event Z-Spread (Tier 2) is 248.52 bps, showing a smaller change compared to the AT1 Z-Spread.

5.3.3.2 Write down AT1 CoCos with a 1 year before and after window

Similarly, as seen in Table 15, which shows the DiD analysis results for treatment group of only write down CoCos, the did_interaction variable is statistically significant (t = 29.047).

Table 15: DiD analysis of Write Down AT1 CoCos (Long term)

Variables	**z_spread (1)**	**z_spread (2)**
intercept	307.5048*** (147.538)	405.3715*** (46.340)
post_event	-58.9818*** (-20.356)	-49.6969*** (-21.242)
treatment	404.6898*** (118.7)	389.4715*** (135.598)
did_interaction	135.1386*** (29.047)	133.9339*** (35.930)
Observations	65784	64211
R-Squared	0.396	0.631
Issuer fixed effects	No	Yes
Durbin-Watson	1.843	1.721
Skew	3.964	3.018
Kurtosis	30.586	27.542
Pre-event average Z-Spread (AT1-Write down):	712.19 bps	712.19 bps
Post-event average Z-Spread (AT1-Write down):	788.35 bps	788.35 bps
Pre-event average Z-Spread (Tier 2):	307.50 bps	299.36 bps
Post-event average Z-Spread (Tier 2):	248.52 bps	240.51 bps

Source: Own work based on Bloomberg[42] (2025)

This t-value is noticeably higher compared to the equity conversion CoCos (8.5566 in Table 14). This suggests that the market may have responded more significantly to the Write Down

[42] As of 09/03/2025

CoCos, reflecting perhaps a higher perceived risk or volatility in this category of bonds post-event.

5.3.3.3 Equity Conversion AT1 CoCos with a 3 month before and after window

Table 16 shows the same DiD analysis, but now for equity conversion AT1 CoCos with a 3 month before and after timeframe. The did_interaction variable is again statistically significant with a t-value of 24.163. This confirms that the Equity Conversion AT1 CoCos group experienced a significant re-pricing of risk in the market even in the short term. The higher t-value (compared to previous models with a 1-year window) further suggests that the market responded strongly and with precision in the short term to the Credit Suisse event.

Table 16: DiD analysis of Equity Conversion AT1 CoCos (Short term)

Variables	**z_spread (1)**	**z_spread (2)**
intercept	249.2094*** (100.965)	446.2493*** (44.396)
post_event	60.728*** (17.143)	63.5289*** (27.731)
treatment	353.0602*** (48.409)	437.4979*** (78.418)
did_interaction	245.6691*** (24.163)	242.0317*** (37.349)
Observations	9732	9403
R-Squared	0.515	0.814
Issuer fixed effects	No	Yes
Durbin-Watson	1.947	1.701
Skew	1.085	1.206
Kurtosis	4.964	10.489
Pre-event average Z-Spread (AT1-Equity conversion):	602.27 bps	602.27 bps
Post-event average Z-Spread (AT1-Equity conversion):	908.67 bps	908.67 bps
Pre-event average Z-Spread (Tier 2):	249.21 bps	241.31 bps
Post-event average Z-Spread (Tier 2):	309.94 bps	299.63 bps

Source: Own work based on Bloomberg[43] (2025)

5.3.3.4 Write down AT1 CoCos with a 3 month before and after window

Similarly to the 3-month equity conversion results, the DiD analysis of the write down CoCos in Table 17 over the same time period yield similar results. The did_interaction variable is statistically significant with a t-value of 29.581. This shows that the re-pricing of risk for write down AT1 CoCos was significantly affected by the Credit Suisse event, confirming that this group experienced a statistically significant shift in market perceptions

[43] As of 09/03/2025

of risk in the short term, similar to the results observed for equity conversion CoCos in the 3-month window.

Table 17: DiD analysis of Write Down AT1 CoCos (Short term)

Variables	**z_spread (1)**	**z_spread (2)**
intercept	249.2094*** (60.551)	446.2142*** (22.514)
post_event	60.728*** (10.281)	63.6006*** (14.080)
treatment	372.7575*** (55.888)	368.9386*** (78.418)
did_interaction	282.8196*** (29.581)	284.7796*** (39.396)
Observations	13827	13498
R-Squared	0.496	0.723
Issuer fixed effects	No	Yes
Durbin-Watson	1.974	1.869
Skew	3.732	3.134
Kurtosis	29.611	29.021
Pre-event average Z-Spread (AT1-Write down):	621.97 bps	621.97 bps
Post-event average Z-Spread (AT1-Write down):	965.51 bps	965.51 bps
Pre-event average Z-Spread (Tier 2):	249.21 bps	241.31 bps
Post-event average Z-Spread (Tier 2):	309.94 bps	299.63 bps

Source: Own work based on Bloomberg[44] (2025)

5.3.4 DiD AT1 write down (treatment) and AT1 equity conversion (control)

To fully comprehend the impact of the Credit Suisse collapse on the European AT1 bond market, an additional DiD analysis is conducted, with write-down (WD) AT1 CoCos as the treatment group and equity conversion (EC) AT1 CoCos as the control group. Since Credit Suisse CoCos were WD, this analysis might give additional insight whether write down CoCos were more impacted compared to EC ones. This distinction will provide insight into whether the market response varied between WD and EC CoCos. The study's conclusion will either confirm or refuse the hypothesis, offering deeper insights on the topic. To test robustness of our results, we will again have 2 regressions in each DiD, one that does not account for issuer fixed effects and one that does.

5.3.4.1 Long term window (1 year)

Table 18 shows results of the DiD analysis where WD AT1 CoCos are the treatment group and EC AT1 CoCos are the control group over the long term horizon of the event.

[44] As of 09/03/2025

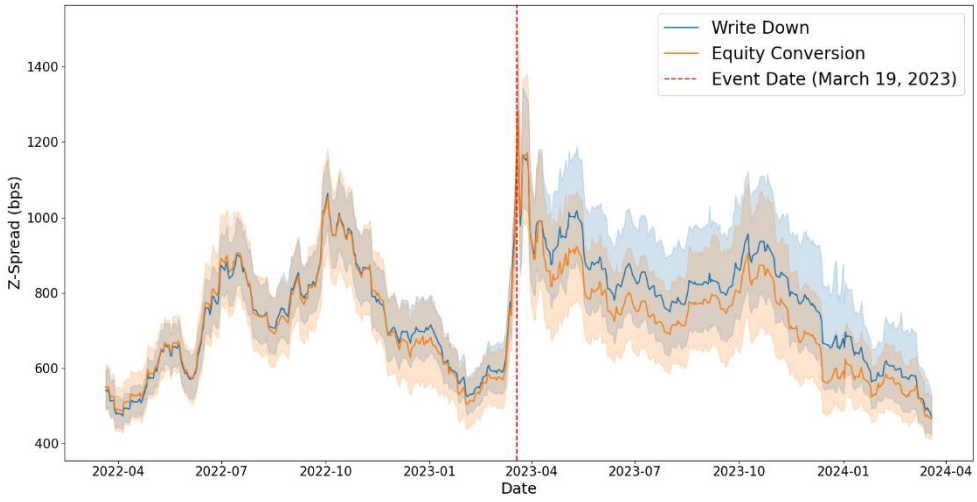
Table 18: DiD analysis of AT1 CoCos, WD as treatment and EC as control (Long term)

Variables	**z_spread (1)**	**z_spread (2)**
intercept	706.8568*** (85.840)	1.647e+13 (0.531)
post_event	23.5748** (2.200)	77.1844*** (10.419)
treatment	5.3377 (0.591)	-1.647e+13 (-0.531)
did_interaction	52.5820*** (4.449)	29.2785*** (3.595)
Observations	31344	31344
R-Squared	0.009	0.563
Issuer fixed effects	No	Yes
Durbin-Watson	1.778	1.521
Pre-event average Z-Spread (Write Down):	712.19 bps	712.19 bps
Post-event average Z-Spread (Write Down):	788.35 bps	788.35 bps
Pre-event average Z-Spread (Equity Conversion):	706.86 bps	706.86 bps
Post-event average Z-Spread (Equity Conversion):	730.43 bps	730.43 bps

Source: Own work based on Bloomberg[45] (2025)

The treatment coefficient of 3.5377 is not statistically significant, indicating that there is no significant difference in the z_spread between the treatment group and the control group before the Credit Suisse event, which makes sense, since both bonds are AT1 and should not have different Z-spreads before treatment has been administered.

Figure 15: Daily Z-Spread for AT1 WD and AT1 EC CoCos (Long term)



Source: Own work based on Bloomberg[46] (2025)

Furthermore, the did_interaction coefficient of 52.5820 is statistically significant. This suggests that the Credit Suisse collapse had a larger positive impact on write-down CoCos

[45] As of 09/03/2025
[46] As of 09/03/2025

compared to equity conversion CoCos, as indicated by the more substantial change in the z_spread for the treatment group, seen in Figure 15.

5.3.4.2 Short term (i.e. 3 month) window

In Table 19 we can see DiD analysis results where WD AT1 CoCos are the treatment group and EC AT1 CoCos are the control group over the short term horizon of the event.

Table 19: DiD analysis of AT1 CoCos, WD as treatment and EC as control (Short term)

Variables	**z_spread (1)**	**z_spread (2)**
intercept	602.2696*** (38.442)	6.635e+13 (0.244)
post_event	306.3972*** (14.084)	328.6662*** (23.754)
treatment	19.6973 (1.143)	-6.635e+13 (-0.244)
did_interaction	37.1505 (1.544)	19.4205 (1.272)
Observations	6459	6459
R-Squared	0.170	0.676
Issuer fixed effects	No	Yes
Durbin-Watson	1.902	1.716
Pre-event average Z-Spread (Write Down):	621.97 bps	621.97 bps
Post-event average Z-Spread (Write Down):	965.51 bps	965.51 bps
Pre-event average Z-Spread (Equity Conversion):	602.27 bps	602.27 bps
Post-event average Z-Spread (Equity Conversion):	908.67 bps	908.67 bps

Source: Own work based on Bloomberg[47] (2025)

Here we can see the main difference when comparing to the 1-year time horizon lies in the did_interaction coefficient which has a value of 37.1505 and is not statistically significant, indicating that the difference in the effect of the Credit Suisse event between the two groups is not large enough to be statistically significant at the 5% level. This suggests that, within the 3-month period, the Credit Suisse collapse may not have had a substantially different impact on the treatment group compared to the control group.

6 CONCLUSION

This thesis set out to explore the impact of the 2023 collapse of Credit Suisse on the European Contingent Convertible bond market, specifically focusing on the Additional Tier 1 bonds, and to evaluate whether such events influence the broader European AT1 bond market. The initial research question was aimed to examine the controversial decision by the Swiss Financial Market Supervisory Authority to write down $17 billion in AT1 CoCos,

[47] As of 09/03/2025

while allowing Credit Suisse's equity holders to retain value in the form of $3 billion in equity. The findings of this thesis indicate that this decision can be traced to a specific feature of the CoCo bonds: the discretionary Point of Non-Viability (PONV) trigger. Under Basel III, CoCos are designed to absorb losses first in times of distress, with the aim of preventing taxpayer-funded bailouts. Swiss regulators opted to prioritize the protection of systemic stability, which led to the controversial decision to favour equity holders over bondholders. This action was based on the broader context of the Credit Suisse collapse, where concerns about the bank's solvency and systemic risk outweighed the usual hierarchy of claims between bondholders and equity holders.

The analysis of Credit Suisse's specific CoCo terms, including the PONV trigger and its hybrid nature, confirms that while the action by FINMA was legally justified within the framework of Swiss banking laws, it diverged from common practice observed in other European banking crises, where bondholders are typically given priority over equity holders.

This action has led to significant legal and financial controversy, with ongoing lawsuits filed by investors seeking compensation for their losses. These legal battles highlight the complex nature of CoCo bonds and the challenges regulators face when implementing these instruments during financial distress. As of now, the case is still open, and its outcome could set a precedent for future regulatory decisions concerning the treatment of CoCo bonds in distress situations. Therefore, the answer to this research question is that the regulatory decision was driven by exceptional circumstances, and the case remains unresolved as the lawsuits continue to unfold.

The second research question was addressed through an in-depth empirical analysis using a difference-in-differences approach. The study compared AT1 bonds with Tier 2 bonds as a control group and examined Z-spread differences across both a long-term window (1 year before and after) and a short-term window (3 months before and after). The findings showed a repricing of risk following the Credit Suisse event, with AT1 bonds experiencing significantly wider Z-spreads relative to Tier 2 bonds, indicating heightened risk perception. Importantly, this effect persisted over both time horizons, suggesting that the market impact was not just a temporary shock but reflected a deeper reassessment of AT1 bond risk.

The analysis was further refined by separating AT1 bonds into two groups based on their loss-absorption mechanisms: equity-converting CoCos and principal write-down CoCos. Results showed that write-down bonds, like those issued by Credit Suisse, were more severely impacted than equity-converting ones when looking at a longer time frame of 1 year, while a shorter time frame of 3 months after the event does not show significance. This suggests that investors view write-down structures as riskier, likely due to the finality and irreversibility of losses, as opposed to conversions which may at least offer partial recovery through equity. The Credit Suisse case, which involved full write-down instruments, served as a trigger for repricing similar structures across the market.

This research sheds light on the complexities of CoCo bonds and their role in managing bank capital during times of financial distress. The case of Credit Suisse highlights both the potential advantages and the risks associated with these instruments. CoCos are designed to act as a shock absorber during crises, ensuring that financial institutions can stabilize without relying on taxpayer-funded bailouts. However, the Credit Suisse crisis demonstrated the challenges regulators face when applying CoCos in practice, particularly in cases where the bonds are written down at the expense of bondholders while equity holders are protected.

From a regulatory perspective, this research highlights three key lessons. First, clarity and consistency in regulatory decision-making are crucial. The Credit Suisse crisis highlighted the need for a clear and predictable framework for how CoCo bonds should be handled during times of financial distress. This would help avoid confusion in the market and reduce the risk of legal challenges from bondholders who may feel unfairly treated. Secondly, transparency and communication about the terms and triggers of CoCo bonds are essential. The lack of understanding and misinterpretation of CoCo bond structures by investors was a key factor that amplified the market's negative reaction. Regulators should ensure that these instruments are clearly communicated to the market, so that all stakeholders understand the risks involved. Finally, the divergence between Swiss and European regulators underscores the need for harmonized approaches to avoid fragmented market conditions and strengthen investor confidence across jurisdictions.

In conclusion, while CoCos are an important tool for maintaining financial stability, their implementation must be handled with care. Regulators should consider the broader implications of their decisions, ensuring that they are fair, transparent, and consistent. This thesis emphasizes the need for ongoing refinement in regulatory frameworks to accommodate the evolving landscape of financial instruments and ensure that both the banking sector and investors can navigate future crises with greater confidence.

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APPENDICIES

Annex 1: Used CoCo Bonds in DiD analysis

Issuer Name	Amt Issued	Cpn	ISIN	Cap Type CoCo Action	CoCo Initial Trigger	CoCo Trigger Level
ABANCA CORP BANCARIA SA	250000000	10.625	ES0865936027	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
ABN AMRO Bank NV	1000000000	4.375	XS2131567138	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
ABN AMRO Bank NV	1000000000	4.75	XS1693822634	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
ABN AMRO BANK NV	750000000	6.875	XS2774944008	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
AIB Group PLC	625000000	6.25	XS2010031057	Temporary Write Down	Common Equity Tier 1 Ratio	7
BANCO BILBAO VIZCAYA ARG	1000000000	8.375	XS2638924709	Equity Conversion	Common Equity Tier 1 Ratio	5.125
Banco Bilbao Vizcaya Argentaria SA	1000000000	6	ES0813211028	Equity Conversion	Common Equity Tier 1 Ratio	5.125
Banco BPM SpA	400000000	6.5	XS2284323347	Permanent Write Down	Common Equity Tier 1 Ratio	5.125
Banco BPM SpA	300000000		XS2398286471	Temporary Write Down	Common Equity Tier 1 Ratio	7
BANCO BPM SPA	300000000	9.5	IT0005571309	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
BANCO COMERC PORTUGUES	400000000	8.125	PTBCPKOM0004	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
Banco de Sabadell SA	750000000	5	XS2389116307	Equity Conversion	Common Equity Tier 1 Ratio	5.125
Banco de Sabadell SA	500000000	5.75	XS2310945048	Equity Conversion	Common Equity Tier 1 Ratio	5.125
BANCO DE SABADELL SA	500000000	9.375	XS2471862040	Equity Conversion	Common Equity Tier 1 Ratio	5.125
Banco Santander SA	1000000000	3.625	XS2388378981	Equity Conversion	Common Equity Tier 1 Ratio	5.125
Banco Santander SA	1500000000	4.75	XS1793250041	Equity Conversion	Common Equity Tier 1 Ratio	5.125
Banco Santander SA	1500000000	4.375	XS2102912966	Equity Conversion	Common Equity Tier 1 Ratio	5.125
Banco Santander SA	750000000	4.125	XS2342620924	Equity Conversion	Common Equity Tier 1 Ratio	5.125
BANK OF CYPRUS HOLDINGS	220000000	11.875	XS2638438510	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
Bank of Ireland Group PLC	675000000	7.5	XS2178043530	Temporary Write Down	Common Equity Tier 1 Ratio	7
Bank of Ireland Group PLC	300000000	6	XS2226123573	Temporary Write Down	Common Equity Tier 1 Ratio	7
Bankinter SA	350000000	6.25	XS2199369070	Equity Conversion	Common Equity Tier 1 Ratio	5.125
BANKINTER SA	300000000	7.375	XS2585553097	Equity Conversion	Common Equity Tier 1 Ratio	5.125
BAWAG Group AG	300000000	5	XS1806328750	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
Belfius Bank SA	500000000	3.625	BE0002582600	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
BNP PARIBAS	1250000000	7.375	FR001400F2H9	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
BNP Paribas SA	1000000000		FR001400BBL2	Temporary Write Down	Common Equity Tier 1 Ratio	5
BPER BANCA	500000000	8.375	IT0005579492	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
CAIXABANK SA	750000000	7.5	ES0840609053	Equity Conversion	Common Equity Tier 1 Ratio	5.125
CAIXABANK SA	750000000	8.25	ES0840609046	Equity Conversion	Common Equity Tier 1 Ratio	5.125
Commerzbank AG	500000000	4.25	DE000CZ45WA7	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
Commerzbank AG	1250000000	6.125	XS2189784288	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
Commerzbank AG	500000000	6.5	DE000CB94MF6	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
Cooperatieve Rabobank UA	750000000	3.1	XS2332245377	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
Cooperatieve Rabobank UA	1000000000	4.375	XS2202900424	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
Cooperatieve Rabobank UA	1250000000	3.25	XS2050933972	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
Cooperatieve Rabobank UA	1000000000	4.625	XS1877860533	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
Cooperatieve Rabobank UA	1000000000		XS2456432413	Partial Permanent Write Down	Common Equity Tier 1 Ratio	4.875
Credit Agricole SA	750000000	4	FR0013533999	Temporary Write Down	Common Equity Tier 1 Ratio	5.125

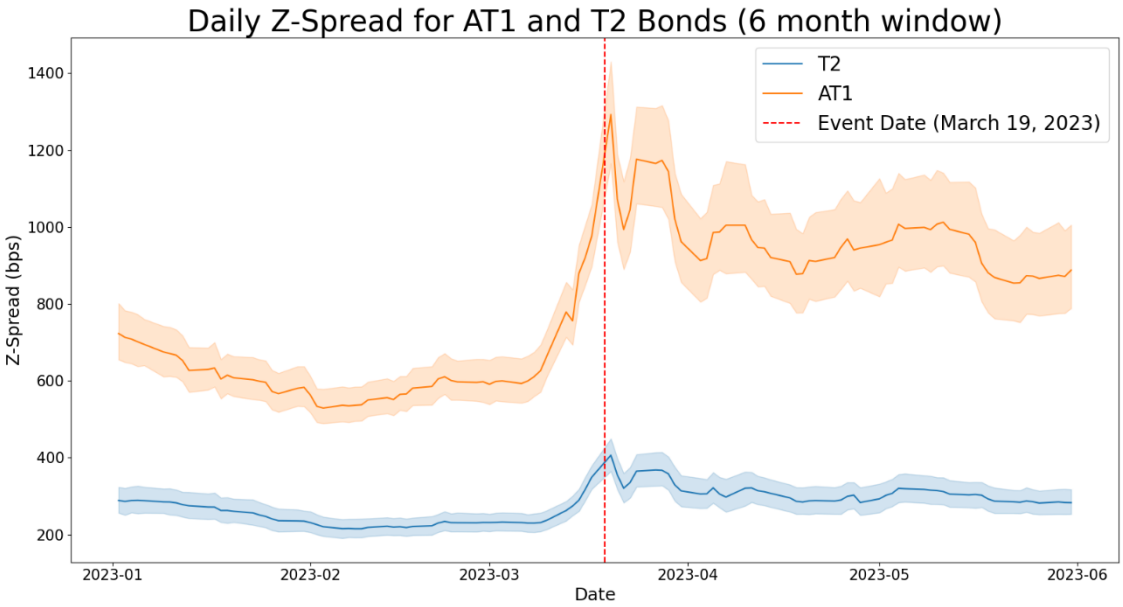
CREDIT AGRICOLE SA	1250000000		FR001400F067	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
CREDIT AGRICOLE SA	1250000000	6.5	FR001400N2U2	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
CRELAN SA	250000000	5.248	BE6332311545	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
de Volksbank NV	300000000		XS2454874285	Permanent Write Down	Common Equity Tier 1 Ratio	7
Deutsche Bank AG	1250000000	4.5	DE000DL19V55	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
Deutsche Bank AG	1250000000	4.625	DE000DL19VZ9	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
Deutsche Bank AG	1250000000		DE000A30VT97	Temporary Write Down	Common Equity Tier 1 Ratio	10
Deutsche Bank AG	750000000		DE000DL19WG7	Temporary Write Down	Common Equity Tier 1 Ratio	6.75
Erste Group Bank AG	500000000	3.375	XS2108494837	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
Erste Group Bank AG	500000000	5.125	XS1961057780	Temporary Write Down	Tier 1 Ratio	5.125
ERSTE GROUP BANK AG	500000000	8.5	AT0000A36XD5	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
FINECOBANK SPA	500000000	7.5	XS2776665700	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
HSBC Holdings PLC	1250000000	4.75	XS1640903701	Equity Conversion	Common Equity Tier 1 Ratio	7
Intesa Sanpaolo SpA	750000000	3.75	XS2124979753	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
Intesa Sanpaolo SpA	750000000	4.125	XS2124980256	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
Intesa Sanpaolo SpA	1250000000	7.75	XS1548475968	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
Intesa Sanpaolo SpA	750000000	5.5	XS2223762381	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
Intesa Sanpaolo SpA	750000000	5.875	XS2223761813	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
Intesa Sanpaolo SpA	1000000000		XS2463450408	Temporary Write Down	Common Equity Tier 1 Ratio	6.375
INTESA SANPAOLO SPA	1250000000	9.125	XS2678939427	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
JULIUS BAER GROUP LTD	400000000	6.625	XS2586873379	Permanent Write Down	Common Equity Tier 1 Ratio	5.125
KBC Group NV	1000000000	4.25	BE0002592708	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
KBC GROUP NV	750000000	8	BE0002961424	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
La Banque Postale SA	750000000	3	FR0014005O90	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
La Banque Postale SA	750000000	3.875	FR0013461795	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
Landesbank Baden-Wuerttemberg	750000000	4	DE000LB2CPE5	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
Nordea Bank Abp	750000000	3.5	XS1725580465	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
Nykredit Realkredit AS	500000000	4.125	DK0030352471	Permanent Write Down	Common Equity Tier 1 Ratio	7.125
Permanent TSB Group Holdings PLC	250000000		XS2538798583	Temporary Write Down	Common Equity Tier 1 Ratio	13.25
Piraeus Financial Holdings SA	600000000	8.75	XS2354777265	Non-Specified	Common Equity Tier 1 Ratio	5.125
Raiffeisen Bank International AG	500000000	4.5	XS1756703275	Temporary Write Down	Core Tier 1 Ratio	5.125
Raiffeisen Bank International AG	500000000	6	XS2207857421	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
SOCIETE GENERALE	1000000000	7.875	FR001400F877	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
Unicaja Banco SA	500000000	4.875	ES0880907003	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
UniCredit SpA	1250000000	3.875	XS2121441856	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
UniCredit SpA	750000000	4.45	XS2356217039	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
UniCredit SpA	1000000000	5.375	XS1739839998	Temporary Write Down	Common Equity Tier 1 Ratio	5.125
UniCredit SpA	1000000000	7.5	XS1963834251	Temporary Write Down	Common Equity Tier 1 Ratio	5.125

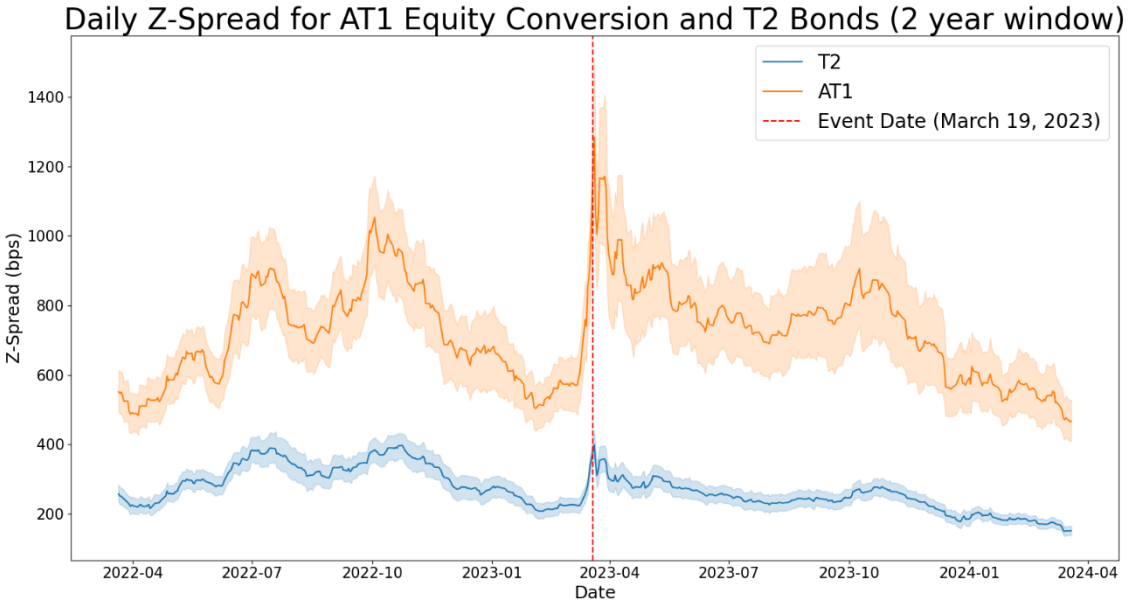
Annex 2: Used Tier 2 bonds in DiD analysis

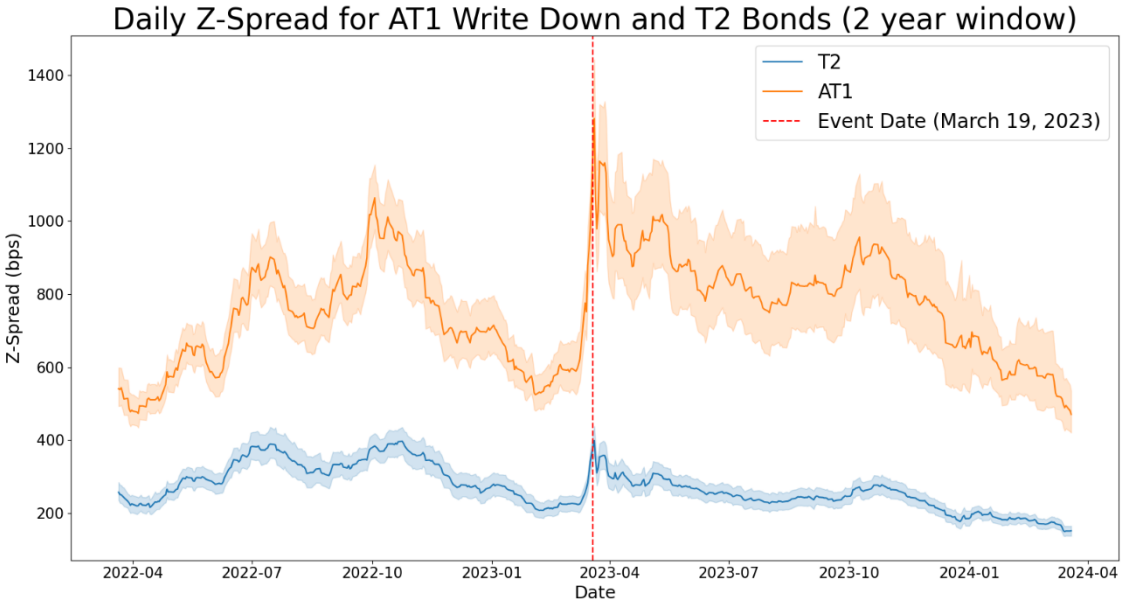
Issuer Name	Amt Issued	Cpn	ISIN
ABANCA CORP BANCARIA SA	300,000,000.00	4.625	ES0265936015
ABN AMRO BANK NV	1,000,000,000.00	5.125	XS2558022591
AIB Group	1,000,000,000.00	2.875	XS2230399441
BANCO BILBAO VIZCAYA ARG	1,000,000,000.00	3.5	XS1562614831
BANCO BILBAO VIZCAYA ARG	200,000,000.00	4	XS1569874503
Banco BPM SpA	400,000,000.00	3.375	XS2434421413
Banco BPM SpA	300,000,000.00	2.875	XS2358835036
BANCO BPM SPA	500,000,000.00	5	XS2229021261
Banco BPM SpA	400,000,000.00	3.25	XS2271367315
Banco de Sabadell SA	500,000,000.00	2.5	XS2286011528
Banco de Sabadell SA	500,000,000.00	5.625	XS1405136364
Banco Santander SA	1,000,000,000.00	1.625	XS2247936342
Banco Santander SA	1,500,000,000.00	2.5	XS1201001572
Banco Santander SA	1,500,000,000.00	3.25	XS1384064587
BANCO SANTANDER SA	1,000,000,000.00	3.125	XS1548444816
BANK OF CYPRUS HOLDINGS	300,000,000.00	6.625	XS2333239692
Bank of Ireland Group PLC	500,000,000.00	1.375	XS2340236327
BANKINTER SA	800,000,000.00	1.25	ES0213679OF4
BANKINTER SA	84,141,680.00	6	ES0213679030
Belfius Bank SA	500,000,000.00	1.25	BE6331190973
BNP PARIBAS	500,000,000.00	2.375	FR0013381704
BNP PARIBAS	1,000,000,000.00	0.875	FR00140057U9
BNP PARIBAS	1,000,000,000.00	1.125	FR0013476611
BNP PARIBAS	1,100,000,000.00	1.625	FR0013431277
BNP Paribas SA	1,500,000,000.00	2.5	FR0014009HA0
BPER BANCA	600,000,000.00	3.875	XS2433828071
BPER BANCA	400,000,000.00	3.625	XS2264034260
CAIXABANK SA	1,000,000,000.00	1.25	XS2310118976
CAIXABANK SA	1,000,000,000.00	2.25	XS1808351214
Commerzbank AG	500,000,000.00	1.375	DE000CZ45WP5
Commerzbank AG	1,000,000,000.00	4	DE000CZ40LD5
Cooperatieve Rabobank UA	800,000,000.00	3.875	XS2524143554
Credit Agricole SA	800,000,000.00	1.625	FR0013516184
CREDIT AGRICOLE SA	1,300,000,000.00	2	XS1968706108
CRELAN SA	300,000,000.00	2	FR0013513645
de Volksbank NV	500,000,000.00	1.75	XS2202902636
Deutsche Bank AG	1,300,000,000.00	2.75	DE000DB7XJJ2
Deutsche Bank AG	1,300,000,000.00	5.625	DE000DL19VB0
Deutsche Bank AG	800,000,000.00	4.5	DE000DL40SR8
Erste Group Bank AG	500,000,000.00	0.875	AT0000A2U543
Erste Group Bank AG	500,000,000.00	1.625	AT0000A2J645
ERSTE GROUP BANK AG	500,000,000.00	1	XS2083210729

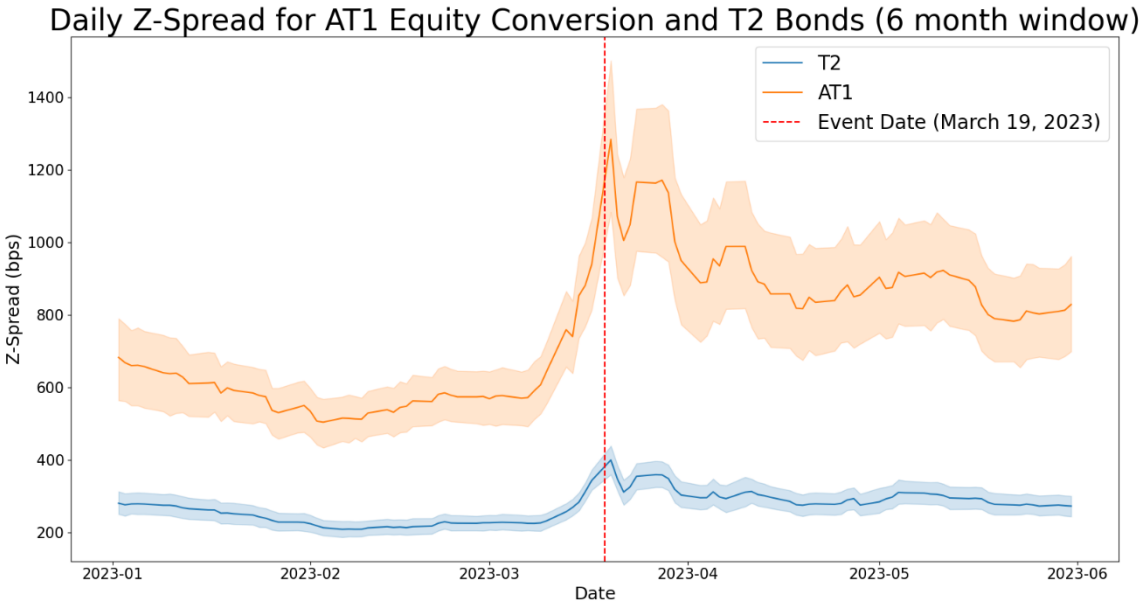
HSBC Holdings PLC	1,500,000,000.00	3	XS1254428896
IBERCAJA BANCO SA	500,000,000.00	2.25	ES02442411015
Intesa Sanpaolo SpA	300,000,000.00	3.75	IT0005412264
Intesa Sanpaolo SpA	1,000,000,000.00	3.928	XS1109765005
Intesa Sanpaolo SpA	500,000,000.00	2.925	XS2243298069
Intesa Sanpaolo SpA	500,000,000.00	2.855	XS1222597905
Intesa Sanpaolo SpA	600,000,000.00	7.748	IT0005412256
Intesa Sanpaolo SpA	200,000,000.00	1.98	IT0005390833
KBC Group NV	800,000,000.00	0.625	BE0002819002
KBC GROUP NV	10,000,000.00	2	BE0002223890
LA BANQUE POSTALE	700,000,000.00	3	FR0013181898
La Banque Postale SA	800,000,000.00	0.75	FR0014001R34
Landesbank Baden-Wuerttemberg	500,000,000.00	2.2	DE000LB13HZ5
Nordea Bank Abp	1,000,000,000.00	0.625	XS2343459074
NYKREDIT REALKREDIT AS	300,000,000.00	2	DK030507694
Permanent TSB Group Holdings PLC	300,000,000.00	3	XS2321520525
Raiffeisen Bank International AG	500,000,000.00	1.375	XS2353473692
Raiffeisen Bank International AG	500,000,000.00	2.875	XS2189786226
SOCIETE GENERALE	500,000,000.00	5.25	FR001400CKA4
Unicaja Banco SA	300,000,000.00	3.125	ES0280907025
UniCredit SpA	1,300,000,000.00	2.731	XS2101558307

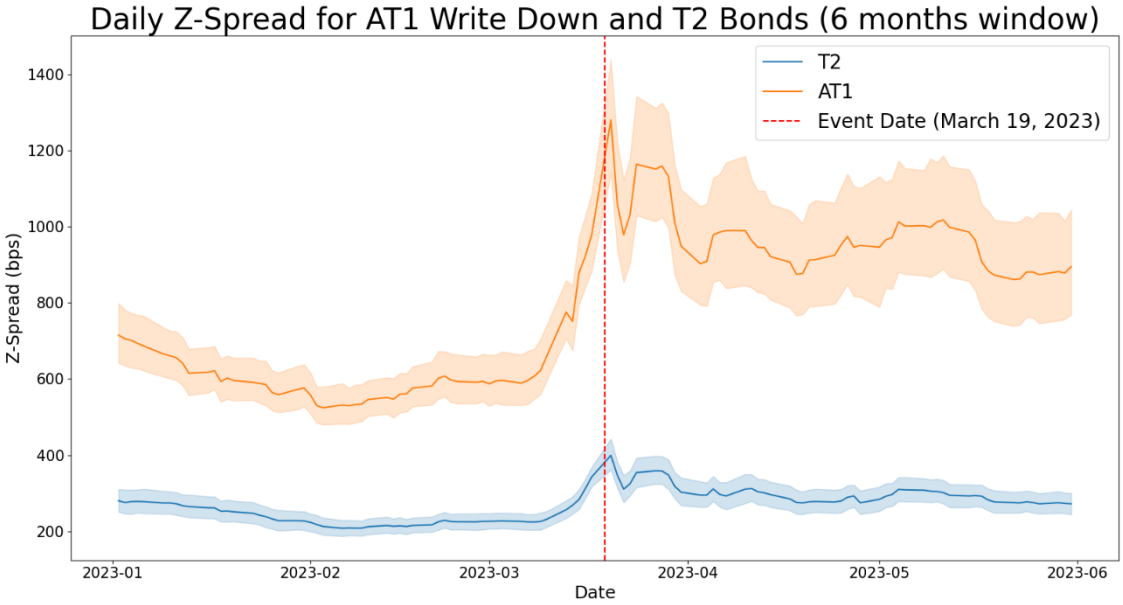
Annex 3: Daily Z-spread graphs used in difference-in-differences analysis

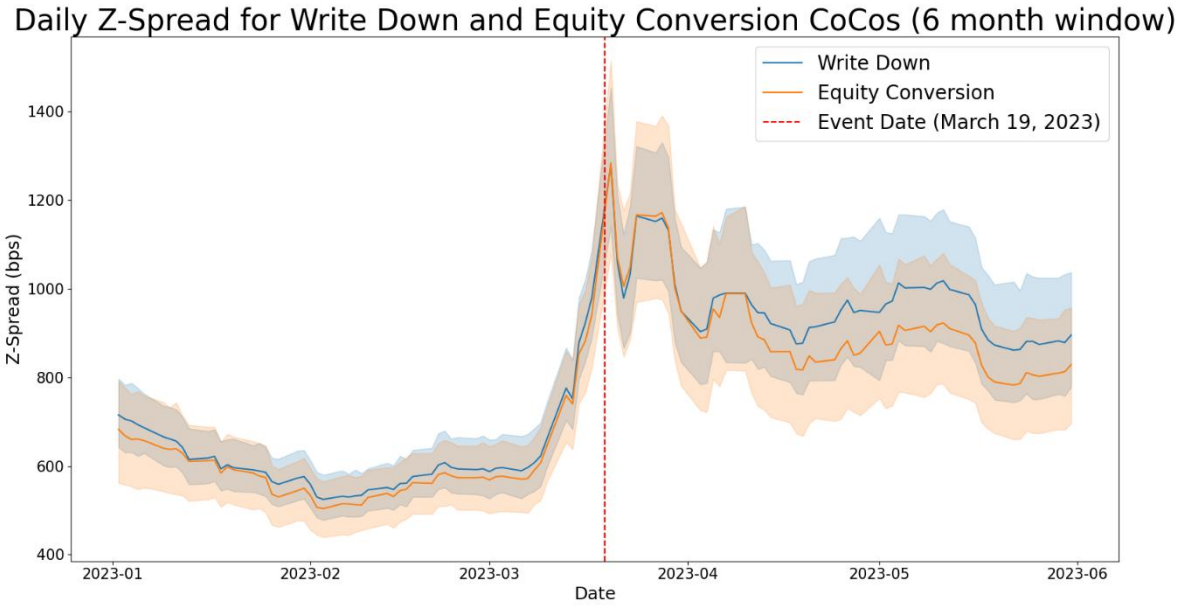





Daily Z-Spread for AT1 Write Down and T2 Bonds (2 year window)
T2
AT1
Event Date (March 19, 2023)
Z-Spread (bps)
1400
1200
1000
800
600
400
200
2022-04
2022-07
2022-10
2023-01
2023-04
2023-07
2023-10
2024-01
2024-04
Date


Daily Z-Spread for AT1 Equity Conversion and T2 Bonds (6 month window)
T2
AT1
Event Date (March 19, 2023)
Z-Spread (bps)
1400
1200
1000
800
600
400
200
2023-01
2023-02
2023-03
2023-04
2023-05
2023-06
Date


Daily Z-Spread for AT1 Write Down and T2 Bonds (6 months window)
T2
AT1
Event Date (March 19, 2023)
Z-Spread (bps)
1400
1200
1000
800
600
400
200
2023-01
2023-02
2023-03
2023-04
2023-05
2023-06
Date


Daily Z-Spread for Write Down and Equity Conversion CoCos (6 month window)
Write Down
Equity Conversion
Event Date (March 19, 2023)
Z-Spread (bps)
1400
1200
1000
800
600
400
2023-01
2023-02
2023-03
2023-04
2023-05
2023-06
Date