



How do financial distress events affect bank returns and what is the role of capital related or bank specific variables in this context?

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Dissertation written under the supervision of professor Eva Schliephake

Dissertation submitted in partial fulfilment of requirements for the MSc in Economics, at the Universidade Católica Portuguesa, 12th of September 2023

Abstract

This thesis analysis the impact of financial distressed banks on the stock return of the banking sector using event study methodology (ESM). In our thesis we are only going to consider financial distressed banks which either write down their Additional Tier 1 (AT1) bonds or convert their AT1 bonds into equity. The write down or conversion of AT1's happen to be terms of the acquisition of the financial distressed bank in most of our selected events. Because we want to estimate the abnormal returns (ARs) for various securities over time, we are going to use the cumulative average abnormal return (CAAR) approach. Furthermore, we are going to use regression analysis to investigate the relationship between the previously calculated cumulative abnormal return (CAR) of banks as dependent variable, our control variables and our variables of interest. The event study results present that the selected events have statistically significant negative impacts on banking sectors stock returns. The regression results show us that our variables of interest including the presence of AT1 bonds in banks assets and Tier 2 ratio do not have statistically significant impacts on the dependent variable, whereas the capital adequacy ratio is statistically significant. Our bank-specific control variables size and profit show statistically significant impacts on the CAR of banks, whereas the variables capital and efficiency have statistically insignificant impacts. Our event study results and our regression results are overall robust.

Title: How do financial distress events affect bank returns and what is the role of capital related or bank specific variables in this context?

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Keywords: Write Down • Conversion • AT1 Bonds • Contingent Convertible (Coco) Bonds • AR

Resumo

Esta tese analisa o impacto dos bancos em dificuldades financeiras na rentabilidade das acções do sector bancário utilizando a metodologia de estudo de eventos. Na nossa tese, vamos considerar apenas os bancos em dificuldades financeiras que reduzem as suas obrigações AT1 ou convertem as suas obrigações AT1 em acções. Na maior parte dos eventos seleccionados, a amortização ou a conversão das obrigações AT1 são os termos da aquisição do banco em dificuldades financeiras. Como queremos estimar as rentabilidades anormais de vários títulos ao longo do tempo, vamos utilizar a abordagem da rentabilidade anormal média acumulada. Além disso, vamos utilizar a análise de regressão para investigar a relação entre o retorno anormal acumulado previamente calculado dos bancos como variável dependente, as nossas variáveis de controlo e as nossas variáveis de interesse. Os resultados do estudo de eventos mostram que os eventos seleccionados têm impactos negativos estatisticamente significativos nos retornos das acções do sector bancário. Os resultados da regressão mostram-nos que as nossas variáveis de interesse, incluindo a presença de obrigações AT1 nos activos dos bancos e o rácio Tier 2, não têm impactos estatisticamente significativos na variável dependente, enquanto o rácio de adequação de capital é estatisticamente significativo. As nossas variáveis de controlo específicas dos bancos, dimensão e lucro, mostram impactos estatisticamente significativos no retorno anormal acumulado dos bancos, enquanto as variáveis capital e eficiência têm impactos estatisticamente insignificantes. Os resultados do nosso estudo de eventos e os resultados da nossa regressão são globalmente sólidos.

Título: Como é que as situações de dificuldades financeiras afectam os rendimentos dos bancos e qual é o papel das variáveis relacionadas com o capital ou específicas dos bancos neste contexto?

Autor: Yusuf Berkant Tektas

Palavras-chave: Redução de valor • Conversão • Obrigações AT1 • Obrigações convertíveis contingentes • Rendimento anormal

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List of Abbreviations

AT1	Additional Tier 1
AR	Abnormal Return
CaR	Capital Adequacy Ratio
CAAR	Cumulative Average Abnormal Return
CAR	Cumulative Abnormal Return
Coco	Contingent Convertible
ESM	Event Study Methodology

1. Introduction

The unexpected acquisition of the Credit Suisse Group by competitor UBS during 19th March 2023 upset many investors, particularly holders of AT1 bonds. As part of the takeover, Credit Suisse's AT1 bonds were written down to zero by Swiss regulators which resulted in Investors losing all of their money. Analysis of legal terms reveal that AT1's are Coco bonds which have discretionary triggers that can be activated by supervisors during times of financial distress. These triggers can also be activated by mechanical triggers which are predefined capital ratios that will be triggered in case of the bank's capital ratio falling below certain thresholds. Activated triggers can lead either to the partial or full write down of the bond or to the conversion of the bond into equity (Macey-Dare, 2023).

In this thesis we are going to answer following research question: 'How do financial distress events affect bank returns and what is the role of capital related or bank specific variables in this context?' To address the research question, we focus on financial distress events including banks which either write down their AT1 bonds or convert their AT1 bonds into equity, often as terms of their acquisition.

We select five financial distress events including Banco Popular, the Venetian Banks, Monte dei Paschi di Siena, Yes Bank and Credit Suisse as real-world examples. We analyze the individual impact of every financial distress event on the stock returns of 184 banks. To do this we are using an ESM to get ARs. Because we want to estimate the ARs for securities over time, we are going to use the CAR (Ullah et al., 2021).

We investigate the relationship between the previously calculated CAR of banks, our capital related variables and bank specific variables using OLS regression. The CAR of banks will be our dependent variable. Capital related variables will include the presence of AT1 bonds in bank assets, the T2 ratio and the CaR of banks which will be simultaneously our variables of interest. The bank specific variables include size, profit, capital and efficiency and represent our control variables.

We have 920 observations for our OLS regression because every event affects 184 banks during five different points in time. This type of data is called Panel data. Due to this we control for

the time the events happened using time fixed effects. Furthermore, we will control for the location of the banks using country fixed effects.

The event study results present that the selected events have statistically significant negative impacts on banking sectors stock returns. The regression results show us that our variables of interest including the presence of AT1 bonds in banks assets and T2 ratio are not statistically significant, whereas the CaR is statistically significant. Our bank-specific control variables size and profit are statistically significant, whereas the variables capital and efficiency are statistically insignificant. Our event study results and our regression results are overall robust.

Carlini et al. (2020) lays the foundations for our quantitative research. We use the similar approach to investigate the effect of events on the return of banks. Additionally, the same approach is used to examine the relationship between, the dependent variables, control variables and variables of interest. Our contribution to the literature is the application of the quantitative analysis to another area of interest.

Section 2 of the Thesis depicts the origin of Coco bonds, their structure and their legal framework. Furthermore, we select six financial distressed banks which either write down or convert their AT1 bonds and summarize their history. We introduce the quantitative analysis of our thesis. Section 3 develops the hypothesis which will be tested and Section 4 provides us details about the data used, the ESM and the regression analysis which will be fundamental for the quantitative analysis. The further section shows us the results of the event study and regression, whereas Section 6 runs robustness tests on the results. The following section discusses about limitations of the thesis and implications for further research and the last section provides us with a brief conclusion.

1.1. The origin of Coco bonds

The financial crisis caused by Lehman Brothers exposed the structural weaknesses in the Eurozone and all over the world resulting in the bail out of Greece, Ireland, Portugal and Spain. These bail outs were mainly at the expense of the taxpayer. The Eurozone responded over the years by providing solutions to prevent taxpayer-funded bailouts of banks including the concept of increasing the amount of banks capital. This resulted in the introduction of the new asset class called Coco bonds. The idea behind Coco bonds were that bank creditors should be ‘bailed

in to increase the amount of loss absorbing capital prior to any taxpayer funded government support’ (McCutcheon, 2017).

1.2. Structure of Cocos

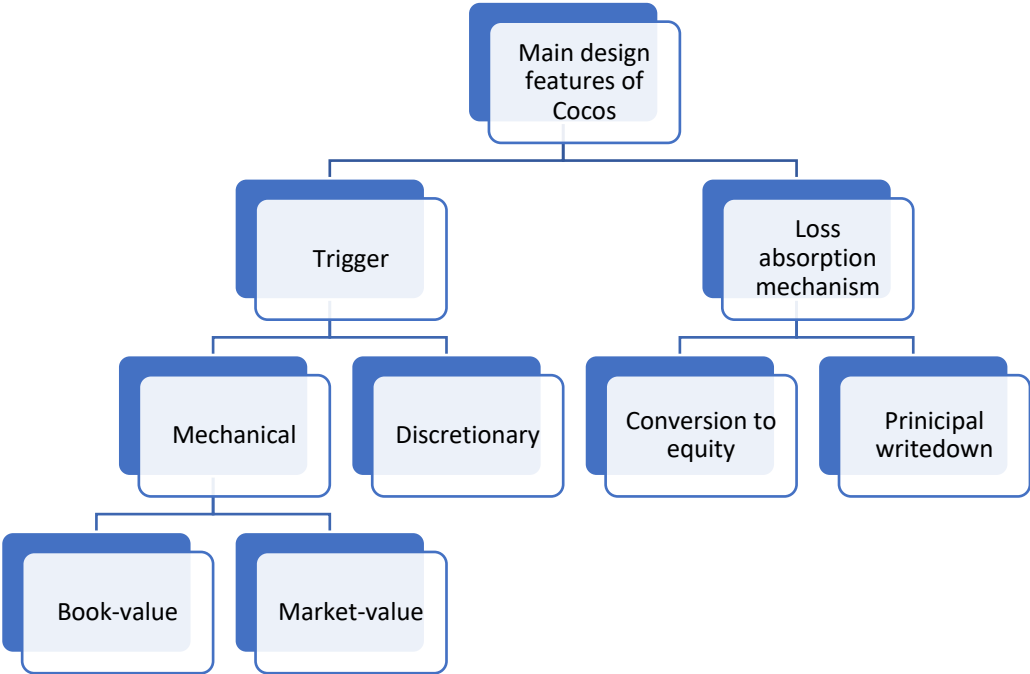


Figure 1: Structure of Cocos – Adapted version from Avdjiev et al. (2013)

The concept of Cocos was made primarily to be the available source of capital during times in need (Avdjiev et al., 2013).

To achieve this objective, Cocos have two substantial characteristics including ‘the loss absorption mechanism and the trigger that activates that mechanism’. Fig. 1 further illustrates those characteristics. Losses can be absorbed either by converting debt instruments into equity or by writing the debt instruments down. The trigger is the moment during which the loss absorption mechanism will be released and can be either activated mechanically or discretionary.

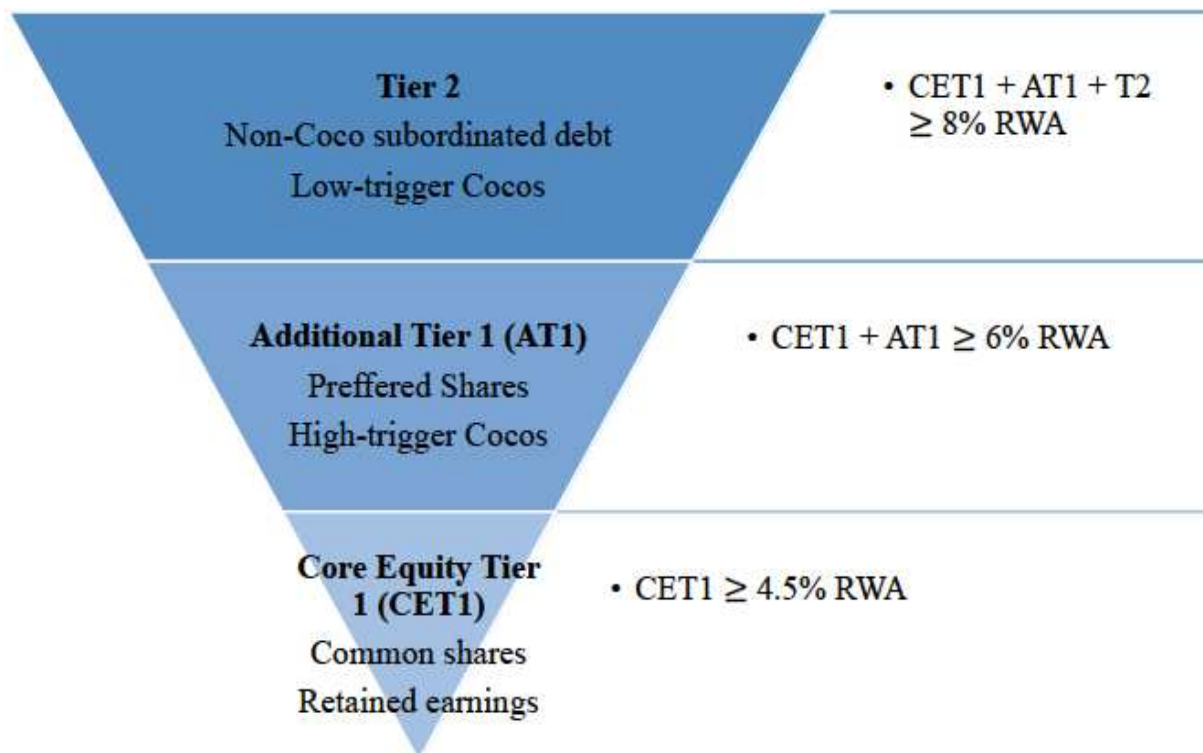
Mechanical Triggers are predefined capital ratios which will be triggered in case of the bank’s capital ratio falling below certain thresholds. Discretionary triggers are triggers which are subject to the judgement of supervisors. Book value or accounting value triggers are mechanical triggers and typically are calculated as the ratio of book value of Common Equity Tier 1 over risk-weighted assets. The disadvantage of book value triggers is that these ratios have the

danger of not being activated timely due to the fact that they need to be calculated frequently. Other mechanical triggers are market value triggers which are calculated as banks market capitalization over their total assets. This trigger can address the disadvantage of the book value trigger due to their frequently updated market value, however they offer space for incentivizing stock price manipulation. Discretionary triggers also called point of non-viability triggers are initiated based on the judgement of supervisors about the bank's situation. Those supervisors can trigger the loss absorption mechanism if they are convinced to prevent the bank from failing. The advantage is that they don't suffer from the disadvantages, book value triggers face, however such power 'could create uncertainty about the timing of the activation'.

The second key characteristic of Cocos is the loss absorption mechanism which happens 'by the conversion of the debt instruments into equity or by writing the debt instruments down' and is activated by the trigger. The conversion is done either based on the market price of stocks at the time of the activated trigger, a predefined stock price or the combination of both mentioned possibilities. Converting the bonds at market price during the time of conversion has the disadvantage of leading to a substantial loss to the equity holders as the price of the stock is likely to be very low. A predefined price on the contrary would limit the probability of fundamental losses for equity holders. Another loss absorption mechanism is the principal write down of the Cocos. The write-down of the bonds can be done partially or fully with the latter being the standard for most banks.

1.3. Position of Cocos in Basel III

During the 2008/2009 financial crisis, it became clear that sudden shocks can quickly diminish the capital of banks. Leaders of the G20 responded and introduced Basel III. The intention of Basel III was to prevent future crisis or at least minimize strong negative financial impact on the banking sectors. Furthermore, Basel III requirements intend to level up the quality of banks capital (Kiewiet et al., 2017). The following Figure underlines one of the 'highest priority issues' of Basel III (King and Tarbert, 2011).



'The list of instruments in this graph is not exhaustive and is included solely for illustrative purposes. For a complete list of instruments and associated criteria for inclusion in each of the three capital buckets, see BCBS (2011). The above shares of RWA represent the bare minimum capital requirements and do not account for any add-ons, such as the capital conservation buffer, the countercyclical buffer and the SIFI surcharge' (Avdjiev et al., 2013)

Figure 2: Position of Cocos in Basel III - Adapted version from Avdjiev et al. (2013)

Fig. 2 shows that the highest quality of capital in this framework is Core Equity Tier 1 (CET1) which includes common shares and retained earnings. The second layer of the pillar are AT1 bonds and essentially consist of preferred stocks or high-trigger Cocos. Lastly, the third layer of the pillar are T2 bonds and essentially consist of subordinated debt which are non-Cocos or low-trigger Cocos. The selected five financial distressed banks which will be described in the following section (*1.4 Background of Financial Distress Events*) are referring to high-trigger and low-trigger bonds when talking about AT1 bonds or T2's, respectively.

High-trigger Cocos are triggered in severe financial distress and are designed to be triggered when banks are in severe financial distress. Low-trigger Cocos are triggered in less severe circumstances and are designed to absorb losses in earlier stages (Avdjiev et al., 2013).

AT1 and T2's share fundamental characteristics with each other. Both are subordinated bonds which can be written off or converted into equity (Avdjiev et al., 2013). This will be substantial for our hypothesis development.

Fig. 2 exhibits that the CaR is calculated as the sum of CET1, AT1, T2 and T3 divided by total risk-weighted assets of the bank. In our dataset we won't find banks which offer T3's. This is the reason why we will use the CaR as synonym for the sum of CET1, AT1 and T2 divided by total risk-weighted assets of the bank. The CaR has to be at least 8%. At least 6% of the ratio has to be going-concern capital (sum of CET1 and AT1) and the remaining 2% can be filled with T2's.

The CaR will be fundamental for our hypothesis development as it 'ensures the financial soundness of banks in absorbing a reasonable amount of loss' (Fatima, 2014).

Additionally, Fig. 2 demonstrates that the going-concern ratio is computed as the sum of CET1 and AT1 divided by total risk-weighted assets of the bank and has to be at least 6%. At least 4.5% of the going-concern ratio has to be CET1 and the remaining 1.5% has to be filled with AT1's. The CET1 ratio is computed as the amount of CET1 divided by the total risk-weighted assets of the bank and has to be at least 4.5%.

1.4. Background of Financial Distress Events

Banco Popular founded during 1926 in Spain, targeted mainly small and medium sized companies in the Spanish market. Their rise succeeded due to plenty mergers with domestic banks and international expansions over the decades, becoming the 6th largest bank in Spain in 2017 (Sabate and Fonts, 2018). Unfortunately, Banco Popular's peak started to shatter after the financial crisis. The reasons were to aggressive investment strategies, non-performing loans in the real estate sector and poor capital positions which ultimately lead to financial troubles (Kozinska, 2018). On June 6, 2017 the European Central Bank (ECB) officially stated that 'Banco Popular is failing or likely to fail'. Reaching the point of non-viability resulted in the resolution of the bank and the acquisition by the Spanish competitor Banco Santander. Banco Popular had two outstanding AT1 bonds with a face value of 1.25 billion euros but they were written down to zero as part of the acquisition (McCutcheon, 2017).

Banco Popolare di Vicenza and Veneto Banca, two Italian banks which once were the biggest banks in terms of asset size in Veneto and known for their bond with the local economic companies. Banco Popolare di Vicenza founded in 1866 was the first cooperative bank

established in Veneto striving for greatness by following two simple principles. The first principle described that the quantity of shares members had weren't relevant, they wouldn't have more than one vote. The second principle specified that members couldn't have more than 1% of banks total capital. This rules, should aim to build and maintain healthy relationships between the bank and its local actors. Veneto Banca was the second largest bank in the local area behind Banco Popolare di Vicenza and was founded eleven years after them. Their success story mainly consisted of expanding their business to foreign countries which lead to numerous branches located in eastern Europe countries. The economic crisis in 2008/2009 caused serious troubles for venetian companies which resulted in bankruptcies and overall decrease in economic output. Considering this fragile economic context, the banks in Veneto suffered low levels of liquidity and plenty numbers of impaired loans. Banco Popolare di Vicenza's and Veneto Banca's stock prices fell significantly over the years. Teetering on the brink of collapse the Italian government forced the two venetian banks to divide their assets into good and bad assets. These assets would then be allocated to good and bad banks. While the bad banks and their bad assets will be set aside the good banks will be bought by the italian bank Banca Intesa Sanpaolo (Bilotta, 2017). This plan got confirmed by the European authorities and included complete write downs of AT1 and T2 securities (Mills, 2017).

Monte dei Paschi di Siena is the worldwide oldest bank located in Italy and has been lending money even before Italy became one nation. The history of the Italian bank started during 1472 when the magistrature of the republic founded Monte Pio which mainly focused on loans to people from the lower class. Monte Pio survived centuries of economic and political crises, becoming an orthodox commercial bank during the 16th century. During this century they expanded their business by creating another bank and merged with them during the late 17th century to become Monti Riuniti. In 1872 they changed their name to the today known Monte dei Paschi di Siena. One of their success stories was contributing millions annually to the 'social, cultural and economic activities' in Siena to become one of the largest Italian banks in terms of assets (Bilotta, 2017). Although the Italian bank has been substantial for the local economy, series of wrong management decisions, scandals, broken structure of the institution and high amounts of non-performing loans led to the need of recapitalization (Menasci, 2019). The recapitalization included converting junior subordinated bonds worth over four billion euros into equity and further capital injection of about four billion euros. The recapitalization concept was approved by the European Commission during July 2017 (Farina et al., 2022).

Yes Bank founded in 2004 by Rana Kapoor and Ashok Kapoor became one of the largest banks by assets in India during the last years. Their success was due to many right decisions over the lifetime of the bank. The diversification of their business into retail banking and their decision to go public one year after their foundation, were amongst other reasons substantial for the rise of the Indian bank (Sarkar, 2020). After years of success the bank from India was slowly getting into financial troubles due to various reasons. The reasons for the financial troubles were mainly the failure in growth of assets, non-performing assets, issues with the governance and excessive withdrawals of depositors and resulted in the bank being placed under surveillance during the beginning of March 2020. (Jawahar et al., 2021). One day after the beginning of the surveillance the replacement of the Indian bank took place. The new board responded quickly by proposing a reconstruction scheme to the Government of India. This Scheme included the write down of two AT1 bonds worth 8,415 crore and was confirmed on 13th March 2020. The Indian government confirmed the full and permanent write down of the two bonds one day after the submission of the Reconstruction Scheme. However, the Indian bank didn't write down all the three issued AT1 bonds since it's foundation but two of them. Furthermore, one hotly debated decision was the write down of AT1 bonds prior to the write down of common equity which usually has an inferior position of priority (Wadhwa and Bharadwaj, 2022).

The origins of Credit Suisse started during 1856 when the domestically well-known politician, business leader and pioneer Alfred Escher founded the bank called 'Schweizerische Kreditanstalt'. The intended purpose of the bank was the financing of the railroad expansion as well as expanding the industrialization in Switzerland. The bank from Switzerland started to show presence internationally by opening foreign representative offices and building new branches. Credit Suisse became a success over the next centuries due to strong growth, very important mergers and acquisitions (Credit Suisse Website). The issues of Credit Suisse started after the global financial crisis who were since then involved in several scandals, fines, litigations and other events to eventually become the 'problem child' of the worldwide banking sector. The last straw however started with the failure of the Silicon Valley and Signature Bank causing Investors to panic worldwide. The trust in the worldwide banking system was gone which led to a selloff of bank shares, including the ones from Credit Suisse. Due to reduced liquidity Credit Suisse was hoping to get capital injection from its biggest shareholders which are amongst many others the Saudi National Bank. During an Interview one of Saudi National Banks representatives stated that they won't inject money into Credit Suisse due to regulatory reasons that prohibit 'other banks holding more than 10% ownership of other banks. The share

price of Credit Suisse declined substantially. This led to the immediate withdraw of money from Credit Suisse depositors due to fear of the collapse of the Suisse bank. On March 19, 2023 the Swiss Central Bank announced that Swiss rival UBS will acquire Credit Suisse, guaranteeing UBS assistance and support throughout the process (Ozili, 2023). As part of the emergency packet Credit Suisse AT1 regulatory capital had been written down to zero. However, the terms of the deal caused negative market reactions due to the fact that the write down of the bonds violated the usual priority order between debt and equity. Indeed, equity holders of Credit Suisse retained over three billion of share value while AT1 bond holders faced a complete write down of 17 billion dollars. Regulators including the European Central Bank, the Bank of England and others stated that there is no intention to follow the decision made by the Swiss National Bank (Bolton et al., 2023).

2. Literature Review

Valbuena and Eidenmüller (2023) introduce the unconventional Credit Suisse bailout by analyzing the motivation behind the write down of AT1 bonds, legal consequences and hand out advices to investors. The authors emphasize the noteworthiness of the Credit Suisse case because writing down AT1 bonds while offering shareholders UBS shares is against the priority rule which is fundamental in the world of finance. The paper examines contract terms regarding AT1's and advocates for righteous treatment between shareholders and bondholders, however the lack of contract terms enables banks enough room to lay the rules for the benefit of themselves. Further implications are to prioritize shareholder losses during bailouts to maintain the credibility of the priority rule. In conclusion the paper analyzes the Credit Suisse bailout, focusing on contractual issues and further implications to extend the regulatory principles.

The paper "Event Study Estimations Using Stata: The estudy command" introduces an innovational approach to use event study methodologies in finance using the program Stata. Event studies investigate how peculiar events impact financial markets. The authors, Fausto, Luigi Vena and Andre Venegoni introduce the user-friendly tool called the "estudy" command to simplify event study estimation. The paper starts with summarizing the historical development of the event studies, highlighting the importance in evaluating market reactions to different events. The paper gives detailed description about the command while emphasizing its efficiency, flexibility and simplicity. They apply the command to real-world examples. The

paper also mentions limitations and further improvement of the methodology such as the quality of data and the specification of the model. Furthermore, econometric issues that could arise in event studies could be addressed more intense. In conclusion the paper is valuable for providing simplified but efficient and user-friendly tools for financial research. However, further implications may address the limitations associated with the tool.

Carlini et al. (2020) provides us the useful approach for the quantitative analysis of the thesis. The paper separates the quantitative analysis in two parts. The first approach includes the analysis of the effect of governance news on bank stock returns by using ESM. The information release is categorized into negative, neutral and positive tone. Notably, Carlini et al. (2020) focus on the effect of negative governance news and demonstrate significantly negative impact on banks CAR across the most event windows. The second part includes the investigation of the relationship between the CAR which is used as dependent variable, bank specific variables which are the control variables and the variables of interest. The variables of interest include media coverage, degree of certainty and other categories while bank specific variables encompass size, profitability, capital and efficiency. Focusing on the impact of bank-specific variables on the dependent variables indicate that capital has a statistically significant effect whereas in our thesis size and profit are statistically significant.

3. Hypothesis Development

The previously described framework and literature will be our foundation for the hypothesis development.

Hypothesis 1: The failure of the previously described banks and the corresponding acquisitions, write downs or conversions of bonds should alert investors which should result in reduced trust of the banking sector. Therefore, we hypothesize a significant negative impact of the events on banking sectors CAAR.

Dahiya et al. (2001) supports our hypothesis by finding significant negative effects of wealth for shareholders who announce their bankruptcy or are on the verge of failing.

Hypothesis 2: The presence of AT1 bonds in banks' assets will enhance impact on the CAR.

Cooper et al. (2023) state while reporting about the Credit Suisse write down that AT1 bonds ‘are the riskiest types of bonds a bank can issue’ and that ‘investors will be much more cautious about buying AT1’s in the future’. Furthermore, we assume that AT1’s will be associated with financial distress of banks due to their corresponding write downs and conversions which will be perceived negatively by investors. Delivorias (2016) even claims that Coco conversions or write downs at one bank may increase the probability of runs of other banks. AT1’s will also lack credibility because they violate the priority rule in some events.

Hypothesis 3: The T2 Ratio of Banks will enhance the impact on the CAR.

Due to the already mentioned similarities of bond characteristics between AT1 and T2 Bonds (*both subordinated bonds which can be written off or converted into equity*) investors will be cautious regarding those bonds.

Hypothesis 4: Banks with higher CaR will moderate the negative effect on stock prices.

As already mentioned during the conceptual framework of the CaR the Ratio itself ‘ensures the financial soundness of banks in absorbing a reasonable amount of loss.’ Therefore, a higher CaR should be seen as a sign of viability to investors and result in less impact by the shock.

4. Data and Methodology

In the following section we will illustrate our research design. We will use ESM to compute the impact of the previously described events on the banking sector’s CAAR. Furthermore, we will use OLS regression analysis to capture the impact of the independent variables including variables of interest and control variables on the banking sector’s CAR which represents our dependent variable.

4.1. Data

Year of Bond Write-Down or Conversion	Number of Events	Number of Banks	Total Observation
2017	3	184	-
2020	1	184	-
2023	1	184	-
Total	5	184	920

Table 1: Descriptive Statistics of Events

Table 1 shows that we focus on all in all five events over the course of six years from 2017 till 2023. Three of the events happened during 2017, one happened during 2020 and the remaining event occurred during 2023. These events are the events described during 2.4. of the thesis.

The database we use for our thesis is Refinitiv Eikon. We decide to use data specifically from the banking sector. Refinitiv Eikon provides us an initial database of 1,990 worldwide listed banks. Furthermore, we focus on banks from Europe, the United States and China instead of using all worldwide listed banks.

To calculate the impact of the five events on the CAAR of banks we need daily stock data for certain periods of the years 2017, 2020 and 2023. We exclude all banks who don't have available daily stock data for the previously mentioned periods. We furthermore exclude the banks of the events itself.

For the OLS regression we need quarterly balance sheet data of the second and third quarter of 2017 and for the first quarter of 2020 and 2023. Again, we exclude all banks who don't have available balance sheet data for the previously mentioned periods.

Additionally, we eliminate outliers or negative balance sheet data. This approach will lead to a final of 184 banks. 79 of the banks have AT1's in their assets and the remaining don't. To get the overall observation we will multiply the total amount of five events with the total number of 184 banks which results in 920 observations.

Troubles we face are the need to individually download daily data for all banks because downloading daily data for over hundreds of banks causes Refinitiv Eikon to hang. Additionally, the final data of 184 banks isn't equally distributed over the three chosen regions

due to the lack of fully available data for European countries and China. We have 33 European and Chinese listed banks in the dataset and 151 listed banks from the United States. Furthermore, we only consider events between 2017 and 2023 because including prior data would substantially reduce the data size due to the lack of daily return data.

4.2. Event Study Methodology

4.2.1. The Event Timeline

Regarding Martins & Cro (2022) the ESM is an appropriate approach measuring abnormal stock price reactions to events. To ensure the usefulness of the methodology some assumptions have to be taken. The first assumption is that markets need to be efficient. In that case any financial important information that reaches investors will be priced in stocks as quick as possible. Secondly, we have to assume that events are unpredictable. This means that the market didn't have previous event-related information. The last assumption suggests that there are no confounding effects from other events during the event timeline. Confounding effects during the event timeline should be isolated. If the mentioned assumptions are guaranteed, ESM is an effective and strong tool.

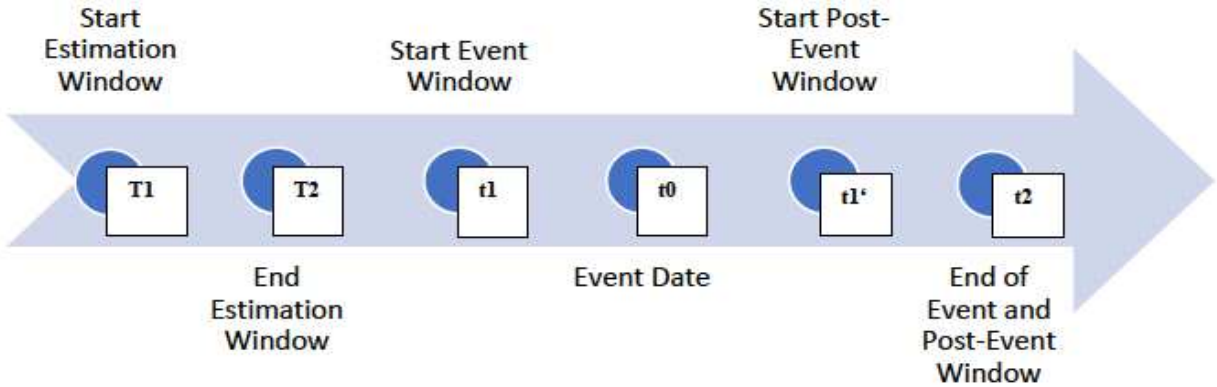


Figure 3: The Event Timeline – Adopted version from (Ullah et al., 2021)

To measure the AR of our events we are using ESM. Firstly, we need to define amongst others the event timeline. Fig. 3 illustrates the event timeline which is composed of the event itself, the event date, the estimation window, the event window and the post-event window.

To define an event date, we have to first define our events itself. The events we selected for the banks included are in section 1.4. In this regard the event dates will be the days of the selected

events. In case the event dates fall on weekends or in case that the date is not available in the dataset, we follow the suggested approach to use the next trading day (Ullah et al., 2021). Furthermore, the event date is a day within the event window (Fig.1). The event date is essential for the computation of the CAAR of the banking sector. It ‘allows researchers to compare firm returns before an event with returns subsequent to the news reaching the market, in order to measure the ARs earned due to the analysed event’ (Ullah et al., 2021).

The estimation window is a period of at least one month prior to the event window (Fig.1) to avoid anticipation effects or news leakages (Pacocco et al., 2018). In our thesis we are going to use 120 days as window which is sufficient (Yousaf et al., 2022). The estimation window is essential for calculating the expected returns during the event window in an event study (Ullah et al., 2021). It indicates what returns should be during the event window by using the returns during times of usual market behavior (Aktas et al., 2007).

The event window is a period after the estimation window and prior to the post-event window (Fig. 1). Regarding the period of the event window there is ‘no fixed numbers of days, weeks or months that form the event window’. Rather it is recommended to use good evaluation of suitable event windows (Pacocco et al. 2018). Other paper however, suggest calculating the CAAR for event windows in between 10 days prior to the event and 10 days after the event to choose the event windows with the most significant and highest CAAR afterwards (Fang et al. 2015). In our thesis we will use a combination of judicious selection of the event window and the statistical approach.

Looking at Fig. 1 the lower bound is the point in time that start collectively with the event window (t_l) during a period prior to the event day but just reaches till the event date (t_0). The upper bound starts after the event day (t_l') and reaches till the end of the event window (t_2) (Pacocco et al., 2018).

The judicious selection would be in terms of selecting the lower bound of the event window by following the approach of Sakawa & Watanabel (2022) who set the lower bound to be the event date. Additionally, we apply the statistical approach of Fang et al. (2015) to get the upper bound of the event window.

The event window is important for measuring the impact and magnitude of the event on firm returns because different event windows would result in different CAAR (Ullah et al., 2021).

Lastly, Fig. 2 shows us that the post-event window represents the period after the event date.

Events	Estimation Window	Event Date	Event Window
Banco Popular	30.09.2016 – 27.04.2017	07.06.2017	(0; +4)
Venetian Banks	25.10.2016 – 17.05.2017	26.06.2017	(0; +10)
Monte dei Paschi di Siena	07.11.2016 – 31.05.2017	06.07.2017	(0; +6)
Yes Bank	25.07.2019 – 13.02.2020	16.03.2020	(0; +7)
Credit Suisse	03.08.2022 – 16.02.2023	20.03.2023	(0; +10)

Table 2: Descriptive Statistics of Event Timeline

Table 2 summarizes the estimation windows, event dates and chosen event windows for the five events who got their bonds completely written down. To avoid confounding effects during the event timeline of the first three events it is important to set the estimation window of Monte dei Paschi di Siena before the first event date of Banco Popular.

4.2.2. Abnormal Returns

ARs are profits investors make mainly due to atypical events. They are calculated by using the ‘realized ex-post returns of stocks over the event window and subtracting them with the expected return of the firm over the event window’ (Ullah et al., 2021).

$$(1) AR_{it} = R_{it} - E(R_{it}) = R_{it} - (\alpha_i + \beta_i R_{mt} + \varepsilon_{it})$$

AR_{it} denotes the AR of firm i on day t , R_{it} denotes the realized ex-post return of stocks of firm i on day t and $E(R_{it})$ denotes the expected return of firm i on day t (Homburg et al., 2014). To calculate the expected returns, we will use the CAPM which reveals better results for the usage of ESM regarding Yousaf et al. (2022). $E(R_{it})$ is the expected return of firm i on day t , α_i and β_i are firm-specific estimates, R_{mt} is the benchmark index (in our case it’s Thomson Reuters’ Global Bank Index) of the respective market and ε_{it} denotes the error term of firm i on day t (Homburg et al., 2014).

4.2.3. Cumulative Abnormal Return and Cumulative Average Abnormal Return

The CAAR approach is very useful for researchers who want to estimate the ARs for various securities over time (Ullah et al., 2021). There are two ways to estimate the CAAR. The first way includes calculating the average AR of the event window at first (Kumari et al., 2021).

$$(2) AAR_t = \frac{1}{N} \sum_{i=1}^N AR_{it}$$

AAR_t denotes the average AR during time t , N is the number of firms and AR_{it} is the already described AR of firm i on day t . To get the average AR we are adding up the ARs of all firms and divide it by the number of firms (Kumari et al., 2021).

$$(3) CAAR_p = \sum_{t=1}^n AAR_t$$

$CAAR_p$ denotes the CAAR over the event window p , n denotes the amount on days during the event window and AAR_t denotes the previously described average AR on day t . To get the CAAR we are adding up the average ARs of n days in the event window (Kumari et al., 2021).

The second way to compute the CAAR return is described in the following passage.

$$(4) CAR_p = \sum_{t=1}^n AR_t$$

CAR_p denotes the CAR over the event window p , n describes the amount on days in the event window and AR_t describes the AR on day t . To get the CAR during period p we are summing up the ARs of n days in the event window (Carlini et al., 2020)

$$(5) CAAR_p = \frac{1}{N} \sum_{i=1}^N CAR_p$$

$CAAR_p$ denotes the CAAR over the event window p , N describes the number of firms and p specifies the event window. To get the CAAR we have to add up the CAR during period p and divide it by the number of firms (Carlini et al., 2020).

4.2.4. Statistical Significance

Testing the statistical significance of the CAAR can be realized either by using parametric or nonparametric tests. Parametric tests assume certain distributions of stock returns whereas non-parametric tests don't require prior assumptions (Pacocco et al., 2018). In our thesis we are going to use the non-parametric test from the authors Kolari and Pynnönen (2011) because it promises better performance than parametric tests. The null hypothesis would suggest no event effect and the possibility of event-induced variance whereas the alternative hypothesis would implicate the opposite (Kolari & Pynnönen 2010). In case of statistical significance in our thesis the null hypothesis would be rejected and the event would have a significant effect on the CAAR of the banking sector.

4.3. OLS Regression

In the following section we will use OLS Regression analysis to investigate the relationship between the dependent variable and the independent variables (Carlini et al., 2020).

$$(6) CAR_i = \alpha + \beta_1 X_i + \beta_2 \Omega_k + \beta_3 TimeFE_{i,t} + \beta_4 CountryFE_{i,j} + \varepsilon_i$$

The cross-section of the announcements is denoted by i , time is represented by t , k and j denote banks and countries, respectively (Calini et al., 2020)

The dependent variable will be the in the previous sections described CAR of banks. X_i is the vector for our variables of interest which will answer the hypothesis 2-4 of our thesis. The first variable of interest is the presence of AT1 bonds (AT1) as dummy variable. It takes the value one if the bank holds AT1 bonds in their assets and zero otherwise. The second variable of interest is the T2 ratio of banks and is computed by dividing their T2 capital over total risk-weighted capital. Our last variable of interest is the CaR of banks and is estimated by dividing their total regulatory capital over total risk-weighted assets (Refinitiv Eikon).

Ω_k represents bank-specific control variables. We will use the control variables suggested for measuring bank performance by Carlini et al. (2018). The first control variable is the size of banks (Size) using the natural logarithm of banks. The second control variable is the capitalization of banks (Capital) which is estimated by dividing bank's total equity over their total assets. Another control variable is the profitability (Profit) of banks using the return on equity which is estimated by bank's net income over total equity. Instead of the suggested return on risk-weighted assets by Carlini et al. (2018) as profitability measure, we decide in this case to use return on equity as profitability measure as it is 'the most important measurement of banking returns' (Bashir, 1999). Due to the lack of net income data in Refinitiv Eikon we substitute the ROE by using the ROE TTM. The last control variable is the efficiency (Efficiency) of the banks using Refinitiv Eikon's efficiency ratio which is estimated by dividing bank's non-interest expense over total revenue less interest expense. Again, we decide to use another measure as the cost-to-income ratio recommended by Carlini et al. (2018) because the efficiency ratio is favored by many financial analysts of banks (Hays et al., 2009).

Lastly, we include time and country fixed effects in our model to control for the time the events happened and the location of the banks (Carlini et al., 2018).

	AT1	Tier2	CaR	Size	Capital	Profitability	Efficiency
AT1	1.000						
Tier2	0.220***	1.000					
CaR	-0.094***	0.193***	1.000				
Size	0.441***	0.328***	-0.040	1.000			
Capital	-0.284***	-0.306***	0.166***	-0.343***	1.000		
Profitability	0.062*	0.019	-0.035	0.078**	-0.135***	1.000	
Efficiency	-0.129***	-0.113***	0.055*	-0.353***	0.197***	-0.168***	1.000

Table 3: Correlation Matrix

*** p<0.01, ** p<0.05, * p<0.1

To check if our independent variables are suitable for further analysis, we follow the approach of Carlini et al. (2020) and run a correlation matrix. Statistical significance between the independent variables could signalize unsuitability of the chosen variables which is why we follow the approach of Kumari et al. (2021) and look at the Variance Inflation Factor (VIF) values which check if multicollinearity affect the model fit.

Variable	VIF
AT1	1.53
Tier2	1.29
CaR	1.29
Size	1.27
Capital	1.18
Profitability	1.11
Efficiency	1.04
Mean VIF	1.25

Table 4: VIF Values

The VIF values range between 1.04 and 1.53 which is far below the critical value 10. If the VIF values are below the critical value, the multicollinearity didn't impact the fit of the model (Kumari et al., 2021)

Variables	Symbol	Description
CAR	CAR	CAR from the announcement of the Bond Write-Down
AT1 Bonds	AT1	Bank Dummy Variable: One if AT1 Bonds exists; Zero otherwise
T2 Ratio	Tier2	Bank's T2 Capital over Total Risk-Weighted Capital
CaR	CaR	Bank's Total regulatory capital over total risk-weighted assets
Size	Size	Bank's natural logarithm of total assets
Capitalization	Capital	Bank's Total Equity over Total Assets
Profitability	Profit	Bank's Net Income over Total Equity
Efficiency	Efficiency	Bank's Non-Interest Expense over Total Revenue less Interest Expense
Time Fixed Effects	Time FE	Controls for the period in which the Bond Write-Down was announced
Country Fixed Effects	Country FE	Controls for the countries in which the banks are located

Table 5: Description of Variables

Table 5 summarizes the Variables, Symbols and Descriptions used in our thesis.

5. Empirical Results

5.1. Event Study Results

In the following section we are going to present the results using ESM. We are only going to consider negative CAAR in our case due to following reason:

Bond write downs or conversions are in most of our case linked to the acquisition of banks due to prior financial distress. Huerta et al. (2011) confirm that banking industries could display significant reduction in volatility after bailouts which will lead to positive market reactions. We are *assuming* that positive market reactions are rather linked to the market observing reduced risk and therefore, only consider negative market reactions. Therefore, negative market reactions should display a higher probability of the market reacting to bond write downs or conversion than positive market reactions.

Events	CAAR
Banco Popular	-0.0134***
Venetian Banks	-0.0105**
Monte dei Paschi di Siena	-0.0240***
Yes Bank	-0.0124***
Credit Suisse	-0.0391***

Table 6: Event Study Results

*** p<0.01, ** p<0.05, * p<0.1

Table 6 shows the CAAR's of the events. All five events have statistically significant CAAR's, four of them being statistically significant at 1% and one of them being statistically significant at 5%. The Venetian Banks have the lowest CAAR with -1.05% and Credit Suisse the highest with -3.91%. In between are the Yes bank with -1.24%, Banco Popular with -1.34% and Monte dei Paschi di Siena with -2.4%.

The results in Table 6 confirm our first hypothesis that we will have 'a significant negative impact of the events on banking sectors CAAR'.

5.2. OLS Regression Results

5.2.1. Data Description

The following section will show the descriptive statistics of all variables.

Variable	Observations	Mean	Std.Dev.	Min	Max
CAR	920	-0.0243	0.0578	-0.3888	0.5989
AT1	920	0.4761	0.4997	0.0000	1.0000
Tier2	920	0.0178	0.0104	0.0028	0.0790
CaR	920	0.1499	0.0322	0.0800	0.3030
Size	920	23.3404	1.9788	19.9123	29.4427
Capital	920	0.1080	0.0269	0.0445	0.2222
Profit	920	0.0262	0.0257	0.0002	0.7010
Efficiency	920	0.6141	0.1436	0.1799	1.0216

Table 7: Descriptive Statistics of all variables

The variables of the sample got already described previously and the number of observations got mentioned as well. The CAR of the banking sector is on average negative with a value of -2.43%. The AT1 variable displays an average value of 0.4761 which means that we have slightly more banks in our data that don't have AT1's in their assets than banks that have AT1's in their assets. Tier2, CaR, Capital, Profitability and Efficiency are on average positive with percentage values of 1.78%, 14.99%, 10.80%, 2.62% and 61.41%, respectively. Lastly, the size variable is positive with an average value of 23.34. Further details about the standard deviation, the lowest and the highest value can be seen in Table 7 as well.

5.2.2. OLS Regression Results

Following section will show us the impact of the chosen independent variables on the dependent variable. Furthermore, it will give us details about our hypothesis made during the hypothesis development.

VARIABLES	(1) CAR
AT1	-0.0055 (0.0039)
Tier2	-0.1600 (0.1851)
CaR	0.0930* (0.0555)
Size	0.0047*** (0.0011)
Capital	-0.0432 (0.0731)
Profit	0.9023*** (0.0692)
Efficiency	0.0026 (0.0133)
Constant	-0.1632*** (0.0305)
Observations	920
Adjusted R^2	0.1817
Time FE	YES
Country FE	YES

Table 8: Regression Results

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Firstly, we are going to analyze our variables of interest and the corresponding hypothesis. Recalling the second hypothesis that ‘*the presence of AT1 bonds in banks’ assets will enhance the impact on the CAR*’, we can say that this is true. There is indeed a slightly negative impact (-0.0055) of the presence of AT1 bonds within banks assets on the CAR but the impact is not significant.

The T2 Ratio of Banks will enhance the CAR is the third hypothesis which is true. We can see that there is a negative impact (-0.1600) on the dependent variable. The effect however is statistically insignificant.

The last hypothesis that *banks with higher CaR will moderate the negative effect on stock prices* is true. We have a positive significant effect (0.0930) at 10% level of the CaR on the dependent variable.

Analyzing our results for the control variables we see that both size and profit have a positive statistically significant impact on the dependent variable at 1% level. The effects of the

variables size and profit are 0.0047 and 0.9023 respectively. The remaining control variables capital and efficiency are not statistically significant with the former having a negative impact of -0.0432 and the latter having a positive impact of 0.0026 on the dependent variable.

Furthermore, the results show us again the number of observations. Instead of using the commonly reported R^2 of the regression which quantifies the variance of the dependent variable explained by the regression model we are going to use the adjusted R^2 . We use the adjusted R^2 because R^2 ‘overestimates the amount of variance explained in the population’, however the adjusted R^2 gives more accurate results (Karch, 2020). The adjusted R^2 in our thesis is 0.1817.

Lastly, we show that we include time and country fixed effects to control for the location of the bank and to control for the time of the events.

6. Robustness Checks

To assess the validity of our event study results we are going to use the market adjusted model instead of the CAPM to calculate expected returns. The market adjusted model is a special case of the CAPM, where ‘constraints on the parameters α_i and β_i wants them to be set equal to 0 and 1, respectively’ (Pacocco et al., 2018).

Events	CAAR
Banco Popular	-0.0112***
Venetian Banks	-0.0074*
Monte dei Paschi di Siena	-0.0231***
Yes Bank	-0.0156***
Credit Suisse	-0.0447***

Table 9: Robustness Check of Event Study Results

*** p<0.01, ** p<0.05, * p<0.1

Table 9 indicates that there are no changes of significance or negativity in most events. The only change happens to be for the Venetian Banks which changes from being statistically significant at 5% to being statistically significant at 10%.

To assess the validity of our OLS regression results we are going to perform two different robustness tests. These robustness tests analyze firstly, whether our model is sensitive to the

computation of the dependent variable. We are going to test the sensitivity of the dependent variable by using different event windows. Secondly the robustness of the regression model will be tested through excluding and including variables separately (Carlini et al, 2020).

Events	Event Window	CAAR
Banco Popular	(0; +10)	-0.0025
Venetian Banks	(0; +9)	-0.0097**
Monte dei Paschi di Siena	(0; +10)	-0.0218***
Yes Bank	(0; +7)	-0.0124***
Credit Suisse	(0; +8)	-0.0310***

Table 10: Descriptive Statistics of different Event Windows

*** p<0.01, ** p<0.05, * p<0.1

During the first robustness test we decide to take the event window with the second highest negative CAAR. The Bank from India only has one negative CAAR value for the combinations of the various event windows which is why we take the CAAR of the previous event window in this case.

Table 10 shows that not all five bank events produce statistically significant CAAR's. Three of them are statistically significant at 1% and one of them is statistically significant at 5%. Banco Popular has the lowest CAAR with -0.25% and Credit Suisse the highest with -3.10%. In between are the Venetian Banks with -0.97%, Yes Bank with -1.24% and Monte dei Paschi di Siena with -2.18%.

VARIABLES	(1) CAR
AT1	-0.0063 (0.0041)
Tier2	-0.1144 (0.1953)
CaR	0.1056* (0.0585)
Size	0.0060*** (0.0011)
Capital	-0.0371 (0.0771)
Profit	0.9067*** (0.0730)
Efficiency	0.0001 (0.0140)
Constant	-0.1894*** (0.0321)
Observations	920
Adjusted R^2	0.1802
Time FE	YES
Country FE	YES

Table 11: Results of Robustness Check using different event windows

Standard errors in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

The results in Table 11 show us that our model isn't sensitive to the computation of the dependent variable neither regarding the impact of our variables of interests nor regarding the impact of our control variables on the dependent variables (compare results with Table 8).

Furthermore, we check the validity of the model excluding control variables. We decide to exclude Efficiency as it has the lowest critical value.

VARIABLES	(1) CAR
AT1	-0.0054 (0.0039)
Tier2	-0.1598 (0.1850)
CaR	0.0933* (0.0554)
Size	0.0046*** (0.0010)
Capital	-0.0421 (0.0729)
Profit	0.9004*** (0.0685)
Constant	-0.1603*** (0.0265)
Observations	920
Adjusted R^2	0.1825
Time FE	YES
Country FE	YES

Table 12: Robustness Check excluding Control Variable

Standard errors in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

The results in Table 12 show us that our model isn't sensitive to the removal of control variables (compared to our main model) neither regarding the impact of our variables of interests nor regarding the impact of our control variables on the dependent variable (compare results with table 8).

Lastly, we check the validity of our model by replacing control variables. We decide to use market capitalization as control variable because 'It gives an investor an insight to the future prospects of the company and whether or not they should invest' in the company. We replace the previously removed efficiency variable with the market capitalization (Kumar and Kumara, 2020).

VARIABLES	(1) CAR
AT1	-0.0063 (0.0042)
Tier2	-0.1768 (0.2242)
CaR	0.0903 (0.0719)
Size	0.0101* (0.0054)
Capital	0.0202 (0.1045)
Profit	0.9017*** (0.0707)
Market Cap	-0.0057 (0.0057)
Constant	-0.1736*** (0.0323)
Observations	750
Adjusted R^2	0.2013
Time FE	YES
Country FE	YES

Table 13: Robustness Check replacing Control Variable

Standard errors in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

The results in Table 13 indicate changes regarding the impact of variables of interest and control variables on the dependent variable. Starting with the former we see that there are no changes regarding the positive or negative impact on the dependent variable. Additionally, the AT1 and T2 variables don't show changes in terms of significance, whereas our CaR variable changes to being statistically insignificant. The latter illustrates no changes of positive or negative impact on the dependent variables for the most part. However, the capital variable becomes positive. Furthermore, we can see that in terms of statistical significance the only change is the size variable which gets statistically significant at 10% level instead of the previous 1% level (compare all results with table 8).

Lastly, the observations decrease in sample size from 920 to 750 observations due to adding the market capitalization as control variable.

7. Limitations and Further Research

One of the limitations existing in this thesis occurs in the usage of AT1 and T2 data. Like already explained AT1's can be either preferred shares or high-trigger Cocos and T2's can be either non-Coco subordinated debt or low-trigger Cocos. Refinitiv Eikon doesn't distinguish between those and just provides data for AT1's and T2's in general. Our suggestion is to further distinguish AT1's and T2's.

One general limitation of the thesis is the scarce data available due to missing data. We would suggest to analyze write down or convertible events before the timeline we use and include more banks to get more observations which will lead to overall more robust results.

Further Suggestion are to distinguish between convertible Cocos and write down Cocos. Analyzing the impact between convertible Cocos or write down Cocos within bank assets on the dependent variable could be very interesting.

Researchers could even undertake a Google search analysis to investigate the impact of media presence of the write downs or conversion of bonds on the dependent variable. Whereas, Credit Suisse's and Yes Bank's write down made many headlines in the media, the conversion or write down of the other events were rather more difficult to find. However, the higher presence of the bank from India and Switzerland could be mainly due to the fact that in their cases, the banks retained equity before debt which is usually against the priority of order.

Another suggestion would be to differentiate between the impact of banks on the dependent variable who converted their shares and banks who wrote them down. You could even differentiate between partial and complete write downs.

The last suggestion would be that researchers could separate between the impact of bank events during which the bank got acquired and events were the bank just written down or converted their equity.

8. Conclusion

The purpose of the study was to investigate the impact of financial distressed banks and their corresponding acquisitions, write downs or conversions of AT1 bonds on bank stock returns using ESM. Additionally, we wanted to analyze the relationship between CAR of banks as dependent variable, our control variables and our variables of interest using regression analysis. Our control variables are bank-specific controls and our variables of interest include AT1 related concepts.

The event study results confirmed that all selected events have statistically significant negative impact on banking sectors return which confirmed our first hypothesis. We find that our results are robust to alternative measures of the expected market return.

The relationship between the presence of AT1 bonds in bank assets on the dependent variable doesn't confirm our second hypothesis. However, we can say that there is a slightly negative impact of having AT1's in bank assets on bank stock returns even though not a statistically significant one like hypothesized. Our third hypothesis gets confirmed and we can see that there is indeed a negative impact of the T2 ratio on the dependent variable. We don't hypothesize a statistically significant impact because the selected events mainly focus on the write down or conversion of AT1's. Our last hypothesis confirms the hypothesis which states that the CaR has a positive significant impact on the dependent variable. The significant impact happens to be at 10% level.

The further analysis between the bank specific control variables and the dependent variable showed us that the variables size and profit have positive statistically significant impacts on the dependent variable at 1% respectively. However, the control variables capital and efficiency don't have statistically significant impacts on the CAR of the banking sector.

Evaluating the robustness of our regression results we can see that our regression model isn't sensitive to the usage of other event windows. Additionally, excluding the efficiency variable doesn't have an impact on the results of the regression either. Our last robustness check included the simultaneous removal of the efficiency variable and insertion of the market capitalization as control variable. In this case we could observe small changes in our regression results. Overall, we can say that our results are robust.

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