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Banking Paradox: The dual impact of M&A deals on EU bank stability amid global crises

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ABSTRACT

The dissertation investigates the impact of Mergers and Acquisitions (M&A) on the risk profile and financial stability of European banks, focusing on the period between 2007 and 2022. This topic has remained inconclusive in previous research. Findings reveal that both the quantity and normalized value of M&A deals enhance bank profitability and stability. However, M&A deals paradoxically increases insolvency risk. The study further exposes the significant negative impact of the Global Financial Crisis and the COVID-19 crisis on the risk profile and financial stability of banks. This research also underscores the need for strategic M&A planning and robust risk management in the banking sector, especially in the dynamic financial landscape of the EU banking sector.

Keywords: M&A, Banks, Financial Stability, Insolvency Risk, European Union

JEL codes: G33, G34

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CHAPTER 1: Introduction

The financial world was shocked by the news of the collapse of Silicon Valley Bank, which was considered a critical institution for sustainable startups in Silicon Valley (Makortoff & Paul, 2023). Subsequently, Credit Suisse, the second-largest bank in Switzerland, suffered a liquidity crisis which resulted in its collapse in March 2023. Hence, the Credit Suisse was bought by rival UBS for about 3.3 billion USD (Economics Observatory, 2023). This naturally sparked fears around the world, prompting the question of whether we are heading towards another global financial crisis. Besides that, Figueiras (2021) has pointed out that the euro area banking sector has undergone consolidation since the global financial crisis, resulting in a more concentrated market. However, excess capacity and weak profitability persist, particularly for smaller banks burdened by high fixed costs associated with maintaining physical banking infrastructure. To address this issue, policymakers are proposing further consolidation, especially among smaller banks and measures to reduce costs to improve financial stability. This raises the question whether merger and acquisitions (M&A) activities in the banking sector would lower the risk of the next global financial crisis in the euro area banking sector. Consequently, I aim to analyze the impact of M&A activities on financial stability in the European Union (EU) banking sector, including the United Kingdom.

M&A activities have repeatedly been examined due to their relevance in the banking sector. For instance, Beccalli and Frantz (2009) examine the impact of M&A activities on bank performance that occurred in the EU. Their findings reveal a deviation from the dominant trend of consolidation within the banking sector. Rather than improving financial performance, their dataset suggests that M&A actions can slightly decrease return on equity, cash flow returns, and profit efficiency. However, it's notable that these activities significantly enhance cost efficiency. Thenceforth, the results of several studies with the focus on bank mergers occurred in Europe are various. On this matter, Altunbas and Ibáñez (2004) argue that M&A activities that occurred in the EU banking industry between 1992 and 2001 resulted in improved accounting profitability on average. By contrast, Altunbas et al. (1997) had already presented empirical evidence suggesting that the possibilities for cost reduction might be restricted in the case of major mergers in the banking industry. This means that the potential cost savings from merging large banks may not be as significant as anticipated. These two articles mainly focus on cost savings through M&A deals and their contribution to the financial stability of the banking sector. Lastly, Pana et al. (2010) report that the bank mergers can also impact aggregate

liquidity and market competition. Overall, it is worth mentioning that the literature regarding M&A activities in the banking sector has been prominent in the academic world.

However, there appears to be a gap in academia regarding studies focused on the impact of M&A activities on financial stability in the euro banking sector both before and after the 2008 global financial crisis and the COVID-19 crisis. To fulfill this gap, the financial stability first ought to be delineated as it is a comprehensive concept. The financial stability is built up onto three pillars: financial intermediaries, markets and financial systems. This dissertation concentrates only on the financial intermediaries such as commercial and investment banks. In a recent study, Ijaz et al. (2020) conclude that reduced competition in the banking sector enhances financial stability where M&A activities lead to reduced competition in the banking sector. Likewise, Soedarmono et al. (2011) conducted research on the positive impact of market power on the relationship between economic growth and financial stability in Asian countries. This paper distinguishes itself by especially examining the impact of M&A activities on the financial stability of banks in the European Union (EU) while accounting for idiosyncratic and systematic through bank-level and country-level control variables. Ultimately, this leads me to the following central research question: What is the impact of M&A activities on the insolvency risk and financial stability in the European Union (EU) banking sector, with a focus on the period between 2007 and 2022?

I study this research question by making use of the macroeconomic data in the EU provided by the European Central Bank and of the M&A deals dataset from Orbis, including the United Kingdom. The analysis encompasses all banks located in European Union that have engaged in M&A deals within the timeframe of 2007 to 2022. Subsequently, I regress the quantity and normalized volume of all completed bank M&A transactions on following financial stability indicators, as adopted from the article by Soedarmono et al. (2011). The standard deviation of banks' return on average assets (SDROA) and of banks' return on average equity (SDROE) are used to measure bank income volatility, since bank income volatility indicates the risk-taking strategies of banks. Afterwards, the Z-score method based on Return on Average Assets (ROAA) is utilized to evaluate the risk of a bank becoming insolvent. Soedarmono et al. enlightened the calculation method as follows: "The Z-score (ZROA) indicates the number of standard deviations that the bank's ROAA has to fall below its expected value before equity is completely exhausted. Thus, higher Z-score is interpreted as a decrease in bank insolvency risk." That means that a higher Z-score is indicative of a decreased

likelihood of bank insolvency, implying that the bank's financial health is more stable. Likely, the Z-score based on ROAE (ZROE) is also added to check for robustness. Additionally, it is worth mentioning that the ratio of total equity to total assets (EQTA) serve as a proxy for bank capitalization. Using the OLS regression and random effects model, I regress the quantity and normalized volume of all completed bank M&A transactions in the EU on the following financial stability indicators SDROA, SDROE, ZROA, ZROE and EQTA.

Subsequently, the results of this regression are controlled for other factors to reduce the omitted variable bias. These control variables are also adopted from the paper by Soedarmono et al. (2011). The first control variable is firm size (SIZE), as the firm size may determine their M&A strategies and different regulatory requirements may apply to larger firms. The size of a bank can potentially lead to an increase in risk-taking, driven by the 'too big to fail' phenomenon commonly seen in larger banking institutions, as suggested by Kane (2000) and Mishkin (2006). Specifically, firm size is represented by natural logarithm of total assets. Furthermore, the annual inflation rate (INF) is used as fluctuations at macroeconomic level can impact financial stability, aligning with the paper by Schaeck and Cihák (2007). Moreover, the ratio of net loan to total assets (NLTA) is utilized to measure bank liquidity, which may contribute to bank default probability. Afterwards, technical efficiency is assessed using the overhead expenses (OVERHEAD), based on the research findings of Agoraki et al. (2011) and Boyd et al. (2006). This ratio enables me to capture differences in how efficiently banks manage their operational costs relative to their asset base. Lastly, I incorporate a global crisis variable (GFC) and COVID-19 crisis variable in the form of a dummy variable to control for the effects during and after periods.

My hypothesis is that bank M&A deals significantly influence the financial stability of banks at firm level that have engaged in M&A transactions. I expect to indicate this relationship through significant coefficients from the regression analysis. Subsequently, this dissertation makes a valuable contribution to the existing literature by examining the impact of bank M&A transactions on financial stability at the firm level, while considering the effects of the global financial crisis and COVID-19 crisis. The obtained results can provide insights into possible effects of further consolidation, which can help policymakers to prevent the possible side effects of M&A deals for banks and lower the risk of the next banking crisis.

CHAPTER 2: Theoretical Framework

2.1 Financial Stability

To ensure a comprehensive examination of the research question, it is of paramount importance to provide a more thorough explanation of the prominent concepts involved. The initial focus is on defining financial stability, which serves as the dependent variable in the research question. However, it has been noted in significant academic papers that defining financial stability is challenging, especially when compared to other economic concepts that rely on precise formulas. The Governor of the Swedish central bank set this forth as follows: "the concept of stability is slightly vague and difficult to define. (Heikensten, 2004, p. 3)" Despite this difficulty, the European Central Bank offers a comprehensive perspective by identifying three essential pillars that contribute to understanding financial stability adequately.

"Financial stability can be defined as a condition in which the financial system – comprising of financial intermediaries, markets and market infrastructure – is capable of withstanding shocks and the unravelling of financial imbalances, thereby mitigating the likelihood of disruptions in the financial intermediation process which are severe enough to significantly impair the allocation of savings to profitable investment opportunities (European Central Bank, 2007)."

The first pillar focuses on the health and resilience of individual financial intermediaries such as banks, insurance companies and investment firms, which play a crucial role in allocating economic resources such as funds, capital and risks. Afterwards, financial markets as the second pillar facilitate the connection between savers and investors, as well as risk sellers and risk buyers, providing an alternative avenue for financing outside of traditional financial institutions. They also enable the redistribution of risks among different financial intermediaries (European Central Bank, 2007). The financial infrastructure, involving payment and settlement systems that allows the financial markets and institutions are considered as the third pillar of the financial stability system. Therefore, the whole financial system needs to function efficiently and collectively, meaning that any vulnerability may disturb the whole financial system.

Likewise, Schinasi (2004) gives a parallel definition of the financial stability and define it as the capacity of the financial system to fulfil three main objectives: "(a) to facilitate both an efficient allocation of economic resources—both spatially and especially intertemporally—and the effectiveness of other economic processes (such as wealth accumulation, economic growth, and ultimately social prosperity); (b) to assess, price, allocate, and manage financial risks; and (c) to maintain its ability to perform these key functions—even when affected by external shocks or by a build-up of imbalances—primarily through self-corrective mechanisms." However, these are the core requirements to maintain the financial stability for the whole economic system, Allen and Wood (2006) assert that the financial stability for banks is highly comparable to the whole financial system's stability. Hence, these elements are of paramount importance to gain insight into the financial stability regarding the banking sector.

Consequently, this thesis focuses on the first pillar of the system, namely on the banking sector. In this context, Allen and Wood (2006) set forth that financial stability for banks can be considered as a condition where banks can carry out their operations efficiently, without significant disturbances that would harm individuals who could not reasonably have anticipated a bank's collapse. The financial stability for banks includes the efficient allocation of savings towards investment opportunities, stability in asset prices, and the prevention of financial market bubbles or excessive volatility. This is also in line with three main objectives stated by Schinasi (2004) as the efficient allocation and managing of economic resources and financial risks contribute to the financial system's stability.

2.2 Mergers and Acquisitions

2.2.1 Quantity and volume of M&A-deals

From 1985 to 2023, the global value of mergers and acquisitions (M&A) has been consistently increasing and reached unprecedented levels in recent years, despite occasional fluctuations. In 2021, there were a total of 57,948 global M&A activities, indicating that a deal took place approximately every 9 minutes. Thus, the number of M&A activities in 2021 was twice as high as the ratio mentioned in the paper by Cartwright and Schoenberg (2006) for the year 2004. Furthermore, the value of the deals in 2021 amounted over 5.2 trillion dollars. The underlying reason behind this phenomenon is caused by the so-called mega deals which are M&A deals worth one billion dollars (*Number of M&A Deals Globally 1985-2023 | Statista*, 2023b).

2.2.2 Definition of M&A deals

As the predicator of the regression, it is of paramount importance to first provide a definition of mergers and acquisitions (M&A) to get an enhanced understanding. In relation to this, Rao and Kumar (2013) interpret mergers and acquisitions as processes that involve activities such as corporate takeovers, structural adjustments, or shifts in corporate control. These activities subsequently lead to changes in how companies are owned. Moreover, M&A activities can come about through various mechanisms such as buyouts, minority acquisitions, and divestments (Teerikangas, Joseph & Faulkner, 2012). Nevertheless, this paper takes only mergers and acquisitions into consideration. Despite different manners, one has the identical purpose by engaging M&A deals, namely generating value added to the entity. In the following paragraphs of this chapter, I give the comprehensive definition of mergers and acquisitions and how they are stated in the academia.

Hogarty (1970) conducted a research on the concept of M&A, which ultimately resulted in one of the foremost seminal studies in this literature. He defines a merger as a business strategy of combining two or more companies into a single company to improve the financial and operational strengths and stability of both organizations in question. Subsequently, Hogarty (1970) sets forth that a merger often involves a larger company absorbing a smaller one, which will then cease to exist. The larger company's stock continues to be traded, while the smaller company's shares are no longer in circulation, and its shareholders receive equivalent shares from the larger company.

On the other hand, the process of an acquisition is comparable where one company acquires the business assets of the target company. In an acquisition process, the acquiring company can purchase the target company's stock or assets (Snow, 2011). As a result of this reallocation, the control of the target company is transferred to the acquiring company. In general, the target company often ceases to exist after the acquisition process is completed.

2.3 Relationship between M&A-deals and Financial Stability

The research on the relationship between M&A deals and financial stability of banks remains inconclusive. First, Beccalli and Frantz (2009) research the impact of M&A activities on bank performance, whereby they analyze a sample of 714 M&A deals in the EU between 1991 and 2005. Their paper revealed a divergence from the dominant trend of consolidation within the banking sector. Rather than improving financial performance, their dataset suggests

that M&A actions can slightly decrease return on equity, cash flow returns, and profit efficiency. However, it's notable that these activities significantly enhance cost efficiency. Likewise, Shah and Khan (2017) drawn a comparable conclusion that the operating performance which is measured with profitability and stability ratios of acquiring banks such as ROE and ROA, has deteriorated after a merger period. Nevertheless, these two articles are not in line with the highly regarded paper by Vennet (1996) that focuses on analysing the performance effects of M&A specifically between EC credit institutions from 1988 to 1993. They conclude the following in their work: "The results indicate that domestic mergers among equal-sized partners significantly increase the performance of the merged banks." On the other hand, Badreldin and Kalhöfer (2009) researched the effect of M&A activities in Egypt after the global financial crisis by utilizing ROE as performance measurement. They infer that sufficient evidence could not be obtained to draw a conclusion that M&A activities affect the profitability a financial stability of banks. All studies considered, there is no dominant conclusive inference in this context. In addition, SDROA, SDROE and EQTA are utilized in several articles to indicate the income volatility, bank performance and bank capitalization, aligning with the papers by Shah and Khan (2017) and Soedarmono et al. (2011). Considering the recent papers regarding this research field, I formulate the first null hypothesis of this paper:

Hypothesis 1: M&A activities positively influence the financial stability and profitability of a bank in the European Union.

To better comprehend the effects of M&A deals, research on consolidation in the banking sector can provide partial insights into the post-deal effects on financial stability. This is because bank consolidation can occur, among other methods, through M&A activities. Levine et al. (2006) underscore in their work that countries with less competitive banking systems tend to face a higher risk of encountering banking crises. Given that M&A activities contribute to bank concentration, it can be inferred from their work that M&A activities helps to reduce bank insolvency risk, both at the bank level and at the system level. This is contrary to the paper by De Nicoló et al. (2003), as they concluded that higher banking concentration does not directly lead to increased fragility in the banking system.

In another study conducted by Uhde and Heimeshoff (2009), banking sector consolidation and corresponding insolvency risk are examined by analyzing a significant sample of EU-25 banks spanning from 1997 to 2005. Moreover, the Z-score has been utilized to calculate the banks' insolvency risk. Their conclusion is that there is a direct link between banking sector concentration and two key factors: bank profitability and the likelihood of bank insolvency. They observed that as the concentration within the banking sector increased, both the profitability of banks and the probability of bank insolvency also rose. Consequently, this leads to the second null hypothesis:

Hypothesis 2: M&A activities has a positive influence at reducing bank insolvency risk in the European Union.

CHAPTER 3: Data

3.1 Dataset enlightenment

The required dataset is obtained from Orbis, which includes the M&A deals and corresponding bank financial data. Considering the fact that the M&A deals are general term for reallocation for the companies, there are, as mentioned earlier, more than a few methods by which M&A activities occur through several methods such as leveraged buyouts, joint-venture and capital increase. Nevertheless, I have exclusively selected the mergers and acquisitions deals to delineate the scope of the research and to avoid regulatory issues. Afterwards, those deals have been filtered by the banking sector and the location as the European Union countries, including the United Kingdom. Subsequently, the dataset includes only the deals that are registered as completed in the dataset because the deals announced or pending do not provide any reliable information and their effects cannot be measured reliably. After applying those criteria to the dataset, I ultimately acquired the dataset consisting of 781 mergers and acquisition deals, which are engaged by 261 banks. Afterwards, the corresponding financial variables of banks engaged a M&A deal are also acquired from Orbis. Although this dissertation examines deals that occurred between 2007 and 2022, the financial data of banks involved in these deals were collected starting from 2005. This was done to enable the calculation of standard deviations over a three-period rolling window. Lastly, inflation rates per country over the chosen period are acquired from the database of the European Central Bank.

The composition of the dataset is of paramount importance for understanding the critical aspects of the data. The dataset contains three distinct dimensions: banks' financial data, deal-related variables, and three macroeconomic variables, namely inflation, the Global Financial Crisis and the COVID-19 pandemic. To create a comprehensive dataset, I utilized the identification numbers of the banks and the deal numbers, taking into consideration that the financial data of banks encompasses several years. Similarly, the INF variable, which is determined by the acquirer's country, spans multiple years. In contrast, the deal value is exclusive to each deal, leading to a discrepancy in the number of rows. To address this discrepancy, I opted to generate row duplicates for each deal, while also incorporating the time-variant financial data into each row. However, this approach does not allow me to measure the intended effect accurately. Therefore, I have created a new dummy variable, called 'Deal Dummy', to precisely indicate the occurrence of a deal. Utilizing this dummy variable, the deal effect after a deal can be measured more accurately.

3.2 Dependent variables: Financial Stability

This dissertation exploits five dependent variables to measure the financial stability of a bank, by which bank income volatility, bankruptcy risk and capital base are used to capture the financial health of a bank by several aspects. To assess the volatility of bank income, I utilize the standard deviation of banks' return on average assets (SDROA) and return on average equity (SDROE). These calculations are carried out over a moving window of three periods. This indicates that SDROA and SDROE encompasses values from period *t* to *t-2*. This method is namely in line with Soedarmono et al. (2011) and Agoraki et al. (2011). Afterwards, the bank capitalization base is captured by the ratio of total equity to total assets (EQTA) and is calculated where *i* and *t* indicate bank and time respectively.

$$EQTA_{i,t} = \frac{Equity\ or\ Shareholders'\ Equity_{i,t}}{Total\ Assets_{i,t}}\ x\ 100$$

To address the potential risk of bank insolvency, the Z-score (ZROA) method is employed, which relies on the Return on Average Assets (ROAA). Soedarmono et al. (2011) enlightens the ZROA as follows: "The Z-score (ZROA) indicates the number of standard deviations that the bank's ROAA has to fall below its expected value before equity is completely exhausted. Thus, higher Z-score is interpreted as a decrease in bank insolvency risk." Hence, the ZROA is calculated below.

$$ZROA_{i,t} = \frac{ROAA_{i,t} + EQTA_{i,t}}{SDROA_{i,t}}$$

To obtain a comprehensive and robust evaluation of the bank's solvency risk, the Z-score is calculated again, but this time based on the Return on Average Equity (ROAE). By incorporating the ROAE in the formula, the Z-score (ZROE) provides an additional indicator to measure the bank's financial stability and the likelihood of insolvency.

$$ZROE_{i,t} = \frac{ROAE_{i,t} + 1}{SDROE_{i,t}}$$

Hence, this dual approach utilizing both the ZROA and ZROE enables me to acquire a robust evaluation of the bankruptcy risk.

3.3 Explanatory variables: Quantity and Normalised Volume of M&A deals

This section focuses on two explanatory variables, namely: the quantity and normalised volume of M&A deals engaged by a bank. The quantity stands for the number of completed M&A deals that a bank has already engaged in the past. This enables me to account the effect of each incremental M&A deal. Similarly, the volume of a deal plays a determinative role in M&A transactions as it essentially affects the liabilities, equity and the essential credit risk in the firm. However, the mega deals may mislead the relationship between the volume of a deal and a banks' financial stability. For this reason, I normalized the volume of each deal by dividing it with total asset from the previous year.

$$Normalised\ Volume_{i,t} = \frac{Volume\ M\&A\ deals_{i,t}}{Total\ Assets_{t-1}}$$

3.4 Control variables

To reduce the endogeneity that would invalidate the outcome of the regression, there are seven control variables added to the regression. First, the firm size is formulated as natural logarithm of total assets for each year. The reason of adding firm size as a control variable is that firm size may results in an increase in risk-taking, driven by the 'too big to fail' phenomenon as suggested by Kane (2000) and Mishkin (2006). Afterwards, the weighted average of the harmonised index of consumer price (HICP) is incorporated in the regression for each countries' annual inflation rate (INF). Schaeck and Cihák (2007) state in their paper that fluctuations at macroeconomic level can cause financial instability and can decrease the likelihood of engaging a deal. Furthermore, the ratio of net loan to total assets (NLTA) is included in the regression to control for bank liquidity. Agoraki et al. (2011) and Boyd et al. (2006) suggest that the overhead expenses (Overhead) can provide crucial insights into differences in operational costs relative to their asset base. Considering the chosen timeframe from 2007 to 2022, the global financial crisis (GFC) and COVID-19 crisis ought to be incorporated in the form of a dummy variable to control for the effects during and after the crisis periods. To capture the beginning and ending effects of the GFC, I decided to set up the timeframe from 01-01-2007 to 31-12-2009. Likewise, there is also the COVID-19 crisis dummy variable added in the regression for the time period of 01-01-2020 to 31-12-2022. The reason for this exact period is that the UN World Health Organization (WHO) has declared an end to

the COVID-19 crisis on 5 May 2023 (*WHO chief declares end to COVID-19 as a global health emergency*, 2023). However, my research timeframe does not contain the year 2023.

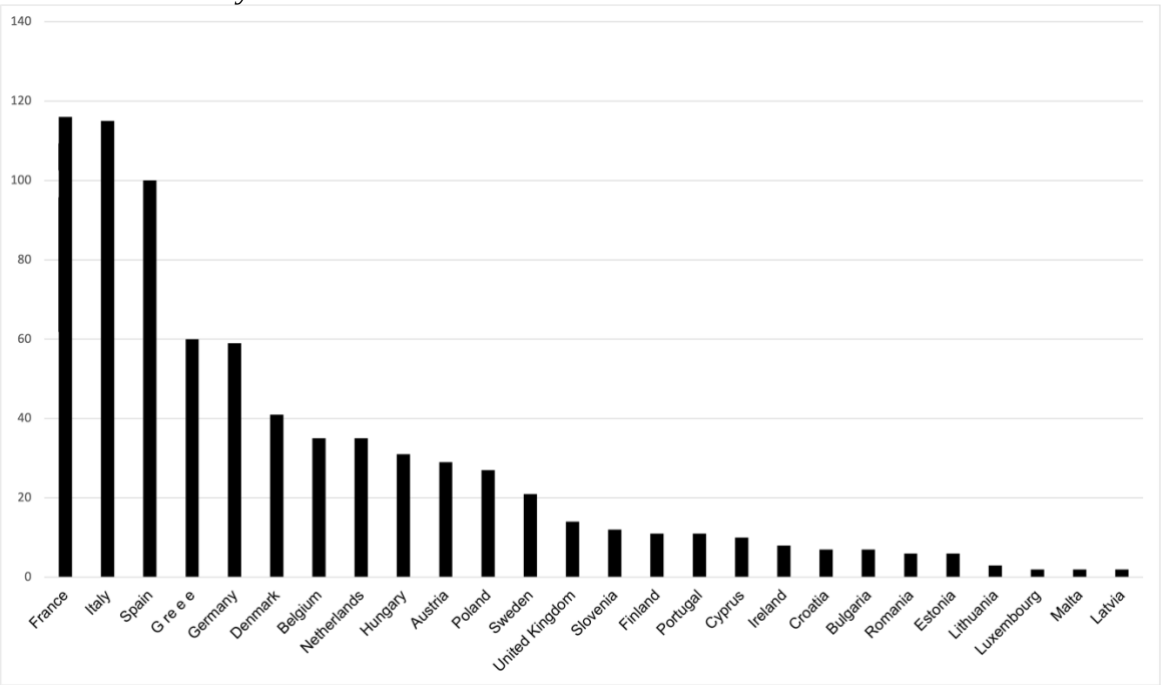
3.5 Descriptive statistics

Considering the number of variables over the period from 2005 to 2022, I decided to stack the variables from corresponding years into a single column in order to present them appropriately. Despite that, it can be seen in Table 1 that the number of observations does not match entirely. The first explanation for this is that not every bank has existed for the entire period. For instance, there are a few banks that ceased to exist at a particular moment in time due to reasons such as bank collapse, mergers, and acquisitions. This raises the question of how reliable and complete the dataset is in this case. Regarding this issue, the planes that returned in one piece after the Second World War are the most famous example of survivorship bias. The purpose is thereby not to examine the bullet points to track down the weak points of a plane. On the contrary, the places without a bullet point are considered the weakest parts. Likewise, bank collapses are a comparable instance in this context. In order to measure the effect of mergers and acquisitions appropriately, the banks with missing values after a certain moment in time should be taken into consideration as well. Otherwise, it would be the case that only the banks that endured the crises or bank insolvency risks are included in the regression. All things considered above; I conclude that utilizing more than one indicator, namely 5, regarding financial stability enables me to measure the effects of M&A activities from several perspectives.

Prior to describing the variables, proving a figure with countries where the deal found place is efficient for grasping the anatomy of the dataset. In figure 1 it can be seen that France, Italy and Spain are precursors when it comes to M&A deals. Except for France, Italy, and Spain, which have faced several crises in the past, these countries have engaged in a higher number of deals compared to countries with a larger GDP, such as Germany and the Netherlands. This suggests that banks in Italy and Spain have utilized M&A activities as a means of recovering from crises.

Figure 1

Countries summary

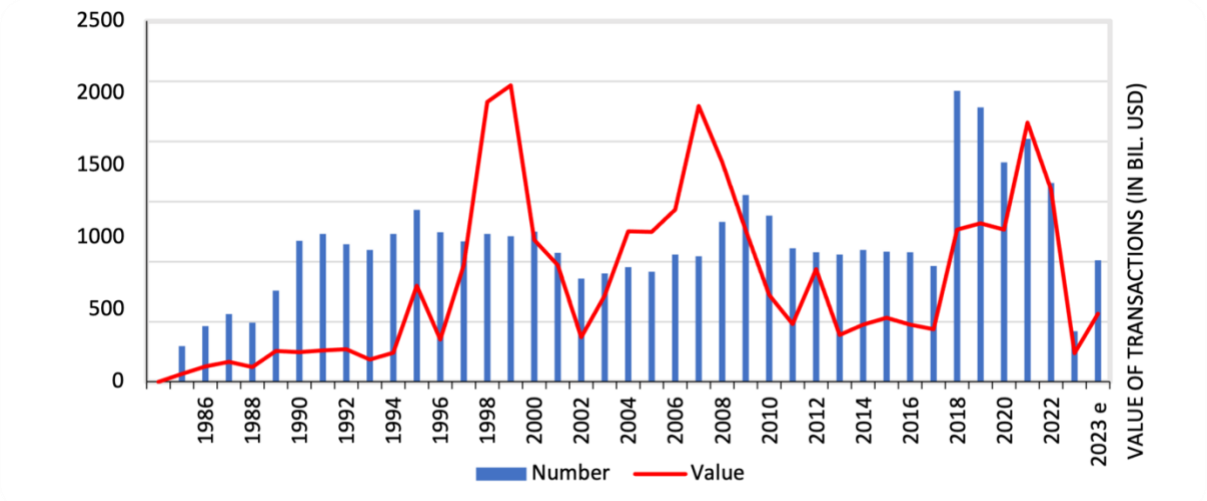


Notes: This figure illustrates the origin countries of banks that have engaged deals from 2007 till 2022.

Furthermore, it should be stated that figure 2 illustrates the prominence of M&A activities over the past years in the EU. However, the number of deals has slightly decreased following the global financial crisis, leading to a tremendous drop in their value. One would expect to observe a similar pattern during the COVID-19 crisis. In contrast, the level of deal numbers and their value has almost reached the same level as before the global financial crisis. This phenomenon may suggest that banks preferred to engage M&A activities in order to survive the crisis.

Figure 2

M&A activities in the banking sector in the EU



Notes: This figure is adopted from Imaa-institute (2021, December 6).

Subsequently, one notable aspect is the bank's maximum number of engaged deals, with a mean of 4.380, while the highest recorded number is 27. Additionally, mega deals are also evident in the volume variable, with a mean of 560 million euros and a maximum of 29.6 billion euros. This emphasizes the significance of normalizing the volume. However, there is a discrepancy in the number of observations between the Adjusted Volume and the Volume, specifically 602 and 781, respectively. Nevertheless, it is crucial that mega deals are not as dominant after normalization as they were before in terms of the Volume. As illustrated in Table 1, the mean decreased tremendously to 24 million euros, with a maximum of 1.1 billion euros. Hence, it is conclusive to include only the normalised volume in the research. Moreover, the deal percentage during the global financial crisis is equal to 24.8 %. In contrast to figure 2, only 9.9 % of deals in the dataset has occurred during the COVID-19 crisis. The phenomenon would mean that other kinds of M&A methods have been preferred that are not included in the current dataset. Lastly, Table A1 accounts for the multicollinearity, suggesting that there is no evidence of multicollinearity among the variables used in this paper.

Table 1
Descriptive statistics

Variables	Definition	Obs.	Mean	Std. Dev.	Min	Max
EQTA	Ratio of equity to total asset	*3,692*	13.619	18.080	-3.931	100
SDROA	Standard deviation of ROA from three-year rolling window	*2,323*	1.284	2.313	0.004	24.675
SDROE	Standard deviation of ROE from three-year rolling window	*4,176*	5.997	15.823	0.000	580.977
ZROA	Z-score based on ROA	*1,869*	26.773	49.651	-61.583	936.622
ZROE	Z-score based on ROE	*2,150*	7.457	71.655	-454.735	1,855.363
Quantity	The number of deals engaged by a bank	*781*	4.380	4.700	1	27
Volume	Deal Value (In thousands)	*781*	559,809	1,967,970	34	29,609,699
Norm. Volume	Normalized Deal value (In thousands)	*685*	23,045	77,386	2	1,072,566
NLTA	Ratio of net loan to total assets	*3,524*	51.949	23.771	0.000	98.798
SIZE	Logarithm of total average assets	*3,691*	19.278	9.150	1.008	28.514
Overhead	Ratio of operating expenses to total revenue (In thousands)	*3,674*	2,216,918	4,995,559	-15,000	48,015,000
INF	Annual inflation rate based on HICP	*9180*	2.569	1.699	-4.478	15.402
GFC	Global Financial Crisis Dummy	*781*	0.248	0.432	0	1
COVID19	COVID-19 Crisis dummy	*781*	0.099	0.298	0	1

Notes: the definitions of the variables are adopted from the article by Soedarmono et al. (2011).

CHAPTER 4: Method

Considering the scope and complexness of the collected data, I make use of Python for better data management. To estimate the causal relationships in the panel data as described in the hypothesis 1 and 2, the Ordinary Least Squares regressions (OLS) and random effects (RE) models are utilized. Afterwards, the financial stability is captured by five indicators, namely: SDROA, SDROE, ZROA, ZROE and EQTA. Initially, it can be seen in the first regression that there were two explanatory variables included: Quantity and normalised volume, where *i*, *t* and *y* indicate bank, time and country index, respectively:

$$Financial\ Stability_{i,t} = \alpha + \beta_1 * Quantitiy_{i,t} + \beta_2 * Norm.Volume_{i,t} + \varepsilon_{i,t} \quad (1)$$

Subsequently, the control variables act as a mechanism to reduce omitted variable bias, as they also serve as indicators for both idiosyncratic and systematic risk. For instance, the control variables Size, NLTA, and Overhead incorporate idiosyncratic risk, thereby measuring corresponding effects. Similarly, the variables INF, GFC, and COVID19 enable me to account for systematic risk. Lastly, an indicator for deal occurrence is added in the form of a dummy variable to track the effects of a deal on the financial stability indicators. After adding the control variables, it results in the following equation:

$$Financial\ Stability_{i,t} = \alpha + \beta_1 * Quantitiy_{i,t} + \beta_2 * Norm.\ Volume_{i,t} + \gamma_1 * SIZE_{i,t} + \gamma_2 * INF_{y,t} + \gamma_3 * NLTA_{i,t} + \gamma_4 * Overhead_{i.t} + \gamma_5 * GFC_{i,t} + \gamma_6 * COVID19_{i,t} + \gamma_7 * DealDummy + \varepsilon_{i,t} \quad (2)$$

Subsequently, the White coefficient covariance method is used as a tool to address heteroskedasticity and autocorrelation issues for OLS regressions. Nevertheless, it remains unclear in the outcomes of OLS regressions whether there are any omitted variables that might interfere with the relationship between the predictor and outcome. In this regard, utilizing random or fixed effects in panel data analyses allows me to account for factors specific to individual banks and time-specific characteristics that cannot be directly observed, especially in panel data analysis. Consequently, I have chosen to use the Durbin–Wu–Hausman test to distinguish between fixed and random effects. The null hypothesis is that the difference in coefficients between the random-effects and fixed-effects models is not systematic or significant. Based on the probability value of 1.000, there is no evidence to reject the null

hypothesis. Thus, it can be concluded from this that the coefficients in the random-effects model are consistent and robust. Any differences observed between the random-effects and fixed-effects models can be attributed to random variation or noise. In addition, it should be highlighted that the White test for random-effects models is not required, as the random-effects model already controls for unobserved heterogeneity by accounting for bank-specific effects.

CHAPTER 5: Results & Discussion

5.1 Regression results

The obtained regression results are presented in Table 2, which is discussed in this chapter. Table 2 displays the previously mentioned regressions, where the rows represent the explanatory and control variables, and the columns illustrate the predicted variables.

5.2 Hypothesis 1 analysis

The first hypothesis concerns the positive relationship between the financial stability/profitability of a European bank and M&A activities within the European Union. Therefore, the regressions on SDROA, SDROE and EQTA as dependent variables are discussed regarding the analysis of the first hypothesis.

5.2.1 Regression on SDROA

In the context of the first conducted OLS regression, the coefficient of the quantity independent variable is found to be significantly positive at the 1% level and equals to 0.035. This indicates that a one-unit increase in quantity corresponds to an average increase of 3.5% in the SDROA, ceteris paribus. Although this OLS regression is controlled for heteroskedasticity and autocorrelation issues via the White test, the random-effects (RE) models in panel data account for unobserved bank-specific effects. The use of the RE model yields a slight difference, shifting from 3.5% to 3.9%. This coefficient is also significant at the 1% level. This implies that an increase in the number of completed M&A deals a bank has previously engaged in contributes positively to its financial stability and profitability.

Subsequently, the coefficient of the normalised volume independent variable in the OLS regression is found to be significantly negative at the 1% level. The coefficient of the normalised volume is equal to 0.001, representing generally a diminutive effect. Nevertheless, the small magnitude of this coefficient does not necessarily imply that the normalised volume does not have a significant impact on the financial stability and profitability of a bank. Considering that the normalised volume can reach significant values in the millions or even billions, the coefficient still offers sufficient insight. The interpretation of the coefficient relates to the normalized volume, the mean of which is 23 million. This implies that a one-unit increase in the normalised volume leads to a significant average increase of 2.3% in the SDROA, ceteris

paribus. The RE model then estimates the coefficient as 0.002 at the 5% level, higher than the OLS regression estimate. Using the same mean value and RE model, an increase in the normalized volume corresponds to an average increase of 4.6%, all other variables being constant. Given the coefficient of normalized volume from the RE model, it must be concluded that the normalized volume variable positively influences a bank's financial stability and profitability.

5.2.2 Regression on SDROE

The same pattern is also observed in the regressions on SDROE using both OLS and RE models. Initially, the estimations of both the OLS and RE model are found to be significantly positive at the 1% and 5% levels, respectively. Subsequently, the coefficient of the quantity variable decreases from 4.5% to 4.3% after accounting for unobserved bank-specific characteristics through the RE model. Hence, when a bank engages in an additional M&A deal, this results in an average increase of 4.3% in the SDROE, ceteris paribus.

Subsequently, the coefficient of the normalised volume utilizing the OLS regression is found to be significantly positive at the 1% level and equals to 0.001. Reapplying the RE model results in the same coefficient, which is significant at the 5% level. Similarly, the RE model estimates the same coefficient of 0.001 for the normalized volume. Using the mean of the normalized volume as a reference, a one-unit increase in the normalized volume results in an average increase of 2.3% in the SDROE. Thus, from the above discussion, it can be inferred that both the quantity and normalized value have a positive impact on an individual bank's financial stability and profitability.

5.2.3 Regression on EQTA

It is notable that all three explanatory variables show approximately the same pattern across the board. First, the OLS model yields a positive estimation of 23.4% for the quantity on the EQTA. Afterwards, the RE model estimates a positive estimation of 79.6% for the quantity, which is nearly four times higher than the estimated coefficient via OLS. This difference can be explained by the functionality of the RE model, which is designed to account for potential unobserved effects that are not constant over time. In contrast, the OLS model cannot adequately handle these time-varying unobserved effects. Consequently, the RE model may provide a more accurate representation of the data, which can possibly contain time-varying

unobserved effects. Furthermore, these coefficients are again significant at the 1% level. With a one-unit increase in quantity, that results in an average increase of 79.6% in EQTA.

Afterwards, the OLS and RE models present a positive coefficient for the normalised volume variable, which are both found to be significantly negative at the 1% level. The use of the RE model yields a difference, shifting from 0.008 to 0.024. To demonstrate the effect of this magnitude, I reuse the mean of the normalized volume. Consequently, a one-unit increase in the normalized volume results in an average increase of 55.2% in the EQTA. This increase is sufficient to form the conclusion that both the quantity and normalized value significantly positively affect an individual bank's financial stability and profitability.

Since the RE and OLS models on SDROA, SDROE and EQTA demonstrate a significant positive relationship between both the quantity and normalized value of M&A deals and a bank's financial stability and profitability, the first null hypothesis must be accepted as this hypothesis states that M&A activities have a positive impact on the financial stability and profitability of a bank in the European Union. After enlightening the results for the first hypothesis, it is of paramount importance to discuss and to link the results to the reviewed literature in the second chapter. As the first hypothesis is rejected, the finding of this paper is indeed in line with the paper by Vennet (1996). He infers in his work that domestic mergers have a significant positive impact on the performance of the merged banks.

Table 2
Regression results

Explanatory	*SDROA*		*SDROE*		*ZROA*		*ZROE*		*EQTA*	
variables	*OLS (1)*	*RE (2)*	*OLS (3)*	*RE (4)*	*OLS (5)*	*RE (6)*	*OLS (7)*	*RE (8)*	*OLS (9)*	*RE (10)*
Quantity	0.035***	0.039***	0.045***	0.043***	-2.730***	-2.488***	-6.770***	-6.729***	0.234***	0.796***
	(0.003)	(0.013)	(0.005)	(0.012)	(0.432)	(0.785)	(0.744)	(1.080)	(0.015)	(0.106)
Normalized	0.001***	0.002**	0.001***	0.001**	-0.051***	-0.037***	-0.120***	-0.120**	0.008***	0.024***
Volume	(0.001)	(0.001)	(0.000)	(0.001)	(0.016)	(0.041)	(0.022)	(0.055)	(0.001)	(0.006)
NLTA	-0.004**	-0.003*	-0.006***	-0.011***	0.957***	0.957***	0.455	0.466**	-0.133***	-0.099***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.125)	(0.140)	(0.211)	(0.211)	(0.011)	(0.005)
Size	-0.270***	-0.316***	-0.231***	-0.261***	-1.604	-4.100*	17.094***	17.735***	-3.452***	-5.671***
	(0.029)	(0.025)	(0.033)	(0.030)	(1.733)	(2.007)	(2.979)	(3.008)	(0 .128)	(0.101)
Overhead	0.000**	0.000**	-0.000	-3.62e-06	0.003***	0.004***	0.002**	0.002***	0.001***	0.000**
	(4.30e-06)	(6.57e-06)	(5.02e-06)	(7.78e-06)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
INF	-0.027***	-0.014*	0.177***	0.215***	-3.664***	-3.518***	-0.853	-0.851	-0.060	-0.030
	(0.007)	(0.008)	(0.020)	(0.011)	(0.690)	(1.025)	(0.868)	(2.154)	(0.046)	(0.019)
GFC	0.060	-0.010	-0.141*	-0.251***	-27.792***	-26.053***	43.834**	43.555***	-0.850***	-0.887***
	(0.058)	(0.050)	(0.036)	(0.064)	(8.811)	(6.282)	(20.253)	(11.736)	(0.201)	(0.116)
COVID_19	-0.075*	-0.062	0.259***	0.208***	-42.439***	-44.855***	-65.270***	-65.896***	0.347	0.770***
	(0.039)	(0.050)	(0.049)	(0.064)	(4.169)	(6.177)	(5.818)	(11.604)	(0.340)	(0.118)
Deal Dummy	0.366***	0.151***	0.463***	0.185***	-13.772**	-9.248	-38.677***	-36.379***	2.527***	1.845***
	(0.056)	(0.055)	(0.058)	(0.070)	(5.751)	(6.233)	(10.899)	(11.604)	(0.271)	(0.134)
Constant	7.130***	7.330***	6.150***	6.485***	108.361***	164.861***	-311.573***	-305.372***	99.329***	151.581***
	(0.664)	(0.597)	(0.724)	(0.686)	(37.957)	(46.461)	(67.409)	(70.087)	(3.261)	(2.408)
R-square	0.025	0.055	0.089	0.084	0.025	0.024	0.020	0.020	0.287	0.253
Observations	10,436	10,436	10,436	10,436	10,232	10,232	9,952	9,952	10,448	10,448

Notes: This table includes 5 OLS regressions and 5 random-effects models with 5 different dependent variables: SDROA, SDORE, ZROA, ZROE and EQTA. Afterwards, the normalized volume and overhead are presented in millions to demonstrate their effect more clearly. Standard errors are demonstrated in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5.3 Hypothesis 2 analysis

The second null hypothesis states M&A activities has a positive influence at reducing bank insolvency risk in the European Union. Based on the regression models' results on ZROA and ZROE, this hypothesis is enlightened in the following paragraphs.

5.3.1 Regression on ZROA

Using OLS model, the quantity variables' coefficient is found to be significantly negative at the %1 level. In contrast to the regression in the second section. After utilizing the RE model, the coefficient yields a slight difference, increasing from -2.730 to -2.488. This implies that a one-unit increase results in an average decrease of 2.488 points in the ZROA. Therefore, it can be inferred that an increase in the number of completed M&A deals a bank has previously engaged increases a bank's insolvency risk.

Afterwards, the OLS model estimates the coefficient for the normalized volume as -0.051. Similarly, the use of the RE model increases the coefficient from -5.1% to -3.7% in comparison to the OLS model. Both coefficients are found be significant at the 1% level. To illustrate the magnitude of the normalized volume, the mean of the normalized volume is again used as a reference. This indicates that a one-unit increase in the normalized volume results in an average decrease of 0.851 points in the ZROA, meaning that the magnitude again is sufficient to draw a conclusion. Hence, it must be concluded that a banks' insolvency risk will increase if the normalized volume rises as well.

5.3.2 Regression on ZROE

The coefficient of the quantity is in line with the regressions' results on ZROA as in the sign and magnitude. Both the OLS and RE models estimates the coefficients of the quantity significantly negative at the 1% level. The RE model yields a slight difference, increasing from -6.770 to -6.729. This coefficient can be interpreted as indicating that an increase in the number of completed M&A deals a bank has previously engaged in will have a negative influence on bank insolvency risk.

Aligning with the regression on the ZROA, the OLS and RE models estimates the coefficient for the normalised volume variable as -0.120. These coefficients are significant at

the 10% and 5% levels, respectively, meaning that a one-unit increase in the normalised volume leads to a significant average decrease of -1.2% in the ZROE. Thus, it can be concluded that an increase in the normalised volume of a deal has a negative impact on a bank's insolvency risk.

Considering the negative coefficients obtained in both regression models for ZROA and ZROE, it can be concluded that the quantity of M&A deals a bank has previously engaged in has a negative influence on its insolvency risk. Similarly, both the OLS and RE models for ZROA and ZROE estimate that the normalized volume of a deal has a negative impact on a bank's insolvency risk. The second null hypothesis, which suggests that M&A activities have a positive influence on reducing bank insolvency risk in the European Union, should be rejected based on the findings related to the quantity and normalised volume variables.

Furthermore, the findings regarding the second hypothesis align with the research conducted by Uhde and Heimeshoff (2009). They concluded that an increase in concentration within the banking sector leads to higher bank profitability but also increases the probability of bank insolvency. This conclusion precisely aligns with the conclusions regarding the first and second hypotheses. In addition, both studies distinguish themselves by scrutinising the impact of M&A activities from an individual bank's perspective, thus providing valuable and comparable insights into the relationship between deal volume and bank insolvency risk.

5.4 Interpretation of control variables

In addition to the explanatory variables, control variables were included in the regression models. Their results hold significant importance for understanding of other main variables. Notably, the size variables largely demonstrated a significantly negative effect. This implies that large banks, as indicated by their natural logarithm of total assets, experience a detrimental impact on their financial stability following engagement in a deal. The findings contrast with the expectation that big firms would benefit from positive size effects due to economies of scale and scope. However, this negative relationship can be explained by the higher risk-taking attitudes of larger banks, which can be attributed to the 'too big to fail' effects observed (Kane, 2000; Mishkin, 2006). For instance, larger banks may willingly undertake higher-risk deals, which can potentially result in short-term financial instability. Afterwards, the magnitudes of the overhead expenses remain diminutive despite of scaling them in millions. Furthermore, most of the models observe a significantly negative relationship with the inflation

control variables. This finding is remarkable as it suggests that the increasing inflation at the country level can lead to a decrease in a bank's financial stability.

Subsequently, I initially included the control variables for the Global Financial Crisis (GFC) and COVID-19 to account for the effects of these significant crises in history. In the majority of the regression models, both crisis variables were found to have a significantly negative impact. This suggests that deals engaged in during these crises resulted in financial instability for banks. Furthermore, Figure 2 illustrates the decline in the number of M&A deals after the GFC and COVID-19, indicating that banks may have already observed and responded to this phenomenon.

5.5 Robustness check

While several control variables have been included in the models discussed in previous sections, not all have proven to be significant. Consequently, I've opted to exclude those control variables that did not demonstrate significance, as can be seen in Table B1. The underlying reason behind this is that insignificant control variables may lack relevance to the model and/or may not reveal a causal relationship with the variables being predicted. This approach allows me to revise the impact of explanatory variables, examining their validity under altered conditions. Comparing this with Table 2, there are no major changes in the sign and magnitude of the coefficients for both the quantity and normalized volume of M&A deals. Therefore, the results in Table B1 align with those found in Table 2.

After removing insignificant variables from the regressions, the deal time is incorporated as an additional control variable. The reason for this is that the timing of the deal may influence both the quantity and size of M&A transactions, and it may also impact the financial stability and insolvency risk of banks. The deal time is then computed as the number of days between the announcement date and the closing date. In line with this, Table B2 indicates that the results closely mirror those in Table 2. Given that the results remain consistent across both models, I can conclude that the obtained results are robust and still hold true across different specifications.

5.6 Limitations

To the best of my knowledge, there is one crucial limitation of this paper, which relates to the calculation of SDROA and SDROE dependent variables. These variables are computed using a three-period rolling window. In the field of Finance, it is common for literature to prefer a longer historical window covering more than three years because it better captures long-term cyclical trends and provides a more robust dataset for statistical analysis. However, this dissertation is constrained by the available financial data of banks, which only covers up to the year 2005. Otherwise, the initial number of deals in the chosen period equals to around fourteen thousand. This limitation resulted in reducing the number of deals included in the data. On this matter, one potential improvement is to collect financial data from a different data provider or specifically request data from banks that have engaged in deals prior to 2005 in order to increase the number of rolling windows for future research.

CHAPTER 6: Conclusion

The purpose of this dissertation is to examine the impact of M&A deals on the risk and financial stability of European banks. The study provides a comprehensive understanding of how M&A deals affect the risk and financial stability of European banks by examining 781 M&A deals that took place between 2007 and 2022, along with the corresponding financial data of the banks involved in these deals. Previous research on this matter has remained inconclusive and insufficient to form a definitive conclusion from a bank's perspective. Unlike previous research, this dissertation focuses on the impact of M&A deals on the risk and financial stability of European banks, taking into account significant events such as the global financial crisis and the COVID-19 crisis to adjust for temporary outlier effects. Thus, the central research question of this dissertation is: What is the impact of M&A activities on the insolvency risk and financial stability of the European Union (EU) banking sector, with a focus on the period between 2007 and 2022?

This research question is addressed through a quantitative analysis of the dataset described earlier, which is collected from Orbis and the European Central Bank. I analysed this dataset using the OLS and RE models. The findings reveal a mixed relationship of factors. On the one hand, the analysis shows a positive causal correlation between both the quantity and normalized value of M&A deals and a bank's financial stability and profitability. This essentially suggests that M&A activities can potentially reinforce banks by augmenting their profitability and supporting their resilience. This insight could serve as an essential strategic contribution for banks, suggesting that they can enhance their financial performance and stability through carefully planned and well-executed M&A activities.

On the other hand, the research also exposes a counterintuitive insight. While the M&A activities appear to enhance financial stability and profitability, they also increase a bank's insolvency risk as the quantity and normalized volume of M&A deals increase. This led to the rejection of the second hypothesis that suggested a decrease in a bank's insolvency risk with an increase in these variables. This finding can have significant implications, alerting that the benefits from M&A activities may be overshadowed by the increased risk of insolvency. Therefore, banks need to exercise strategic discernment when planning M&A deals, ensuring that the potential benefits are not overshadowed by the mentioned risks.

This assertation also securitizes the impact of macroeconomic shocks on the banking sector as the effect of the Global Financial Crisis and the COVID-19. The analysis showed that these crises significantly and negatively impacted insolvency risk and financial stability of banks. These findings reveal that banking institutions are vulnerable large-scale economic disorders. This emphasize the importance of robust risk management mechanisms and resilient strategic planning to reduce the impacts of such macroeconomic shocks.

In conclusion, this paper provides valuable insights for banks and regulatory authorities alike. While M&A activities hold promising prospects for enhancing banks' profitability and stability, they can paradoxically worsen their insolvency risk. This paradoxical situation demands a careful balancing act from the banks' side in executing their M&A strategies. Additionally, M&As can potentially result in a monopoly, reducing excessively competition in the banking sector. As a result, this could lead to adverse implications for customers in terms of increased pricing, diminished service quality and a lack of innovation. Therefore, banks should exercise caution in executing their M&A strategies, taking into account not only the potential profitability but also the wider implications for the banking sector and the economy as a whole. Furthermore, the pronounced effect of global crises on bank risk and stability underscores the critical need for the banking sector to maintain a rigid risk management system. All things considered, these findings can guide policymakers and strategic decisions in the banking sector to ensure both growth and stability in a complex and dynamic economic landscape.

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Appendix A: Correlation table

Table A1

Correlation matrix

	Volume	Norm. Volume	Quan-tity	EQTA	NLTA	Over-heads	SDROE	SDROA	ZROE	ZROA	SİZE	INF	COVID - 19	GFC
Volume	1.000													
Norm. Volume	0.9992	1.000												
Quantity	-0.0283	-0.0331	1.000											
EQTA	-0.0320	-0.0232	-0.1362	1.000										
NLTA	-0.0311	-0.0293	-0.1072	-0.0720	1.000									
Over-heads	0.1187	0.1086	0.4130	-0.2382	-0.2984	1.000								
SDROE	-0.0093	-0.0043	-0.0336	0.3302	0.0322	-0.1158	1.000							
SDROA	-0.0080	-0.0023	-0.0429	0.3726	0.0426	-0.1217	0.9038	1.000						
ZROE	-0.0058	-0.0070	-0.0172	-0.0617	0.0059	0.0577	-0.0718	-0.0687	1.000					
ZROA	-0.0128	-0.0128	-0.0252	0.0664	0.0671	0.0486	-0.0985	-0.0921	0.7848	1.000				
SİZE	0.1596	0.1500	0.4367	-0.4602	-0.2090	0.7408	-0.1874	-0.2137	0.0669	0.0199	1.000			
INF	-0.0181	-0.0185	0.0396	-0.0107	0.0823	-0.0170	0.1102	-0.0356	-0.0193	-0.0657	-0.0319	1.000		
COVID-19	0.0003	0.0005	-0.0064	0.0259	-0.0776	0.0265	0.0674	-0.0214	-0.0783	-0.0908	0.0392	0.2690	1.000	
GFC	0.0043	0.0038	0.0235	-0.0801	0.0371	-0.0113	-0.0495	-0.0346	0.0632	-0.0237	0.0129	0.1318	-0.2138	1.000

Notes: The correlation matrix indicates that there is no evidence of multicollinearity among the variables of interest.

Appendix B: Robustness tests

Table B1

Robustness tests: Addressing Insignificant Results

Explanatory	*SDROA*		*SDROE*		*ZROA*		*ZROE*		*EQTA*	
variables	*OLS (1)*	*RE (2)*	*OLS (3)*	*RE (4)*	*OLS (5)*	*RE (6)*	*OLS (7)*	*RE (8)*	*OLS (9)*	*RE (10)*
Quantity	0.035***	0.049***	0.045***	0.042***	-2.890***	-2.947***	-7.365***	-6.803***	0.234***	0.802***
	(0.003)	(0.013)	(0.005)	(0.012)	(0.458)	(0.751)	(0.776)	(1.069)	(0.014)	(0.105)
Normalized	0.001***	0.002**	0.001***	0.001**	-0.051***	-0.047***	-0.109***	-0.120**	0.008***	0.024***
Volume	(0.001)	(0.001)	(0.000)	(0.001)	(0.016)	(0.041)	(0.024)	(0.055)	(0.001)	(0.006)
NLTA	-0.004**		-0.006***	-0.011***	0.947***	0.924***		0.452**	-0.133***	-0.100***
	(0.002)		(0.002)	(0.002)	(0.118)	(0.139)		(0.208)	(0.010)	(0.005)
Size	-0.269***	-0.344***	-0.251***	-0.269***			21.349***	17.956***	-3.429***	-5.645***
	(0.029)	(0.025)	(0.033)	(0.025)			(2.979)	(3.968)	(0 .128)	(0.101)
Overhead	0.000**	0.000**			0.003***	0.003***	0.002	0.002***	0.001***	0.000**
	(4.30e-06)	(6.82e-06)			(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
INF	-0.031***		0.177***	0.215***	-3.396***	-3.434***				
	(0.007)		(0.020)	(0.011)	(0.690)	(1.025)				
GFC			-0.141**	-0.250***	-28.490***	-27.149***	36.365*	42.117***	-0.970***	-0.947***
			(0.036)	(0.064)	(8.668)	(6.261)	(19.563)	(11.381)	(0.184)	(0.114)
COVID_19			0.262***	0.208***	-42.583***	-45.338***	-68.221***	-68.411***		0.690***
			(0.049)	(0.064)	(4.135)	(6.177)	(5.119)	(10.887)		(0.107)
Deal Dummy	0.333***	0.224***	0.462***	0.185***	-14.942**	-11.439**	-35.617***	-35.888***	2.514***	1.825***
	(0.048)	(0.052)	(0.058)	(0.070)	(5.751)	(6.140)	(10.352)	(10.307)	(0.266)	(0.133)
Constant	7.130***	8.798***	6.150***	7.262***	71.956***	71.759***	-361.274***	-309.888***	98.696***	150.81***
	(0.664)	(0.597)	(0.724)	(0.686)	(5.889)	(9.943)	(64.680)	(69.022)	(3.230)	(2.387)
R-square	0.057	0.085	0.089	0.084	0.025	0.024	0.021	0.020	0.287	0.253
Observations	10,436	11,017	10,436	10,436	10,232	10,232	10,473	10,094	10,597	10,597

Notes: This table includes 5 OLS regressions and 5 random-effects models with 5 different dependent variables: SDROA, SDORE, ZROA, ZROE and EQTA. This table illustrates only significant variables. Afterwards, the normalized volume and overhead are measured in millions to present their effect more clearly. Standard errors are demonstrated in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B2

Robustness tests with deal time

Explanatory	*SDROA*		*SDROE*		*ZROA*		*ZROE*		*EQTA*	
variables	*OLS (1)*	*RE (2)*	*OLS (3)*	*RE (4)*	*OLS (5)*	*RE (6)*	*OLS (7)*	*RE (8)*	*OLS (9)*	*RE (10)*
Quantity	0.035***	0.048***	0.044***	0.042***	-2.92***	-2.971***	-7.550***	-6.935***	0.232***	0.802***
	(0.003)	(0.013)	(0.006)	(0.013)	(0.462)	(0.753)	(0.810)	(1.070)	(0.015)	(0.105)
Normalized	0.001***	0.002**	0.001***	0.001**	-0.053***	-0.046***	-0.102***	-0.117**	0.008***	0.024***
Volume	(0.001)	(0.001)	(0.000)	(0.001)	(0.016)	(0.040)	(0.024)	(0.055)	(0.001)	(0.006)
NLTA	-0.004**		-0.006***	-0.011***	0.951***	0.927***		0.465**	-0.133***	-0.100***
	(0.002)		(0.002)	(0.002)	(0.119)	(0.139)		(0.208)	(0.010)	(0.005)
Size	-0.269***	-0.343***	-0.252***	-0.269***			21.755***	18.186***	-3.426***	-5.645***
	(0.029)	(0.024)	(0.022)	(0.025)			(2.894)	(2.969)	(0 .127)	(0.101)
Overhead	0.000**	0.000**			0.003***	0.003***	0.001	0.002***	0.001***	0.000***
	(4.30e-06)	(6.82e-06)			(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
INF	-0.031***		0.177***	0.215***	-3.605***	-3.438***				
	(0.008)		(0.020)	(0.011)	(0.690)	(1.024)				
GFC			-0.138**	-0.250***	-28.545***	-27.174***	35.945*	41.809***	-0.975***	-0.947***
			(0.061)	(0.064)	(8.654)	(6.261)	(19.511)	(11.383)	(0.184)	(0.114)
COVID_19			0.262***	0.209***	-42.489***	-45.294***	-67.965***	-68.178***		0.690***
			(0.050)	(0.064)	(4.150)	(6.175)	(5.117)	(10.888)		(0.107)
Deal Time	0.000	-0.001	0.000	0.000	-0.015	-0.012	-0.068**	-0.051	-0.001	-0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.014)	(0.024)	(0.028)	(0.033)	(0.001)	(0.004)
Deal Dummy	0.334***	0.224***	0.462***	0.185***	-15.185**	-11.552*	-37.003***	-36.849***	2.502***	1.825***
	(0.048)	(0.052)	(0.058)	(0.070)	(5.969)	(6.146)	(10.481)	(10.318)	(0.268)	(0.133)
Constant	7.116***	8.798***	6.421***	7.261***	73.445***	72.857***	-363.132***	-310.161***	98.696***	150.838***
	(0.659)	(0.597)	(0.501)	(0.583)	(6.074)	(10.213)	(65.032)	(68.953)	(3.230)	(2.406)
R-square	0.057	0.085	0.077	0.074	0.025	0.025	0.021	0.021	0.286	0.252
Observations	10,436	11,017	10,436	10,436	10,232	10,232	10,473	10,094	10,597	10,597

Notes: This table includes 5 OLS regressions and 5 random-effects models with 5 different dependent variables: SDROA, SDORE, ZROA, ZROE and EQTA. The deal time is incorporated as an additional control variable to test the robustness of the main results in Table 2. Afterwards, the normalized volume and overhead are measured in millions to present their effect more clearly. Standard errors are demonstrated in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$