

The Effects of Mergers and Acquisitions on Bank Risks

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The Effects of Mergers and Acquisitions on Bank Risks

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ABSTRACT

This thesis examines the effects of bank mergers on acquiring banks' default risk and on their contributions to systemic risk using an international merger sample, covering the period between 1998 and 2015. Furthermore, it investigates whether the changes in acquirers' default risk after acquisitions have impacts on banking firms' stockholders (idiosyncratic risk); or whether they spread to other banks (systemic risk) and all listed firms (systematic risk). Also, this thesis extends the established literature by providing original evidence on the determinants of these merger-related changes in acquiring banks' default risk, systemic risk, systematic risk and idiosyncratic risk of shareholders.

An ongoing debate in the literature is whether or not bank mergers help to lower bidders' default risk. Using Distance to Default methodology from Vallascas and Hagendorff (2011), this thesis brings robust evidence that bank mergers reduce the default risk of bidders. The results also show that not all forms of diversification exert an equal effect on the reduction of bidders' default risk. Product diversification is found to reduce bidding banks' default risk meanwhile geographic diversification does not have a statistically significant relationship to the reduction in default risk of acquiring banks.

Additionally, this thesis extends the debate regarding the effects of bank mergers on bidders' contribution to systemic risk. Employing Marginal Expected Shortfall from Acharya et al., (2017) and ΔCoVaR from Adrian and Brunnermeier (2016), the findings suggest that bank mergers, on average, do not impact on acquiring banks' contribution to systemic risk. However, product-diversifying deals lead to a reduction in acquirers' contribution to systemic risk for non-US

acquirers only. It also transpires that with deals financed by cash only, the acquirers' contribution to systemic risk increases.

Finally, this thesis investigates the impact of the changes in default risk on changes in systematic risk, idiosyncratic risk and systemic risk following mergers, using the empirical framework as in Fiordelisi and Marqués-Ibañez (2013). The results from this thesis suggest that, during a pre-merger period (without M&As), the risk of default on any individual bank does not only affect this bank's stockholders, but also extends to other banks in the banking system, causing the banking industry to become fragile and volatile. Furthermore, when the effects of bank mergers are taken into consideration, the changes in acquirers' default risk have direct positive impacts on the changes in their' own idiosyncratic risk. It is significant to note that bank mergers are proven to reduce the default risk of acquiring banks earlier in this study. Therefore, it is concluded that the reduction in acquirers' default risk following a merger, also results in the reduction of their idiosyncratic risk, which means that M&As lead to safer banks in general.

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LIST OF ABBREVIATIONS

BIS	the Bank for International Settlements
CoVaR	Conditional Value-at-Risk
DCC	Dynamic Conditional Correlation
DD	Distance to Default
GARCH	General Autoregressive Conditional Heteroskedasticity
MES	Marginal Expected Shortfall
OLS	Ordinary Least Square
SIFIs	Systemically Important Financial Institutions
TBTF	Too Big to Fail
VAR	Value-at-Risk

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DECLARATION

I declare that all the material contain in this thesis is my own work.

DEFINITIONS

Terms	Definitions
Default risk	The potential that a bank borrower or counterparty will fail to meet its obligations in accordance with agreed terms (Basel Committee on Banking Supervision, 1999, p.1)
Idiosyncratic risk (specific-risk)	Specific to each asset or firm. It represents the remaining part of an asset's volatility that is not correlated to the market
Merger and Acquisition	A general term describes the consolidation of firms or assets via various types of financial transactions
Systematic risk	The risk of being affected by general market movements. For instance, an increase in interest rates will cause some new issued bonds to increase in value, whilst causing some company stocks to fall in price, as investors perceive executive teams to be cutting back on spending. It represents the part of a firm or an asset's volatility that is precisely, positively or negatively correlated with the market
Systemically important financial institutions	Financial institutions 'whose disorderly failure, because of their size, complexity and systemic interconnectedness, would cause significant disruption to the wider financial system and economic activity (The Financial Stability Board, 2010)
Systemic risk	The risk that (i) an economic shock such as market or institutional failure triggers (through a panic or otherwise) either (x) the failure of a chain of markets or institutions or (y) a chain of significant losses to financial institutions, (ii) resulting in substantial financial-market price volatility (which price volatility may well reflect increases in the cost of capital or decreases in its availability (Schwarcz, 2008, p.198)
Too big to fail	Commonly a large institution, involved with distinctive regulations from the government to prevent bankruptcy during its existence. It may also entail a unique bankruptcy system compared to the conventional bankruptcy processes that other institutions exercise within the industry, at least with regards to allocating losses, after failure (Kaufman, 2014)

Chapter 1: Introduction

1.1 Introduction

Since the 1990s, successive waves of mergers and acquisitions (M&As), driven by globalisation and deregulation, have reshaped the world banking industry. Consolidation activities have not only broadened banking institutions' scale and scope but have also resulted in a remarkable surge in concentration levels in almost every banking market. The main reasons for a banking firm to engage in an acquisition activity include: the possible reduction of idiosyncratic risk, diversification of loan portfolio, the bank's assets and its operations that would result in higher capital buffers, lowered cash flow variability and thus decreased default risk (see Koerniadi et al., 2015; Weiß et al., 2014).

Lately, this combined process has been granted additional stimulus by the global financial crisis of 2007-2009, after regulators highlighted the role of M&As as a tool in which to avoid banking firms' failures and costly bailouts for the governments themselves. (Group of Thirty, 2009). The fundamental notion was that via an acquisition, a healthy bank acquires a troubled bank, protecting the economy from the full cost of the distressed bank's failure. This resolution was favoured because the government did not have to bail out the troubled banks using public funds, which would have been more expensive and greatly unpopular with the public (White and Yorulmazer, 2014). Several most prominent and renowned cases of such mergers include the Bank of America's acquisition of Merrill Lynch, Wells Fargo's merger with Wachovia, Lloyds TSB and Halifax Bank of Scotland. Numerous Governments considered the endurance of such very large consolidated banks as associated with the welfare of the whole economy. While this policy has advantages, it has also led critics to argue that if

the primary issue were that troubled banks were too systemically important to fail, then the resolution of an acquisition would simply lead to an even larger and riskier banking firm (because of its increased interconnectedness with other financial firms through direct exposures in the banking system). As such, a merger could even destabilise the banking system. Hence, the global financial crisis 2007-09 demonstrates a genuinely striking tension between whether bank mergers add stabilising or destabilising effects to the stability of the banking system. It also revives the broader controversies around this topic in academic literature on 1) how strong the degree of interconnectedness between banking firms is, 2) how directly idiosyncratic shocks can transform into systemic crises in the banking industry, 3) the relationship between bank concentration and systemic risk, 4) safety net subsidies and their impact on financial stability and 5) the effects of bank M&As on the different types of risks (e.g. default risk, systematic risk, credit risk, total risk).

Given all the debates to date, some gaps emerge within literature. First, most papers study changes in the different types of acquirers' risks following a merger on a country or continent level, for instance: Europe (Vallascas and Hagendorff, 2011), Japan (Harada and Ito, 2011), Pakistan (Afzal and Mirza, 2012) and cross-border mergers between U.S. acquirers and international targets (Koerniadi et al., 2015). To the best of the author's knowledge, no study has examined the implication of bank M&As activity on the different types of bank risks in a global sample. An international setting allows for an experiment with rich variation in the indication and level of changes in bidders' risks witnessed across deals; thereby possibly yielding impressive results. Accordingly, this study is believed to be the first to extend literature by examining the different risk

implications of bank mergers using an international sample. Another interesting point to highlight is that the sample in this study contains both domestic and cross-border deals,¹ in addition to focusing and activity-diversifying mergers². Indeed, since the 1980s banking deregulations have been gradually introduced across countries globally, including the UK, US, Europe, Japan, Canada and China, allowing banks to merge internationally and permitting them to acquire other kinds of financial institutions, including security companies, insurance firms and investment banks. These developments in cross-border mergers, as well as activity-diversifying mergers, may offer substantial diversification benefits, and thus, may yield exciting findings on the influence of M&As on different types of banking risks. Accordingly, it enables the author to give valuable suggestions to banking supervisors and policymakers worldwide regarding the impact of different types of M&As on the stability of the combined firms as well as the banking system.

Second, this is the first study to shed light on the effect of individual bank default risk on systemic, systematic and idiosyncratic risks under the context of M&As. It is broadly recognised within the extant M&A literature that consolidation activities change the risk profiles of acquirers, especially the risks of large banking firms whose liquidity or credit problems might influence many other banks (Casu et al., 2015; Laeven et al., 2016; Weiß et al., 2014). When the risk of a

¹ Domestic merger: M&As deal where acquirer and target are in the same country. Cross-border merger: M&As deal where acquirer and target are from different countries. These are two types of geographic diversification.

² Focusing merger: where acquirer and target are both banks. Activity-diversifying merger: where acquirer is a bank and target can be non-bank financial firms such as insurance company, securities company, financial services company. These are two types of product diversification.

consolidated institution is greater than before the merger, it increases the possibility that the bank may default or become illiquid prior to settling all of its payment duties. Furthermore, it exposes other banks straight to risks as payees, or indirectly via adding to stock market problems or panic runs. As a result, in the banking sector, default risk can also become systematic when the default of a single institution impacts, not only the bank itself but spills over to other either financial or non-financial firms. However, there are also banking firms that their failures do not affect other institutions; in that case, default risk is considered to be idiosyncratic and can be diversified away by investors (a more detailed explanation can be found in section 7.2.2.1). Existing evidence on the relationships between these banking risks is mostly mixed: Denis & Denis (1995) and Vassalou & Xing (2004) find that default risk is mainly associated with aggregate factors. This, in turn, indicates that bankruptcy risk could be positively related to systematic risk. On the contrary, Asquith & Gertner (1994) and Dichev (1998) propose that default risks are mainly related to idiosyncratic elements. Fiordelisi & Marqués-Ibañez (2013), on the other hand, assert that for listed banking firms, individual banks' default risk increases the systemic and systematic risks in their sample of European listed commercial banks. Therefore, a study that examines the relationships between default risk and other risks, taking M&As into consideration, is missing and may reveal interesting results as well as policy implications. If individual default risk positively influences systematic risk and systemic risk of the banking system, then banking regulators may consider using a macroprudential framework. For instance, a merger involved in risky and large banking institutions should be subjected to a stricter

merger approval process. Furthermore, the new combined entity may be required to set aside extra capital buffers to cope with unexpected shocks.

In addition, this study adds to original evidence in literature for the determinants of the changes in acquirers' default risk and systemic risk following a merger. Those shreds of evidence will benefit bank managers by proposing the ways in which they should manage and minimise their risks when engaging in M&A activity, both nationally and internationally. This evidence can also assist banking supervisors in imposing appropriate control, and in monitoring the process of bank M&A deals, in order to minimise banking risk. As a reminder, this supervisory control is crucial because the interconnected nature of the banking industry deems it more vulnerable to systemic risk. In other words, the failure of one single bank can cause cascading collapse, which may, in turn, bankrupt the whole system.

Broadening and deepening understanding of the effects of M&As on banking risks is extremely important, especially in the context of the global financial crisis 2007-09, where taxpayers' dollars were used as government bailouts to rescue the TBTFs. Therefore, these gaps and the lengthy debates in the literature above serve as the motivation for this study to shed light on the effects of bank M&As on acquiring banks' default risk and the contribution to systemic risk. Moreover, it aims to provide original evidence on the determinants of these merger-related changes in acquiring banks' default risk and systemic risk. Finally, this study contributes to the extant literature (Fiordelisi and Marqués-Ibañez, 2013) by exploring whether the changes in default risk affect acquirers' systematic risk, systemic risk and idiosyncratic risk, following a bank merger. The remaining sections of Chapter 1 proceed as follows. First, the objectives and

research questions of this study will be discussed following by an outline of the whole study. Next, it summarises the findings and contributions of this study, before moving on to a concluding discussion of this chapter.

1.2 Study Objectives and Research Questions

The overall aim of this study is first to examine the effects of bank mergers on acquiring banks' default risk and its contribution to systemic risk, covering the period between 1998 and 2015. Moreover, it investigates whether the changes in acquirers' default risk following a merger have an impact on banking firms' stockholders (idiosyncratic risk); or whether it extends to other banks (systemic risk) and all listed companies (systematic risk). To achieve these objectives, this study is divided into three empirical chapters.

Chapter 5 examines the effects of M&As on acquiring banks' default risk. In addition, the sample is broken into different deal types, such as geographic diversification (domestic versus cross-border mergers) and product diversification (focusing versus activity-diversifying deals), in order to examine the changes in acquirers' default risk by deal type. Furthermore, this chapter studies the influence of deal and acquirers' characteristics, as well as country controls, on the changes in default risk of acquirers' post-merger, via a multivariate analysis.

Next, Chapter 6 focuses on the effects of M&As on acquiring banks' contribution to systemic risk. The sample is divided into five sub-samples, featuring deal value (high, medium and low deal value), geographic diversification (domestic versus cross-border), acquirer profitability (high, medium and low profitability), concentration (high, medium and low concentration) and markets (emerging and developed markets). Following this, the influence of acquirers and deal's characteristics and country controls on acquirers' contributions to systemic risk, are examined using a multivariate analysis.

Finally, Chapter 7 investigates the impact of the changes in default risk on systematic risk, idiosyncratic risk and systemic risk, using the empirical framework as in Fiordelisi and Marqués-Ibañez (2013). First, systematic risk and idiosyncratic risk of acquirers are measured under the same estimated time frame as the two previous empirical chapters, in order to provide consistency in comparing the relationships among these risks. Next, the analysis of such impacts will be based on firstly, the pre-merger period and secondly, the difference between post-merger and pre-merger period, in order to achieve further conclusion on how these impacts change, with or without M&As.

To achieve these objectives, this study examines the most comprehensive sample of international bank M&As in order to tackle the following questions:

Empirical Chapter 5: The Effects of Bank M&A on Bidders' Default Risk:

- a. To what extent bank M&As affect acquiring banks' default risk post-merger compared to pre-merger period?
- b. Which characteristics of acquirers' pre-merger and/or deal characteristics affect merger-related changes in the acquirers' default risk?
- c. Which macro-environment factors of acquirers' home countries influence the merger-related changes in the acquirers' default risk?

Empirical chapter 6: The effects of bank M&A on bidders' contribution to systemic risk:

- d. To what extent bank M&As cause changes in the acquirers' contribution to systemic risk?
- e. What are the determinants of merger-related changes to the acquirers' contributions to systemic risk?

Empirical chapter 7: Is Default Risk Systematic, Idiosyncratic or Systemic
in the Context of Bank Mergers?

- f. Does the increase (decrease) in bank default risk (Δ default risk) is associated with the increase (decrease) in acquirers' contribution to systemic risk (Δ MES)³ following a merger?
- f. Which factors affect acquirers' Δ MES with and without a merger?
- g. Does the increase (decrease) in bank default risk (Δ default risk) is associated with the increase (decrease) in acquirers' systematic risk (Δ beta) after a merger?
- i. Which factors affect acquirers' Δ beta with and without a merger?
- j. Does the increase (decrease) in bank default risk (Δ default risk) is associated with the increase (decrease) in acquirers' idiosyncratic risk (Δ idiosyncratic risk) following a merger?
- k. Which factors affect acquirers' Δ idiosyncratic risk with and without a merger?

³ Acquirers' contribution to systemic risk is also referred to as MES (Marginal Expected Shortfall)

1.3 Study Findings and Contributions

Chapter 5 examines the impact of bank M&As on bidders' default risk. Overall, this chapter finds that bank mergers reduce the default risk of bidders. This finding also adheres to the presumption gained from literature that the diversification of assets between two merging institutions, which are imperfectly correlated, should, without countervailing movement from management of acquirers, lead to a reduction in the default risk for the combined firm, both theoretically (Amihud & Lev, 1981; Diamond, 1984) and empirically (Emmons et al., 2004; Koerniadi et al., 2015; van Lelyveld and Knot, 2009). Therefore, the first Hypothesis 5.1 of this chapter, which predicts that M&As reduce the default risk of acquirers, is supported. Also, the results produced in this chapter show that not all forms of diversification exert an equal effect on the reduction of bidders' default risk. Product diversification is found to pose a positive effect on bidding banks' default risk (lower risk), which is in line with the broader literature regarding the diversification benefits of reducing bank default risk, as demonstrated by van Lelyveld & Knot, 2009 and Wall et al., 2007. Thereby, the second Hypothesis 5.2 is supported. Conversely, geographic diversification does not have a statistically significant relationship to the reduction in default risk for acquiring banks; therefore, the third Hypothesis 5.3 is rejected. Finally, the status of target, deal size, return on asset ratio (ROA), leverage and political stability, included as control variables, are all found to play different roles in explaining the changes in bidders' default risk.

Motivated by the results from Chapter 5, in which mergers contribute to the reduction in bidders' default risk, Chapter 6 examines the effects of bank M&As to acquirers' contribution to systemic risk, predicting that mergers also

produce the same risk-reducing effects. First, the findings suggest that M&As, on average, do not impact on acquiring banks' contribution to systemic risk. This result significantly contradicts existing literature, which tends to find that mergers increase the bidder's contribution to systemic risk (Molyneux et al., 2014; Mühlnickel and Weiß, 2015; Uhde and Heimeshoff, 2009). The first Hypothesis 6.1 of this chapter, which predicts that mergers generate a systemic risk-reducing effect on acquiring banks, is therefore rejected. Furthermore, payment method and product diversification are hypothesised to be potential determinants that have impact on the changes in bidding banks' contribution to systemic risk. Indeed, the results show that product-diversifying deals lead to a reduction in acquirers' contribution to systemic risk for non-US acquirers only. This finding is a major contribution to literature as it proves that diversification adds to the stabilising effect of a bank merger. The finding is consistent with arguments that M&As activity broadens the scope of diversification in individual firms, thus, reducing each institution's idiosyncratic risk, which results in the reduction of the probability of default for individual firms and also promotes financial soundness (De Nicolo and Kwast, 2002). Therefore, the second Hypothesis 6.2 of this chapter, which projects that product diversification does bring risk-reducing benefits for banks, cannot be rejected.

It also transpires that with deals financed by cash only, the acquirers' contribution to systemic risk will increase. These findings are in line with the notion that deals which are fully paid for in cash are expected to raise acquiring banks' default risk as acquirers replace safe liquid assets (cash) with riskier balance sheets of set targets, thereby increasing acquirers' contributions to systemic risk (Furfine and Rosen, 2011). Hence, the third Hypothesis 6.3 of this

chapter cannot be rejected. In addition, other controlled variables determining the reduction in acquirers' contribution to systemic risk include a concentrated banking system (HHI) and a stable political environment. In contrast, the factors that contribute to the increase in systemic risk include private targets, a small relative deal size to acquirers' value and TBTF motive. One of the reasons why TBTF motive is one of the contributing factors for the increase in systemic risk is that when a bank is in trouble, they have more motive to engage in M&A activities to become too systemically important to fail and may possibly obtain the government's safety net to avoid failure. The presence of these public guarantees can lead to moral hazard problems that encourages the larger banks' managements to involve in high-risk consolidations which, in turn, may make the whole banking system instable (Uhde and Heimeshoff, 2009). With respect to private targets, private firms are less transparent because they are not subject to public exposures, thereby making it difficult for acquirers to assess the risks associated with the mergers.

Finally, Chapter 7 examines whether the changes in acquiring bank's default risk as a result of M&As have an influence on their own idiosyncratic risk; or whether it extends to other banks (systemic risk) and all listed companies (systematic risk). Therefore, examining the risk profiles of banks during the pre-merger period (without M&As), and the change in risk profiles of acquirers between post-completion and pre-merger period (under the influence of M&As), enables this chapter to create an in-depth investigation into the relationship between default risk and the other risks of acquirers and consequently, to add further insight into existing literature. The findings emerging from this study suggest that, in general, during a pre-merger period (without M&As), acquiring

banks' default risk influence their' contribution to systemic risk (MES). This result is particularly pronounced for non-US acquirers. Similarly, acquirers' pre-merger default risk is also positively related to their pre-merger idiosyncratic risk. This indicates that the risk of default on any individual bank does not only affect this bank's stockholders, but also extends to other banks in the banking system, causing the banking industry to become fragile and volatile. This research finding is consistent with that presented in many other studies (i.e. Asquith and Gertner, 1994; Dichev, 1998; Fiordelisi and Marqués-Ibañez, 2013; Opler and Titman, 1994). In contrast, no relationship is found between acquirers' pre-merger default risk and their pre-merger systematic risk (beta)⁴. However, the results do show that banks with the highest default risk pre-merger witness less systematic risk in general. The explanation for this finding is due to negative information regarding an insolvent bank being embedded in the bank's share prices, even in an inefficient market, thereby causing the most financially distressed banks to earn lower stock returns. Since systematic risk is proxied by subsequent realised returns, lower returns are associated with lower systematic risk (Dichev, 1998). As such, a high default risk bank may witness less systematic risk. Overall, the Hypotheses 7.1 and 7.3 of this chapter are supported whereas Hypothesis 7.2 is rejected.

This study also investigates the relationships among the changes in acquirers' default risk (Δ default risk), acquirers' contribution to systemic risk (Δ MES), acquirers' idiosyncratic risk (Δ idiosyncratic risk) and acquirers' systematic risk (Δ beta), between the pre and post-merger period. Overall, the

⁴ Acquirers' systematic risk is also referred to as beta

results show no relationship between Δ default risk and Δ MES or between Δ default risk and Δ beta, which suggests that, in general, M&As do not affect these relationships. Nevertheless, acquirers with the highest default risk before merger witness an increase in MES post-merger as a result of M&As. This result is specifically more pronounced for U.S. acquirers than for non-U.S. Furthermore, there is weak evidence that, as a result of M&As, beta tends to increase post-merger for non-US acquirers who have a high default risk profile pre-merger. This finding is explained by a bank's motive to become TBTF via M&As in order to exploit the safety net and government bailouts, or to establish a more robust institution (see Molyneux et al., 2014). These banks are often near default and have the lowest possibility of obtaining a bailout before the merger. Therefore, a bank with the highest default risk pre-merger will often witness their contribution to systemic risk increase after a merger. In addition, the Δ default risk of acquirers has a direct positive impact on the change in their' own idiosyncratic risk (Δ idiosyncratic risk), suggesting that bank mergers play an important role in this relationship. It is significant to note that bank mergers are proven to reduce the default risk of acquiring banks in Chapter 5 of this study. Therefore, it is possible to conclude that the reduction in acquirers' default risk following a merger, also results in the reduction of their idiosyncratic risk, which means that M&As lead to safer banks in general. Other control variables, such as cost-income ratio, income diversification and capitalisation are found to be important drivers of Δ idiosyncratic risk. In short, Hypothesis 7.6 of this chapter is supported whereas Hypothesis 7.4 and 7.5 are rejected.

The main contributions of this study follow from the results above. First, the most comprehensive sample of global bank M&As is used, covering the

period between 1998 and 2015. This period characterises the most active period, with respect to financial conglomerates and bank-nonbank partnerships, and therefore, contains the largest and most significant relevant deals. Second, to the best of the author's knowledge, this study is the first to examine various risk implications of bank mergers on a global sample, which allows for experimentation with rich variation in the level of changes in bidders' risks witnessed across the deals in different countries and different markets; thereby extending the literature. For instance, both chapter 5 and 6 of this thesis examines default risk and systemic risk of bidders on different types of markets, including developed, emerging and frontier markets. Therefore, it sheds lights on how M&As affect these risks in different types of markets which has not well been investigated before in the literature. Furthermore, chapter 6 looks at the impact of M&As on bidders' systemic risk under different regions such as US, Europe, Asia and others, therefore, yielding new and valuable insights compared to other empirical studies regarding M&As and risk. Also, it is important to note that the global setting of the sample allows examinations into how GDP, the market concentration index (HHI), the political stability and the rules of law of each country affect the influence of M&As on bank risks in all chapters. Indeed, the political stability and the market concentration index are found to be crucial determinants of the merger-related changes in bank default and systemic risks.

Third, it categorises deals between focusing and product-diversifying mergers (product diversification) and deals between in-country and cross-border mergers (geographic diversification), in order to acknowledge differentiation in the risk effects of M&As when banks merge with different types of targets, and when banks engage in different geographical deals. Therefore, this study

diverges from various studies within literature that do not make these significant distinctions. Fourth, this study provides original evidence on the determinants of these merger-related changes in acquiring banks' default risk, systemic risk, systematic risk and idiosyncratic risk. Finally, for the first time in literature, the coupled relationships surrounding a merger activity amongst default risk and systemic risk, systematic risk and idiosyncratic risk are examined.

1.4 Study Outline

The structure of this study will be organised as follows. Chapter 2 focuses on the background of the banking market and a discussion on the function of banks in general. Additionally, it offers discussions regarding M&As global landscape and bank regulation development across many countries of the globe. Chapter 3 sets out to organise and review the existing body of research on banking risks and bank M&As activity (including M&As wave, driving forces, traditional motives for M&As, in addition to the impact of M&As on bank performance). Furthermore, it involves a thorough discussion of both the theoretical contributions to the phenomenon and a critical analysis and summary of the empirical contributions to the effects of M&As on banking risks. Chapter 4 gives a detailed description of the data collection process as well as sample statistics. Chapter 5 examines M&As effects on bidders' default risk employing the Distance to Default (DD) methodology, as in Vallascas & Hagendorff (2011), in order to measure default risk. Chapter 6 investigates whether bank mergers cause changes in bidders' contribution to systemic risk and the determinants of these changes using both Marginal Expected Shortfall from Acharya et al., (2017) and ΔCoVaR from Adrian and Brunnermeier (2016), in order to measure systemic risk. Finally, Chapter 7 examines the impact of acquirer's default risk on its systematic, systemic and idiosyncratic risk in the context of M&As. Chapter 8 concludes the study with a detailed summary of its results, contributions and implications in addition to suggestions for future research.

Chapter 2: Overview of M&As in the Banking Industry

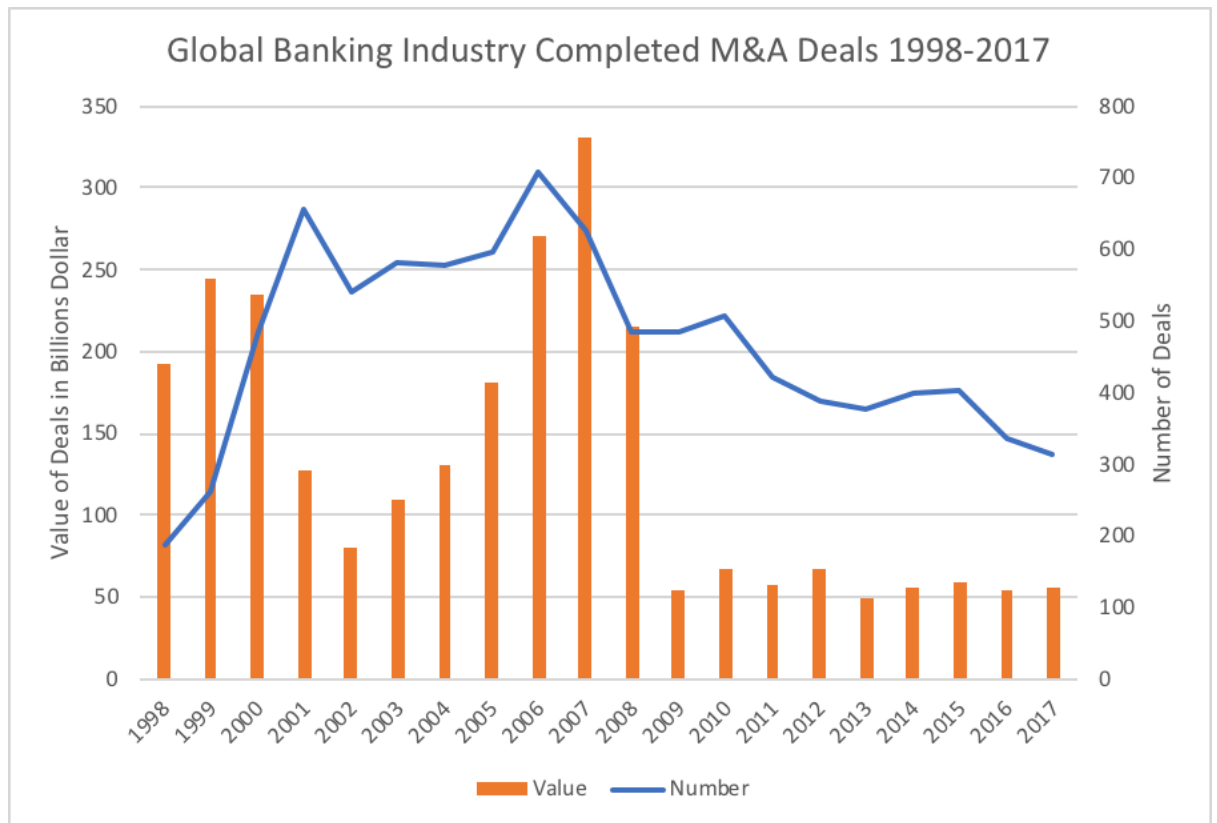
This section outlines the overall M&As background in the banking industry. It first describes the global landscape of bank M&As between 1998 and present times. The second section provides a thorough discussion on M&As and bank regulations across the globe over time.

2.1 Bank M&As Global Landscape

Institutions that form international financial structures have been rapidly consolidated since the 1980s and are encountering further re-structuring given the outcome of the global financial crisis. Lately, many financial institutions have disappeared, leaving survivors only the choice of being more prominent, pursuing geographical and product diversification. During the period since the 1980s, the financial services industry has experienced a rapid surge in both relative size and the number of deals. Data from Bloomberg reports that around 9,328 international mergers in the banking industry⁵ were announced and completed from 1998 to 2017. Significantly, only 4,724 deals revealed their announced merger value, worth approximately \$2,600 billion. Therefore, the actual total merger value of 9,328 deals should be much higher than the \$2.6 trillion total deal value announced. As seen in Figure 2.1, the two peaks in the number of deals were in 2001 (657 deals) and in 2006 (708 deals).

⁵ The 9,328 deals are between acquirers being banks and targets being banks or non-bank financial firms (banks, insurance, diversified financial services, investment, real estate, etc.)

Figure 2.1: M&A Deals in the Global Banking Industry



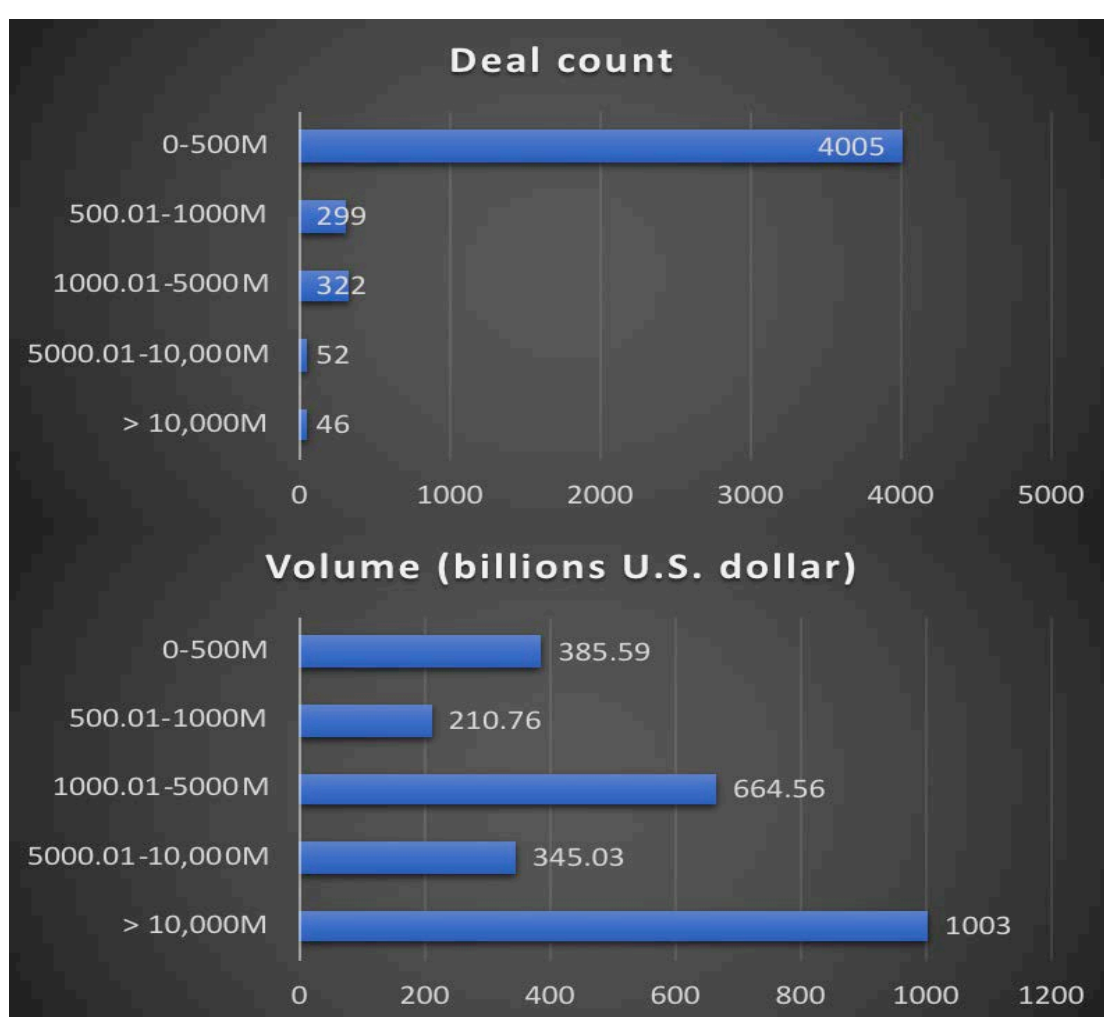
Source: Bloomberg

The sharp increase in the volume of merger deals from 1998 to 2001 could be explained by the U.S. bank deregulation event in 1999. Specifically, the passage of Financial Services Modernization Act (FSMA) of 1999 (or the Gramm-Leach-Bliley Act) allowed banks to merge with non-banks, such as insurance companies and security firms. This deregulation later paved the way for a surge in the number of M&As activities in the banking industry. Following this, the number of merger deals peaked again in 2006 before diving abruptly between 2006 and 2017. Merger values in 2007 witnessed the highest value of deals executed, compared to other years during the whole period, totalling approximately \$330 billion. However, the value of deals decreased sharply between 2007 and 2009 and remained stable until 2017. The 2007-09 global financial crisis may explain the sudden decrease in both the number and value

of deals between 2007 and 2009. During the crisis, banks may have been more reluctant to merge, due to the uncertainty and instability embedded in the financial system and would have taken more caution in M&As decisions. Alternatively, they may have experienced financial difficulty in financing a merger as a number of banking institutions had suffered from significant losses or failed.

Figure 2.2 demonstrates the deal breakdown by size.

Figure 2.2: Deal Size Breakdown

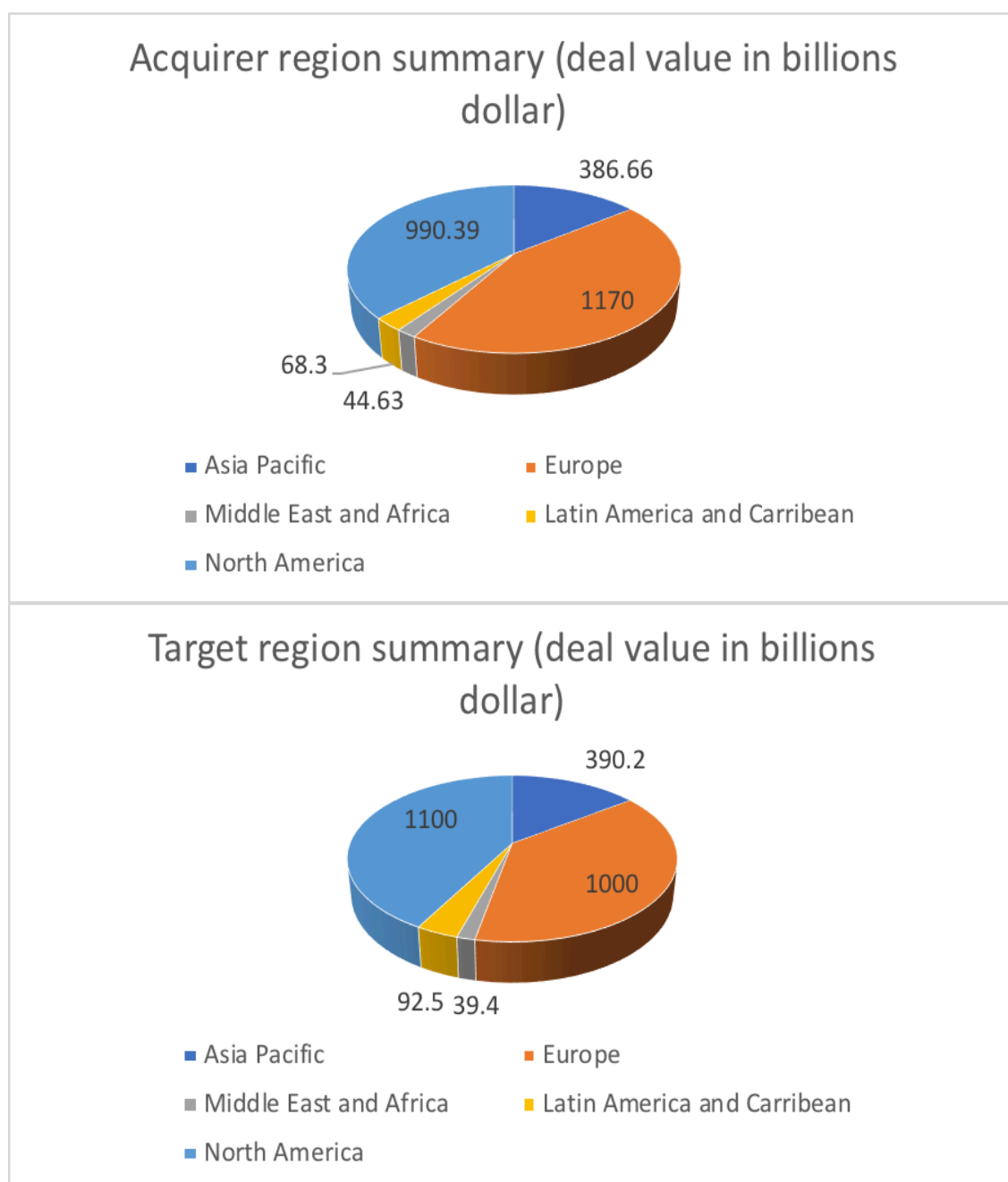


Source: Bloomberg

Concerning the deal count breakdown, it is evident that about 85% of the M&As deals (4005 deals) are in the \$0-\$500 million range. Nevertheless, it appears that mega-mergers have not been uncommon, with 46 deals in the

\$10,000 million plus range, attaining \$1,003 billion in total value. Regarding the average deal value, M&As deals in the \$0-\$500 million range have the lowest average value per deal. Figure 2.3 shows a summary of acquirer and target regions, in terms of deal value via M&As transactions.

Figure 2.3: Acquirer and Target Region Summary

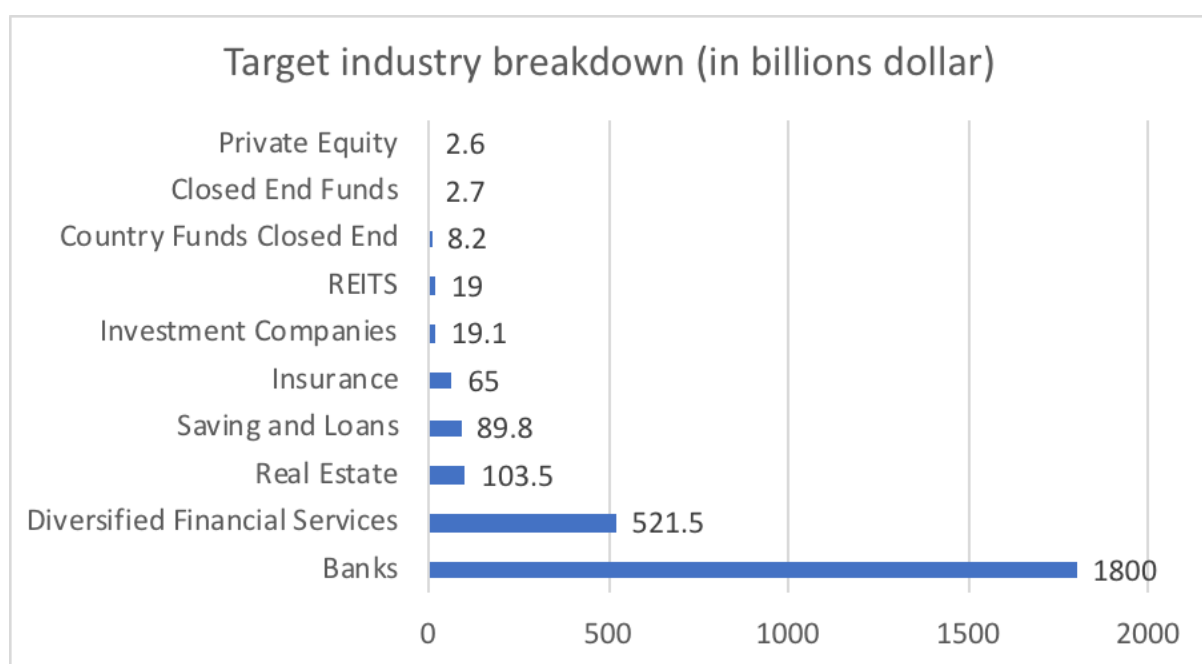


Source: Bloomberg

Overall, it is perceivable that European and North American bidders were among the most active bidders worldwide. The data shows that North American acquirers contribute to 37% of total deal value in these M&As transactions. Similarly, European acquirers are the most active bidders, with the total value of transactions worth \$1,170 billion during the investigated time. In contrast, bidders from continents such as Latin America, Caribbean, Middle East and Africa scarcely engaged in M&As activities. Middle East and African acquirers spent the most modest amount of capital in M&As transactions, approximating \$44.63 billion. In a similar trend, European and North American targets were acquired most; meanwhile limited capital was injected into Latin America, Caribbean, Middle East and Africa economies.

According to Figure 2.4, when targets were broken down by the financial services industry, banks were on top of the list, followed by real estate, diversified financial services and savings, loans and insurance. On the contrary, private equity and closed end funds were the least acquired by banks.

Figure 2.4: Target Industry Breakdown



Source: Bloomberg

In conclusion, most of the M&As transactions in the banking sector were conducted during the period of 1998-2008. Following this, the number of M&As activities dropped sharply and, until recently, remained stable, as 85% of the M&As deals fell into the \$0-\$500 million range. Therefore, it can be concluded that the value of each M&As deal was generally quite small. In contrast, the value of each mega merger was significantly high. Acquirers and targets from North America and Europe were the most active compared to the rest of the world. In terms of target industry breakdown, banks were acquired the most, followed by diversified financial services, real estate and savings and loans. In order to provide a more comprehensive picture of the background to the banking industry, the next section reviews the history of bank regulations and M&As.

2.2 M&As and Bank Regulations

During the last four decades, the global banking sector has experienced rapid changes in regulation, deregulation, consolidation, globalisation and privatisation. The recent global financial crisis and the liberalisation of emerging markets, have influenced the share of the global banking market, leading to the failure of TBTF U.S. financial institutions. Moreover, banks in Latin America and Asia have been purchasing financial firms in the EU. Many nations have liberalised their banking sector since the 1980s, leading to a surge in the number of cross-border and conglomerate mergers. These extensive deregulations stimulate banks to engage in risky activities and a higher level of leverage; thus resulting in the fragility of the financial structure as well as a global banking crisis (Carbo-Valverde et al., 2012; Uhde and Heimeshoff, 2009).

The UK began its deregulation in 1986 when the Big Bang successfully liberalised financial sectors by eliminating the prevention of mergers between banks and non-bank firms, as well as implementing fixed minimum commissions. Commercial banks could acquire brokerage firms; thus, resulting in a substantial number of merger activities; for instance, the mega-merger between stockbroker Charterhouse Group and the Royal Bank of Scotland in 1985. The UK market then witnessed a rise in merger transactions by the U.S. acquirers. The deregulation was somewhat the same in Canada in 1987, known as the 'little bang'. This deregulation encouraged Canadian chartered banks to merge with investment and security dealers; thus, consolidation transactions happened significantly between 1987 and 1988. The 1980s witnessed the same deregulation process in Japan when the targets of Japanese acquirers were the foreign firms in the U.S., UK and Switzerland.

The regulatory climate has been serving as a means of determining how mergers and acquisitions in the financial industry have developed, particularly in the U.S. Contrary to the liberalisation of the European financial sector in 1989, when the EU Council of Ministers adopted the Second Banking Directive, the U.S. financial sector remained intensively splintered until 1999. The U.S. financial regulation from the 19th century prevented financial institutions from enlarging geographically to other states, along with their capability to consolidate with other types of financial institution, including, but not limited to, security companies, insurance firms and investment banks. Due to these legislative obstacles, banking institutions in the U.S. were not able to benefit from merger-related advantages, such as product and geographical diversification or economies of scale and scope ⁶.

A significant milestone in the US financial regulatory history was the passing of the 1999 Financial Services Modernization Act (FSMA) (Gramm-Leach-Bliley Act) to repeal part of the Glass-Steagall Act of 1933. This removed barriers in the market and allowed banking firms to merge with security or insurance companies. This deregulatory event was a result of the intense pressure and lobbying by the financial services sector. Indeed, the merger between Citicorp and Travelers was announced in 1998, despite the fact that the remaining provisions of the Glass-Steagall Act still prohibited banks from consolidating with insurance underwriters. This merger somewhat challenged existing regulations and paved the way for the Gramm-Leach-Bliley Act in 1999. Most of the regulatory obstacles dictated on the finance sectors by the National

⁶ A summary of U.S. bank regulation can be found in Appendix B.

Banking Act of 1864, the Banking Act of 1933 and the Bank Holding Company Act of 1956 were eliminated under FSMA 1999. Explicitly, the Act voided the barriers on commercial and investment banks consolidating with security companies and insurance firms, written in sections 20 and 32 of Glass-Steagall Act. It established new financial holding firms in section 4 of the Bank Holding Company Act of 1956 to involve security and insurance underwrites and merchant bank transactions. However, non-financial transactions of such holding firms were limited to 15% (US Senate Committee on Banking, no date)

In comparison to the US, the European financial industry experienced liberalisation much sooner, via adoption of the Second Banking Directive of 1989, which introduced the concept of a 'single passport,' to allow all European members to partake in banking businesses in any other EU countries. Simultaneously, banks were subject to legislation and regulatory requirements from their home countries. As a result, when a bank operated in another EU country, the policymakers from the host country were to respect the supremacy of the home nation. New member states of the EU, such as Latvia, Poland, Lithuania and Hungary had no choice but to restructure their economy towards the EU benchmarks, thereby moving towards the market economies (Casu et al., 2006). Numerous new member states of the EU then reduced these constraints in their financial markets and initiated vital privatisation plans. Furthermore, the Second Banking Directive permitted European banks to engage in functional diversification across activities such as securities, insurance, investment banking, commercial banking and other financial services. This diversification has led to a surge in financial conglomerates in European countries (Baele et al., 2007).

The 1990s also witnessed numerous significant banking and financial crises in emerging markets, urging governments from these markets to deregulate their financial sector. Some major financial crises from that period include the 1994-1995 tequila crisis, which initiated in Mexico, then expanded to Brazil and Argentina, and the 1997-1998 Asian crisis that hit Thailand first before spreading to countries in Southeast Asia. Significant changes and deregulations were therefore introduced into the emerging markets, after the crises, via bank restructuring plans, broadened access to foreign ownership and by encouraging competition from financial intermediaries (Molyneux et al., 2013).

Although China has circumvented the direct negative influences of the 1997-1998 Asian crisis, it still underwent secondary consequences, resulting in an economic slowdown. Since the slowdown, China has gradually followed the global development of steadily eliminating the strict separations that were conventionally enforced among banks, securities and insurances. The deregulation began with revision of the Law of PRC on Commercial Banks in 2003 to insert the clause 'unless the State Council provides otherwise' to the general ban on banks involved in security transactions and later, insurance businesses. This financial development is characterised by the appearance of several giant financial conglomerates; for instance, China Everbright Group, CITIC Group and China PingAn Group, which created diversified institutions operating in various parts of the financial sector, involving insurance, trusts, asset investments, banks and securities (Huang, 2010).

Following the banking crises in the 1980s and early 1990s, the financial crisis of 2007-09 could be considered the most significant and most extreme financial incident since the economic depression of 1930s, which transformed the

landscape of the global finance and banking sector. The underlying causes for such crisis were known to be a combination of the housing bubble and credit boom. This crisis drove the global economies, banking sectors and financial markets into severe disaster, taking massively financed bailouts from taxpayers to bolster the sector. A courageous response from the U.S regulatory authorities, given the immense damage caused by the financial crisis, was the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010. This Act intended to set up a sound economic foundation to boost employment, protect customers, control Wall Street and Big Bonuses, cease bailouts and the 'too-big-to-fail,' in addition to avoiding another financial crisis. Under the Dodd-Frank Act, the Volcker Rule, finalised on December 2013, aimed to minimise the risks incurred by US banking entities. The Volcker Rule prohibited them from becoming involved in proprietary transactions, acquiring or holding partnerships, equity, or other possessions in a hedge fund or private equity fund, or from acting as a promoter for a hedge fund or private equity fund.

Given the adverse effects of the global financial crisis on the EU market, the Liikanen report was commissioned by the EU to determine whether the structural reforms of banking and financial services in the EU could enhance financial stability, promote efficiency and increase customer protection. An example of these measures on EU proposals is where proprietary activities and other essential trading transactions had to be appointed to an independent legal entity and a segregated number of transactions would form an essential share of a bank's transactions. Furthermore, the EU was also nominated to employ more robust risk measurements in the resolve of minimum capital requirements and

more persistent risk management in internal models (Europa, accessed 18 March 2018).

In response to the financial crisis, the UK also launched the Financial Services (Banking Reform) Act of 2013 in order to make provisions for changes in the banking industry. This included an announcement of the Financial Services Compensation Scheme, which protected depositors in the case of default of financial service companies. It also ensured the new Prudential Regulation Authority had enough power to hold banks responsible for how they split their investment transactions and retail trading.

Overall, during the last three decades, numerous causes have drastically changed how financial firms are operating. The prospects for higher profitability, provided by technological and financial advances and the growing popularity of capital markets, have led to a structural evolution in the conventionally fragmented function of financial service institutions. Following a chain of delayed reactions, between regulation, circumvention and deregulation, the formation and consolidation of very big, international, multi-product financial operating institutions are presently the norms, rather than the exception. Financial institutions still find methods in which to circumvent or avoid the constraints that have been set, because regulations and loopholes exist together in every regulatory and legislative system. Therefore, all the leading financial markets' authorities are still attempting to implement regulatory changes to the landscape of their financial systems in order to strengthen financial stability, efficiency and consumer protection.

Chapter 3: Literature Review

This chapter examines the extant body of the academic literature on the motives for financial conglomerates and non-conglomerate types of mergers, in addition to reviewing the impact of these mergers on bank performance and risks. In the first section, the first part discusses M&A waves and driving forces. The second and third parts review the traditional motives for M&As in general and specifically. The final part of this section presents the impact of M&As on bank performance. Second, the next section provides a detailed discussion regarding the influence of M&As on banking risks both theoretically and empirically.

3.1 Bank and M&As Activity

3.1.1 M&As wave and driving forces

M&As are significant activities, whereby two firms are consolidated with the aim of attaining specific strategic and corporate objectives, such as market power, maximisation of shareholder wealth value and increased profitability. The most remarkable feature of M&As as a phenomenon, is that they happen in waves. The opposing explanations of merger waves can be classified into two viewpoints: the neoclassical hypothesis and the behavioural hypothesis.

The neoclassical hypothesis suggests that when a regulatory, technological and economic shock to an industry occurs, the joint responses of companies inside and outside the industry are such that the assets of the industry are reallocated via mergers and partial-firm acquisitions. The acquiring firm managers react simultaneously to the shock and then compete for the best mix of assets; therefore the merger activity clusters over time. It is only when sufficient capital liquidity endures accommodating assets reallocation, that an industry shock will generate a merger wave. Noticeable regulatory and economic shocks

will lead to merger waves (Harford, 2005). The payment method for mergers will be either cash or stock, and partial-company activities for cash will be noticed. A firm might pursue a cash partial-company transaction and/or a stock swap. On the other hand, the behavioural viewpoint explains that mergers occur when acquirers' managers utilise over-valued shares to acquire lower-valued companies' assets. To produce a merger wave, it demands waves of high valuations for enough institutions. Thus, the behavioural hypothesis makes the following predictions. First, merger waves will happen after a period of abnormally high stock returns or market-to-book ratios, mainly when the diffusion in these returns or ratios is substantial. Second, industries experiencing waves will witness abnormal low returns after the height of the waves. Third, recognisable regulatory or economic shocks will not systematically precede the wave, because there is no economic driver enforcing the wave. Fourth, stock-financing mergers are tremendously seen in a wave, whereas cash-financing method should not raise in frequency throughout waves. Finally, due to the wave being compelled by consolidation of real assets with overvalued shares, partial-firm transactions for cash should not be the norm, and they should be particularly uncommon in companies that finance their mergers by stock (Harford, 2005).

From the neoclassical viewpoint, empirical evidence from literature demonstrates that companies with a significant amount of cash reserves are more dynamic in M&As market, hence supporting arguments for the neoclassical view (Harford, 1999). The earliest study by Coase (1937), asserts that changes in technology result in mergers. Maksimovic & Phillips (2001) utilise performance enhancements at the plant-level to defend the neoclassical view of merger waves. The neoclassical view is confirmed in the most recent study by Harford

(2005), which investigates both groups of explanations, the neoclassical model and the behavioural model. The author concludes merger waves are caused by industry economic, regulatory and technological shocks.

Regarding the behavioural view, Viswanathan & Rhodes-Kropf (2004) jointly constructed a model of rational managerial behaviour and unpredictability, related to the causes of overvaluation or undervaluation, and to the correlation between merger waves and market performance. This model suggests that rational acquired firms will agree more deals with overvalued acquirers because they do not have precise information throughout the peaks of market valuation and therefore, miscalculate synergies during this period. A merger wave is created from a higher flow of transactions. Indeed, Ang and Cheng (2006) and Dong et al., (2006), apply accounting data to measure a fundamental value and to observe evidence consistent with the behavioural hypothesis of merger wave. In addition, Rhodes–Kropf et al. (2005), in their empirical study, assert that collective merger waves occur when market valuations, calculated as market-to-book ratios, are high in comparison to good valuation, measured by residual income models or industry multiples. One of the advanced aspects of this empirical study is their attempt to interpret and classify their evidence based on different opposing hypotheses of merger wave; meanwhile, other authors investigating the behavioural view often seek evidence consistent with that view, rather than exploring both behavioural and neoclassical explanations and then correctly rejecting the latter one.

In relation to the possible drivers of merger waves, it is notable that, since the 19th century, the globe has witnessed six significant merger waves, each wave occurring within specific types of industry. The first wave (ca. 1895-1904)

happened within eight leading industries in the US, including food products, petroleum, chemicals, metals, transportation equipment, fabricated metal products, machinery and bituminous coal (Nelson, 1959). Most industries in the U.S. witnessed an increasing level of concentration. It is deemed that the first wave is a US event and its influence did not spill over into the UK, Asia or Europe. This first merger wave results from various situations. First, with regards to transaction costs, many substantial advances in the physical infrastructure of the U.S. and the production technology of companies (Markham, 1955; Salter and Weinhold, 1980) were perceived to reduce the cost of internalising many markets at this period, therefore encouraging M&As. Meanwhile, the regulatory and legal environment played an important role in triggering the wave. Before 1904, the courts stimulated agglomeration by demonstrating in various separate rulings that cartels and trade associations were far more vulnerable (Chandler, 1990). Based on the drivers of merger wave, it can be said that this wave is explained by neoclassical hypothesis whereby economic and regulatory shocks lead to merger wave.

The second wave (ca. 1918-1929) occurred in the US, motivated by changes in the physical operating setting of a US institution (Gaughan, 2015). The majority of mergers concentrated on vertical integration, unrelated conglomeration and the creation of oligopoly, instead of monopolistic acquisitions. The second merger wave occurred in mining, manufacturing, public utility and banking industries (Gaughan, 2015). The lack of a unified regulatory scheme to challenge all anti-competition or regulations is perceived to play a role in explaining the second merger wave. This wave ended on Black Thursday – 24 October 1929 with a large sink of stock market in its history.

The growth of the modern management theory, which was, among other elements, dispersed from the US to the UK, drove the third wave (ca. 1960-1969). The third wave was greatly driven by financial innovation. The boom in M&As transactions is due to the fact that stock-financed mergers were usually non-taxable. During this period, empirical evidence from literature shows the market supported diversification. Akbulut & Matsusaka (2010), Klein (2001), Matsusaka (1993) and Ravenscraft & Scherer (1989), all demonstrate that unrelated mergers in the 1960s produced a significant positive performance. This wave ended in 1969 with the fall of the stock market.

The first anti-merger wave, the fourth wave (ca. 1981-1989), occurred when institution leaders realised that many conglomerates, established in the 1960s, were not as valued as when they performed individually (Shleifer & Vishny, 1991). Throughout this period, M&As activities grew from the US to the UK and the EU. Mitchell & Mulherin (1996) assert that certain shocks, such as deregulation, foreign competition and oil-price shocks, explain numerous M&As transactions in the 1980s. Conglomerate firms were ripped up and restructured by hostile raiders when these conglomerate firms did not diagnose the flawed nature of diversification. The rise in concentration levels within broadcasting, entertainment, natural gas, trucking industries and air transport is explained by deregulation (Mitchell & Mulherin, 1996). The fourth wave terminated in 1989 when the US economy went into mild recession.

The fifth wave, from 1991 to 2001, was driven by a number of factors, such as globalisation, market liberalisation and deregulation (De Pamphilis, 2008; Gaughan, 2015). The world experienced an extremely high volume of M&As activities during this period, spreading even to Asia (Sudarsanam & Mahate,

2003). The number of hostile deals decreased in the UK and the US, although, increased in Europe (Gaughan, 2015). The fifth wave is seen as the wave with the most significant losses, as \$2.31 was lost for every \$1 financing on acquisitions. Dong et al. (2006), Harford (2005), Shleifer & Vishny (2003) and Viswanathan & Rhodes-Kropf (2004) all advise that the fifth wave was the result of market timing by corporate managers. Hence when the bubble burst in March 2000, the wave swiftly ended.

The sixth wave (ca. 2003-2008) was considered to be the first worldwide merger wave, as well as the first wave of the 21st century. In this wave, private equity corporations exploited historically low interest rates in order to complete risky acquisitions. The fraction of stock-swap financing deals decreased by more than 57% during this period, and the fraction of equity-financing deals sank by 32%, while numerous, wholly cash-financing mergers increased, in comparison to the level observed in the 1980s. Therefore, it seems that the neoclassical suggestion, which advises that merger wave is driven by plenty of liquidity, more effectively explains the rise of this merger wave than the behavioural theories⁷. The global banking panic in the autumn of 2008 drove worldwide economies into severe losses. Despite the various efforts of government interventions, to boost the solvency and liquidity of financial markets and the so-called 'too-big-to-fail' organisations, the market still witnessed an excessive slump of almost all commodities and asset prices, the surge of borrowing costs for both individuals and institutions and the rarely-observed volatile increase of the financial market. Modest growth projections prevented business leaders from pursuing M&As

⁷ For details of merger waves see McCarthy & Dolfsma (2013) and Appendix A for a summary table.

externally and shareholder enthusiasm was kept very low due to the shortage of customer and business confidence. As a result, the sixth merger wave finished between 2008 and 2009 and the M&As transactions dropped deeply to their lowest position since 2004.

Following the discussion of merger wave and its driving forces, it is also important to understand the motives for M&As in general, and for bank M&As specifically. This will be discussed in the next section.

3.1.2 Traditional motives for M&As

Berkovitch and Narayanan (1993) suggest three main motives for M&As, namely the synergy motive, the agency motive and hubris. Under synergy motive, the occurrence of M&As is explained by the economic benefits that are arising from the merger of resources between two corporations. The agency motive proposes that managers engage in M&As for their self-interest at the expense of acquiring a firm's shareholders. The hubris hypothesis suggests that managers of acquiring firms overpay for targets due to hubris and pursue M&As when no synergy is recognised. They also find that the three motives exist simultaneously in many U.S. mergers, which is in line with the findings of Seth et al. (2000); Nguyen et al. (2012). Similarly, empirical evidences of multiple motives are found in UK acquisitions (Arnold and Parker, 2009; Hodgkinson and Partington, 2008).

3.1.2.1 Synergy motive

The term synergy often refers to the form of reaction that happens when two entities integrate in order to generate a combined stronger effect than could be accounted for individually. Discussions regarding synergies often refer to Ansoff's synergy concept that illustrates positive synergies such as " $2 + 2 = 5$ ". In M&As context, synergy explains the capability of a combined entity to be more

profitable than the single parts of the two corporations that were merged. The predicted presence of synergistic welfares permits corporations to incur the cost of the merging process as well as affords to pay a premium for target shareholders (Gaughan, 2015). Synergies comprise operating and financial synergies. Operating synergy can arise from gains that improve revenues or those that decrease costs. The revenue-enhancing operating synergies can be achieved through greater pricing power, a merger of functional strengths and growth from fast-growing markets or new emerging markets. It is worth noting that because revenue enhancement synergies are difficult to achieve, managers from acquiring firms tend to expect more cost-decreasing synergies, which can be achieved through economies of scale reduction in the costs per unit that is associated with the increasing scale and size of a firm's operations. Economies of scope are another concept often connected with scale economies, which explains the capability of a corporation to make use of one set of inputs to deliver a variety of products and services. Scope economies are said to be one of the underlying elements behind the M&As activities across the banking sector during the fifth merger wave. Financial synergies in the context of M&As can result in two forms, which are either higher cash flows or lower costs of capital for the acquiring or combined firm (Gaughan, 2015). In a theoretical and empirical analysis, documented by Bradley et al. (1988), synergistic gains were found, but distributed inequitably between the target and acquiring shareholders. The sample consists of successful tender offers between 1963 and 1984, in which the target shareholders enjoyed the lion's share of synergistic gains; the share of gains has increased considerably since the passage of the Williams Amendment in 1968. Conversely, acquiring shareholders recognised significant positive gain,

only before the change in the legal environment; however, they experienced a substantial loss afterwards. The findings may indicate that any legal or institutional changes have considerably affected the share of synergistic gains between target and acquirer shareholders. This result is consistent with Berkovitch & Narayanan (1993) and Seth et al. (2000), that synergy gain is the main reason for both in-country and foreign acquisitions of US firms. The result, however, is inconsistent with the hubris hypothesis of Roll (1986), which will be discussed in the latter part of this section.

3.1.2.2 Agency motive

Under the agency motive, Jensen (1986) proposes the agency costs of free cash flow theory which, among many theories, can relevantly explain M&As. The free cash flow theory anticipates that mergers and acquisitions are more likely to demolish, rather than to create value. As such, the conflict of interest between managers and shareholders is present. This also indicates that managers of companies with unexploited borrowing power and large free cash flows are more likely to pursue M&As that are low-benefit or value-decreasing. The extant literature has extensive evidence of agency motive behind M&As. Malatesta (1983) investigates that mergers with agency motive normally destroy the value of acquirers. Shleifer and Vishny (1989), report that acquiring managers undertake M&As in order to increase the reliance of the company on their skills, regardless of whether such mergers are value enhancing or value destroying. Also, Morck et al. (1990) determine that many acquisitions focus on expanding company size, rather than its value. All of these findings may suggest that agency is a value-destroying motive for M&As.

3.1.2.3 Hubris

The hubris hypothesis, developed by (Roll 1986), explains that M&As happen because key decision makers in acquiring companies are infected by hubris⁸. Moreover, acquisitions are undertaken even when the valuation of targets exceeds the current market price, which merely reflects a valuation error. Indeed, Moeller et al. (2004), suggest that hubristic managers of big corporations have a tendency to propose higher acquisition premiums and are more likely to complete an acquisition than their smaller peers within the same industry. Moreover, substantial evidence, that supports hubris (defined as over-confidence, Malmendier & Tate, 2008) as a motive for acquisitions, is found in UK samples (Firth, 1980), among Japanese bidding firms (Lin et al., 2008) and among U.S. domestic M&As (Nguyen et al., 2012). Conversely, Aktas et al. (2009) find that the decreasing trend of cumulative abnormal returns over deals does not necessarily mean hubris exists; it can be affected by other factors such as budget limits or growing competition throughout M&As waves.

3.1.2.4 Other motives

Apart from the motives discussed, it is suggested that M&As involve numerous motivations. Amihud & Lev (1981) propose that corporations pursue diversification in order to attain a more stable operating performance. In addition, it allows managers to lower the risk to personal capital. Shleifer and Vishny (1989) propose a model of managerial entrenchment in which managers pursue M&As, not only for increasing their job's security and obtaining higher salaries and bonuses from shareholders, but also for greater freedom in decisions on business

⁸ The theory of managerial hubris (Roll, 1986) suggests that managers may have good intentions in increasing their firm's value but, being overconfident, they overestimate their abilities to create synergies.

strategies. The model contains some empirical implications consistent with evidence on the behaviours of managers. Furthermore, evidence of conflicting M&As motives found in Mehrotra et al. (2011) is consistent with the observation that the wealth gains over M&As announcements periods in Japan are lacking. To conclude, it is challenging to draw a good picture of the underlying motives for mergers, as multiple motives often exist simultaneously. In the next section, motives for M&As in the banking industry will be discussed.

3.1.3 Motives for bank M&As

3.1.3.1 Motives for non-conglomerate bank mergers

As stated in the previous section, motivations for M&As in any sector, including the banking industry, can be summarised as synergy, agency and hubris. Additionally, in Berger et al. (1999) framework, the fundamental motive for consolidation in the financial services industry is to maximise shareholder wealth value. Managers of bidding firms expect to maximise value through mergers, mainly by enhancing participants' market power in setting prices or by boosting efficiency, and sometimes by making themselves more accessible to a safety net. Empirical proof on the motivations for non-conglomerate bank M&As (i.e. banks merge with banks) in Europe and North America, have a tendency to emphasize the importance of synergy motive (Focarelli et al., 2002); (Wheelock and Wilson, 2004).

Indeed, in most research from the 1980s and the early 1990s on the presence of economies of scale in retail, commercial banking observes a flat U-shaped average cost curve, with medium-sized banks being slightly more scale efficient than either bigger or smaller banks. This outcome is quite robust and holds for Canada, Europe and the US (Amel et al., 2004). Altunbaş et al. (2001)

find evidence of economies of scale, ranging from 5% to 7% in their sample of European banks between 1989 and 1997, with assets from €1 billion to €5 billion. Furthermore, these outcomes also imply that, although the largest banks in Europe do not seem to benefit from economies of scale benefits as smaller banks do, they do gain advantages from the technical progress in decreasing bank costs. In a similar vein, Cavallo & Rossi (2001) confirm the existence of higher scale economies in smaller banks in all countries in Europe. Furthermore, they find the presence of scale economies at any production scale and for every banking type. The findings are similar to that of the US banking sector, where the minimum optimal size appears to be less than \$500 million of assets on samples which examine mostly small banks from \$2 billion to \$10 billion of assets, containing mainly large banks or samples that regard risk as one of the related factors (Berger, 2000). Potentially significant economies of scale are found in a sample of hypothetical large bank M&As in Canada between 1976 and 1996 (McIntosh, 2002).

In contrast, Berger et al. (1993) found that the largest banks encounter insignificant diseconomies of scale, even though revenues grow marginally from 1% to 4% with bank size. Hughes et al. (2001) asserted that most studies observe scale diseconomies, as they do not consider the distinctions in the capital structure of banks and their levels of risk-taking. Their studies showed that large banks possibly enjoy protection under the TBTF status and utilise safety net subsidies from the government; thus, they maintain lower capital than the cost-minimising standard level. Meanwhile smaller banks keep more than the cost-minimising standard level of capital. Likewise, evidence from Japan indicates that handling risk overturns the more common outcomes of the existence of scale

efficiencies within the banking sector. Indeed, a study from Altunbas et al. (2000) observed diseconomies of scale from their sample of Japanese banks where risk was taken into account.

Regarding scope economies, empirical evidence from Australia proposes that scope economies were not exhausted by financial deregulation (Edirisuriya and Brien, 2001; Cavallo and Rossi, 2001). Evidence in which four leading Australian banks, still observing substantial scope economies after their deregulation periods (from 1982 to 1993), implies that they managed to adjust their joint production costs efficiently, and they have not entirely embraced deregulation (Edirisuriya and Brien, 2001). The study's outcomes suggest that the Australian banking sector could be more competitive and efficient if further deregulation is imposed. Similarly, significant economies of scope are found for all output ranges within the European banks' sample over the period of 1992-1997 (Cavallo and Rossi, 2001). These findings support the prediction that the deregulation towards universal-type banking organisations, encouraged by the Second European Banking Directive, contributed to the increase of scope economies degree. It is also advised that small banks should expand production scale; meanwhile large banks may focus on the output mix diversification.

Among the most popular discussions about synergy motive for bank consolidation, is by Hankir et al. (2011) who investigate market power motive as one of their primary motivations behind bank M&As transactions in North America and Europe, over the period 1990-2008. The market power hypothesis is based on the anti-competitive effects arising from M&As transactions. Under the market power hypothesis, the increased market power for an individual bank, as well as higher market concentration, would enable bidding banks, targets and their rivals

to set higher prices, thereby maximising their profit by employing customer surplus. This hypothesis can justify 10% of all bank mergers within that specific period. From the findings, it is concluded that the market power hypothesis cannot be deemed as the only primary merger motive, even though it has the highest occurrence rate compared to the other motives. Secondly, regulators should take into consideration the actual market concentrations and the levels of competition in the banking market, given the fact that more investors are confident about the prospect of market power exploitation, than synergy efficiency.

In addition to the above motivation behind bank M&As, a managerial motive is found among large US bank mergers in a study by Bliss & Rosen (2001). The authors detected that the compensation of CEO increases during the post-merger period, irrespective of value creation or productivity enhancements, and translated the results into evidence of managerial empire building.

To summarise, synergy appears to be the most popular motive for the EU, US and Canada bank M&As during the 1980s and 1990s which is contradictory with the scale of inefficiency found among Japanese bank mergers, when risk is taken into consideration. In addition, the evidence of managerial and market power motive in the US and EU, suggest that multiple motives often coexist and it is difficult to have a good picture of the fundamental motives behind bank M&As.

3.1.3.2 Motives for product diversification and geographical diversification

Theories summarise the motives for product diversification (i.e. banks merge with non-banks) under the general headings of agency, market power and resource views. Under the market power view, managers of bidding firms pursue diversification with the expectation to employ anti-competitive behaviour, through either cross subsidisation, reciprocal buying or mutual forbearance. The resource

view suggests that corporations own multiple ranges of resources, unique capabilities and core competencies. These unique resources can provide corporations with growth opportunities, cost reductions via scope economies and revenue improvements. If the market could sell these assets, it would no longer be necessary to pursue diversification; although, diversified corporations may be able to employ these resources in different markets when transaction costs are high (Wilson et al., 2010). In addition, a variety of studies have investigated the motivation of firms' diversification and the successive influence of diversification on organisational values. Santomero & Eckles (2000) assert that the explanation for diversification within the financial and banking industry is to obtain advantages via co-insurance (Asquith and Kim, 1982) expansion and development and efficiency achievement through scale and scope economies, thereby diminishing a company's default' risk (Halpern, 1983) and enhancing stability of the financial system.

The utilisation of economies of scale is possibly the most popular motive for bank diversification regarding efficiency gains. Indeed, Hughes et al. (2001) confirm that economies of scale are positively related to bank size and diversification, whilst being negatively related to the balance sheet assessment of risk. In fact, considering risk would increase the possibility of achieving economies of scale and scope in managing risk. The more significant the scale is, means more diversified products and financial services will be offered. The expanded spread of risks geographically, often indicates the potential for better diversification; therefore, financial institutions can be protected against financial hardship with fewer capital resources. For instance, McAllister & McManus (1993) observed scale economies from a diversified portfolio of loan risk. The

standard deviation of the return rate on loans was shown to decrease abruptly when the portfolio of a bank loan rose to approximately \$1 billion. Empirical research has been carried out on economies of scale and scope across the Taiwan banking industry (Tai-Hsin and Mei-Hui, 2004). The authors conclude that Taiwan banks in the sample, experience scale economies and reveal diseconomies of scope, which suggests that more substantial product diversification could lower costs within the banking industry, via product-mix economies. Accordingly, diversifying business lines further within the financial services industry may be beneficial for banks.

Unlike scale economies, the effects of scope economies or agency costs are confirmed to be challenging when used to measure within the financial services industry due to econometric difficulties and the unavailability of data (Berger & Humphrey, 1994). Despite this, Fiordelisi & Ricci (2011) attempt to measure cost and profit efficiency of acquisitions between Italian banks and insurance firms. In general, no firm evidence is detected to support efficiency gains from bancassurance, and bank mergers with life business do not perform better than their counterparts in either profit or cost.

In the most thorough study of its type, Laeven & Levine (2007) investigated the diversification effects on the market value of large financial services corporations throughout 42 countries and reported less positive findings. The authors noticed that diversified financial services companies' market values tended to be less than their counterparts. It is concluded that the potential scope for economic benefits is not adequate to enhance the market value of diversified banks, and diversification turns out to raise agency problems. Agency problems are also detected in the studies of Mester (1991) in mutual savings and loans, as

demonstrated by scope diseconomies, before deregulation in the financial services industry. However, after the deregulation in the middle of the 1980s, agency costs decreased.

Similar to product diversification, geographical diversification in the financial services industry often associates with scale, scope, geographic and international integration; and is thereby as motivated by the potential economies of scale and scope as the other types of integration (Berger, 2000). Likewise, Caiazza et al. (2012) find that cross-border M&As in the banking sector is more likely to be stimulated by diversification motives than in-country deals, possibly bringing potential benefits to the economy. In a more recent study, Karolyi and Taboada (2015) discovered evidence of a form of regulatory arbitrage⁹ whereby acquisition flows involve acquirers from countries with stronger regulations than their targets. Using a sample of 7,297 domestic and 916 majority cross-border deals, announced between 1995 and 2012, they show that target and aggregate abnormal returns around deal announcements are positive and more significant when acquirers come from more restrictive bank regulatory environments. This evidence can be interpreted as more consistent with a gentle form of regulatory arbitrage than a possibly destructive one.

In conclusion, motives behind the following complex type of mergers and acquisitions in the banking sector: consolidation between banks, integration of banks and nonbank firms as well as cross-border M&As, can be summarised as synergy, agency, managerial motive, hubris and risk diversification. Empirical evidence found from various studies suggests that multiple motives often coexist

⁹ Regulatory arbitrage is a practice whereby firms capitalise on loopholes in weak regulatory systems to circumvent unfavourable regulation

and that value-enhancing motives, in addition to value-decreasing motives, may exist simultaneously in a merger deal.

3.1.4 Impact of M&As on bank performance

Economic literature pays attention to the performance of banks, expressly regarding competition, concentration, efficiency, productivity and profitability. The literature has tried to measure these unobservable variables via many different methods, none of which, however, has been entirely conclusive or unchallenged. Aside from theoretical shortcomings, the practical problem is that different methods yield different estimates.

It can be said that M&As directly influence bank performance. For instance, the sources of financial benefits produced by M&As can enhance the efficiency of an operation or the rise in market power. Merger-related enhancements can be measured straightforwardly in the efficiency of the combined entity's operation, by comparing accounting ratios before and after the merger or by using the efficiency frontier method. The consensus regarding the outlook of bank M&As and their effect on accounting ratios, cost and profit efficiency enhancements throughout the 1990s, was vague.

An alternative stream in literature uses an event-study methodology to capture the bond and security market reaction around merger announcements. These studies attempt to detect abnormal returns to bidders and target shareholders during the M&As announcement because these returns indicate the market's perception of whether the merger creates or destroys value. Abnormal return is the amount by which a share price in the actual market exceeds the forecasted share price by an asset-pricing model. The consensus outlook regarding the event study of bank mergers during the 1990s is that, in general,

acquiring banks' shareholders experienced slightly negative abnormal returns, shareholders of target received significant positive abnormal returns, meanwhile the abnormal returns from the combined entity were statistically insignificant (Hudgins & Seifert, 1996; Subrahmanyam et al., 1997). Nevertheless, the post-2000 studies regarding M&As performance produce adverse findings with a pre-2000 outlook. More recent works propose that both bank M&As in the EU and North America enhance efficiency; however, only bank mergers in the EU create value for shareholders. In general, the following discussions will focus on merger performance under different types of M&As, namely non-conglomerate bank mergers (banks with banks), conglomerate bank mergers (banks with non-banks) and cross-border bank mergers.

3.1.4.1 M&As impact on the performance of non-conglomerate bank mergers

In general, a sizable number of recent studies on bank M&As in the EU produce convincing evidence of the enhancements in performance. Huizinga et al. (2001), investigate 53 bank mergers in the EU from 1994 to 1998 and find evidence of positive enhancements in cost efficiency, but quite minor gains in profit efficiency. Furthermore, other evidence from the EU studies witnesses efficiency and gains in profit after the deal (Diaz et al. 2004; Altunbas & Marques 2008; Hagendorff & Keasey 2009). Some features of these pan-EU studies are that non-conglomerate bank mergers (Diaz et al. 2004) and merger deals, in which both acquirers and target implement comparable strategies (Altunbas and Marques, 2008), tend to have better performance regarding profit and efficiency.

Regarding stock market reaction, Beitel et al. (2004) examined 98 bank merger deals in the EU between 1985 and 2000 and found positive cumulative

abnormal returns for both acquirers and target stockholders. It is estimated that 60% of all merger deals create value for their shareholders. Non-diversified deals are found to have significant wealth effects; the same results are found for acquiring banks involved in fewer merger deals and when the acquired bank demonstrated a history of poor stock performance. In a similar vein, Campa & Hernando (2006) investigated 244 bank merger transactions in the EU from 1998 to 2002 and detected minor effects on acquirers share prices. However, positive abnormal returns were found for stockholders of target along with a substantial enhancement of a target's financial performance two years after the completion of the deal.

In a recent study on stock market reaction to European merger announcements and completions, during the recent global financial crisis (2007-2010), Beltratti & Paladino (2013) found no significant abnormal returns around the deal announcements, but did find positive abnormal returns on deal completions. Also, they discovered that the characteristics of acquiring banks determine the returns at the announcement; meanwhile the returns after completion depend on a target's opacity and on the reduction of idiosyncratic instability, which relates to the decrease in uncertainty. To conclude, the authors notify that bank M&As transactions are different during the financial crisis period.

Evidence from the US also reports quite positive findings as seen in the EU in the post-2000 studies. Hannan & Pilloff (2009) utilise a hazard function methodology in order to study the characters of acquiring banks from 1996 to 2003, and discover that banks operating in a cost-efficient manner tend to merge with their less efficient counterparts. This result indicates the presence of potential gain from performance, after the deal. In contrast, accounting statistics

are used in Hagendorff & Keasey (2009), to compare bank mergers in the EU and the US from 1996 to 2004. The evidence suggests that US acquirers tend to concentrate on the generation of revenue after the completion of the deal, even though this does not lead to enhanced performance, because of the rise in costs.

Evidence outside the EU and the US also shows enhancements in performance as a result of M&As. McIntosh (2002) found the potential of substantial economies of scale from their sample of Canadian bank mergers. Hosono et al. (2006) reported significant cost and profit efficiency improvements after merger deals in their Japanese bank merger studies. In a more recent study, Sufian and Kamarudin (2017) examine the impact of mergers and acquisitions on the productivity of the Malaysian banking sector, finding that the Malaysian banking sector has exhibited a higher total factor productivity level during the post-merger period, attributed to technological progress. Overall, evidence worldwide shows optimistic findings concerning merger-induced cost and profit efficiency improvements within the last two decades.

3.1.4.2 M&As impact on banking product diversification and geographical diversification

Literature suggests that evidence of the effects of product diversification on bank performance are mixed. Hendershott et al. (2002) investigated the market reaction to the Gramm-Leach-Bliley Act of 1999, concluding that non-bank financial institutions are likely to enjoy more benefits from product diversification than from banking institutions. The authors also found that investment banks and insurance companies witnessed positive abnormal returns as a result of the Act; meanwhile, commercial banks experienced no change in share prices. However, another US study reports less positive findings before the

Act, in their sample of US mutual fund M&As from 1994 to 1997 (Jayaraman et al., 2002). Here the authors find that acquirers witness negative abnormal losses, whereas target stockholders experience positive abnormal returns.

Numerous studies have focussed on specific nations within the EU. For instance, Acharya et al. (2006) discovered that asset diversification across individual bank loan portfolios does not enhance the risk profile or performance of Italian banks. Hayden et al., (2007) utilised statistics on individual bank loan portfolios for their sample of German banks in order to evaluate the extent to which diversification in lending, within different regions and different industries, enhances performance. They detected that all kinds of diversification result in poorer bank performance.

In the most comprehensive study of its kinds, Dontis-Charitos et al. (2011) employed the event study method to measure abnormal returns around merger announcements of banks and insurance firms from different countries. They reported that European, U.S. and Canadian bancassurance transactions yield positive returns, whilst Australian acquirers receive an insignificant valuation from the market. The authors also highlight that when a suitable institutional model is carefully chosen, mergers between banks and insurance firms can add value to shareholders. In a more recent study, Varmaz and Laibner (2016) aimed to empirically analyse the success of European bank mergers and acquisitions (M&As), including targets who involved in insurance, brokers, real estate and holding and investments. Their study focused on the analysis of the shareholder value implications of stock market reactions, which announced and cancelled M&As from 1999 to 2015. The paper found that European bank M&As had not been successful, regarding shareholder value creation for acquiring banks,

whereas targets experienced significant value gains. Abnormal returns for bidders and targets exhibited the same characteristics upon the announcement of M&As that were cancelled at a later date, whereas the results for transaction cancellations deviated. Targets experienced greater negative abnormal returns than upon the transaction announcement. The findings for bidders are striking, as they destroyed shareholder value upon the transaction cancellation, and consequently, they suffered twice. In particular, banks with higher profitability, higher efficiency and lower liquidity experienced negative abnormal returns around the announcement dates. Negative abnormal returns before the transaction announcement and provision for loan losses significantly increased the likelihood of M&As cancellation.

In terms of geographic diversification, recent studies on cross-border bank M&As in the US and the EU have had a tendency to obtain little or no proof of enhancement in cost efficiency (Berger & Deyoung, 2001), though some evidence of accounting returns improvements and profit efficiency enhancements were found (Elsas et al., 2010). Indeed, Berger & Deyoung (2001) found that bank holding companies in the U.S. expanded more geographically as a result of the consolidation trend within the banking industry. However, this expansion brought about managerial obstacles for the merging bank, hence the efficiency of operation decreased. Becher & Campbell (2005) observed that focused mergers, before and after the geographic deregulation (Riegle-Neal Act), experienced different announcement effects. Geographically focused deals witnessed significant abnormal returns in the pre-deregulation period; hence these are value-enhancing deals. Nevertheless, focused mergers were demonstrated to be less efficient than expanding deals after the Act. These

results might suggest that market power seems to be hard to achieve via M&As after deregulation when the entry barriers are lower, putting pressure on profit margins. Finally, in the most comprehensive study of its type on the impact of the global financial crisis on cross-border deals in the global banking sector, Rao-nicholson & Salaber (2016) noticed that banks from emerging markets seemed to be the leading bidders after the crisis, and they targeted developed economies in the EU as well as neighbouring nations.

In conclusion, pre-2000 studies have usually focussed on bank mergers in the US after the consolidation process happened in the US, and earlier than the EU and other continents. Literature before 2000 summarises that bank M&As are likely to enhance efficiency, although the event-study method does not detect substantial evidence of positive shareholder wealth effects. Post-2000 literature has witnessed a clearer consensus from the EU M&As transactions, which seems to lead to both efficiency benefits and value creation. This may be because European acquirers' managers have learnt both the best and worst practices from earlier mergers.

3.2 Impact of M&As on Bank Risks

3.2.1 Conceptual framework

Banks exist in order to take on the risks of their clientele. By providing risk management products and services to its customers; many risks are added to each operation (refer to Appendix C for discussion regarding bank risks). These products and services are priced accordingly, based on the estimation of the expenses of managing the risks inherent in each transaction. Since banks are risk intermediaries, they retain an inventory of risk that should be measured responsibly in order to guarantee that the risk exposure does not intimidate the bank's solvency. It is also widely accepted within existing literature that M&A activities alter the risks of acquiring banks, particularly the risks of large banks whose credit or liquidity problems may affect many other institutions (Casu et al., 2015; Laeven et al., 2016; Vallascas and Hagendorff, 2011; Weiß et al., 2014). These risks consist of acquirers' idiosyncratic risk, default risk, contribution to systemic risk and others. Therefore, this section aims to discuss different theoretical models in the literature explaining the rationale behind the relationships between M&As and bank risks.

First, the reasoning behind the relation between M&As and idiosyncratic risk in the banking sector can be explained by the Modern Portfolio Theory of Markowitz (1952). According to the theory, diversification between portfolios that do not have perfectly correlated returns should result in lower variance of the combined portfolio. M&As activity is generally seen as the diversification of portfolios between acquirers and targets. In the absence of perfect correlation between the returns of acquirers and targets, the total variance after merger is less than the simple sum of the individual variances. In other words, idiosyncratic

risk of the merged firms is reduced following M&As activity. Also, as a further development of the modern portfolio theory within the M&As context, Levy and Sarnat (1970) assert that if the expected return post-merger of the combined firm is presumably the weighted average of each acquirer-target returns, the total risk should be decreased without any change in the level of return for the merged firm, which signifies an efficient combination of the risk-return features of the new firm.

Second, the relationship between mergers activity and banks' default risk is enlightened by a theory of financial intermediation by Diamond (1984) in which diversification is the key to this theory. The natural reasoning for the significance of diversification is marginally distinctive between model with risk neutral agents and the model with risk-averse agents. In the former model, diversification is crucial since it raises the chance that the bank has adequate loan incomes to pay a fixed liability claim to depositors; in the limit, this likelihood is one, and the likelihood of experiencing bankruptcy costs is nil. In the latter model, diversification raises bank's risk tolerance toward each loan, to an extent that permit the risk-bearing essential for incentive purposes to be cheaper. When expanding to the case of mergers activity, this delegated monitoring model envisages that well-diversified banking firms as a result of the combination between acquirers and targets carry less default risk. Indeed, Levy and Sarnat (1970) add that mergers raise the size of the company, therefore, might produce financial benefits such as greater access to the capital markets and experience substantial cost savings when ensuring their financing requirements. The cost savings seemingly indicate the decrease in banks' default risk attained via diversification. Presumably that it always exists some positive possibility of a

bank to experience significant losses to the extent that a default can occur, it can be demonstrated that the joint possibility of such default event is decreased by a merger. Undoubtedly, the probability that significant losses that happen at the same time for both acquirer and target of the merger are much lower than each individual probability of default. Therefore, mergers often lead to a reduction in default risk for the combined firms.

In contrast, there are several theoretical models in the literature predicting that mergers increase default risk of acquirers. One of the reason for firm's default risk to increase is because of the increase in financial leverage of the combined entity post-merger. Morellec and Zhdanov (2008) design a dynamic model for merger activity, in which they demonstrate the existence of an asymmetric equilibrium in financing policies among leverage, insolvency, acquisition terms. In this model, the acquirers with the lowest leverage succeed the acquisition game. Also, bidders have a tendency to lever up after the completion of the acquisition which may contribute to the rise of merging firm's default risk post-merger. The second reason for the increase in default risk is related to asymmetric information¹⁰. When asymmetric information exists, management can better conceal possible value-reducing transactions from external shareholders. One of the proxies for asymmetric information is the idiosyncratic volatility of share, in which greater values may enable management to conceal risk-increasing transactions since they may merely be explained as indicating a random result of higher ex-ante uncertainty (Dierkens, 1991).

¹⁰ Asymmetric information sometimes referred to as information failure, is present whenever one party to an economic transaction possesses greater material knowledge than the other party

Third, the reason why M&As activity affects systemic risk of the combined firms are explained in a theoretical model by Wagner (2010). His model shows that while diversification may diminish a corporation's probability of bankruptcy, it also raises the tendency for that corporation to break down at the same time as other corporations; in other words, it creates higher probability of a systemic crisis. Extending beyond diversification, he asserted that various kinds of financial unification, for example, M&As (both geographical and functional mergers) or bancassurance businesses, are similar to diversification, in the sense that they increase the likelihood of systemic breakdown. For instance, when two banking corporations guarantee each other against liquidity collapse, they are likely to face the shared breakdown, possibly placing destructive influences on the financial system as a whole. As a result, the cons of diversification with systemic crises usually begin to exceed the pros for an adequately high degree of diversification. It is worth noting that the detrimental influences of diversification in Wagner's setup is not subject to contagion, instead, the influence emerges for a merely mechanical reason that when risks are shared evenly among corporations, the probability of joint collapse rises.

On the contrary, there are theoretical motivations in the literature supporting the notion that bank mergers help to reduce individual bidders' risk and as a result, a reduction in systemic risk. For instance, Allen and Gale (2000, 2004) argue in their model that monopolistic banks in a concentrated banking system with a few banking firms are able to produce greater capital buffers that can be used as a cushion against external distress to the financial system. Besides, M&As lead to greater diversification in terms of loan portfolios (Diamond, 1984) and less costs for scrutinising of their rivals (Allen and Gale,

2000); therefore, they can result in better financial stability for the individual banks as well as the financial system.

In conclusion, M&As activity changes different types of risks that the merged banks have to bear, namely idiosyncratic risk, default risk, systemic risk, amongst the others. Generally, diversification benefits deriving from M&As are the centre of the key theories that explain why M&As reduce merged banks' risks. However, diversification also makes banking firms becoming more identical to each other in terms of portfolios held, thereby making systemic crises more likely as firms are exposed to the same risks.

3.2.2 Empirical evidence

In the previous section, a number of theoretical models are discussed to examine the relationship between M&As activity and bank risks. This section, as a result, provides discussions on empirical evidence regarding the impact of M&As on bank risks in different regions. Empirical evidence in North America concludes that expansion of banks into less traditional financial activities is associated with increased risk and lower returns (DeYoung and Roland, 2001). Similarly, cross-border M&As by US banks appear to be associated with higher risk and lower returns (Berger et al., 2016). In contrast, Deyoung and Torna (2013), using a sample of US banks covering the global financial crisis 2007-09, found that banks that diversify their activities via M&As to pure fee-based non-traditional activities, such as securities brokerages and insurance sales, enjoyed stable revenue and consequently had a lower probability of default. However, large banks may also engage with asset-based non-traditional activities, which may increase the probability of bank failure. Hence the overall influence of diversification on the hazard of failure is somewhat cancelled out.

Outside the US, the picture seems to be less uniformed. In a study of Russian banks, Berger et al., (2014) find that middle ground between complete focus and full diversification via M&As increases expected returns and decreases risk and the probability of default. For cross-country studies of European banks, Lepetit et al., (2008) finds that risk is negatively related to the extent of bank trading activities, while Mercieca et al., (2007) asserts that small banks, that have diversified into non-interest income activities, are riskier than those that focus on traditional areas of business. The effects of cross-border bank mergers on bank risk, also remains an open question in literature. Through geographically diversifying, bank M&As have the possibility to decrease the risk of bank insolvency. They also have the possibility to increase that risk due to the increase in risk-taking incentives by bank managers and stockholders following these transactions. Choi et al., (2010) empirically investigates whether cross-border bank mergers raise or reduce the risk of acquiring banks, as captured by changes in acquirers' yield spreads. Following M&As announcements, the paper also investigates how dispersions in the institutional environments between acquirer and target countries influence changes in yield spreads. Overall, the study finds that bondholders, in general, perceive cross-border bank M&As as risk-increasing activities, unlike domestic bank mergers. This study also uncovers that these yield spreads are significantly affected by the differences in investor-protection and deposit insurance environments between the transacting countries. The overall evidence results in a policy implication that regulators should assess the relative market, in both the home and the host countries, in evaluating the associated risks of an active multinational banking firm and in setting the sufficiency of the banks' reserve positions.

To elaborate further, one of the recent vigorous debates in literature is the diversification effects of M&As upon systematic risk and idiosyncratic risk. Researchers in support of diversification have asserted that this strategy helps to reduce total risk via a decrease in idiosyncratic risk. Mishra et al. (2005) confirm this argument in their empirical study of U.S. non-conglomerate types of mergers, specifically, banks with banks, where acquirers use equity to finance their mergers. They find that tremendously statistically significant evidence of M&As between banks helps to decrease total risk and unsystematic risk, although these do not have a statistically significant effect on systematic risk. The authors conclude that diversification appears to be a possible motive for bank M&As.

In contrast, other authors are against risk diversification benefits, disputing that, financial firms might be vulnerable to similar shocks, due to diversification, which in turn can cause fragility of the entire financial system. Therefore, to verify the above hypothesis, that risk is reduced through diversification, Casu et al. (2015) broke down total risk into systematic and idiosyncratic components and measured risk for acquirers before and after M&As announcement. They examined bank consolidations with insurance providers and with securities firms from 1991 to 2012. Their results indicated that M&As between banks and security companies raised the total risk via the higher level of systematic and idiosyncratic risks. Conversely, the consolidation of banks and insurance firms and insurance agencies/brokers recognise market betas (systematic risk) increase. On the basis that the period 2007-2012 witnessed an increase in the combined entity' risk after the announcement, the authors advised that it is the financial crisis which causes markets' caution. The authors also highlight the significance of bank size as a significant contributor to systematic risk. The existence of a substantial size effect

promotes the assertion that regulators should impose excessive regulatory inspection on systemically important banks in the form of improved risk-based capital, liquidity and leverage requirements along with better information disclosure to the public (Krainer, 2012).

Similarly, a study from Baele et al. (2007) utilised a stock-return methodology to investigate franchise value, systematic risk and idiosyncratic risk in EU banks from 1989 to 2004. They confirmed that franchise value was promoted by the rise in non-interest income, however, increases in systematic risk, indicate that from time to time bank returns are directly connected to the market. The diversification effect on the idiosyncratic risk element is non-linear and mainly downward sloping; therefore, some European financial conglomerates can reduce idiosyncratic risk providing they do not exceed the optimal size. These outcomes present different implications for various bank stakeholders, for instance, shareholders, bank management, supervisors and investors. Investors, such as pension funds, can diversify themselves; therefore, they consider the exposures of systematic risk. European bank investors experience the typical risk/return trade-off in which the higher the expected returns, the higher the systematic risk will be. In addition, shareholders of banks, borrowers, managers and customers are all interested in idiosyncratic risk. For these stakeholders, diversification brings benefits with regards to bank risk reduction in the case of European banks, although it is unsafe to rely too much on non-interest income due to the non-linear relationship. Finally, from the policymakers and bank supervisors' point of view, both the systematic and idiosyncratic share of bank risks need to be considered, since they are responsible for regulating and enhancing the soundness of the financial system.

For systematic risk, large diversified banks should be supervised cautiously because these financial conglomerates tend to have higher market betas.

With regards to geographic diversification, Buch & DeLong (2008) investigated a sample of international bank acquisitions between 1998 and 2002, finding that the host countries' supervisory scheme impacted on the changes in total risk after completion of the deals, but did not seem to influence systematic risk. Acquiring banks operating in a territory with strict supervision is deemed to shift risk back to its home nation. These outcomes indicate that a strong supervisory scheme within the banking sector can help a nation to diminish return variability (total banking risk) and regulatory schemes might promote a risk-connected motive for cross-border consolidations within the banking industry. Contradicting Buch & DeLong (2008), Amihud et al. (2002) asserted that the acquiring bank's total risk and systematic risk via cross-border M&As, remained unchanged in the predator's home banking sector during the post-merger period, in their sample of bank mergers from 1985 to 1998. The implication, in this case, is that policymakers should not adopt a systematic policy to restrict cross-border M&As. Instead, policymakers from both home and host country should adopt a case-by-case approach when risk is taken into account. It is possible that these contradictory results arise from the use of a slight difference in methodology by Buch & DeLong (2008), since they break down the risk of security return of a bank into systematic risk and idiosyncratic risk, in addition to using different samples in different periods, compared to Amihud et al. (2002).

In conclusion, it is observed that many empirical pieces of evidence show the increase in systematic risk as a result of product diversification. Studies regarding the effects of non-conglomerate bank mergers and cross-border

acquisitions on total risk, systematic risk and idiosyncratic risk, are still limited and produce mixed results.

The debate regarding the link between systemic risk and bank M&As is also very fruitful. In the most recent empirical study, by Weiß et al. (2014), of the international and cross-border M&As transactions and their contribution to systemic risk, they find strong evidence for the substantial increase in acquiring banks' contributions to systemic risk as a result of consolidation. The findings entail two major policy implications. Firstly, bank managers and supervisors should impose stricter supervision of merger deals, given the negative effects of bank M&As on systemic risk. Secondly, the findings highlight the significance of market discipline, as government intervention, such as government-owned banks or deposit insurance guarantees, are one of the factors that contribute to the adverse effects of bank M&As to systemic risk. Likewise, De Nicolo et al. (2004) investigate the relationship among consolidation, conglomeration and systemic risk potential within the banking sector, by using the Z-score technique. Their international evidence highlights the increasing trend of positive correlation between banking structure instability and concentration. Furthermore, large conglomerate institutions tend to take a higher level of risk in comparison with their smaller and specialized counterparts. Indeed, Caminal & Matutes (2002) observed that monopolistic financial institutions are able to generate risky loans that bring about negative effects on the overall financial structure. In a similar vein, Uhde & Heimeshoff (2009) also use Z-score techniques as do De Nicolo et al. (2004), in order to examine European banks between 1997 and 2005, whereby they found that market concentration in the banking industry at national level caused the EU banking system to become unstable. The policy implications

developed from the findings are that European policymakers and supervisors should enhance cross-border cooperation and should carefully explain responsibilities for prudential supervisions and the regulation of EU banks operating cross-country.

An alternative perspective supports the view that a concentrated banking structure with several large banks is less vulnerable to systemic crises than a less concentrated banking structure with many more banks (Allen & Gale 2000; Allen & Gale 2004a). It is suggested that the concentrated banking structure might improve market power and enhance bank profits. The higher profits then bring greater capital buffers that could assist the financial structure against sudden shocks from the external factors, as well as enhancing the bank's franchise value and charter (Allen & Gale, 2004a), decreasing bank managers' motivations to become involved in excessive risk-taking projects and thereby lowering the possibility of a systemic shock in the banking industry (Hellmann et al., 2000; Matutes & Vives, 2000). Moreover, it is possibly more straightforward and more efficient to regulatory and supervisory authorities to control the concentrated financial structure, because of the decreasing numbers of financial market players, hence resulting in a systemic risk reduction. In an empirical study using data from 69 countries, between 1980 and 1997, Beck et al. (2006), found that a more concentrated banking structure indicates less systemic risk. However, the authors do highlight that their study is yet to explore the mechanisms behind these findings; thus, the results should not be regarded as a suggestion for regulators to promote bank concentration. In a somewhat similar vein, Schaeck et al. (2009) investigated a sample consisting of 31 systemic banking crises in 45 countries, in order to evaluate the effects of concentration and competition on the

stability of the banking structure. Their empirical evidence shows that both competition and concentration reduces the probability of a systemic crisis and rise time to crises which is consistent with the results from (Beck et al., 2006). The policy implication arising from this study shows that if regulators impose policies that encourage bank competition, and those policies are executed appropriately, they might help to enhance the stability of the financial system.

To summarise, the diversification effects, as well as M&As' effects on systemic risk in the banking industry, remain ambiguous regarding theoretical and empirical evidence. It is possible that the mixed findings arise from the fact that authors of the above papers use different methodologies to measure systemic risks, such as Z-score, marginal expected shortfall or a logit probability model that is robust to heteroskedasticity under different samples and a different time period (before and after the global financial crisis 2007-09).

One strand of literature looks more deeply into the causal link between CEO's and Board of Directors' incentives, and their risk-taking behaviours in the context of bank M&As. For instance, Hagendorff and Vallascas (2011) examine how the structure of CEO compensation of acquiring banks affected the default risk implications of mergers in a sample of 172 U.S. bank mergers. The findings show that contractual risk-taking incentives (vega) were raised following the passing of the Gramm-Leach-Bliley-Act, 1999, and for the largest banks in our sample. While the former suggests that bank compensation encourages CEOs to take advantage of the growing opportunity investment set, which resulted from the deregulation of bank activities, the finding that vega is higher for the largest banks is somewhat alarming. The link between bank size and CEO vega suggests that executive remuneration in large banks encourages risk-shifting

activities, whereby shareholders in systemically important banks encourage CEOs to undertake risk-increasing investment choices in order to extract wealth from regulators and bondholders. The policy implication arising from this finding can be that regulating executive compensation in banking could take the form of imposing limits on the amount of risk-inducing compensation. Alternatively, it could take the form of linking capital requirements or deposit insurance premiums to risk-taking incentives embedded in CEO compensation or of increases in the amount of deferred compensation. Evidence from Japan offers somewhat conflicting results as Sakawa and Watanabel (2016) found that bank board size is negatively correlated with bank risk-taking. In other words, smaller bank boards contribute somewhat to excessive risk-taking. This finding contradicts with the expectation that the expansion of Japanese banks, after a series of M&As booms due to financial deregulation, is expected to be a driver behind their risk-taking.

In conclusion, the question of whether diversification benefits of mergers and acquisitions reduce the risks for banking firms is an area of active research and researchers have examined the link between diversification and risk from a variety of perspectives. Given the previous discussion on the endogeneity of risk-taking, it is not surprising that it has been challenging to find a clear and stable link between the measures of diversification and risk. Overall, no consensus was found on those who studied the impact of diversification on banking risk in the US and around the world. Risk-taking is endogenous, and optimising managers may choose to exploit any diversification gains by increasing returns or adding risk in another dimension. Many papers, however, have found that risk-adjusted returns declined with the expansion of activities. Finally, it is important to note the recent

focus on the link between the diversification of financial institutions and financial stability.

Chapter 4: Sample Description and Data Collection

The primary aim of this chapter is to provide a detailed discussion on the selection of sample and the variables used in the whole study.

4.1 Sample Description

The selected sample of bank mergers is gathered from Bloomberg Terminal and contains merger announcement dates, which fall between 1998 and 2015. The reason for collecting merger deals from 1998 is to fully capture the effects of product diversification due to the Financial Services Modernisation Acts of 1999 in the US. The Act voided the barriers on commercial and investment banks consolidating with securities companies and insurance firms, written in sections 20 and 32 of the Act. Considerable diversification effects on bank risk may be observed, since US acquirers constitute a significant proportion of the sample. In order to study the most up to date merger deals, the sample includes mergers announced up to 2015, which allows the existing literature to be extended by examining deals long after the 2007-09 global financial crisis. Acquiring banks and targets are located worldwide. Acquirers include bank holding companies, commercial banks and credit institutions; whereas, target banks include life and accident insurance companies, mortgage finance and securities companies, etc. Acquiring banks are listed with equity returns and accounting data available on Bloomberg. Methods of payment may be cash and/or stock. Deals that contain failing banks will be omitted and will be verified via Bloomberg or press coverage around the deal.

Based on the above criteria, the initial sample contains 3,130 deal observations. In addition, it is essential that the acquisition is completed and is not categorised as a private acquisition, liquidation, bankruptcy, restructuring,

privatisation, reverse takeover, repurchase, leveraged buyout or minority stock purchase. As a result, the sample was reduced to 2,940 deals. Additional criteria are required to ensure that all deals in the sample have a potential impact on acquirers' risks. For instance, only deals where the time elapsed between the date of announcement and the completion date is less than one year will be selected (Vallascas and Hagendorff, 2011). As a result, the sample was further reduced to 2,863 deals. Furthermore, merger deals were chosen where acquirers purchased at least 50% of the target banks and the acquiring banks' ownership of target banks following mergers exceeds 90% (Koerniadi et al., 2015). Hence, 204 acquisitions were omitted as a consequence of this criterion. Moreover, it is expected that only targets with a substantial size in comparison to acquirer size may have an impact on the risk of acquiring banks. Therefore, the ratio of deal size to acquirer's total assets is at least 1%, but no more than 150%, as suggested by Furfine & Rosen (2011). This criterion eliminates a substantial amount of deals, leaving only 887 deals in the sample. The confounding events will be bypassed by choosing deals with at least 180 trading days between two separate deal announcements by the same banking firm, and not more than one deal pending until 180 days following completion of a deal by the same bank (Vallascas and Hagendorff, 2011). This left the sample with 766 deals in this category. The minimum size requirement of a deal is \$10 million because minor deals are not expected to impact on acquirers' risk, consequently, 24 deals were omitted in this category. Finally, the sample consists of 608 deal observations after excluding deals where data on share prices was only available for less than the estimation period (six months before merger announcement and six months after deal completion) and deals where data on share prices was only available

in an infrequent basis and illiquid. The resulting dataset is described in Table 4.1 as follows:

Table 4.1: Overview of M&As Sample Distribution by Year

Year	Number of Mergers	%	Total Deal Value (million US\$)	%	Average Deal Value (million US\$)
1998	48	7.89	161,104.86	14.50	3,356.35
1999	43	7.07	84,977.83	7.65	1,976.23
2000	49	8.06	140,399.1	12.64	2,865.29
2001	44	7.24	49,579.35	4.46	1,126.80
2002	26	4.28	38,792.47	3.49	1,492.02
2003	42	6.91	68,607	6.17	1,633.50
2004	50	8.22	70,097.91	6.31	1,401.96
2005	44	7.24	88,520.18	7.97	2,011.82
2006	42	6.91	119,508.57	10.76	2,845.44
2007	37	6.09	95,405.37	8.59	2,578.52
2008	20	3.29	101,698.78	9.15	5,084.94
2009	13	2.14	5,243.91	0.47	403.38
2010	14	2.30	23,252.54	2.09	1,660.90
2011	13	2.14	7,162.99	0.64	551.00
2012	18	2.96	8,948.96	0.81	497.16
2013	27	4.44	9,781.25	0.88	362.27
2014	46	7.57	17,620.88	1.59	383.06
2015	32	5.26	20,446.26	1.84	638.95
Total	608	100.00	1,111,148.21	100.00	

Table 4.1 provides an overview of the M&As sample distribution by year. As shown, the majority of sample mergers were announced between 1998 and 2007. This figure continues to fall sharply to only 13 deals in 2009 and 2011 but increases gradually up to 2015. This observation can be explained by the effects of the global financial crisis. Companies may not be healthy enough to engage in costly M&As transactions, or they may just be reluctant to risk the uncertainty. Additionally, the total deal value has decreased sharply over the sample period, from US\$ 161,104 million in 1998 to about US\$ 20,446 million in 2015, except for a peak between 2006 and 2008. Likewise, the most substantial average deal value observed in 2008 is about US\$5,084 million whereas the lowest number is

seen in 2013 (US\$362 million). Hotchkiss and Mooradian (1998) state that companies within the same industry often buy firms in financial trouble because acquirers tend to have some form of past relationship with targets. Therefore, acquirers may already know the actual value of the firm being acquired through bankruptcy. Also, acquirers would benefit from synergies when merging with same-industry targets. The prices that are paid by acquirers are at a substantial discount, compared to prices paid for matched non-bankrupt firms that offer more enormous potential for positive returns around M&A announcements during the financial crisis. The fact that the 2007-09 global financial crisis did indeed offer a higher number of bargains in the banking sector explains why both tremendous total deal value and the most significant average deal value are observed between 2006 and 2008.

Table 4.2 below provides more information regarding the regions of acquirers and targets as well as the number of different deal types in the sample.

Table 4.2: Merger Sample Distribution of Acquirers and Targets by Region and Deal Type

	(1)		(2)		(3)		(4)		(5)		(6)	
Regions	BD	TG	BD	TG	BD	TG	BD	TG	BD	TG	BD	TG
Africa	6	4	6	4								
Asia	52	56	43	47	1	1	6	6			2	2
Europe	66	60	47	44	2	2	14	10		1	3	3
Oceania	9	9	4	4	1	1	4	4				
South America	12	11	11	9			1	2				
North America	463	468	432	435	2	2	25	28	3	2	1	1
Total	608	608	543	543	6	6	50	50	3	3	6	6

Note:

(1) All deals

(2) Focusing deals

(3) Bank-Insurance

(4) Bank-Financial Services (Mortgage Finance, Speciality Finance, Consumer Finance)

(5) Bank-Other (Asset Manager, Securities Companies)

(6) Bank-Investment Services

BD: bidders

TG: targets

As shown in Table 4.2, it is evident that the sample consists of mergers with bidding banks and targets predominantly located in Asia, Europe and North America. There occurred 463 mergers involving bidders in North America and 66 mergers in entire Europe. In Asia, 52 transactions were completed, while the remaining deals were completed in other regions (South America, Oceania and Africa). For 599 transactions (98.5%) both bidding banks and targets originate in the same region. It is also notable that the phenomenon of focusing deals is predominantly observed in the sample, whereas the number of product-diversifying deals is far less. The focusing deals are relatively evenly distributed across Asia and Europe, although the majority of them are witnessed in North America. Examples of focusing deals are as follows: Wells Fargo & Co acquired Wachovia Corporation (2008), Royal Bank of Scotland Group PLC acquired

Charter One Financial Inc (2004) and Bank of America acquired FleetBoston Financial Corporation (2003). Regarding product-diversifying deals, mergers between banks and financial services account for the most substantial proportion. The majority of bank-financial services mergers are conducted within the North American borders, followed by Europe and Asia. The number of bank-insurance, and bank-investment service deals, are the same, originating mostly in Europe and Asia. Some examples of product-diversifying deals include: Barclays PLC acquiring Woolwich Ltd (2000), Canadian Western Bank acquiring HSBC Canadian Direct Insurance Inc (2004) and Bradford & Bingley PLC acquiring GMAC-RF mortgage portfolio.

Table 4.3 demonstrates the merger sample, which has been divided, based on different categories, such as target status, payment method, geographic location of the deal and product diversification.

Table 4.3: Merger Sample by Different Categories

	Target status		Payment method		Deal geography		Product diversification	
	Private	Listed	Cash only	Cash and stock, stock	Cross-border	Domestic	Focusing	Activity diversifying
Full sample (608 deals)	600	8	157	451	50	558	543	65
US sample (452 deals)	451	1	87	365	3	449	427	25
Non-US sample (156 deals)	149	7	70	86	47	109	116	40

Regarding target status, private targets account for the most prominent number in all cases, including the US sample and non-US sample. It is worth noting that there are only a few deals where acquirers engage in acquisitions with public-listed targets within the sample. This may be because private firms experience increasing pressure to merge, due to the decrease in government ownership or the phasing out of public guarantees of their liabilities. With respect to the payment method, deals financed by cash only in the non-US sample constitute up to around 45% of 156 deals in total, whereas this is only 19% in the US sample. Regarding deal geography, it is observed that US acquirers tend to engage in domestic mergers (99%), meanwhile non-US acquirers are fond of cross-border deals more than US acquirers (30%). Regarding product diversification, both US and non-US acquirers show more interest in focusing

deals than on activity diversifying deals, although the balance is more on the non-US acquirers' side.

4.2 Data Collection

4.2.1 Definitions and statistics of variables

In empirical Chapters 5, 6 and 7 of this thesis, the following variables are used and collected from different reliable sources, such as Bloomberg Terminal and World Bank database. The definition of each variable, and the summary statistics, are provided in Tables 4.4 and 4.5 below, followed by an explanation and the justification for each variable used in each chapter.

Table 4.4: Variables Definition

Variable name	Definition	Data source
<i>Risk Measures</i>		
Pre-merger DD	Pre-merger distance to default (180 days to 11 days before merger announcement)	Bloomberg , own calculation
Post-completion DD:	Post-merger distance to default (11 days to 180 days after the deal completes)	Bloomberg , own calculation
ΔDD	Merger-related change in distance to default	Bloomberg , own calculation
Pre-merger MES	Pre-merger MES (180 days to 11 days before merger announcement)	Bloomberg , own calculation
Post-completion MES	Post-merger MES (11 days to 180 days after the deal completes)	Bloomberg , own calculation
ΔMES	Merger-related change in MES	Bloomberg , own calculation
Pre-merger $\Delta CoVaR$	Pre-merger $\Delta CoVaR$ (180 days to 11 days before merger announcement)	Bloomberg , own calculation
Post-completion $\Delta CoVaR$	Post-merger $\Delta CoVaR$ (11 days to 180 days after the deal completes)	Bloomberg , own calculation

Change in ΔCoVaR	Merger-related change in ΔCoVaR	Bloomberg , own calculation
Pre-merger beta	Pre-merger systematic risk (180 days to 11 days before merger announcement)	Bloomberg , own calculation
Δbeta	Merger-related change in systemic risk (beta) between pre-merger beta and post-completion period	Bloomberg , own calculation
Pre-merger idiosyncratic risk	Pre-merger idiosyncratic volatility (180 days to 11 days before merger announcement)	Bloomberg , own calculation
$\Delta\text{idiosyncratic risk}$	Merger-related change in idiosyncratic volatility between pre-merger and post-completion period (11 days to 180 days after the deal completes)	Bloomberg , own calculation

Acquirer and deal characteristics

Payment method	Equals 1 if the deal is fully financed by cash (zero otherwise)	Bloomberg
Status of target	Equals 1 if the target is a private firm (zero otherwise)	Bloomberg
Deal size	Natural logarithm of the deal value (in millions of US dollar)	Bloomberg
Relative size	Ratio of the deal value to the acquirer's market value the year before the announcement (%)	Bloomberg , own calculation
Cross-border	Equals 1 for cross-border mergers (0 for domestic mergers)	Bloomberg
Product diversification	Equals 1 if the acquirer and the target do not share the same four-digit ICB ¹¹ code (0 otherwise)	Bloomberg
ROA	Pre-tax profits over total assets (%)	Bloomberg
Market to book ratio	Market-to-book ratio (%)	Bloomberg
Leverage	Long-term debt over total assets (%)	Bloomberg
Operating efficiency	Ratio of operating costs over total assets (%)	Bloomberg
Capital ratio	Book value of equity over total assets (%)	Bloomberg

¹¹ The Industry Classification Benchmark (ICB) is an industry classification taxonomy owned by FTSE. The ICB is used globally to divide the market into increasingly specific categories, allowing investors to compare industry trends between well-defined subsectors. The ICB uses a system of 10 industries, partitioned into 19 super-sectors, which are further divided into 41 sectors, which then contain 114 subsectors.

Acquirers' total assets	Natural logarithm of acquirers' total assets (in millions of US dollar)	Bloomberg , own calculation
High-risk banks	The pre-merger default risk of acquirers, which takes the value of 1 for banks in the first distance to default quartile (i.e. banks with the highest level of pre-merger default risk) and zero otherwise	Bloomberg , own calculation
Cost-income ratio	Operating cost to operating income ratio the year before merger announcement	Bloomberg , own calculation
Income diversification	Non-interest to operating income ratio the year before merger announcement	Bloomberg , own calculation
Capitalisation	Natural logarithm of net equity (in million US dollar) the year before merger announcement	Bloomberg , own calculation
<i>Country control</i>		
GDP	Annual real GDP growth rate (in %)	Bloomberg
HHI	Herfindahl–Hirschman Index computed as the sum of the squared market shares of a country's domestic and foreign banks. A higher value indicates higher concentration	* WITS, World Bank
Political stability	This indicator measures the perceptions of the likelihood that the government will be destabilised or overthrown by unconstitutional or violence. Indicator ranges from (-2.5) to (2.5). A higher indicator value indicates greater political stability	** WDI, World Bank
Rule of Law	The Rule of Law indicator measures the individual's degree of confidence in rules of society and the likelihood of crime and violence. The scores range between -2.5 and 2.5. Higher scores correspond with better outcomes	*** WDI, World Bank

* <http://wits.worldbank.org/CountryProfile/en/Country/BY-COUNTRY/StartYear/2011/EndYear/2015/Indicator/HH-MKT-CNCNTRTN-NDX>

** <http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators>

*** <http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators>

Table 4.5: Summary Statistics of Variables

Summary Statistics. This table reports summary statistics for variables used in this study, including risk measures, deal and acquirer characteristics as well as country control. The sample consists of 608 international bank mergers announced between 1998 and 2015.

		Mean	Std. dev.	Min	Median	Max
Risk Measures	Pre-merger DD	3.747	1.386	1.022	3.536	8.025
	Post-completion DD:	3.766	1.392	1.028	3.573	7.960
	Δ DD	0.020	0.067	-0.160	0.016	0.271
	Pre-merger MES	0.005	0.010	-0.014	0.003	0.036
	Post-completion MES	0.005	0.011	-0.015	0.003	0.042
	Δ MES	0.000	0.011	-0.028	0.000	0.032
	Pre-merger Δ CoVaR	0.002	0.004	-0.003	0.001	0.018
	Post-completion Δ CoVaR	0.002	0.004	-0.004	0.001	0.017
	Change in Δ CoVaR	0.000	0.004	-0.015	0.000	0.013
	Pre-merger Beta	0.263	0.451	-0.601	0.134	1.523
	Δ Beta	0.024	0.391	-0.888	0.004	1.208
	Pre-merger idiosyncratic risk	0.019	0.008	0.008	0.018	0.046
	Δ idiosyncratic risk	0.001	0.010	-0.022	0.000	0.039
Deal Characteristics	Payment method	0.258	0.438	0.000	0.000	1.000
	Status of target	0.987	0.114	0.000	1.000	1.000
	Deal size	5.299	1.932	2.486	4.868	10.331
	Relative size	0.426	0.772	0.032	0.237	1.000
	Cross border	0.082	0.274	0.000	0.000	1.000
	Product diversification	0.106	0.309	0.000	0.000	1.000
Bidders' Characteristics	ROA	1.223	0.627	0.007	1.152	3.544
	Market to book ratio	1.610	0.730	0.476	1.441	4.021
	Leverage	7.240	7.619	0.000	5.404	66.187
	Operating efficiency	2.829	0.980	0.706	2.783	6.425
	Capital ratio	9.201	3.057	2.382	9.027	20.838
	Acquirers' total assets	8.742	1.852	5.942	8.303	13.459
	High-risk banks	0.250	0.433	0.000	0.000	1.000

Country Control	Cost-income ratio	2.387	2.374	-1.116	1.850	14.304
	Income diversification	1.139	1.199	-0.352	0.805	7.168
	Capitalisation	6.318	1.752	3.556	5.961	10.761
	GDP	3.122	1.874	-2.780	2.810	8.899
	HHI	0.083	0.074	0.050	0.070	0.540
	Political stability	0.467	0.548	-1.600	0.575	1.425
	Rule of Law	1.372	0.516	-0.700	1.546	1.915

4.2.2 Variables used in Chapter 5

This section addresses the issues of how merger-related changes in acquirers' default risk can be explained in the multivariate analysis by a group of bidders, and deal characteristics as well as variables on the acquiring banks' macroeconomic environment. The dependent variable of this chapter, ΔDD , is the difference between post-completion DD and pre-merger DD. Independent variables of this chapter include cross-border and product diversification. First, product diversification is a dummy variable, equal to 1 for bank merge with non-bank financial firms and 0 for mergers between bank and bank. This variable is used to test the diversification effects of bank mergers on ΔDD of acquirers (Hypothesis 5.2 of this chapter). Empirical evidence in the literature suggests that consolidation into non-traditional banking activities can benefit banks from both financial synergies, via asset growth and improved profits, operating synergies through co-insurance (Asquith and Kim, 1982) and economies of scale and scope. Therefore product diversification should lead to lowering a firm's default risk (Halpern, 1983; Boyd and Graham, 1988; Estrella, 2001; van Lelyveld and Knot, 2009). The second independent variable is cross-border, a dummy variable equalling 1 for cross-border deals and 0 for domestic deals. This variable is employed in order to examine whether deals involving geographic diversification affect ΔDD (testing for Hypothesis 5.3 in the chapter). Various studies on cross-

border deals suggest that bidders can gain higher valuation by purchasing international targets in a related industry (Dos Santos et al., 2008) or by acquiring targets from nations that have a weaker governance scheme ((Bris and Cabolis, 2008; Moeller and Schlingemann, 2005). Furthermore, banking firms are highly regulated, and thus banking supervisors and policymakers often act in ways in which to thwart merger deals that increase risk (Buch & DeLong, 2008; Elyasiani & Jia, 2008; Koetter et al., 2007). Consequently, cross-border mergers are expected to reduce acquirers' default risk.

The cross-sectional analysis of this chapter also includes control variables such as deal and bidders characteristics, as well as bidders' macroeconomic environment, which are predicted to impact on ΔDD of acquirers. More specifically, deal characteristic variables consist of the payment method, target's status, deal size and relative size. The first variable, payment method, is represented by a dummy variable which equals one if the merger is financed in cash and zero otherwise. Furfine & Rosen (2011) propose that deals that are fully paid for in cash are expected to raise acquiring banks' default risk as acquirers are replacing safe liquid assets (cash) with a riskier balance sheet of the target. Additionally, target status is controlled via a dummy variable, which differentiates between private (dummy equals one) or public-listed target institutions. Merger deals involved in private targets are expected to generate a risk-increasing effect. This is because private firms are subject to lower disclosure requirements; thus it limits the acquirers' capabilities to evaluate the risks associated with private targets themselves, as well as making bidders' due diligence ineffective (Vallascas and Hagendorff, 2011). The variable deal size is evaluated by the logarithmic transformation of the US dollar value of mergers in regressions. There

are various ways in which deal size can impact on the riskiness of bidders. Specifically, bigger deals can generate risk-reducing effects for bidding banks as a result of diversification benefits. Nevertheless, Hughes et al., (1999) assert that if bigger mergers produce diversification effects, bigger deals can also stimulate banks to engage in more risk-taking, after the completion of the deal. Furthermore, Knapp et al. (2005) raise the issue of the complicated integration process in bigger acquisitions; thus resulting in complex organisational merging of banks. This complex organisational structure might, consequently, increase acquirers' default risk post-merger. Since small deal values in absolute terms could produce similar risk effects for small bidders, more so than bigger mergers, the relative size variable is included in the ratio of deal value to acquiring banks' market value at the end of the year, prior to the announcement of the deal. Therefore, the signs for variables deal size and relative size are unrestricted.

With respect to the bidders' characteristics, measures of ROA, market-to-book ratio, leverage and operating efficiency are taken into consideration. The ROA ratio (pre-tax profits over assets) is chosen as profitability performance, because ROA captures the key financial ratio, which relates to the performance of the company. ROA is projected to have a risk-reducing effect on acquirers, since the more profitable a bank is, the more capital buffer they can hold to cope with sudden shock. Moreover, the market-to-book ratio is included in the regressions as a proxy for executive hubris. A higher market-to-book ratio may indicate that a company is over-valued, suggesting negative effects of market-to-book ratio to the default risk of bidders. On the other hand, Keeley (1990) asserts that more valuable banking institutions have less motivation to take part in risky transactions, because valuable charters cannot be traded if they go bankrupt.

Hence, it is difficult to predict the effect of market-to-book ratio on bidders at this point. Besides, Berger & Bonaccorsi di Patti (2006) confirm that leverage encourages banking institutions to lower agency cost. Leverage increases liquidation risk (with the outlook of pay losses for executives) and puts pressure on executives to produce high and sufficient cash flows for interest payments. Consequently, executives in banking firms with low leverage might be more inclined to engage in risky transactions, such as M&As, with their free cash flows to raise their pay levels, with the possibility of organisational collapse. The leverage of acquiring banks is measured by long-term debt, over total assets, prior to the deals. In order to assess the influence of management quality on the merger-related changes in bidders' default risk, the operating efficiency ratio is added to the regressions (the ratio of operating costs over total assets). This variable is expected to produce a risk-reducing effect for bidders (Vallascas and Hagendorff, 2011).

In terms of the acquirers' macroeconomic environment, the GDP real growth rate is included in the model in order to evaluate the impact of country characteristics on the risk effects of acquisitions. In addition, an indicator of political stability, an indicator variable for the rule of law and the HHI of the bidding bank's home country, are included as further control variables (Vallascas and Hagendorff, 2011).

It is also essential that a multicollinearity check is applied to all the variables used to avoid any disturbance in the data. Table 4.6 below shows the correlation coefficients among all variables used in this chapter. As can be seen, all of the correlation coefficient values are small and do not incur any problem of multicollinearity. When checking the variance inflation factors in Table 4.7 (part

a), it is also observed that all values of centred VIF are below ten, which indicates that there is no multicollinearity. Unexpectedly, deal value and relative size are far from perfectly correlated ($r=0.196$). Thus, both variables provide different information on deal characteristics. Also, a summary of all variables used in this chapter as well as their expected influence on the change in Distance to default is summarised in part b of Table 4.7. It is important to note that the smaller the DD, the smaller the distance of a firm from default point, whereby the default probability is higher. Therefore, if a variable has positive influence on ΔDD , it means that this variable is expected to produce a risk-reducing effect on ΔDD and vice versa.

Table 4.6: Correlation Table for Chapter 5

a. Correlation table with significance for p-value

	<i>ADD</i>	<i>Product diversification</i>	<i>Cross- border</i>	<i>Payment method</i>	<i>Status of target</i>	<i>Deal size</i>	<i>Relative size</i>	<i>ROA</i>	<i>Market to book</i>	<i>Leverage</i>	<i>Operating efficiency</i>	<i>GDP</i>	<i>HHI</i>	<i>Political stability</i>	<i>Rule of Law</i>
ADD	1.00														
Product diversification	0.06	1.00													
Cross-border	0.05	0.11***	1.00												
Payment method	0.08*	0.2***	0.26***	1.00											
Status of target	-0.07*	0.04	-0.18***	-0.06	1.00										
Deal size	-0.07*	0.14***	0.28***	-0.06	-0.12***	1.00									
Relative size	0.01	-0.04	0.08**	0.00	-0.01	0.2***	1.00								
ROA	0.12***	-0.04	0.07*	0.06	-0.11***	-0.07*	-0.12***	1.00							
Market to book	-0.03	-0.08**	0.05	-0.15***	-0.06	0.08**	-0.21***	0.23***	1.00						
Leverage	0.00	0.1**	0.24***	0.02	-0.06	0.27***	0.07*	-0.05	-0.01	1.00					
Operating efficiency	0.02	-0.12***	-0.15***	-0.12***	0.02	-0.17***	-0.1**	0.14***	0.05	-0.19***	1.00				
GDP	0.04	0.02	0.16***	0.08**	-0.03	0.03	-0.04	0.29***	0.21***	0.00	-0.02	1.00			
HHI	0.05	0.14***	0.3***	0.17***	-0.11***	0.09**	-0.01	0.1**	-0.04	-0.04	-0.15***	0.13***	1.00		
Political stability	-0.12***	0.08**	0.07*	-0.05	0.07*	0.14***	0.03	-0.12***	-0.08**	0.05	-0.23***	-0.03	0.05	1.00	
Rule of Law	-0.11***	-0.04	-0.16***	-0.14***	0.12***	-0.11***	-0.08**	-0.26***	-0.01	-0.04	-0.2***	-0.26***	-0.16***	0.62***	1.00

**, * Denotes significance at 5%;10%

*** Denotes significance at 1%

b. Correlation table with t-statistic from t-test

	<i>ΔDD</i>	<i>Product diversification</i>	<i>Cross-border</i>	<i>Payment method</i>	<i>Status of target</i>	<i>Deal size</i>	<i>Relative size</i>	<i>ROA</i>	<i>Market to book</i>	<i>Leverage</i>	<i>Operating efficiency</i>	<i>GDP</i>	<i>HHI</i>	<i>Political stability</i>	<i>Rule of Law</i>
ΔDD															
Product diversification	1.52														
Cross-border	1.29	2.71													
Payment method	1.86	4.95	6.66												
Status of target	-1.75	0.98	-4.39	-1.57											
Deal size	-1.70	3.46	7.25	-1.37	-3.05										
Relative size	0.23	-0.96	1.98	-0.03	-0.24	4.93									
ROA	3.07	-1.04	1.77	1.60	-2.70	-1.77	-2.89								
Market to book	-0.65	-2.01	1.21	-3.72	-1.60	2.07	-5.34	5.80							
Leverage	-0.05	2.43	6.12	0.48	-1.41	6.91	1.72	-1.16	-0.30						
Operating efficiency	0.47	-2.94	-3.74	-3.03	0.39	-4.19	-2.48	3.44	1.20	-4.82					
GDP	1.02	0.51	4.00	1.99	-0.73	0.85	-0.92	7.44	5.17	-0.01	-0.58				
HHI	1.20	3.44	7.82	4.24	-2.60	2.21	-0.26	2.36	-1.09	-0.97	-3.84	3.26			
Political stability	-2.92	1.98	1.83	-1.22	1.68	3.54	0.79	-2.98	-2.08	1.30	-5.73	-0.64	1.30		
Rule of Law	-2.74	-1.03	-3.97	-3.43	2.99	-2.76	-2.07	-6.69	-0.24	-1.10	-4.93	-6.56	-3.88	19.30	

Table 4.7: Variance Inflation Factor for Chapter 5

a. Variance Inflation Factor

Variable	Coefficient variance	Centered VIF
ΔDD	2.18E-04	1.326
Diversification	7.19E-05	1.241
Cross-border	1.00E-04	1.43
Payment method	3.20E-05	1.141
Status of target	0.001	1.138
Deal size	2.15E-06	1.602
Relative size	1.10E-09	1.168
ROA	3.53E-05	1.276
Market to book	2.45E-05	1.235
leverage	1.27E-07	1.215
Operating efficiency	1.17E-05	1.352
GDP	3.38E-06	1.4
HHI	1.00E-03	1.201
Political stability	5.06E-05	1.726
Rule of Law	6.69E-05	1.4

b. Expected influences of various variables on the change in DD

Variable	Expected influence on ΔDD
Diversification	+
Cross-border	+
Payment method	-
Status of target	-
Deal size	+/-
Relative size	+/-
ROA	+
Market to book	+/-
Leverage	+/-
Operating efficiency	+
GDP	+
HHI	+
Political stability	+
Rule of Law	+

4.2.3 Variables Used in Chapter 6

This section examines how merger-related changes in acquirers' contribution to systemic risk can be explained in the multivariate analysis, by a group of bidders and deal characteristics, in addition to variables on the acquiring banks' macroeconomic environment. The dependent variables of this chapter are ΔMES and change in ΔCoVaR . Independent variables of this chapter include product diversification and payment method. Dummy product diversification is stimulated by the second Hypothesis 6.2 of this chapter, predicting that product-diversifying deals generate a more systemic risk-reducing effect than focusing deals. This is because diversification can bring about benefits through co-insurance (Asquith and Kim, 1982), expansion and development, efficiency achievement through scale and scope economies and improved profit; thereby lowering a firm's default risk (Halpern, 1983) and maintaining the stability of the financial system. The payment method is motivated by Hypothesis 6.3 of this chapter, which predicts that deals financed by cash only will have a risk-increasing effect on systemic risk. As mentioned above, cash-financing mergers are expected to raise acquiring banks' default risk because acquirers are replacing safe liquid assets (cash) with a riskier balance sheet of the target; thus it is also reasonable to expect that cash-financing deals may weaken the stability of the financial system.

The multivariate analysis of this chapter also includes control variables, such as deal and bidders characteristics and bidders' macroeconomic environment, which are predicted to impact ΔMES and change in ΔCoVaR of acquirers. Deal characteristics used in the multivariate analysis consist of: status of target, deal size, relative size and cross-border. In terms of status of target, as

mentioned above, merger deals involved with private targets are expected to generate risk-increasing effect for acquirers because private firms are less transparent, thereby making it difficult for bidders to evaluate the associated risks. Regarding the deal size and relative size, both variables' signs are expected to be unrestricted. Firstly, large deals may produce a risk-reducing effect on acquirers' contribution to systemic risk, as larger banks may be able to diversify their credit and asset portfolios better. However, larger deals are positively connected with organisational and procedural complexity, integrating with the target, hence reducing transparency (Beck et al., 2006; Huang et al., 2012; Laeven et al., 2016). Finally, it is difficult to project the sign of dummy variables cross-border because possible diversification benefits, as a result of globalisation, could correspond with potential combination problems post-merger (Mühlnickel and Weiß, 2015).

Furthermore, a group of bidding banks' characteristics will be included in the regressions, such as ROA, market-to-book ratio, leverage, capital ratio, operating efficiency, acquirers' total assets and high-risk banks. The ROA is expected to be negatively associated with systemic risk, i.e. enhancing banking stability. Moreover, the projected sign of the coefficient for the market-to-book ratio is positively associated with systemic risk, as both papers from Vallascas & Hagendorff (2011) and Milidonis and Stathopoulos (2011) hypothesise that higher values of market-to-book ratio could imply high growth expectations on the part of the investors, leading to excessive risk-taking. Regarding acquirers' leverage, it is expected that variables leverage and capital ratio (an additional proxy for leverage) signs are unrestricted. On the one hand, leverage increases liquidation risk (with the outlook of pay losses for executives) and puts pressures

on management to produce high, and sufficient cash flows for interest payments. Thus, executives at banking firms with low leverage may be more interested in engaging in risky transactions, such as M&As, with their free cash flows, which in turn raise their pay levels and consequently the possibility of organisational failure, destabilising the banking system (Vallascas and Hagendorff, 2011). On the other hand, banking firms with a low level of leverage can be overcapitalised in comparison to their target's capital ratio. Therefore, acquiring banks can be driven to acquire a target with a high level of leverage, instead of, e.g. issuing new debt. In the case of an acquiring bank merely altering its capital structure, the rise in leverage should not be associated with any substantial changes in the acquiring bank's total risk (Weiß et al., 2014). In order to assess the influence of management quality on the merger-related changes in bidders' contribution to systemic risk, the operating efficiency ratio is added to the regressions and is expected to have a negative relationship with systemic risk. In terms of an acquirer's total assets, the influence of a bidding bank's pre-merger size on systemic risk measures is projected to be positive. This is because larger banks tend to be motivated toward engaging in M&As and becoming TBTF which, in turn, increases bidders' contribution to systemic risk (Benston et al., 1995; Mühlhnickel and Weiß, 2015). Finally, the motives for bank M&As were different before and during the crisis, and the occurrence of the 2007-09 global financial crisis has raised the need to consider 'TBTF motive' as a significant motive for M&As. During the global financial crisis, banking firms could be stimulated to engage in M&A transactions in order to become SIFIs to exploit the safety net, for government bailouts or to establish a more robust institution (see Molyneux et al., 2014). Therefore, variable high-risk banks, as a proxy for TBTF motive, are

included in the regressions to test whether banks drive findings with the motivation to merge into TBTF (i.e., banks that were near default and had the lowest possibilities of obtaining a bailout before the merger). To construct the variable, first, utilising the Merton distance-to-default methodology as in Vallascas and Hagendorff (2011), the pre-merger default risk of acquirers in the sample will be extracted from the previous empirical chapter. Following this, the dummy variable takes the value of 1 for banks in the first distance to default quartile (i.e. banks with the highest level of pre-merger default risk) and 0 otherwise.

The third set of control variables accounts for the macroeconomic environment of acquirers, as it may influence the relationship between bank mergers and systemic risk. For accuracy, the annual real GDP growth rate, political stability, the rule of law and the HHI of the bidding bank's home country are included. Generally, a country with a stable political environment, high GDP growth rate and stricter rule of law, may promote safer markets for a bank to operate in. Therefore, the signs for all these three variables are expected to be negatively associated with systemic risk. The sign for the HHI index, however, is expected to be unrestricted. Some authors suggest that in a more concentrated banking sector, a few market participants are seen to hold higher capital buffers against external shocks and higher return via credit rationing, whilst being easy to monitor and thereby improving stability for the entire banking system (Allen and Gale, 2000, 2004; Beck et al., 2013). However, other authors argue that a banking sector with a high concentration degree often leads to moral hazard problems, organisational and procedural complexity and contagion, due to high interconnectedness among banks, and hence, systemic risk increase.

As further checks for multicollinearity, as can be seen from the below Table 4.8, the set of variables used do not suffer from multicollinearity, thus eliminating the need for further transformations of these variables. The variance inflation factor (VIF) is also performed for all dependent, independent and control variables to ensure that all the regression models are free from correlation (see Table 4.9, part a) and it indicates that there is no multicollinearity among variables used. Also, a summary of all variables used in this chapter as well as their expected influence on ΔMES and the change in ΔCoVaR is summarised in part b of Table 4.9.

Table 4.8: Correlation Table for Chapter 6

a. Correlation table with significance for p-value

	AMES	Change in ΔCoVaR	Product diversification	Payment method	Status of target	Deal size	Relative size	Cross border	ROA	Market to book ratio	Leverage	Operating efficiency	Capital ratio	Acquirers' total assets	High risk banks	GDP	HHI	Political stability	Rule of Law
AMES	1.00																		
Change in ΔCoVaR	0.7***	1.00																	
Product diversification	-0.04	-0.04	1.00																
Payment method	0.08**	0.06	0.2***	1.00															
Status of target	0.02	0.06	0.04	-0.06	1.00														
Deal size	-0.02	-0.05	0.14***	-0.06	-0.12***	1.00													
Relative size	-0.1**	-0.09**	-0.04	0.00	-0.01	0.2***	1.00												
Cross border	0.01	0.02	0.11***	0.26***	-0.18***	0.28***	0.08**	1.00											
ROA	0.03	-0.02	-0.04	0.06	-0.11***	-0.07*	-0.12***	0.07*	1.00										
Market to book ratio	0.07*	0.03	-0.08**	-0.15***	-0.06	0.08**	-0.21***	0.05	0.23***	1.00									
Leverage	-0.04	-0.03	0.1**	0.02	-0.06	0.27***	0.07*	0.24***	-0.05	-0.01	1.00								
Operating efficiency	0.00	0.01	-0.12***	-0.12***	0.02	-0.17***	-0.1**	-0.15***	0.14***	0.05	-0.19***	1.00							
Capital ratio	0.00	0.00	-0.11***	0.03	-0.05	-0.3***	-0.09**	-0.16***	0.3***	-0.25***	-0.22***	0.25***	1.00						
Acquirers' total assets	0.00	-0.02	0.21***	0.05	-0.1**	0.9***	-0.01	0.32***	-0.08*	0.07*	0.29***	-0.21***	-0.36***	1.00					
High risk banks	-0.11***	-0.07*	0.01	-0.01	0.00	0.01	0.1**	-0.02	-0.05	-0.09**	0.01	0.1**	-0.02	-0.02	1.00				
GDP	0.02	-0.02	0.02	0.08**	-0.03	0.03	-0.04	0.16***	0.29***	0.21***	0.00	-0.02	0.1**	0.00	-0.01	1.00			
HHI	-0.04	-0.04	0.14***	0.17***	-0.11***	0.09**	-0.01	0.3***	0.1**	-0.04	-0.04	-0.15***	0.00	0.11***	0.01	0.13***	1.00		
Political stability	-0.11***	-0.05	0.08**	-0.05	0.07*	0.14***	0.03	0.07*	-0.12***	-0.08**	0.05	-0.23***	-0.21***	0.17***	0.06	-0.03	0.05	1.00	
Rule of Law	-0.09**	0.04	-0.04	-0.14***	0.12***	-0.11***	-0.08**	-0.16***	-0.26***	-0.01	-0.04	-0.2***	-0.15***	-0.07	-0.15***	-0.26***	-0.16***	0.62***	1.00
**, * Denotes significance at 5%; 10%																			
*** Denotes significance at 1%																			

b. Correlation table with t-statistic from t-test

	<i>Δ</i> MES	<i>Change in</i> <i>Δ</i> CoVaR	<i>Product</i> <i>diversification</i>	<i>Payment</i> <i>method</i>	<i>Status of</i> <i>target</i>	<i>Deal size</i>	<i>Relative</i> <i>size</i>	<i>Cross</i> <i>border</i>	<i>ROA</i>	<i>Market to</i> <i>book ratio</i>	<i>Leverage</i>	<i>Operating</i> <i>efficiency</i>	<i>Capital</i> <i>ratio</i>	<i>Acquirers'</i> <i>total assets</i>	<i>High risk</i> <i>banks</i>	<i>GDP</i>	<i>HHI</i>	<i>Political</i> <i>stability</i>	<i>Rule of</i> <i>Law</i>
<i>Δ</i> MES																			
Change in <i>Δ</i> CoVaR	24.18																		
Product diversification	-0.92	-0.87																	
Payment method	2.06	1.53	4.95																
Status of target	0.43	1.48	0.98	-1.57															
Deal size	-0.52	-1.17	3.46	-1.37	-3.05														
Relative size	-2.38	-2.13	-0.96	-0.03	-0.24	4.93													
Cross border	0.37	0.37	2.71	6.66	-4.39	7.25	1.98												
ROA	0.72	-0.47	-1.04	1.60	-2.70	-1.77	-2.89	1.77											
Market to book ratio	1.71	0.71	-2.01	-3.72	-1.60	2.07	-5.34	1.21	5.80										
Leverage	-0.94	-0.79	2.43	0.48	-1.41	6.91	1.72	6.12	-1.16	-0.30									
Operating efficiency	-0.09	0.16	-2.94	-3.03	0.39	-4.19	-2.48	-3.74	3.44	1.20	-4.82								
Capital ratio	0.05	0.01	-2.66	0.70	-1.13	-7.63	-2.31	-3.88	7.82	-6.28	-5.52	6.26							
Acquirers' total assets	-0.03	-0.50	5.28	1.11	-2.57	52.03	-0.35	8.20	-1.90	1.84	7.57	-5.25	-9.53						
High risk banks	-2.71	-1.77	0.23	-0.27	0.00	0.33	2.50	-0.51	-1.30	-2.34	0.22	2.35	-0.61	-0.41					
GDP	0.46	-0.39	0.51	1.99	-0.73	0.85	-0.92	4.00	7.44	5.17	-0.01	-0.58	2.46	0.06	-0.37				
HHI	-0.91	-0.96	3.44	4.24	-2.60	2.21	-0.26	7.82	2.36	-1.09	-0.97	-3.84	-0.04	2.84	0.33	3.26			
Political stability	-2.65	-1.19	1.98	-1.22	1.68	3.54	0.79	1.83	-2.98	-2.08	1.30	-5.73	-5.19	4.14	1.52	-0.64	1.30		
Rule of Law	-2.22	0.96	-1.03	-3.43	2.99	-2.76	-2.07	-3.97	-6.69	-0.24	-1.10	-4.93	-3.71	-1.64	-3.80	-6.56	-3.88	19.30	

Table 4.9: Variance Inflation Factor for Chapter 6

a. Variance Inflation Factor

Variable	Coefficient Variance	Centered VIF
Δ MES	2.57E-05	1.426153
Change in Δ CoVaR	3.12E-06	1.705363
Product diversification	2.12E-06	1.212238
Payment method	1.08E-06	1.452447
Status of target	5.97E-06	1.138466
Deal size	3.58E-07	6.783691
Relative size	2.03E-11	1.765539
Cross-border	2.95E-06	1.953894
ROA	8.04E-07	1.717404
Market to book	8.47E-07	2.18947
Leverage	3.89E-09	1.188438
Operating efficiency	3.20E-07	1.559079
Capital ratio	2.90E-08	1.596446
Total assets	4.48E-07	7.673152
High-risk banks	1.50E-06	1.328068
GDP	8.70E-08	1.562179
HHI	2.60E-05	1.271175
Political stability	1.46E-06	2.336973
Rule of Law	2.04E-06	2.57942

b. Expected influences of various variables on Δ MES and Δ CoVaR

Variable	Expected influence on Δ MES and Δ CoVaR
Product diversification	-
Payment method	+
Status of target	+
Deal size	+/-
Relative size	+/-
Cross-border	+/-
ROA	-
Market to book	+
Leverage	+/-
Operating efficiency	-
Capital ratio	+/-

Total assets	+
High-risk banks	+
GDP	-
HHI	+/-
Political stability	-
Rule of Law	-

4.2.4 Variables Used in Chapter 7

This section aims to address how merger-related changes in acquirers' idiosyncratic risk, systematic risk and systemic risk can be explained in the cross-sectional analysis, by acquirers' default risk, as the independent variable on top of a group of bidder characteristics and variables on the acquiring banks' macroeconomic environment as control variables. The dependent variables of this chapter include: pre-merger MES, pre-merger beta, pre-merger idiosyncratic risk, Δ MES, Δ beta and Δ idiosyncratic risk. Specifically, pre-merger MES, pre-merger beta and pre-merger idiosyncratic risk are the average of acquirers' contribution to systemic risk, the average of systematic risk and the average of idiosyncratic risk of acquirers respectively, in the pre-merger period (180 days to 11 days before merger announcement). Furthermore, Δ MES, Δ beta and Δ idiosyncratic risk are the differences between post-completion and the pre-merger period of acquirers' MES, beta and idiosyncratic risk respectively. The independent variables of this chapter include pre-merger DD and Δ DD. Existing evidence from the studies of Denis and Denis (1995), Lang and Stulz (1992) and Vassalou and Xing (2004) on the relationships between default risk and systematic risk find that that default risk could be positively related to systematic risk. Moreover, Asquith and Gertner (1994), Dichev (1998) and Opler and Titman (1994) suggest that bankruptcy risks are idiosyncratic. Indeed, some studies find that default risk is positively associated with systemic risk (see Fiordelisi and Marqués-Ibañez, 2013). Consequently, the signs of pre-merger default risk are hypothesised to be positively associated with pre-merger MES, pre-merger beta and pre-merger idiosyncratic risk (Hypotheses 7.1,7.2,7.3 of this chapter). Additionally, the influences of the change in default risk on Δ MES, Δ beta and

Δ idiosyncratic risk are hypothesised to be positive (Hypotheses 7.4,7.5,7.6 of this chapter).

Besides the independent variables, other factors may also influence idiosyncratic risk, systematic risk and systemic risk, on top of the possible impact of acquiring bank's default risk and are included as control variables. These factors may be at bank level (e.g. cost efficiency, business model and size), or industry level (e.g. banking industry concentration) and country (GDP growth rate). More specifically, the control variables in the acquirers' characteristics group include: cost-income ratio, income diversification, capitalisation and high-risk banks. First, cost efficiency is estimated using the cost-income ratio (i.e. operating cost over operating income). It is recognised that efficiency is likely to have an impact on the link between individual bank default risk and systematic risk, as well as idiosyncratic risk. Therefore, cost-income ratio is considered, since banks aim to increase profits by reducing their costs and this may impact on their risk-taking profile (Fiordelisi and Ricci, 2011). Second, it is recognised that bank business models may also influence the link between bank default risk and systematic risk (Bertrand and Schoar, 2003). Hence building on the previous work of Baele et al., (2007); De Jonghe (2010); Fiordelisi and Ricci (2011); Lepetit et al. (2008), income diversification is accounted for (measured as the ratio of non-interest to total operating income) and the sign is unrestricted. Third, bank size is controlled, as it is widely believed that systematic and systemic risks are highly related to bank size, as larger institutions have more weight on the broad economy, the financial system and tend to be more interconnected. DeYoung et al., (2009) document that bank size is a central aspect of M&As. Size confers, among other things, management quality, market power, political influence, the

extent of access to safety net provisions, in addition to establishing relations with profitability, efficiency and risk. In the context of the present analysis, the relationships between acquirers' default risk and other risks may vary with bank size for different factors. Hence, capitalisation variable is included, which is the natural logarithm of its net equity capital. The sign of the coefficient of this variable is unrestricted. Finally, variable high-risk banks are included in the regression for systematic and systemic risk to test whether banks with the highest default risk (i.e., banks that were near default before the merger) drive the findings pre-merger.

Furthermore, macroeconomic factors are also likely to impact on systemic and systematic risks. Therefore, several macroeconomic variables commonly used in the banking literature for this purpose are included (e.g. Brissimis et al., 2008; Demirgüç-Kunt and Huizinga, 2010; Salas and Saurina, 2003; Yildirim and Philippatos, 2007). These variables are the annual real GDP growth to capture the business cycle and HHI of the bidding bank's home country. As mentioned in the previous section, GDP growth rate is expected to be negatively associated with systemic risk and systematic risk, whereas the sign for the HHI index is unrestricted.

Table 4.10 (part a) shows the correlation coefficients among all variables in this study during a pre-merger period and the change of risks between post-completion and pre-merger period. All of the correlation coefficient values are small and do not incur any problem of multicollinearity. The only exception is the coefficient between pre-merger MES and pre-merger systematic risk is considered to be high (0.81). However, it is argued that this number does not show perfect multicollinearity between the pair; therefore, each variable pre-

merger MES and pre-merger systematic risk still provide different information regarding the risk profiles of banks. Also, a summary of all variables used in this chapter as well as their expected influence on dependent variables is summarised in part b of Table 4.10.

Table 4.10: Correlation Table for Chapter 7

a. Correlation Table

Panel A: Pre-merger risk measures						
	Pre-merger DD	Pre-merger MES	Pre-merger systematic risk	Pre-merger idiosyncratic risk		
Pre-merger DD	1.00					
Pre-merger MES	-0.06	1.00				
Pre-merger systematic risk	0.08*	0.81***	1.00			
Pre-merger idiosyncratic risk	-0.75***	-0.06	-0.23***	1.00		
Cost-income ratio	-0.09**	0.09**	0.08*	0.11***		
Income diversification	-0.11***	0.11***	0.07*	0.17***		
Capitalisation	0.19***	0.14***	0.13***	-0.07*		
High-risk banks	-0.66***	0.12***	-0.03	0.67***		
GDP	-0.04	-0.32***	-0.32***	0.11***		
HHI	0.02	0.01	-0.03	-0.02		
Panel B: Change in risk measures						
	Δ DD	Δ MES	Δ systematic risk	Δ idiosyncratic risk		
Δ DD	1.00					
Δ MES	-0.05	1.00				
Δ systematic risk	0.00	0.64***	1.00			
Δ idiosyncratic risk	-0.24***	0.13***	0.03	1.00		
Cost-income ratio	-0.05	0.02	-0.01	-0.03		
Income diversification	0.00	-0.01	-0.04	-0.06		
Capitalisation	-0.04	0.01	-0.04	0.08*		
High-risk banks	-0.1**	-0.11***	-0.01	-0.18***		
GDP	0.04	0.02	0.02	0.09**		
HHI	0.05	-0.04	-0.03	0.00		
Panel C: Control variables						
	Cost- income ratio	Income diversificati on	Capitalisati on	High-risk banks	GDP	HHI
Cost-income ratio	1.00					
Income diversification	0.77***	1.00				
Capitalisation	-0.05	0.21***	1.00			
High-risk banks	0.13***	0.17***	-0.01	1.00		
GDP	-0.05	-0.03	0.02	-0.01	1.00	
HHI	-0.06	0.00	0.12***	0.01	0.13***	1.00
**, * Denotes significance at 5%, 10%						
*** Denotes significance at 1%						

b. Expected influences of various variables on dependent variables

	(1) Pre-merger MES	(2) Pre-merger systematic risk	(3) Pre-merger idiosyncratic risk	(4) Δ MES	(5) Δ systematic risk	(6) Δ idiosyncratic risk
Pre-merger default risk	+	+	+			
Δ default risk				+	+	+
Cost-income ratio	+/-	-	-	+/-	-	-
Income diversification	+/-	+/-	+/-	+/-	+/-	+/-
Capitalisation	+/-	+/-	+/-	+/-	+/-	+/-
Pre-merger high risk banks	+	+	+	+	+	+
GDP	-	-		-	-	
HHI	+/-	+/-	+/-	+/-	+/-	+/-

Chapter 5: The Effects of Mergers and Acquisitions on Acquiring Banks' Default Risk

5.1 Introduction

In August 2007, dilemmas in sub-prime mortgage lending in the U.S. spread globally and triggered a global financial crisis. Turmoil in the global financial markets has badly influenced the banking industry, which was previously considered fast growing, profitable, vigorous and innovative. Many banks failed and suffered significant losses and had to raise extra capital to cope with damages caused by the global financial crisis, through various bailout systems or via M&As. One important effect of the global financial crisis is the decrease in M&A activities around the globe, both in the volume of mergers and in total deal value. Nevertheless, this trend is not exclusive to the banking sector, rather, it reflects a general economic recession in many countries (Rao-nicholson and Salaber, 2016). The global financial crisis has also highlighted a deficiency within supervisory establishments to diagnose reliable indicators of distress in the banking sector. One of the primary objectives of regulators and supervisory authorities is to enhance competitiveness within the financial services sector, meanwhile minimising the risk of system failure. Despite this, investors continue to show interest in low risk and high returns, whilst depositors, policymakers, and bondholders are keen on minimising company-specific risk. For such reason, the effect of M&As on the risk of acquiring banks in particular, and also of the financial system in general, is an essential issue for all stakeholders.

In the aftermath of the global financial crisis 2007-09, a handful of continuous research has reconsidered the measurement of default risk of banking firms, as well as the impact of M&As on merging firms' default risk. The

initial stream of literature suggests that M&As lead to diversification effects, therefore, resulting in higher capital buffers and lowered cash flow variability, which is, associated with a decrease in default risk. This notion has been approved theoretically by Amihud and Lev (1981) and empirically by Emmons et al., (2004), Hughes et al., (1999) and Van Lelyveld and Knot (2009). An alternative stream of research asserts that an increase in default risk post-merger may be due to either the transfer of risk from targets to bidders (Billett et al., 2004; Furfine and Rosen, 2011), managerial compensation at the expense of risk increase (Harford and Li, 2007) or the increase in bidders' leverage both theoretically in Morellec & Zhdanov (2008) and empirically in Ghosh and Jain (2000).

Besides the debate on diversification benefits and risk-reduction effects attributed to M&As, the literature suggests that supervisory schemes might promote a risk-connected motive for consolidation in the banking industry. One strand of literature proposes that stricter supervision of banks is likely to prevent acquirers from making bad acquisitions, thereby reducing risk (Buch and DeLong, 2008; Vallascas and Hagendorff, 2011). In contrast, empirical evidence from Hoque et al. (2015) shows that higher supervisory power increased risk-taking during the credit crisis. This risk-increasing can be explained by the rent-seeking view of supervisors as they employ power to benefit favoured voters, attract donations and extract bribes (Djankov et al., 2002; Quintyn and Taylor, 2003).

These controversies within existing literature provide the motivation for this chapter to investigate the effects of M&As on bidding banks' default risk. Employing a global sample of 608 bank M&A deals from 1998 to 2015 and applying the Distance to Default (DD) methodology, as in Vallascas and

Hagendorff (2011), to measure default risk of acquiring banks, this study extends literature on the risk effects of bank mergers. Furthermore, it provides original evidence on the determinants of merger-related changes in bidding banks' default risk. The main findings and contributions of this chapter are discussed below.

The contribution of this chapter is threefold. Firstly, it contributes to ongoing academic and policy debates regarding the effects of M&A activities on acquirers' default risk using a global bank M&A sample. This global sample offers a particularly suitable setting and is expected to yield interesting findings. Specifically, the sample set is divided into emerging markets, developed markets and frontier markets in order to examine the risk effects of bank consolidations within different markets. This paper also separates U.S. acquirers and non-US acquirers because of the high volumes of mergers in the U.S. Overall, this chapter finds that bank mergers reduce the default risk of bidders. This finding also adheres to the presumption gained from literature that the diversification of assets between two merging institutions, which are imperfectly correlated, should, without countervailing movement from management of acquirers, lead to a reduction in the default risk for the combined firm both theoretically (Amihud and Lev, 1981; Diamond, 1984) and empirically (Emmons et al., 2004; Koerniadi et al., 2015; van Lelyveld and Knot, 2009). Therefore, the first hypothesis of this chapter, which predicts that M&As reduce the default risk of acquirers, is affirmed.

Secondly, this is the first study that shed light on the risk effects of both geographic and product diversifications on acquirers' default. Previous work on risk-taking and bank mergers has only involved European bank mergers (Vallascas and Hagendorff, 2011), U.S. bidders in domestic mergers (Furfine and

Rosen, 2011), Japanese focusing mergers (Harada and Ito, 2011) and most recently, the U.S. acquiring firms in cross-border mergers (Koerniadi et al., 2015). Focusing mergers relies merely on portfolio diversification benefits, whereas diversifying deals are expected to generate synergies at many levels of the value chain with more integration at the operational level (Berghe Van Den and Verweire, 2001). Likewise, cross-border deals usually comprise complex elements, such as: political and economic concerns, various accounting and information disclosure systems and cultural matters. These activities can produce various benefits that are not accessible within domestic markets; for instance, more relaxed supervisory systems, favourable tax treatments and cheaper labour costs (Koerniadi et al., 2015). Therefore, the different relationships between default risk and both types of diversification are projected in hypothesis 5.2 and 5.3 of this chapter which predicts that bidders' default risk reduce under product-diversifying mergers and cross-border deals respectively. The results produced in this chapter show that not all forms of diversification exert an equal effect on the reduction of bidders' default risk. Product diversification is found to pose a positive effect on bidding banks' default risk (lower risk) which is in line with the broader literature about the diversification benefits of reducing bank default risk, as demonstrated by van Lelyveld and Knot, (2009) and Wall et al., (2007). Thereby, the second hypothesis is affirmed. Conversely, geographic diversification does not seem to have a statistically significant relationship to the reduction in default risk for acquiring banks; therefore, the third hypothesis is rejected.

Finally, this study provides valuable insight into the underlying factors and possible explanations that influence the changes in the default risk of acquirers'

post-merger. Specifically, deal size, ROA and status of the target are all found to play important roles in affecting the risk profile of acquirers. Initially, large deals prevent acquirers from realising the risk-reduction effects associated with M&As. The finding that deal size demonstrates a negative influence on the change in distance to default raises concerns about the risk implications of mega-mergers on banking sector stability. This demonstrates that large merger deals bring about organizational and procedural hurdles in the post-merger integration process that might prevent the advantages of merger from materializing (Knapp et al., 2005). Additionally, since banks develop substantially via M&A, they also acquire more risk (Hughes et al., 1999). This is also consistent with banks facing incentives to use mergers to become too big to fail in an attempt to extract benefits from regulators. Furthermore, bidding banks with higher pre-merger performance enjoy more default risk reduction following the deal. These results support the notion that higher profitability creates a larger buffer, therefore providing greater ability to absorb adverse shocks to asset values and a further likelihood of rebounding as the market improves. Finally, acquisitions of private targets increase the default risk for acquirers. This is because private firms are subject to lower disclosure requirements; hence, restricting the acquirers' capabilities to evaluate the risks associated with private targets for themselves in addition to making acquirers' due diligence ineffective.

The remaining sections of this chapter will be planned as follows. The next section discusses the existing literature of the default risk's implications of bank mergers and the regulatory incentive for M&As as well as the hypotheses of the study. The third section describes various models used to compute bidders' default risk, with particular attention given to the DD model. A detailed analysis

of the results is included in section four and is followed by a conclusion in section five.

5.2 Literature Review

The objective of this section is to investigate the extant body of academic literature on the effects of bank mergers on default risk. The first part concentrates on the definitions of default risk, followed by a discussion regarding the diversification effects on bank default risk on part two. Furthermore, a summary of the literature regarding the influence of regulators' incentive on the risk effect of bank merger is provided. Finally, the research hypotheses of this chapter are discussed.

5.2.1 Definition of default risk

The Banking Supervision Basel Committee highlighted that because the exposure to credit risk remains to be the dominant source of problems in banking organisations globally, it is essential for banking firms and supervisory authorities to learn valuable lessons from previous several financial crises. Banking firms should address themselves to the need of identify, estimate, monitor and oversee credit risk; at the same time, controlling that banks hold enough capital buffer against these risks and that they are sufficiently compensated for the risks incurred. Banking supervisors, on the other hand, should stimulate sound practices for managing credit risk at an international level. The effective credit risk management is a crucial element of a thorough approach to risk management and vital to the long-run success of any banking firms (Basel Committee on Banking Supervision, 1999).

In the simplest of terms, credit risk is defined as “the potential that a bank borrower or counterparty will fail to meet its obligations in accordance with agreed terms” (Basel Committee on Banking Supervision, 1999, p.1). As such, measuring credit risk relies upon the probability of default of a company to fulfil

its contractual obligation and upon the extent of loss if default occurs. In the event of the default, the Basel Committee provides clear guidance that “a default is considered to have occurred with regard to a particular obligor when either or both of the two following events have taken place: (1) the bank considers that the obligor is unlikely to pay its credit obligations to the banking group in full, without recourse by the bank to actions such as realising security (if held) and/or (2) the obligor is past due more than 90 days on any material credit obligation to the banking group. Overdrafts will be considered as being past due once the customer has breached an advised limit or been advised of a limit smaller than current outstanding”. As so defined, Golin and Delhaise (2013) suggest that credit risk and default risk are essentially synonymous and will be used interchangeably in this paper.

5.2.2 Diversification effects on bank default risk

Since it is not possible to assess whether a potential borrower would be able to meet its required obligation, the lending decision and the credit spread have to be based on the creditworthiness of that corporation (Berger et al., 2015). To justify the risk of default (among other financial risks), shareholders inevitably demand a spread, in the form of dividends or share price appreciation, over the risk-free interest rate. The higher the risk they have to bear, the higher the return they expect. Classic modern portfolio theory demonstrates that investors can diversify their portfolios to reduce risk. Hence, fundamentally, the spread needed to invest in a firm, is affected by systematic elements. In essence, banking organisations can diversify themselves via three types of financial integration: (1) domestic M&As within a single product type (e.g. a bank with a bank); (2) the consolidation of a bank into universal-type corporations, for instance, merging

investment banks and securities companies and (3) cross-border acquisitions. These M&A types are expected to produce diversification benefits and reduce risks. There are two strands in the literature regarding the default risk effects of bank acquisitions. Firstly, M&As deliver diversification effects and lower risk, and alternatively, stimulus from regulators, which might motivate the higher level of risk taking.

The question raised by the first strand of literature is whether M&As within the banking industry are deriving diversification¹² benefits and whether or not they reduce risk. The supporters of the diversification strategy declare the presence of synergies via cost economies, asset growth and improved profits. In addition, the imperfect correlation of revenue flows from various activities. Indeed, Diamond (1984) construed the fundamental insight of portfolio diversification as a means of reducing the risk for banks. Banks could decrease the default risk of their asset portfolios without losing on their expected return by integrating assets where payoffs are not perfectly correlated. Furthermore, some empirical studies have detected the potential for default risk-reducing diversification benefits as a result of the diversification of banks into non-banking activities such as insurance, securities (Van Lelyveld and Knot, 2009; Wall, Reichert, and Liang, 2007) and geographic diversification (Koerniadi et al., 2015).

Conversely, arguments against diversification continue to develop. The most important one regards corporate diversification as unnecessary as investors could diversify away company-specific risk from their portfolios. Similarly, Levy and Sarnat (1970) exploited the portfolio theory to show that without capital cost

¹² The term “diversification” alone in this study refers to the strategy in which acquirers obtain diversified portfolios or product ranges as a result of a merger.

economies and synergistic gains, the potential diversification benefits associated with the acquisition strategy cannot bring about economic gain in a perfect capital market. Furthermore, opponents of the diversification strategy highlight the risk that diversification may spur the management of a firm away from their core competency. For instance, several studies have revealed that managers may undertake M&As which increase risk in exchange for their increasing compensation and bonuses, even when the merger destroys shareholder wealth (Furfine and Rosen, 2011 and Grinstein and Hribar, 2004). Wagner (2010) considers a model with two banks. A bank is considered to be failing if the value of its assets falls below its liabilities. Bank assets are also assumed to be carrying idiosyncratic risk. Thus, diversifying into the asset of the other bank reduces the likelihood of a bank's portfolio value dropping below its liabilities. It lowers a bank's probability of failure, which is the standard effect of diversification. However, large-scale diversification is a common denominator between banks as it exposes them to the same risks.

Despite numerous methodological approaches pursued within the literature, the above debate still prevails. Indeed, survey papers of academic literature give no clear consensus on this matter. Mainly, Wilson et al. (2010) conduct a review of the literature on risk, performance and governance within banking firms. They deduce that, in the US, most empirical studies conclude that diversification into less traditional financial activities leads to higher risk and lower returns. In contrast, Berger et al. (1999) proposed that consolidation is associated with an increase in profit efficiency and hence diversifies the portfolio risk of financial firms. In Europe, Berger et al. (2001) undertook a review of the literature on the effects of M&As regarding the efficiency of the financial services sector.

They summarised that the potential for efficiency gains via consolidation is substantial and is primarily attributable to the diversification of risk. However, most of these gains are offset by the presence of consolidation barriers such as language, distance, culture and implicit regulations against foreign firms.

In addition to the surveys discussed, a variety of studies have utilised merger simulation techniques for their samples. Previously, before using a simulation technique, in the Second Banking Directive of 1989 in the EU and the Gramm-Leach-Bliley Act 1999 in the US, alongside deregulations in other continents, financial regulations around the world restrained the opportunity of banking institutions in order to enlarge geographically to include other states. They also forbade banks to consolidate with other kinds of financial institutions, including securities companies, insurance firms and investment banks. Thereby, simulation approaches allowed researchers to evaluate the effects of banking institutions' expansion within these banned activities. The assumptions of such a hypothetical acquisition approach are relatively simple. The authors presume that the combined entity is the sum of two single companies. The companies are combined based on their book values. However, the shortcoming of this simulation technique is that synergy, premiums, as well as the capital structural changes resulting from the merger, are all ignored. This presumption is undoubtedly impractical; nevertheless, simulation technique is still used because of its simplicity and its ability to examine the effects of prohibited activities (Boyd and Graham, 1988).

These simulation studies reveal that U.S. bank mergers decrease the probability of default of the merging institutions as a result of portfolio diversification (Emmons et al., 2004), product diversification (Boyd and Graham,

1988; Estrella, 2001; van Lelyveld and Knot, 2009) and geographic diversification (Hughes et al., 1999). For instance, acquisitions were simulated in a sample of US community banks from 1989 to 1993, which resulted in community banks obtaining the most significant advantages of risk-reduction via geographical enlargement (Emmons et al., 2004). Although this simulation technique is suitable for diagnosing the sources of bank risk, it might also overstate the advantages of geographic diversification over risk reduction because it does not make any adjustment for cost increase or the exposure to loss that banks may experience when associated with overseeing a firm with geographically dispersed offices.

In line with the findings of Emmons et al. (2004), Hughes et al. (1999) asserted that increasing size tends to raise insolvency risk while geographic diversification helps to reduce this risk. This is because more significant bank holding companies, whose more extensive branch networks have afforded them better macroeconomic diversification, achieve greater safety and improved efficiency, which is priced by capital markets. Their simulation study uses production-based and market-value-based performance measures that utilise both accounting information and stock market data to measure financial performance and the bank safety of U.S. bank holding companies. However, the outcomes of this simulation study should be carefully interpreted as they ignore the complications of organisational inefficiencies within operations, and merger-related changes within the strategy of the bank. Results show that the most substantial economic advantages are observed for banks that pursue interstate enlargement, which diversifies their macroeconomic risk. The improved bank safety resulting from geographic consolidation would benefit society.

Regarding activity diversification, the effect of a hypothetical diversification of bank holding companies (BHCs) into nonbanking, at the risk of BHCs, is examined from 1971 to 1984 (Boyd and Graham, 1988). The authors use the approach of M&A simulations, making a comparison of the results with unmerged banks. The results of their study indicate that the diversification of BHCs into life insurance decreases the default risk as well as the volatility of returns. Nevertheless, mergers between BHCs and real estate developers, securities firms, property and casualty insurance raise the volatility of returns and the risk of default. Craig and Santos (1997) also found the risk-reduction effect of acquisitions using the Z-score methodology. The authors compared the Z-score of each bank in their sample before merging them into the Z-score of a hypothetical bank formed by combining the accounting statements of two merging firms before the acquisition. The Z-scores estimated after the acquisitions were more substantial (which means lower default probability) than those of the hypothetical banking organisations pre-merger. Nevertheless, the authors failed to recognise these risk-reduction effects when using other methodologies, such as computing the deviation and coefficient variation of a bank's profitability. These measures are computed for both the return on assets (ratio of net income to total assets) and the return on equity (ratio of net income to equity capital). Therefore, their findings are not strong enough to conclude that risk diversification is a primary motive behind bank mergers.

Despite the substantial work devoted to these simulation studies, this approach to assessing the risk effects of actual acquisitions suffers from drawbacks. One apparent weakness of the simulation approach is that authors are not able to recognise the positive or negative cash flow synergies that may

happen in actual merged companies. Furthermore, simulation may understate the risk reduction from scale effects, as managers of the combined entity can make changes regarding operations and business strategy, which improve efficiency. More efficiency means lower default probability as the bank engages in a more favourable risk-return frontier. In addition, the absence of real bank M&As and the indirect approach of examining the phenomenon are drawbacks of the simulation approach. The development of financial conglomerates, as well as the relentless wave of bank mergers, has encouraged various studies to generate more reliable outcomes based on actual mergers, hybrid firms or developed extended models.

First, Nurullah and Staikouras (2008) developed a simple approach to assessing the actual expansion of banks into insurance between 1990 and 1999. The authors created measures of risk, profitability and creditworthiness at the company and industry levels in order to investigate the risk-return effects before and after the merger period of European banks' expansion into non-life and life insurance underwriting, and into insurance broking. These findings demonstrate that non-life and life insurance substantially raise default probability and return volatility. Therefore, it is suggested that insurance brokerage is the most appropriate target for bank diversification.

Second, OLS regressions of market-based and accounting-based risk measurements on a set of variables are utilised to examine the relationship between product diversification and banking risk, in a sample of European banks from 1996 to 2002 in Lepetit et al. (2008). The initial evidence demonstrates that traditional banking activities are exposed to lower risk than banking institutions' expansion into non-interest income activities (noncore transactions such as

trading activities, venture capital and investment banking). Nevertheless, further analysis reports that for small banks, trading activities sometimes reduce the default risk of banks.

One of the more developed methodologies widely adopted to measure default risk, both empirically and commercially, is the extended DD model developed by Merton (1974). This model employs both stock market data and balance sheet information, such as the market value of an asset or the book value of a debt. As such, this is a reliable, robust predictor of a firm's default risk. One way to estimate the distance to default is to use Expected Default Frequency (improved by MoodysKMV) as in Furfine and Rosen (2011). Their model employs both stock market data as well as balance sheet information, such as market value of assets and book value of debt. The study reported that M&As increased acquirer's default risk in a sample of North American deals between July 1993 and September 2006. The authors also revealed that the motivation for M&As comes from the private interests of those making the acquisition decisions rather than underlying elements such as potential merger-associated synergies. However, Duan (2012) pointed out that the MoodysKMV estimation method is limited to measure the default risk for financial institutions. Financial institutions usually have a significant portion of liabilities that cannot be accounted for by the MoodysKMV method; therefore, this method tends to exaggerate the volatility of assets leading to the distortion of distance to default.

An alternative estimation method is to employ a Newton search algorithm to diagnose the daily market value of company assets and asset volatility in an iterative process to calculate firms' distance to default, implemented by Akhigbe et al. (2007), Vallasas and Hagendorff (2011), Vassalou and Xing (2004). In a

European context, Vallascas and Hagendorff (2011) report that some less risky bank pre-mergers have witnessed an increase in default risk after completion of the deal, which is somehow in line with findings from Furfine and Rosen (2011). That increase in acquiring banks' risk profile is driven by cross-border mergers and product diversification in addition to weak supervisory schemes. This finding suggests that policymakers should control M&A transactions involved cross-border and product diversification because acquiring banks exhibit a higher default probability after deal completion. In contrast, a study on the US markets shows that acquirers' default risk decreases as a result of cross-border activities (Koerniadi et al., 2015). Their result indicates that the overvaluation of share prices, information asymmetry, geographic expansion and industry significance were the potential elements impacting on the level of default risk after deals have been completed. Specifically, stock overvaluation may give incentive to managers to undertake risk-increasing mergers. In contrast, geographic expansion and industry relatedness reduce bidders' default risk. However, the authors did not recognise a direct influence of option compensation with managers' high risk-taking motives. The latter finding is contradictory, with many authors, such as, Brown et al. (2015); Furfine and Rosen (2011); Harford and Li (2007) and Hagendorff and Vallascas, (2011), demonstrating that CEOs with a higher compensation scheme pursue risk-inducing acquisitions.

Using a Japanese sample of bank M&As in the late 1990s and 2000s, Harada and Ito (2011) also employed distance to default, in order to investigate whether mega-banks use acquisitions as a mean of avoiding default. They estimated the market value of a bank asset via a geometric Brownian motion and logarithmic normal distribution, utilising both equity prices and long-term liabilities

of banks. Their findings are consistent with Vallascas and Hagendorff (2011) in that default probability does not decrease after deal completion. Overall, the distance to default method, employed in the studies above, overcomes the controversy regarding which type of data (accounting or market data) produces a more reliable estimation of risk and return, because these studies utilise both types to compute the default risk. On one side, accounting data is more accurate (as directly observable) but less flexible (as updated only annually). On the other side, market data enables updating the failure probability more frequently; however, this is not directly observable, as it must be inferred from equity prices, Hence, it may under or overestimate the probability of failure. Therefore, both types of data complement each other's weaknesses and provide a better measure of risk. Furthermore, both Gropp et al. (2006) and Harada and Ito (2011) show that distance to default scores are an appropriate indicator and a robust measure of bank health rather than traditional indicators used for European and Japanese banks respectively. It is worth noting that, if the market value of assets plummets severely or has stochastic volatility, a substantial poorer ranking performance is observed when using DD and therefore, may result in a significant underestimation of the banks' default risk.

Instead of looking at the shareholders' perspective, Choi et al. (2010) conducted an empirical study to examine the risk effect of cross-border bank M&As for the bondholders of the acquirer, by looking at the yield spread. The authors show that bondholders recognise cross-border bank mergers as risk-increasing transactions. Indeed, they observe a significant increase in the yield spreads of acquiring banks after the announcement of cross-border deals. As such, acquirers' bondholders demand a higher yield as compensation for the

perceived increase in the risk associated with mergers. This study also advises that policymakers should look at similar circumstances within the host and home nations when assessing the risk of international financial firms, and also when deciding whether these financial institutions' capital reserves are adequate.

5.2.3 The influence of regulators' incentive on the risk effects of bank mergers

Besides the debate of diversification benefits, another strand of the literature suggests that bank consolidation might be driven by risk-shifting or risk-taking due to a favourable regulatory environment. For instance, Buch and DeLong (2008) investigated cross-border deals within the banking sector and concluded that the supervisory schemes of the partners' nations have an impact on the changes in total risk after deal completion. Specifically, an acquiring bank from a nation with a strong supervisory structure decreases its total risk (systematic risk and firm-specific risk) post-merger. Nevertheless, total risk rises when the target bank is situated in a country with quite strong supervision; in this instance, an acquiring bank seems to shift the risk back to its home market. The findings imply that strong supervision in the banking sector of a country can help reduce the total banking risk. Similarly, Hagendorff and Nieto (2015) find that bank acquisitions have weakened bank safety and soundness in some circumstances; their results still point out that strong supervisory regime and regulation can somewhat mitigate this. In contrast, Hoque et al. (2015) assert that official supervision results in an increased default risk for banks (captured by DD method), while a higher level of private control results in the reduction of bank risk during the credit crisis. The outcomes imply that even though supervision and regulatory constraints are vital, it is also essential to maintain improved private

control. On the other hand, Choi et al. (2010) do not regard regulatory structure and supervisors as significant factors in justifying the changes in acquiring banks' yield spreads (due to risk) after merger announcements.

Financial institutions may attempt to shift their transactions to countries with less strict regulation and furthermore, they conduct risk-shifting via an under-priced deposit insurance scheme in order to reduce their risk (Buch and DeLong, 2008). According to Amihud et al. (2002), an under-priced safety net may encourage key decision makers of firms to transfer risk onto banking supervisors and away from the company itself. Regarding the safety net of the government deposit insurance scheme, taxpayer grants and loans from central banks grant thousands of millions of dollars subsidy to financial institutions that operate in investment and commercial banking activities. This assistance from the government indicates that banks have more economical access to capital and are less affected by the market. The activity of the bailout procedures for financial firms, as well as deposit insurance structures, also promotes the moral hazard in the banking sector (Vallascas and Hagendorff, 2011). The subsidy generates stimulus for excess risk-taking via higher leverage level and risky transactions. Therefore, higher default risk and increased number of banking M&As created by the subsidy could build a weaker economy and create a higher risk for taxpayers.

Furthermore, the safety net itself may bring extra safeguarding to firms regarded as TBTF. TBTF banks may take advantage of the under-priced safety net structures in order to strengthen their deposit subsidy, which boosts both the size and total risk of a corporation (John et al., 1991). When banks consolidate with non-bank transactions, such as securities underwriting and insurance, the safety net might also broaden. Kwast and Passmore (2000) explained that bank

holding companies exploit a net subsidy benefit (gross subsidy less regulatory expenses) from the safety net, which has a positive margin with the purpose of maximising their shareholder value. This result might be seen to strengthen the prosperity of the banking industry at the cost of financial service rivals, to a level that may show an inefficient capital allocation.

Several studies focus on one of the signs for safety net subsidy which is the target premium paid on consolidation, with the assertion that banks having the implicit bailout assurance will receive greater premiums upon consolidation. Evidence from Schmid and Walter (2009) shows that substantial premiums are received in large conglomerate M&As (over \$100 billion) when investigating sizeable conglomerate consolidations between 1985 and 2004. Additionally, Brewer and Jagtiani (2013) discovered greater target premiums above a certain significant size. In short, the risk-shifting motivation of safety net subsidy might offset the constructive impact of risk diversification strategies within the banking sector.

5.2.4 Hypotheses development

In finance literature, the vast majority of M&As studies so far have focused on the performance of a transaction, i.e., whether it creates value and for whom. This study takes a different approach by looking at another critical aspect of M&As which is default risk, particularly relevant to banking institutions. This section attempts to develop hypotheses on whether M&As affect the default risk of acquiring banks, and if so, which type of mergers influence the risk-reducing or risk-increasing effect.

M&As activities are conventionally seen to reduce the risk for the merging firms (Amihud and Lev, 1981; Diamond, 1984 and Galai and Masulis, 1976).

Additionally, the merging banks will benefit from both financial synergies via asset growth and improved profits, through operating synergies via co-insurance (Asquith and Kim, 1982) and economies of scale and scope. All this should lead to lowering a firm's default risk (Halpern, 1983) and creating better stability of the financial system. In the context of bank M&As where default risk is crucial, empirical evidence for the U.S. suggests that the probability of failure after deal completion decreases as a result of portfolio diversification (Emmons et al., 2004), product diversification (van Lelyveld and Knot, 2009) and geographic diversification (Hughes et al., 1999). Furthermore, during the global financial crisis, many major financial institutions worldwide have been encouraged by regulators to merge or take over, mainly to avoid bankruptcy, for example: the Bank of America & Merrill Lynch; J.P. Morgan & Bear Stearns; Wells Fargo & Company and the Wachovia Corporation in the U.S., Lloyds TSB & Halifax Bank of Scotland (HBOS) in the U.K. (Douglas, 2009); Caisse Nationale des Caisses d'épargne (CNCE) & Banque Fédérale des Banques Populaires in France and Fortis NV/SA & BNP Paribas in Belgium (Molyneux et al., 2014). Hence from a regulator's perspective, M&As are often perceived as a tool to avoid bankruptcy for the merging institutions. Taking this into consideration, the first hypothesis of this chapter is formulated as follows:

Hypothesis 5.1 M&As lower the default risk of acquiring banks

This is followed by examining whether product diversification plays a role in the changes in acquiring banks' default risk post-merger. The potential for risk-reducing in mergers is especially noticeable for product-diversifying acquisitions, as this type of merger has the potential to significantly reduce the volatility of profitability (Estrella, 2001; Boyd et al., 1993). Indeed, Wall et al. (2007) assert

that acquisitions between banks and non-bank institutions are carried out only if management perceives that the benefits from the consolidation are likely to outweigh the costs. Hence, the merged entity could enjoy risk-reducing effects from owning a more diversified portfolio, by either holding riskier assets than either firm can hold on a stand-alone basis. Banks can also achieve economy of scale and scope via M&As. One area where scale economies are made possible is in risk management. However, the use of derivatives in risk management can be costly and complicated; therefore, only big institutions are more likely to use derivatives. The more prominent scale arising from merging a bank with a nonbank institution might permit a combined firm to tolerate the fixed costs related to more sophisticated risk management tools. Considering this, the second hypothesis will be:

Hypothesis 5.2 Product-diversifying mergers bring more risk-reducing effects for acquiring banks than focusing deals.

With respect to international bank mergers, cross-border deals can bring about various benefits, for instance, more relaxed supervisory systems, favourable tax treatments, cheaper labour costs or a combination of reasons not accessible in the domestic market. Indeed, Hughes et al. (1999) assert that increasing size tends to raise the insolvency risk while geographic diversification helps to reduce this risk. The most substantial economic advantages are observed for U.S. banks that pursue interstate enlargement, which diversifies their macroeconomic risk. The improved bank safety resulting from geographic consolidation would benefit society. Koerniadi et al. (2015) also reach the same conclusion in their cross-border sample consisting of U.S. acquirers and international targets. Their result indicates that geographic expansion is one of

the possible elements that have a positive impact on the level of post-merger default risk (lower default risk). These findings help motivate the third hypothesis:

Hypothesis 5.3 Acquiring banks will be able to decrease their default risk even more when targeting cross-border institutions as opposed to domestic ones.

To test these hypotheses, the next section explains in detail the methodologies used to measure the post-merger change of the default risk of acquiring banks, as well as the determinants of such change.

5.3 Research Methodology

5.3.1 Default risk measurement models

There is renewed interest in default risk assessment, driven by the requirements of Basel II/III and substantial growth in the credit derivatives market. Models of measurement for credit risk pay attention to estimate companies' probability of default due to the fact that it is the major area of uncertainty in making the lending decision. The credit risk measurement models may be divided into two broad categories, namely the non-structural models and the structural models. The former's objective set by Beaver (1968) and Altman (1968) is to identify important determinants in evaluating credit risk and adopt fundamental analysis. They evaluate the importance of these determinants and map a condensed set of accounting variables and financial ratios such as leverage, working capital over total assets, retained earnings over total assets, earnings before interest and tax over total assets as well as other information into a quantitative score to measure the default probability of a firm. The latter, on the other hand, goes back to Black and Scholes (1973) as well as Merton (1974) who assume corporate liabilities as contingent claims on a company's assets. The default event of a firm is decided by both the market value of the company's assets along with the liability structure of this company. A company is considered to be in default when the assets value decreases below a specific threshold. Because it is infeasible to observe the market value of assets, share price of the company is utilised instead to infer the assets value, then the probability of default can be determined. There are also attempts from worldwide authors to combine both non-structural model and structural model into a hybrid approach with the expectation to achieve better estimations of default risk; for instance Bellalah et

al. (2016); Doumpos et al. (2014); Li and Miu (2010); Benos and Papanastasopoulos (2007).

Going into more details, with regards to non-structural models, the two most well-known and widely-used models are the Z-Score and O-Score. The Z-Score, developed by Altman (1968), weights the independent variables (financial ratios and accounting variables, for instance, the return on average assets before taxes (ROAA), the capital ratio (equity capital over total assets and profitability) and produces a single composite discriminant score. From an economic point of view, the Z-Score primarily assesses a bank's probability of default when the value of debt is above the value of assets. The Z-Score model has been used in various studies in order to measure default probability; as noted by Hillegeist et al. (2004), Lepetit et al. (2008) and Craig & Santos (1997). Taffler (1983) also proposes a UK-based discriminant function, termed as Z-score. This model is derived for the evaluation of company solvency by public accounting information alone. The model requires the input of four appropriately defined financial ratios, each measuring a distinct aspect of company performance. To test the predictive power of the Z-score, Taffler (1983) identifies 80 potential useful ratios and computes them for each of the 92 companies in his sample. The resulting Z-score can be interpreted as the degree to which the financial profile of the company resembles more than of typical financially healthy companies.

Alternatively, the O-Score, developed by Ohlson (1980), measures the probability of default based on four critical elements of the financial statements (equally weighted); size (logarithm of total assets to GNP¹³ price-level index);

¹³ GNP calculates the monetary value of all the finished goods and services produced by the nation's factors of production regardless of their venue.

leverage (total debts to total assets); performance (net income to total assets and fixed assets to total debts) and current liquidity (working capital to total assets, current assets to current liabilities). This model is applied in numerous empirical studies to examine the probability of bankruptcy such as Karamzadeh (2013), Lawrence et al. (2015).

The main advantages of both Z-Score and O-Score models are their accuracy in assessing default probability. However, the use of financial ratios and accounting data associated with using Z-Score and O-Score create less flexible results. The default probabilities cannot be updated during the fiscal year as accounting statements are generated per annum and quarterly statements are yet to be audited (Bellalah et al., 2016). Besides this, Hillegeist et al., (2004) argue that another critical drawback of accounting-based bankruptcy prediction models is their failure to incorporate a measure of asset volatility. Volatility is an important variable in bankruptcy prediction because it captures the likelihood that the value of the firm's assets will decline to such an extent that the firm will be unable to repay its debts.

Regarding structural models, the original Merton (1974) model proposes that the default event is decided by the market value of a company's assets in combination with the debt structure of the company. When the value of assets drops below a specific threshold, the company is deemed to be in bankruptcy. There are several extensions of the model suggested in literature. For instance, Crosbie and Bohn (2003) review KMV's default probability model, developed by KMV Corporations. Multiple classes of debt are modelled in this method. The three fundamental steps for the determination of default probability are (1) estimating the daily market value of assets and volatility of assets, (2) calculating

the distance-to-default and (3) transforming the distance to default into an expected default frequency (EDF) using an empirical default distribution. The benefit of this model is that it permits default to happen at any point in time and not necessarily when the debt matures, as with the original Merton model. However, despite being used in some studies, such as Furfine and Rosen (2011) and Mitchell et al. (2004), it is problematic to construct theoretical EDF's without an assumption of normal asset returns. Given the fact that the calculation of KMV model requires share price data, it is more difficult to calculate the EDF for private companies, with only accounting data available. Furthermore, Duan (2012) pointed out that the KMV estimation method is limited to measure the default risk for financial institutions. Financial institutions usually have a significant portion of liabilities that cannot be accounted for by the KMV method; this method, therefore, tends to exaggerate the volatility of assets leading to the distortion of distance to default.

There have been some recent papers using this structural approach for assessing the likelihood of corporate failure (e.g., Bharath and Shumway (2008); Hillegeist et al.,(2004) and Vassalou and Xing (2004)). Such a methodological approach encompasses most of the above criticism of accounting-ratio-based models because firstly, it produces a sound theoretical model for firm default and secondly, in an efficient market, stock prices will reflect all the information contained in financial statements and will also contain information, outside the company's accounting statements. Furthermore, market variables are unlikely to be influenced by firm accounting policies, and finally, market prices reflect future expected cash flows, and therefore, should be more appropriate for prediction purposes.

5.3.2 Distance to Default model

In order to measure the changes in default risk associated with M&A activities of acquiring banks, the Merton Distance to Default (DD) model will be employed in this study as extended by Akhigbe et al. (2007); Gropp et al. (2006); Vallasas and Hagendorff (2011) and Vassalou and Xing (2004). DD is a credit score originated from observed share prices and book liability, exploiting the structural model of default risk by Merton (1974). This model has been demonstrated empirically to perform well when it involves ranking companies based on their default risk, as in Bharath and Shumway (2008); Duffie et al. (2007) and Hillegeist et al. (2004). Hence, this method is regularly employed as a measure of ratings to monitor the default risk of companies, as demonstrated by Acharya et al. (2013) and Chava and Purnanandam (2010). DD estimates default risk as the number of standard deviations by which the market value of a firm's assets is beyond the default point. A default point is the point where the market value of assets is lower than the book value of total liabilities (the company is then regarded as bankrupt). Specifically, the smaller the DD, the smaller the distance of a firm from default point, whereby the default probability is higher. For instance, a DD of 3.0 suggests that bank failure within a year is a three-standard-deviation event, assuming that the asset values' fluctuation follows the recent historical value, and the starting point is the current market value of assets. If DD ever becomes zero, it does not necessarily mean that the firm becomes bankrupts at that specific time. The DD negative or being 0.0 indicates that the firm is in a severely vulnerable situation and will be extremely likely to default unless the asset value increases. If short-term liabilities (maturity of less than a year) are not rolled over, the firm might need to consume its assets in order to

pay within a year. Nevertheless, if short-term liabilities are rolled over, the firm would sustain on a cash flow basis, even though this situation is technically regarded as bankrupt. In the situation of a bank run, a sudden default will occur (Harada and Ito, 2011).

The fundamental elements of a simple version of the Merton model applied to derive the DD measure are:

- (1) The process of a company's asset value, V , follows a geometric Brownian motion and thus, specifically, has constant volatility without jumps.
- (2) The capital structure of a company comprises equity and debt, where debt is issued as a single zero-coupon bond. It suggests the company can only fail when the debt matures.

DD is used to measure default risk in this chapter because of the model's various merits. First, DD yields a better measure of the default risk than other traditional accounting-based methods because it combines both market data and accounting information into its measure. Therefore, it simultaneously incorporates an important measure of asset volatility from a market-based method (volatility is a crucial variable in bankruptcy prediction) as well as is measured based on the actual financial situation of the firm from its financial statements. As a result, DD increases the accuracy in assessing the firm's default risk. Indeed, various empirical studies have shown that the DD method is a superior, more reliable predictor of a firm's default risk than other traditional non-structural models, in spite of the model's simplistic assumptions on asset movements and debt structure (Gropp et al., 2006, Harada et al., 2013; Vassalou and Xing, 2004) Second,, Gropp et al. (2004) asserted that dissimilar to credit default spreads, DD methods are reliable indicators for the downturn of bank

health even when a bank is far from default. Third, another advantage of DD measure is its flexibility, as analysts can make frequent adjustments to changes in the market value of a firm's assets, hence continuously updating the probability of default (Bellalah et al., 2016). Finally, Jessen and Lando (2014) also apply simulation studies to demonstrate that the empirical victory of DD might be a consequence of its substantial robustness to model misspecification. They revealed that even when the underlying assumptions of the model are changed, DD still succeeds in ranking companies' probabilities of default.

DD on day t is expressed as

$$DD_t = \frac{\ln(V_{A,t}/L_t) + (r_{ft} - 0.5\sigma_{A,t}^2)T}{\sigma_{A,t}\sqrt{T}} \quad (5.1)$$

where $V_{A,t}$ is the market value of assets, L_t is the face value of total debts, r_{ft} is the risk-free rate (the annualised yield on two-year government bonds in the acquiring bank's country), $\sigma_{A,t}$ is the annualised asset volatility at t and T is the time to maturity of outstanding debt (traditionally set to one year).

The calculation of DD_t requires the estimation of $V_{A,t}$ and $\sigma_{A,t}$. Both of which are unobservable directly. Based on the Black and Scholes (1973) model, the market value of a company's equity can be expressed as a function of asset value for call options with time to maturity equal to T and where L_t plays the role of the strike price of the call:

$$V_{E,t} = V_{A,t}N(d_{1,t}) - L_te^{-r_fT}N(d_{2,t}) \quad (5.2)$$

where:

$$d_{1,t} = \frac{\ln(V_{A,t}/L_t) + (r_{ft} + 0.5\sigma_{A,t}^2)T}{\sigma_{A,t}\sqrt{T}} \quad (5.3)$$

$$d_{2,t} = d_{1,t} - \sigma_{A,t}\sqrt{T} \quad (5.4)$$

Besides,

$$\sigma_{E,t} = \left(\frac{V_{A,t}}{V_{E,t}} \right) N(d_{1,t}) \sigma_{A,t} \quad (5.5)$$

Equation (5.5) is the optimal hedge equation that connects the standard deviation of an acquirer's equity value to the standard deviation of asset values (both on an annualised basis). $V_{E,t}$ is set equal to the total market value of equity based on the closing price at the end of the company's fiscal year. $\sigma_{E,t}$ is calculated by employing daily return data over the whole year (Hillegeist et al., 2004). N is the cumulative density function of the standard normal distribution.

The values of $V_{A,t}$ and $\sigma_{A,t}$ are derived via an iterative process, which employs a Newton search algorithm that ends when the pair of values solves both the call option and optimal hedge equation above. Specifically, daily data from the past 12 months before the deal announcement will be employed to achieve an annualised estimation of the equity volatility $\sigma_{E,t}$, obtained by multiplying the standard deviation of daily equity returns by the square root of the number of trading days (252 days) in the year (Akhigbe et al., 2007). Then the total market value $V_{E,t}$, the annualised equity volatility $\sigma_{E,t}$ and total liabilities L_t will be employed to calculate the starting value for $\sigma_{A,t}$, where $\sigma_{A,t} = \sigma_{E,t} V_{E,t} / (V_{E,t} + L_t)$. The starting value for the market value of assets $V_{A,t}$ equals the sum of the market value of equity $V_{E,t}$ and the face value of total liabilities L_t . The pair $V_{A,t}$ and $\sigma_{A,t}$ will be used as initial values for the iterative process to solve the simultaneous nonlinear equations above (Equations 5.2 and 5.5), generating daily values for $V_{A,t}$ and $\sigma_{A,t}$.

Employing the calculated daily values of $V_{A,t}$ and $\sigma_{A,t}$ from this iterative process as well as T and L_t , the daily distance to default for each bank in Equation (5.1) will be computed.

The change in acquirer DD associated with a merger event is the difference in mean DD before the merger (over a-180 days to a-11 days relative to merger announcement date a) and mean DD after the deal completes (over c+11 days to c+180 days after the completion date c). This time window is suggested in Vallascas and Hagendorff (2011) as it helps to decrease the level of noise inherent in DD and to make sure that the projections of default risk are based on accounting data that relate to the period after the deal completion.

The change in DD for acquiring banks (ΔDD) can hence be expressed as:

$$\Delta DD = \overline{DD}_{(c+11;c+180)} - \overline{DD}_{(a-180;a-11)} \quad (5.6)$$

All of the model inputs are collected from Bloomberg. L_t is the book value of total debts from acquirers of the sample in the year before the merger announcement. The acquirers' historical daily prices of equity are gathered according to three time windows: (1) for the past twelve months before the acquisition occurs to calculate an annualised estimate of the equity volatility $\sigma_{E,t}$, (2) over a-180 days to a-11 days in relation to merger announcement date a and (3) over c+11 days to c+180 days subsequent to the completion date c. Equity prices for both time windows (2) and (3) are used to estimate the change in DD for bidders over these estimation periods. The annualised yield on two-year government bonds in the bidding bank's country is chosen to proxy for the risk-free rate r_{ft} . Finally, to assess whether bank M&As influence the change in default risk of acquirers, a t-test is performed on the mean and median of pre-merger and post-merger DD as well as the merger-related change in DD.

5.3.3 Model of the determinants of merger-related changes in bidders' default risk

Several deal-specific and firm-specific characteristics are employed to evaluate their influence on default risk changes via M&As. The model estimated via OLS with heteroscedasticity-consistent Huber–White standard errors, assumes the following specification:

$$\Delta DD_i = \alpha_0 + \gamma' DC_i + \theta' AC_{i,t-1} + \varepsilon_i \quad (5.7)$$

where:

ΔDD_i is the merger-related change in distance to default

$\gamma' DC_i$ is a (k x 1) vector of merger characteristics

$\theta' AC_{i,t-1}$ is a (j x 1) vector of bidder characteristics at the end of the fiscal year before the deal announcement and bidders' macroeconomic environment.

The vector of merger characteristics consists of the payment method, target's status (public or private), deal size, relative size, cross-border and product diversification. For the bidders' characteristics, measures of size and performance of acquirers (ROA), leverage, market to book and operating efficiency before the acquisition are taken into consideration. Regarding the acquirers' macroeconomic environment, the GDP real growth rate, the rule of law, political stability and the HHI is included in the model to evaluate the impact of country characteristics on the risk effects of acquisitions (Vallascas & Hagendorff, 2011). All explanations and justification of variables used in this chapter are explained in section 4.2.2 of Chapter 4.

5.4 Empirical Findings

5.4.1 Bank merger and acquiring banks' default risk

This section assesses the effects of bank mergers on bidders' default risk in general, and for specific types of mergers, in order to test this chapter hypotheses. Table 5.1 reports the DD of acquiring banks before and after mergers based on the global sample of 608 banks M&As.

Table 5.11: Bank Merger and Distance to Default

Bank mergers and distance to default (DD). The table reports mean (median) distance to default (DD) for a sample of acquiring banks. Distance to default before the merger is computed as the average of the distance to default over the period from -180 days to -11 days relative to the announcement date (a), while the distance to default after the merger is computed as the average distance to default over the period from +11 days to +180 days after the effective date (c). The change in the distance to default is the difference between the post-effective completion date and the pre-announcement period DD, winsorised at the 1%-level. The t-test evaluates if the mean, median DD and ΔDD are equal to zero. The higher the magnitude of t (either positive or negative), the higher the evidence against the null hypothesis that there is no significant difference.

	N	Mean (t-stat)	Median (t-stat)	$\Delta DD > 0$	
				N	%
DD: before merger (a -180, a -11)	608	3.747*** (66.676)	3.536*** (21.363)		
DD: after merger (c +11, c +180)	608	3.766*** (66.719)	3.573*** (21.363)		
ΔDD	608	0.02*** (7.457)	0.016*** (8.002)	397	65

**, * Denotes significance at 5%;10%

*** Denotes significance at 1%

The mean and median DD before mergers are 3.747 and 3.536 respectively and both are statistically different from zero (at the 1% level). As seen in the table, the mean and median DD after completion are both higher than those of DD before the announcement (3.766 and 3.573 respectively), with both statistically different from zero. This means that banks tend to have a higher

default risk pre-merger than post-merger. The mean and median change in DD is 0.02 and 0.016 correspondingly and is statistically different from zero (at the 1% level). Because DD is measured in standard deviations, it can be said that on average, acquiring banks improves about 0.02 standard deviations away from the default point post-merger compared to pre-merger period (they are less risky). Furthermore, it is observed that more than half of the bank mergers (65.3%) produce a positive change in DD which means a significant decrease in default risk following the deal. This finding is inferred the first hypothesis of this chapter, i.e. M&As lower bidders' default risk. Additionally, it adheres to the presumption from literature that the diversification of assets between two merging institutions that are imperfectly correlated should, without countervailing movement from management of acquirers, lead to the reduction in default risk for the combined firm, both theoretically (Amihud and Lev, 1981; Diamond, 1984), and empirically (Emmons et al., 2004; Koerniadi et al., 2015; van Lelyveld and Knot, 2009). The finding is also consistent with Koerniadi et al. (2015), as they find that on average, cross-border M&As decrease the level of default risk of acquiring firms. However, it contradicts Vallascas and Hagendorff's (2011) findings since their evidence suggests that M&As are risk neutral in their European bank mergers sample. Furfine and Rosen (2011) also reach the opposite conclusion by saying that North American firms observe an increase in their default risk post-merger. The differing results from other empirical research may be explained by choice of samples and examination periods in each study. This thesis covers a global sample with acquirers and targets coming from different markets, using developed, emerging and frontier markets within a long examination period (1998 and 2015). Furthermore, this sample contains M&As between banking acquirers and targets

coming from different sectors, such as insurance, security, investment services, mortgage finance and asset managers. Thus, it is reasonable to expect that M&A deals in this sample produce significant geographical and activity diversification benefits, which may explain the decrease in acquirers' default risk post-merger.

In the next step, the risk implications of bank M&As according to the type of deal examined. The potential for risk-reducing in mergers is especially noticeable for either cross-border or product-diversifying acquisitions, as both deal types have the potential to significantly reduce the volatility of profitability of bidding banks (Estrella, 2001; Boyd et al., 1993). Nevertheless, the integration process of merging firms after the completion of the deal involved in diversification might often lead to organisational complexity, and substantial changes in the strategy post-merger may prevent acquirers from realising the risk-reducing benefits associated with diversification.

Table 12: Bank Merger on Distance to Default, by Deal Type

Bank M&As on the distance to default, by deal type. Panel A reports the sample mean (median) of the distance to default (DD) for domestic and cross-border deals. Panel B reports the sample mean (median) of the same risk measures computed for focusing and diversified mergers. A merger is defined as product diversifying if bidder and target do not share the same four-digit ICB code. For each bank, distance to default before the merger is computed as the average of the distance to default over the period from -180 days to -11 days from the announcement (a), while the distance to default after the merger is computed as the average of the distance to default over the period from +11 days to +180 days after the completion date (c). Changes in the distance to default is the difference between the post-completion date and pre-announcement period DD, winsorised at the 1%-level. The t-test evaluates if the mean DD and ΔDD are equal to zero. The higher the magnitude of t (either positive or negative), the higher the evidence against the null hypothesis that there is no significant difference.

	Mean (t-stat)	Median (t-stat)	$\Delta DD >$ 0 (%)	Mean (t-stat)	Median (t-stat)	$\Delta DD >$ 0 (%)
Panel A: geographic diversification	Domestic (588 deals)			Cross-border (50 deals)		
DD: before merger (a -180, a -11)	3.24*** (64.190)	3.523*** (20.466)		3.996*** (18.392)	3.585*** (6.149)	
DD: after merger (c +11, c +180)	3.744*** (64.291)	3.555*** (20.466)		4.019*** (18.260)	3.638*** (6.149)	
ΔDD	0.019*** (6.972)	0.016*** (7.648)	65	0.030** (2.648)	0.010** (2.200)	62
Panel B: product diversification	Focusing (543 deals)			Diversifying (65 deals)		
DD: before merger (a -180, a -11)	3.758*** (63.87)	3.537*** (20.189)		3.656*** (19.507)	3.512*** (7.005)	
DD: after merger (c +11, c +180)	3.776*** (63.857)	3.563*** (20.189)		3.687*** (19.641)	3.621*** (7.005)	
ΔDD	0.020*** (6.539)	0.016*** (7.057)	64	0.032*** (3.974)	0.020*** (4.182)	75

** , Denotes significance at 5%;10%

*** Denotes significance at 1%

Table 13: Bank Merger on Distance to Default, Matched Sample

Univariate analysis- Matched sample. Bank M&As on the distance to default, by deal type. Panel A reports the sample mean (median) of the distance to default (DD) for domestic (matched sample) and cross-border deals. Panel B reports the sample mean (median) of the same risk measures computed for focusing (matched sample) and diversified mergers. A merger is defined as product diversifying if bidder and target do not share the same four-digit ICB code. For each bank, distance to default before the merger is computed as the average of the distance to default over the period from -180 days to -11 days from the announcement (a), while the distance to default after the merger is computed as the average of the distance to default over the period from +11 days to +180 days after the effective date (c). Changes in the distance to default is the difference between the post-effective date and pre-announcement period DD, winsorized at the 1%-level. The t-test evaluates if the mean DD and ΔDD are equal to zero. The higher the magnitude of t (either positive or negative), the higher the evidence against the null hypothesis that there is no significant difference.

	Mean (t-stat)	Median (t-stat)	$\Delta DD >$ 0 (%)	Mean (t-stat)	Median (t-stat)	$\Delta DD >$ 0 (%)
Panel A: geographic diversification	Domestic (50 deals)			Cross-border (50 deals)		
DD: before merger (a -180, a -11)	4.466^{***} (16.282)	4.188^{***} (6.088)		3.996^{***} (18.392)	3.585^{***} (6.149)	
DD: after merger (c +11, c +180)	4.475^{***} (16.423)	4.189^{***} (5.705)		4.019^{***} (18.260)	3.638^{***} (6.149)	
ΔDD	0.007 (1.959)	0.008^{**} (1.959)	67	0.030^{**} (2.648)	0.010^{**} (2.200)	62
Panel B: product diversification	Focusing (65 deals)			Diversifying (65 deals)		
DD: before merger (a -180, a -11)	3.993^{***} (19.709)	3.686^{***} (6.95)		3.656^{***} (19.507)	3.512^{***} (7.005)	
DD: after merger (c +11, c +180)	4.005^{***} (19.826)	3.732^{***} (6.95)		3.687^{***} (19.641)	3.621^{***} (7.005)	
ΔDD	0.013 (1.564)	0.010^{**} (2.43)	59	0.032^{***} (3.974)	0.020^{***} (4.182)	75

^{**}, ^{*} Denotes significance at 5%;10%

^{***} Denotes significance at 1%

Table 5.2 reveals the effects on DD of bidders that can be classified regarding geographical (domestic versus cross-border) or product diversification (focusing versus product-diversifying where acquirer and target do not have the same four-digit ICB code). Table 5.3 demonstrates the effects of M&As on acquiring banks' distance to default on the matched sample of cross-border and activity-diversifying deals. The matched sample is created to reasonably compare the effects of M&As on DD between domestic and cross-border deals, as well as between focusing and activity-diversifying deals, since the number of cross-border mergers and activity-diversifying deals are far less than those of domestic and focusing deals within the entire sample. Precisely, the chosen 50 deals in domestic mergers have the same characteristics as the 50 deals in cross-border mergers. Similarly, 65 deals in focusing mergers are selected to have the same characteristics with 65 product-diversifying mergers. The matched sample is based on the following criteria: (1) both domestic and cross-border mergers have to come from the same acquiring banks' country, (2) the announcement dates of both deals have to be less than one year apart and (3) the discrepancy between both acquiring banks' total asset has to be as small as possible (Moeller et al., 2004)

Panel A of Table 5.2 demonstrates geographic diversification. As seen, the mean and median change in DD, with regards to domestic bank mergers, is 0.019 and 0.016 respectively (statistically different from zero at 1% level). This indicates that domestic deals help to reduce bidders' default risk which is in contrast to Furfine and Rosen (2011) who find that domestic mergers in the U.S. raise the overall default risk for bidders. The difference in findings may come from the sample selection itself as Furfine and Rosen (2011) use only U.S. bidders,

whereas this chapter sample contains worldwide bidders. Concerning cross-border deals, the positive and significant mean and median change in DD (0.03 and 0.01 at 5% level of significance) shows that the acquirers' default risks decrease post-merger. This finding is in line with Koerniadi et al. (2015) who evidence that cross-border acquisition is one of the leading factors found to explain the reduction in default risk of institutions. Also, the mean DD of cross-border deals (0.03) is higher than the mean DD of domestic deals (0.019). As a reminder, the higher DD is, the higher the distance of a firm from default point is and the lower default risk. However, it is also observed that the positive change in DD of domestic deals is slightly higher than that of cross-border deals (65.59% compared to 62%). Moving onto Table 5.3, it is observed that the median change in DD of the matched sample of domestic mergers is slightly lower than that of cross-border deals. However, the recorded positive change in DD is at 67% compared to 62% of cross-border deals. This result differs from Choi et al., (2010) as they find that domestic deals in the banking industry are perceived to be less risky than cross-border deals from bondholders.

Panel B of Table 5.2 focuses on the effect of product diversification on distance to default. It is noticeable that the mean and median changes in DD, of both focusing and product-diversifying deals, are statistically different from zero at a 5% level. Furthermore, the positive change in DD of product-diversifying deals is higher than that of focusing deals (75.3% compared to 64%). According to Table 5.3, the median change in DD of the matched sample of focusing deals is less than that of activity-diversifying deals. Moreover, the positive change in DD of focusing deals is only 59% compared to 75% of activity-diversifying deals. This leads to a preliminary analysis of Hypothesis 5.2 that product-diversifying

mergers generate greater risk-reducing effects for acquiring banks in comparison to focusing deals. It may be the case that securities markets have begun to realise the benefits stemming from product-diversifying deals as well as appreciate financial conglomerates.

To enable further analysis of the risk effects, the entire data sample is divided into several sub-samples and analyses the change in the bidding banks' default risk. Table 5.4 reports the investigation of the sub-samples based on (A) deal value, (B) the home markets in bidders, (C) total assets and (D) ROA.

Table 14: Bank M&A on Distance to Default, Sub-sample Analysis

Bank M&A on the distance to default, sub-sample analysis. Panel A reports the sample mean (median) of the distance to default (DD) for high, medium and low deal value. Panel B reports the sample mean (median) of the same risk measures computed for mergers taken in emerging, developed and frontier market according to MSCI market classification. Emerging markets include Brazil, China, Russia, Malaysia, Korea, etc. Frontier markets include Argentina, Lithuania, Pakistan, Nigeria, etc. Developed markets are US, UK, France, Germany, etc. Panel C reports the sample mean (median) of the distance to default (DD) for high, medium and low bidders' total assets and Panel D reports the sample mean (median) of the distance to default (DD) for high, medium and low ROA. For each bank, distance to default before the merger is computed as the average of the distance to default over the period from -180 days to -11 days from the announcement (a), while the distance to default after the merger is computed as the average of the distance to default over the period from +11 days to +180 days after the effective date (c). Changes in the distance to default is the difference between the post-effective date and pre-announcement period DD, winsorised at the 1%-level. The t-test evaluates if the mean DD and ΔDD are equal to zero.

	DD: before merger (a -180, a -11)		DD: after merger (c +11, c +180)		ΔDD	
A: Deal value	Mean	Median	Mean	Median	Mean	Median
High deal value (203 deals)	3.89^{***} (34.91)	3.59^{***} (12.35)	3.90^{***} (34.87)	3.59^{***} (12.35)	0.01^{***} (3.03)	0.01^{***} (3.22)
Medium deal value (203 deals)	3.89^{***} (41.22)	3.82^{***} (12.35)	3.92^{***} (41.32)	3.85^{***} (12.35)	0.02^{***} (4.67)	0.02^{***} (4.51)
Low deal value (202 deals)	3.45^{***} (42.72)	3.36^{***} (12.32)	3.47^{***} (42.84)	3.38^{***} (12.32)	0.02^{***} (5.87)	0.02^{***} (6.32)

B: Markets						
Emerging markets (55 deals)	3.22^{***} (18.88)	3.15^{***} (6.44)	3.26^{***} (18.99)	3.15^{***} (6.44)	0.05^{***} (3.60)	0.03^{***} (3.19)
Developed markets (539 deals)	3.81^{***} (63.67)	3.64^{***} (20.11)	3.82^{***} (63.63)	3.65^{***} (20.11)	0.01^{***} (6.42)	0.02^{***} (7.39)
Frontier markets (14 deals)	3.33^{***} (9.98)	3.04^{***} (3.26)	3.37^{***} (9.83)	3.02^{***} (3.26)	0.04 (1.49)	-0.01^{***} (0.56)
C: Total assets						
High total assets (203 deals)	4.03^{***} (34.21)	3.68^{***} (12.35)	4.05^{***} (34.21)	3.66^{***} (12.35)	0.02^{***} (3.55)	0.01^{***} (3.76)
Medium total assets (203 deals)	3.85^{***} (45.45)	3.84^{***} (12.35)	3.88^{***} (45.37)	3.86^{***} (12.35)	0.03^{***} (4.79)	0.02^{***} (5.09)
Low total assets (202 deals)	3.35^{***} (42.72)	3.26^{***} (12.32)	3.37^{***} (42.82)	3.29^{***} (12.32)	0.02^{***} (4.66)	0.02^{***} (4.99)
D: ROA						
High ROA (203 deals)	3.79^{***} (36.38)	3.50^{***} (12.32)	3.82^{***} (36.41)	3.56^{***} (12.32)	0.03^{***} (4.50)	0.02^{***} (4.04)
Medium ROA (203 deals)	3.84^{***} (43.26)	3.59^{***} (12.35)	3.86^{***} (43.44)	3.63^{***} (43.44)	0.02^{***} (4.11)	0.02^{***} (4.69)
Low ROA (203 deals)	3.61^{***} (36.76)	3.51^{***} (12.35)	3.62^{***} (36.69)	3.50^{***} (12.35)	0.02^{***} (4.88)	0.01^{***} (5.40)
** , * Denotes significance at 5%;10% *** Denotes significance at 1%						

Panel A of Table 5.4 focuses on deal value, differentiating between high, medium, and low deal values. The results of the computations show a statistically significant, positive change in DD for the bidding banks for all of the sub-samples based on the deal size. The default risk-reducing effect of bank consolidation is therefore common to all of the deals, regardless of the deal value. This is an exciting finding because the literature tends to find that larger deal value increases the risk profile of acquirers post-merger because more significant deals can also stimulate banks to involve in more risk-taking (Knapp et al., 2005; Vallascas and Hagendorff, 2011).

Panel B differentiates among the mergers in emerging markets, developed markets and those in the frontier markets¹⁴. It is expected that mergers in emerging markets and frontier markets are to be primarily motivated by growth considerations and thus will have more risk-reducing effects than mergers in developed countries. The results of the estimations, however, reject this expectation as bidding banks in frontier markets show an insignificant negative median change in DD. This insignificance may be because there are only 14 acquirers in frontier markets. However, it can also be argued that because the frontier market has lower market capitalisation and less liquidity than emerging markets, acquirers in frontier markets experience higher default probability than those in emerging and developed markets. Conversely, bidding banks in developed and emerging markets show significant and positive mean and median change in DD. This means that mergers reduce the default risk of bidding banks in those markets.

Furthermore, Panel C presents the results of the investigation based on acquirers' total assets. The bidding banks' pre-merger level of total assets is used as a proxy for bank size. It is seen that positive and significant mean and median change in DD are observed, and therefore, the reduction in default risk post-merger can also be detected for all bank size levels. Particularly, medium banks experience a significant decrease in default risk due to a merger. Significantly,

¹⁴ Frontier market is a type of emerging market. A frontier market is considered to have lower market capitalisation and less liquidity than many emerging markets. Frontier markets countries include: Argentina, Bahrain, Bangladesh, Burkina Faso, Benin, Croatia, Estonia, Guinea-Bissau, Ivory Coast, Jordan, Kenya, Kuwait, Lebanon, Lithuania, Kazakhstan, Mauritius, Mali, Morocco, Niger, Nigeria, Oman, Pakistan, Romania, Serbia, Senegal, Slovenia, Sri Lanka, Togo, Tunisia and Vietnam.

the results conflict with those investigating the effects of M&A on acquirers' systematic risk and contribution to systemic risk. The importance of bank size is noted as the primary contributor to the increase in systematic risk (Casu et al., 2015) and acquirers' contribution to systemic risk (Weiß et al., 2014). The positive and significant change in the DD of large banks shows that merger also decreases default risk of large banks. Therefore, consolidations among banks do help to reduce the default risk of bidders, regardless of their size.

In the last panel D, the ROA ratios of bidders are used as a proxy for bank profitability performance as in Hagendorff and Nieto (2015). Significant merger-related reduction in bidders' default risk post-merger is observed for all profitability performance levels. When looking at the absolute magnitude of these decreases in default risk, one can see that the decrease in the acquirers' default risk is the largest for bidders with high profitability performance (high ROA) before a merger. The results are consistent with the notion that higher profitability performance creates a larger buffer, providing greater ability to absorb adverse shocks to asset values and greater ability to rebound as conditions improve. If a bank absorbs an adverse shock with low liquidity buffers, it may be subject to considerable stress in order to obtain liquidity in the market short term, whereas banks with large liquidity buffers will have time to demonstrate their underlying solvency to the market. If a bank is insolvent after an adverse shock, the supervisors will likely have more time to respond to the insolvency if the bank is more liquid. Changes in the bank profitability performance should be of interest to supervisors, regardless of whether the changes were caused by the merger or whether the merger simply facilitated changes that the acquirer's management already wanted to implement (Hagendorff and Nieto, 2015).

Finally, in the next table, it is investigated bank consolidations that were completed in the period of pre-crisis prior to 2007, merger deals that were completed during the financial crisis from 2007 to 2009 and deals that were completed after 2009. The findings demonstrate that during the global financial crisis, statistically significant and negative ΔDD can be observed, indicating that default risk raises substantially in both global and U.S. samples. These findings promote the view that bank mergers in periods of financial crisis can, among other determinants, be stimulated by government safety net, and a bank manager's desire to become TBTF; hence producing a raise in default risk. However, in the pre-crisis and post-crisis periods, significant decreases in default risk are noticed for acquirers, in the global, U.S. and non-US samples. The main discovery in this respect, is that bank mergers during the financial crisis do not produce default risk reducing effect for bidders as expected. Rather, it makes bidders riskier and more fragile.

Table 15: Sub-sample Analysis: The effect of the 2007-09 global financial crisis

Bank M&A on the distance to default, sub-sample analysis. This table reports the mean of the change in distance to default (ΔDD), taken into account the pre-crisis period, the 2007-09 financial crisis period as well as the post crisis period for various regions: global, U.S. and non-US countries. For each bank, ΔDD is the difference between the post-effective date and pre-announcement period DD, winsorised at the 1%-level. p-value is denoted in parentheses.

	Global		US		Non-US	
	N		N		N	
Pre-crisis	372	0.02*** (0.00)	281	0.02*** (0.00)	91	0.03*** (0.00)
Crisis	78	-0.02** (0.02)	51	-0.04*** (0.00)	27	0.02 (0.40)
Post-crisis	158	0.03*** (0.00)	120	0.04*** (0.00)	38	0.02 (0.18)

**, * Denotes significance at 5%;10%

*** Denotes significance at 1%

In conclusion, the results from the analysis of sub-samples above show that the default risk-reducing effect of M&A is common among deals and acquirers regardless of deal value, size, performance or geographical diversification and product diversification. Therefore, the Hypothesis 5.1 of this chapter, which projects that M&A reduce acquirers' default risk, is inferred. To control for possible correlations between these variables and biases, originating from omitting macroeconomic control variables, a multivariate analysis of the factors that drive the changes in acquirers' default risk is performed. Therefore, the question of how the merger-related changes in acquirers' default risk can be explained in the cross-section by a set of the deal and idiosyncratic bank characteristics as well as the variables on the mergers' macroeconomic environment will be discussed in the next section.

5.4.2 The determinants of merger-related changes in default risk

To assess the robustness of the univariate tests above, this part examines if certain types of deal and acquirer characteristics influence and can explain for the default risk reduction post-merger of acquirers in the sample. It is expected that cross-border deals and diversifying deals play a role in justifying the risk-reducing effects of mergers as hypothesised. The results are produced by regressing ΔDD of acquirers after merger on independent and control variables capturing specific deal and acquirer characteristics and acquirer's macroeconomic environment (see Equation (5.7)). The outcomes are displayed in Table 5.6 below and reveal several interesting findings.

Table 5.6: Changes in distance to default

Changes in distance to default: deal characteristics, acquirer characteristics and acquirers' macroeconomic environment. The dependent variable is the change in distance to default. The model is estimated via OLS with heteroskedasticity-consistent Huber–White standard errors. Model (1) uses all acquirers with acquirers and deal characteristics and country controls. Model (2) uses the same sample of acquirers but with only acquirers and deal characteristics. Model (3) uses US acquirers with both acquirer and deal characteristics. All variables and data sources are defined in chapter 4. Statistically significant coefficients are highlighted in bold type. The p-values are denoted in parentheses

	(1) All banks	(2) All banks	(3) US banks
<i>Panel A: Acquirers and deal characteristics</i>			
Product diversification	0.0158 *	0.0152 *	0.0072
	(0.0620)	(0.0775)	(0.4568)
Cross-border	0.0126	0.0119	0.0031
	(0.3218)	(0.3417)	(0.9044)
Payment method	0.0020	0.0038	0.0015
	(0.7190)	(0.4891)	(0.7873)
Status of target	-0.0316	-0.0364	-0.0168 **
	(0.4408)	(0.3686)	(0.0233)
Deal size	-0.0029 **	-0.0032 **	-0.0023
	(0.0444)	(0.0202)	(0.1628)
Relative size	0.0000	0.0000	0.0000
	(0.4260)	(0.4357)	(0.6750)
ROA	0.0126 **	0.0138 **	0.0125 *
	(0.0338)	(0.0192)	(0.0750)
Market to book ratio	-0.0035	-0.0027	-0.0037
	(0.4739)	(0.5722)	(0.4935)
Leverage	0.0000	0.0000	-0.0009 *
	(0.9786)	(0.9452)	(0.0911)
Operating efficiency	-0.0007	0.0006	-0.0052
	(0.8312)	(0.8561)	(0.1551)
<i>Panel B: Country control</i>			
GDP	0.0002		
	(0.9010)		
HHI	0.0084		
	(0.8321)		
Political stability	-0.0119 *		
	(0.0942)		
Rule of Law	-0.0013		
	(0.8690)		
Constant	0.0612	0.0543	0.0571
	(0.1648)	(0.2079)	(0.0049)
R-squared	0.0485	0.0384	0.0245

Adj. R-squared	0.0259	0.0222	0.0022
Number of observations	608	608	452

** , * Denotes significance at 5%;10%
*** Denotes significance at 1%

Regression (1) and (2) of Table 5.6 estimates the relationship between the changes in the acquirers' distance to default and acquirer and deal characteristics as well as with and without country control respectively for the full sample of bank mergers.

The first independent variable, product diversification, has a positive and statistically significant coefficient (at 10% level of confidence) in both regressions. It indicates that product-diversifying deals help to decrease acquirers' default risk following a merger. Therefore, the Hypothesis 5.2 of this chapter, which projects that product-diversifying deals produce a default risk-reducing effect, cannot be rejected. This finding is consistent with a handful of theoretical studies (Amihud and Lev, 1981; Diamond, 1984) and empirical studies (van Lelyveld and Knot, 2009) regarding the diversification hypothesis which suggests that the combined banks will benefit from default risk reduction, no matter how diversification is achieved, and as long as the asset diversifications are not perfectly correlated. In terms of Hypothesis 5.3, which projects that acquiring banks decrease their default risk more when targeting cross-border banks as opposed to domestic ones, the coefficients of the cross-border variable in both regressions are insignificant. Therefore, Hypothesis 5.3 is rejected. This finding contradicts with Koerniadi et al. (2015) who evidence that cross-border acquisition is one of the leading factors used to explain the reduction in default risk of institutions.

With respect to control variables, deal size has a statistically significant negative coefficient (at 5% level) in both regressions. In other words, acquirers conduct large M&A deals witnessing their default risk profile increase after a

merger. This finding is consistent with the notion in literature that large bank mergers pose organisational and procedural hurdles in the post-merger integration process that may prevent merger benefits from materialising (Knapp et al., 2005) or that as banks grow via M&A; they also take on more risk (Hughes et al., 1999). Moreover, Beck et al. (2006) warned that an increasing bank size due to M&A activities might result in lower transparency as consolidation allows banks to expand around various geographic markets and business lines, employing sophisticated financial means to established complex corporations. It is also consistent with banks facing incentives, to use mergers to become 'too big to fail' in an attempt to extract benefits from regulators. One can argue that the size of the deal could have a reducing effect on the default risk of bidders because it could enable larger banks to diversify their asset and credit portfolio more efficiently. Additionally, larger deals could facilitate collusion among the remaining competitors, thus increasing profits and ultimately reducing the acquirers' risk. However, the results show that this is not the case. This finding is also in line with Vallascas and Hagendorff (2011) who find the negative impact of deal size on the risk effects of M&A. Overall, the result complies with the univariate test above, in which deal size poses a significant influence on the risk effects of bank mergers.

Pre-merger profitability performance, as proxied by the acquirers' ROA in the pre-merger period, has a statistically significant positive coefficient (at 5%) in both regressions. It indicates that the higher the level of profitability performance of acquiring banks before a merger, the more the default risk reduction is observed following a bank merger. One can debate that it is possible for acquiring banks to temporarily boost pre-merger levels of ROA to enhance its ability to

obtain supervisory approval for the takeover, thereby casting doubts on the significance of ROA to explain risk-reduction effects of M&A. Also, Vallascas and Hagendorff (2011) report the insignificant coefficient of ROA in their sample, indicating that ROA does not have the explanatory power to explain the change in default risk within their sample. Nevertheless, this finding supports the notion that a larger capital buffer, generating from higher profitability performance, enhances a bidder's ability to absorb adverse shocks to asset values and a far improved ability to recover when the market conditions improve. To summarise, this finding is consistent with the univariate test above, that profitability performance of acquiring banks pre-merger significantly and positively influence the risk-reduction of bank mergers.

Regression (3) only uses the 452 mergers of U.S. banking acquirers to check the results on the relation between the acquirer and deal characteristics and the change in DD when non-U.S. bidders are excluded. The status of target variables witnesses a negative and statistically significant coefficient. It indicates that private target is a determinant of the increase in acquirers' default risk post-merger, as hypothesised. Indeed, mergers involved in private targets are projected to produce default risk-increasing effect for acquirers because private firms are subject to lower disclosure requirements; hence, it restricts the acquirers' capabilities to evaluate the risks associated with private targets themselves, as well as making acquirers' due diligence ineffective. Therefore, the acquisitions of hidden risks from target firms may contribute to the increase in acquirers' default risk (Furfine and Rosen, 2011).

The ROA as a proxy for bank profitability performance is found again, to be significantly positively related to the merger-induced change in the acquirer's

distance to default; although the coefficient is weak at 10% level of confidence. Deal size, on the other hand, is not significant in this case. It means that for U.S. acquirers, mega-mergers do not contribute to the increase in their default risk post-merger, in contrast to acquiring banks from other countries. The regression also witnesses a weak negative and significant coefficient of leverage, which suggests that the more leveraged a bank is, the more likely it is that acquirers might witness the increase in their default risk post-merger. This is consistent with the notion that high leverage puts pressure on the executive to produce high and sufficient cash flows for interest payments; urging them to engage in risky transactions and thereby raising their default risk (Berger & Bonaccorsi di Patti, 2006). Also, as a preliminary test which is not included in the main content of this chapter, the effect of leverage on non-US banks is investigated and no statistically significant coefficients are found.

In short, all the regressions affirm the findings on the univariate test above, thereby, inferring Hypotheses 5.1 and 5.2, that M&As, as well as product-diversifying deals, reduce acquirers' default risk. Hypothesis 5.3 is, however, rejected as the coefficient of the cross-border variable is insignificant. When examining the influence of potential factors that are anticipated to have an impact on the change in bidding banks' default risk after the deal completion, deal size, ROA and status of a target are all found to be significant determinants. First, large deals prevent acquirers in realising the risk-reduction effects associated with M&As. Also, bidding banks with higher levels of pre-merger profitability observe more default risk reduction following the deal. Only in the US, private targets contribute to an increase in acquirers' default risk post-merger. To test the robustness of the results obtained in the empirical analysis, it requires the need

to control for a possible heteroscedasticity in the regression, which is currently estimated using Huber–White standard errors. As an alternative, all regressions are re-estimated using Generalized Least Squares (GLS) to correct for possibly inefficient regression coefficient estimates and heteroscedasticity. It is found that the conclusions drawn from the OLS regressions with Huber–White standard errors remain unchanged.

5.5 Conclusion

In conclusion, this chapter examines the impact of bank mergers on bidders' default risk on a global sample. Additionally, it utilises a direct measure of default risk, namely the Distance to Default as in Vallasas and Hagendorff (2011). Academic literature so far has debated the risk implications of bank mergers on acquirers and the determinants of the changes in bidders' default risk. This chapter, for the first time, extends literature by examining the risk effects of the different types of bank M&As, namely product diversification and geographic diversification on bidders' default risk. In addition, it is the first to study the risk implications of bank mergers on a global sample which allows for experimentation with rich variation in the indication and level of changes in bidders' risks witnessed across the deals; thereby possibly yielding interesting results. Furthermore, this chapter provides original evidence in academic literature with regards to the determinants of merger-related changes in bidders' default risk, examining acquirers' characteristics, deal-specific characteristics and bidding banks' macroeconomic environment. Employing a comprehensive and latest global sample of bank M&As from 1998 to 2015, this study provides new insight on the phenomenon, with findings that lead to various implications for policy makers and bank managers, as well as to broader academic literature.

Overall, the findings show that bank mergers significantly and positively affect acquirers' default risk. In other words, bank mergers reduce the default risk of acquiring banks, thereby agreeing with the first Hypothesis 5.1 of this chapter. This finding complies with other theoretical and empirical studies from literature, which suggest that mergers lead to the reduction in default risk for the combined firm (Amihud and Lev, 1981; Diamond, 1984; Emmons et al., 2004; Koerniadi et

al., 2015; van Lelyveld and Knot, 2009 and Koerniadi et al., 2015). However, it differs from Vallascas & Hagendorff (2011) and Furfine & Rosen (2011), since their evidence suggests that M&As are risk-neutral in European bank mergers and increase default risk for North America firms respectively.

With respect to independent variables, the findings show a greater default risk reduction for acquirers who are witnessed in product-diversifying deals following a merger, compared to focusing deals. Therefore, the Hypothesis 5.2 of this chapter, which hypothesises the greater impact of activity-diversifying deals on acquirers' default risk reduction, is supported. Nevertheless, cross-border variable enters all specifications with statistical insignificance at the conventional level of significance within regressions. Therefore, the Hypothesis 5.3 of this chapter, which predicts that cross-border deals reduce bidding banks' default risk post-merger, more than domestic deals, is rejected.

Other control variables such as deal size, ROA, status of a target and leverage, are all found to play essential roles. Initially, large deals prevent acquirers in realising the risk-reduction effects associated with M&As. The finding that deal size demonstrates an adverse influence on the change in distance to default, raises concerns about the risk implications of banking mega-mergers on banking sector stability. The importance of bank size is noted as the primary contributor to systematic risk (Casu et al., 2015). Besides, bidding banks with a higher level of profitability performance before merger observes more default risk reduction following the deal. These findings are consistent with the perception that higher profitability performance creates a more substantial buffer, providing improved ability to absorb adverse shocks to asset values and greater ability to rebound as conditions improve. For US acquirers, private targets contribute to an

increase in acquirers' default risk post-merger. Mergers involved in private targets are projected to produce default risk-increasing effect for acquirers because private firms are subject to lower disclosure requirements; hence, it restricts the acquirers' capabilities to evaluate the risks associated with private targets themselves, in addition to making acquirers' due diligence ineffective. Accordingly, the acquisitions of hidden risks from target firms may contribute to the increase in acquirers' default risk (Furfine & Rosen, 2011). Finally, for US acquirers, the more leveraged a bank is, the more likely it is that acquirers might witness an increase in their default risk post-merger.

The findings from this chapter result in some policy implications for worldwide regulators and policymakers. First, bank M&As are activities that can bring default risk reduction for bidding banks. However, regulators and supervisors should still consider the costs and benefits of bank mergers carefully and impose appropriate control in order to enhance the stability of financial systems. On one side, mergers involving bidding banks with a higher level of profitability or product diversification should be encouraged as they reduce acquirers' default risk. On the other side, the presence of a significant and negative deal size effect leads to a policy implication that mega-mergers in the banking industry should be subject to higher regulatory scrutiny. History shows that large conglomerates utilise their political influence to deteriorate regulatory control and avoid constraints on activities (Carow & Kane, 2002) if they have a competitive disadvantage to their counterparts.

Bank managers will also find this study beneficial because it assists them in making appropriate consolidation decisions. Specifically, they should consider a bank's profitability position before deciding to merge, as it can alter their risk

profile. Furthermore, if a bank is subject to a high risk of default, bank managers can consider conducting activity-diversifying mergers in order to reduce their default risk, whereas, managers of high-risk banks should not involve in mega-mergers and private targets as they deteriorate their risk position.

Chapter 6: The Effects Of M&As on Acquiring Banks' Contribution To Systemic Risk

6.1 Introduction

The overall aim of this chapter is to deliver an empirical analysis regarding the effect of international bank M&As on acquirers' contribution to systemic risk. A crucial regulatory lesson gained from the 2007-09 global financial crisis has been the prerequisite to devote greater attention toward financial stability due to the systemic risk faced by banks. Dilemmas relating to portfolios of subprime mortgages developed into a systemic crisis, deteriorating financial firms and markets across the globe triggering a severe economic recession. Consequently, the development of improved protection against systemic risk has arisen as a regulatory priority, with the aim of strengthening the macroprudential orientation of financial stability frameworks. Sub-prime mortgage lending in the US, along with the 2007-09 global financial crisis, has also revived enthusiasm amongst academics on these issues. This has led to a generation of a wide range of papers focusing on systemic risk measurement and its threat to the stability of the banking sector (see Acharya et al., 2017; Black et al., 2016; Maria et al., 2016; Ellis et al., 2014). For instance, De Jonghe (2010) noticed substantial variety in banks' contributions to the overall stability of the banking industry. This finding is not surprising given the significant developments over the last three decades. Significant banking M&As, the abolition of the legal barriers to the unification of financial services, and technological advancement have all affected the organisational design of banking institutions. These developments result in the emergence of very large and complex banking firms (the TBTF) and financial conglomerates. De Nicolo and Kwast (2002) and De Nicolo et al. (2004) argue

that consolidation and conglomeration activities that create giant financial firms are important factors, which increase systemic risk. Indeed, empirical studies that examine systemic risk issues related to bank or insurance M&As activities, either by looking at a firm's expected shortfall in an undercapitalized market or information on firm's stock and market index, indicate that systemic risk has increased in recent years. This is due to consolidation trends (Lim et al., 2015; Mühlnickel and Weiß, 2015; Weiß et al., 2014).

Extensive research about the effect of bank M&As on acquirers' contribution to systemic risk leads to mixed findings due to using different samples, time frames, methodologies and the parameters employed. Before the financial crisis, the so-called "concentration-stability" hypothesis, which predicts that banking system concentration diminishes fragility, has received theoretical support from Diamond (1984), Allen & Gale (2000b, 2004a), and empirically, from Beck et al., (2006). Based on this hypothesis, large banks with a high concentration are found to be less volatile because they might be more fruitful, easier to oversee, well diversified and, accordingly, less susceptible to market shocks. Promoters of this hypothesis also assert that bank M&As harmonise with a reduction in the bidders' default risk; hence systemic risk decreases, and the financial soundness of the whole banking system is enhanced. In contrast, Caminal and Matutes (2002) and De Nicolo et al., (2004) defend the 'concentration-fragility' hypothesis and regard bank M&As as a probable cause for the increase in systemic risk. This is because the hypothesis anticipates more volatility associated with a concentrated banking structure with several large corporations. These corporations might take excessive risks due to implicit TBTF

schemes or preferences, expected risk return trade-off (Berger, 2000; Mishkin, 1999).

After the global financial crisis, substantial evidence emerged with a significant increase in acquiring banks' contribution to systemic risk as a result of M&A (Weiß et al., 2014). Similarly, Wagner (2010) asserts that diversification causes systemic crises, due to financial institutions becoming more co-dependent as a result of similar business lines, common exposures and portfolios of investment following mergers. Additionally, bank mergers may be motivated by regulatory incentives that aim to gain TBTF status, thus increasing the combined banks' contribution to systemic risk (e.g., Berger, 2000).

As noted in the study of Weiß et al., (2014), when their samples exclude mergers between bank and non-bank financial firms, such as securities firms and insurance firms, it leaves their analysis of probable new insights as large insurers, such as American International Group (A.I.G.) are at the centre of the global financial crisis 2007-09. Furthermore, to the best of the author's knowledge, no previous study has investigated the effects of bank mergers on acquiring banks' contribution to systemic risk using samples containing both focusing and product-diversifying mergers. Therefore, this chapter attempts to fill this gap. These above debates also serve as a motivation to investigate the effects of M&As on bidding banks' contribution to systemic risk. Employing a global sample of 608 bank M&A deals from 1998 to 2015, this chapter applies two reliable, well-known and strong approaches Marginal Expected Shortfall from Acharya et al., (2017) and ΔCoVaR from Adrian and Brunnermeier (2016), to measure the contribution to the systemic risk of acquiring banks. Furthermore, it provides original evidence on

the determinants of merger-related changes in bidding banks' contribution to systemic risk.

This chapter provides three main contributions to M&As literature. First, the findings suggest that M&As, on average, do not impact on acquiring banks' contribution to systemic risk. This result significantly contradicts existing literature, which tends to find that mergers increase the bidder's contribution to systemic risk (Molyneux et al., 2014; Mühlnickel and Weiß, 2015; Uhde and Heimeshoff, 2009). The first hypothesis of this chapter, which predicts that mergers generate systemic risk-reducing effect for acquiring banks, is therefore is rejected.

Furthermore, this is the first study to shed light on the effects of product diversification on acquirers' contribution to systemic risk. Previous studies tend to investigate the influence of specific types of bank mergers on the bidder's contribution to systemic risk, such as bank consolidation, as in Weiß et al., (2014) and insurance consolidation, as in Mühlnickel and Weiß (2015). By including mergers among banks and other non-bank institutions, such as insurance companies, securities, brokerages and credit institutions, this sample offers potentially large diversification benefits. These diversification benefits are further underpinned by many policy initiatives in many countries across the globe, and are aimed at promoting conglomerates which have substantially lowered the entry barriers for banks when engaging in product diversification (refer to section 2.3, Chapter 2). This chapter hypothesises that product-diversifying mergers contribute more to the reduction in systemic risk than focusing on deals. This is due to the substantial, potential of risk diversification benefits. The results show that product-diversifying deals lead to a reduction in acquirers' contribution to

systemic risk for non-US acquirers only. Thus, the second hypothesis of this chapter cannot be rejected.

Finally, this chapter provides original evidence for the underlying factors that influence the changes in bidders' contribution to systemic risk. Specifically, it predicts that a cash-financed merger has a more risk-increasing effect on a bank's contribution to systemic risk than other payment methods. It transpires that with deals financed by cash only, the acquirers' contribution to systemic risk increase. These results are in line with the perception that deals which are fully paid for in cash are expected to raise acquiring banks' default risk as acquirers replace safe liquid assets (cash) with riskier balance sheets of targets; thereby increasing acquirers' contributions to systemic risk (Furfine and Rosen, 2011). Hence, the third hypothesis of this chapter cannot be rejected. In addition, other controlled variables determining the reduction in acquirers' contribution to systemic risk include a concentrated banking system (HHI) and a stable political environment. In contrast, the factors that contribute to the increase in systemic risk include private targets, a small relative deal size to acquirers' value and TBTF motive.

The remaining chapter will be organised as follows. Section 6.2 discusses existing literature of the systemic risk implications of bank mergers, theoretically and empirically, paying particular attention to the concept of systemic risk, various models of systemic risk in the banking industry and two existing hypotheses regarding banking concentration and systemic risk. Section 6.3 describes various models that compute bidders' contributions to systemic risk, including the two models used in this chapter. A detailed analysis of the results is included in section 6.4 followed by a conclusion and study implications in section 6.5.

6.2 Literature Review

The current aim of this section is to examine the extant body of academic literature on systemic risk and bank M&As. The first part discusses about the definitions of systemic risk in addition to the financial fragility hypothesis. The second part reviews the different models of systemic risk in banking, followed by discussions of two hypotheses on bank concentration and systemic risk ('concentration stability' hypothesis and 'concentration fragility' hypothesis). Finally, a summary of the literature concerning the effects of bank M&As on systemic risk is presented, which at the same time sets the foundations for the hypotheses laid out in this chapter.

6.2.1 The systemic risk concept

6.2.1.1 Definitions of systemic risk

The perception of systemic risk is fundamentally important in order to enhance the soundness and stability of the financial system. However, it is difficult to generally define systemic risk. An excellent discussion about the definition of systemic risk in DeBandt & Hartmann (2000, p.10) covers almost all definitions explicitly and implicitly. First, they define a systemic event in a narrow perception as an event, where the announcement of 'bad news' regarding a firm, or even its collapse, or the breakdown of financial market, results in substantial negative influences on one, or some, other firms or markets. for instance, their collapse or crash. Based on this, a systemic crisis can be defined as 'a systemic event that strongly affects a considerable number of financial institutions or markets, thereby severely impairing the general well-functioning of an important part of the financial system.' Therefore, 'systemic risk can then be defined as the risk of experiencing systemic events in the strong sense.' Fundamentally, the

range of systemic risk varies from single systemic events that influence only one firm or one market to the threat of having wide systemic events that influence many more firms and markets. Therefore, systemic risk's geographical extent can be regional, nation-wide or worldwide (DeBandt and Hartmann, 2000, p.10).

The main component of this systemic risk' definition, the systemic event, comprises two significant components itself: shocks and spread mechanism. Based on financial theory, shocks can be idiosyncratic or systematic. Theoretically, idiosyncratic shocks are those that, initially, influence a single financial firm or the value of a single asset. For instance, the default of a single regional bank due to internal fraud can cause idiosyncratic shock to a financial system nationwide. Systematic shocks, on the other hand, influence the entire economy or all financial firms simultaneously. Examples of these widespread shocks include an unexpected increase in the inflation rate or the crash of a stock market. Since investors can diversify their portfolios to protect themselves from idiosyncratic shocks, these shocks are insurable. In contrast, systematic shocks are non-diversifiable (DeBandt and Hartmann, 2000).

The second main component of systemic events is the mechanism via which shocks spread from one financial firm or market to the other. This is regarded as the core of systemic risk concept. From a theoretical viewpoint, it is essential that the spread of shock is a natural part of the self-stabilising amendments of the market structure to a new equilibrium. Both the occurrence of shock, and its successive spread, are unpredictable. Therefore, the significance of systemic risk has two magnitudes: the harshness of systemic events and the probability that they occur. Systemic crises (strong systemic events) are low possibility incidents, which might cause researchers or regulators

to regard them with less concern. Nevertheless, when a systemic crisis arises, the costs can be incredibly enormous.

More recently, Schwarcz (2008, p.204) attempts to encompass a number of existing definitions of systemic risk, defining that "the risk that (i) an economic shock such as market or institutional failure triggers (through a panic or otherwise) either (x) the failure of a chain of markets or institutions or (y) a chain of significant losses to financial institutions, (ii) resulting in substantial financial-market price volatility (which price volatility may well reflect increases in the cost of capital or decreases in its availability)." Therefore, it is important that systemic risk must be differentiated from deteriorations that result from regular market fluctuations. Even these deteriorations are occasionally united with systemic risk; they are more accordingly classified as a systematic risk that is not diversifiable and thus, affect most market participants. Despite the fact that regulators urge the management of systemic risk, it is crucial not to restrain market freedom using methods that prevent systematic risk, since systematic risk promotes market equilibrium and hinders excessive interest rates or periods of inflation.

6.2.1.2 The "financial fragility hypothesis."

Worldwide researchers broadly agree that systemic risk has a non-linear domino effect that threatens the whole financial system (Ding et al., 2017). While, contagion might happen in other areas of the economy, its probability and harshness are usually considered as relatively higher within financial systems. A big systemic crisis in the financial system may have a strong detrimental effect on the health of the broad economy. Therefore, one of the most compelling questions regarding systemic risk, is why it is viewed as a more significant concern for banking institutions and the financial system compared to other

industries. The 'financial fragility hypothesis' is based on the following three inter-related characteristics of banking and finance systems: (1) the operation of banks, (2) the interconnectedness of financial firms through direct exposures and settlement systems and (3) the intensity of information regarding financial contracts and related credibility issues.

First, commercial banks conventionally take deposits which can be withdrawn entirely, at considerably short notice, and lent to industrial firms long-term (Bryant, 1980; Diamond and Dybvig, 1983). Commonly, if the number of deposits is large, only small portions of assets need to be held in liquid reserves to meet deposit withdrawals. This portioned reserve holding can result in illiquidity, and even collapse, when abnormally high withdrawals occur, and long-term loans cannot be liquidated, even though the banking firm may be solvent in the long term. Therefore, the well-being of a bank depends on many factors: its triumph in selecting profitable projects for lending, the depositors' confidence in the value of the loan book, and most significantly, their confidence that other depositors will not run the bank. Nowadays, deposit insurance schemes are implemented in most industrialised nations, protecting depositors. Therefore, it is less likely that confidence crises may arise. It is noted that this particular feature of banks does not apply to most other financial intermediaries, for instance, securities firms and insurance firms, because of different operational structures (see Goodhart et al., 1998). Nevertheless, in the financial conglomerate revolution, which allows banks and other intermediaries to operate under the same corporate umbrella, non-bank intermediaries' issues may still cause a bank's instability.

Second, banks play a critical role in retail and wholesale payment and in settlement systems. Regarding the interconnectedness of financial firms, there is a complicated system of exposure among banking firms, and possibly other financial intermediaries, via the interbank money market, wholesale payments and security settlement systems (Folkerts-Landau, 1991). At specific times during business hours, these exposures can be extremely enormous; thus, if a bank fails to meet their payment obligations, this can result in instantaneous influence on the ability of other banks to meet their payment commitments. As such, several risk management measures are used, such as margin requirements and portfolio insurance in stock markets and derivatives markets, in order to reduce the potential for contagion within payment and settlement systems. These risk measurements can also account for substantial and immediate payments required by banks and other intermediaries.

Finally, the third component is the information and control intensity of financial contracts (e.g. Stiglitz, 1993), whereby financial decisions are based on anticipating the future value of a respective asset or on whether the future cash flows expected in a financial contract are going to be met. Therefore, when ambiguity arises, or the credibility of a financial promise is challenged, the expectations of the market might change significantly within a short time, thereby resulting in investment and disinvestment decisions.

These three characteristics act as the principal sources used to explain why the banking and finance industry are more vulnerable to systemic risk than other areas of the national economy. To understand the process of how systemic risk occurs within the banking system, the next section provides a more detailed

discussion regarding different bank run models and to the relationship between concentration and banking stability.

6.2.2 Models of systemic risk in banking

It has been witnessed several times in history that banks are vulnerable to runs without a safety net in the system because depositors lose confidence when uncertainty occurs (Diamond and Dybvig, 1983). Sometimes, individual runs might affect other areas of the banking industry, conceivably resulting in panic throughout the whole sector. Although various well-developed models of individual runs had been seen, it was only towards the end of the 1990s that modern bank contagion models were developed, taking into consideration the systemic element. The next section begins with a survey of conventional bank run models, with a discussion of recent bank contagion literature within multiple banking systems.

6.2.2.1 The bank run models

The first class of individual bank run models, succeeding Diamond and Dybvig (1983), were developed in order to capture the problems of individual banks' instability with portioned reserve holdings. Banks take short-term deposits and convert them into long-term investments, with a liquidity premium. In the meantime, a first-come-first-served rule is applied when depositors withdraw their money. A portion of depositors would like to withdraw their deposit early because they lose confidence in a bank's investment portfolios, or because uncertainty arises within a bank's liquidity position. A critical issue is the concern of early withdrawals by too many depositors, which might generate a run on the bank. Because of the hypothetical nature of early withdrawals in this model, bank runs are viewed as random phenomena.

For the second class of bank run models, runs are generated by new information announced regarding the feasibility of bank investments. For instance, Jacklin and Bhattacharya (1988) proposed that some depositors may be partially warned that a lower return may be yielded as a consequence of a high-risk investment made by the bank. Depositors may then accordingly withdraw their deposits (facing the first-come-first-served rule), forcing the bank to liquidate their assets prematurely.

6.2.2.2 Extensions of the classical bank run models to multiple bank systems

Jacklin and Bhattacharya's (1988) model, extended in DeBandt (1995), was applied to a multiple banking system¹⁵ in order to examine how aggregate and idiosyncratic shocks can influence a bank's assets return. If depositors in a bank are first notified about the hardship facing their bank, depositors in other banks may lose confidence due to the possibility of shock, and consequently the return on their deposits. This generates a means for the spread of bank collapse.

Temzelides (1997) also extends the model in Diamond and Dybvig (1983) where only a single bank was representative for the whole banking system, by introducing a multiple banking systems. In this model, depositors witness banking collapses in their area and might shift to the panic equilibrium for the next period. It is also observed that more concentrated banking systems are less vulnerable to idiosyncratic shocks and, accordingly, are less sensitive to contagious panics. This is consistent with the concentration stability hypothesis (discussed in section 6.2.2.4 below).

¹⁵ a complex system of exposures among banking firms and other financial intermediaries through the interbank money market, security settlement systems and wholesale payment, see also 6.2.1.2

6.2.2.3 The modern bank contagion models

In the bank contagion model of Allen and Gale (2000), the role of interbank lending is discussed, along with the emphasis on the physical exposures among banks in different regions and the real interconnections between regions. It is seen that the inter-regional contagion of bank defaults can happen, depending on how many liquid assets a bank in region A has access to, and on how much other banks in other regions have, that will be impacted if a bank in A wish to withdraw its interbank deposits. It is the parameter values which decide whether, and how much, diffusion happens. For instance, in an incomplete market where the lending structure is circular (region A lends to B, B to C, C to D and D back to A), the model proves that for specific parameter values, the unanticipated liquidity distress can result in the default of all banks in all regions. Furthermore, they assert that the system seems to be less fragile in a complete market where each bank has lending relationships with two other regions.

Nevertheless, Boss et al. (2006) and Martínez-Jaramillo et al. (2010) do not agree with Allen and Gale's (2000) work, arguing that the geography of the interbank market network alone could not suggest if a system is more or less stable than another. Rather, the likelihood distributions of initial liquidity shock, the extent of the losses incurred, and the correlation between levels of joint collapse, contribute to the crucial judgement of whether a financial system is stable or fragile. The divergence in the two models above is primarily because of the difference between the information analysed and the conceptual framework exploited. Boss et al. (2006) did not build up the macro models related to the banks' individual balances to demonstrate the changes in the risk and macro variables factors. Whereas, Martínez-Jaramillo et al. (2010) instead employ the

distribution of losses (market and credit) associated with individual banks and join them together to achieve a distribution of loss for the whole system. When the latter is obtained, they use it to measure how stable or fragile a financial scheme is. More recently, Ding et al. (2017) designed a banking network established from information on communication and credit connections through the balance sheets of banks, in order to measure the scheme of systemic risk. They also examine the dynamic mechanism of contagion for liquidity and default infection, as well as the determinants that influence the extent of the contagion. The findings suggest that the inflexibility of the banking sector increase because of asymmetric information interaction, which can result in a shortage of liquidity and the probable failure of the entire banking market. The drawback of systemic risk within the complex banking structure may be characterised by the partial discount element using illiquid assets in the information network. By improving the interlinkages of the information network, the spread of contagion can be partially slowed.

In short, the complex and robust linkages among financial firms that cause idiosyncratic shock to individual banks, or to parts of the financial scheme, may transform into systemic shocks. First, banks are connected via interbank market and securities lending contracts, whereby each bank holds short-run deposits with their counterparts in the interbank money market to maintain their liquidity. Therefore, a bank suffering from idiosyncratic shock can lower the capability of that bank to pay back their short-run debt. Furthermore, it can lower the market value of the underlying interbank deposits held by that bank because they must liquidate the interbank deposits prematurely. The short-run wholesale funding market, thereby, produces a strong channel of systemic contagion that spreads negative shocks (see also López-espínosa et al., 2015).

6.2.2.4 “Concentration stability” and “concentration fragility” views

The major concerns regarding very large bank failures, their effects on financial markets and the broad economy in light of the global financial crisis 2007-09, are strengthened by theoretical debates and inconclusive empirical evidence regarding the connection between the banking structure and stability. The concentration stability view hypothesises that a more concentrated banking system is more stable, whereas the concentration fragility hypothesis supports the opposite view. With respect to concentration stability hypothesis, a theoretical inspiration for this view is demonstrated by Allen and Gale (2000, 2004), who suggest that in a concentrated-banking scheme, larger and monopolistic banking firms might increase profit and thus, produce higher capital buffers that can act as a cushion to safeguard them against external macroeconomic and liquidity shocks (see also Boyd et al., 2004). Second, larger banks have a tendency to undertake credit rationing¹⁶ because more qualitative credit investments can raise the income of the individual investment and thus promote financial stability (Boot and Thakor, 2000). Furthermore, those larger banks are deemed to have comparative advantages in providing credit monitoring services, perhaps due to the possession of localised informational advantages or to the bank serving borrowers' transaction account. Furthermore, Allen and Gale (2000) asserted that a more concentrated banking system with fewer larger banks might be easier to oversee. Therefore, the regulation and supervision of banking firms can be more effective, and the risk of contagion for the entire system should diminish.

¹⁶ Credit rationing refers to any situation in which lenders are not willing to provide additional funds to a borrower even at a higher interest rate (Stiglitz and Weiss, 1981).

Empirical evidence by Beck et al. (2006), and more recently Beck et al. (2013), confirm this concentration stability hypothesis by establishing that bank concentration at a national level tends to lower the probability that a country will experience a systemic crisis within their banking sector. This is because increased competition, which lowers banks' pricing power, increases a bank's risk-taking behaviour and is hence detrimental to financial stability. These findings hold firmly when controlling for various factors, such as regulation, employing different definitions of concentration and crises, along with breaking down various sub-samples of countries. Similarly, Berger et al. (2009) assert that the higher level of concentration caused by the 2007-09 global financial crisis, might lead to riskier loan portfolios. However, banks are more likely to hold higher capital buffers or to use other mechanisms in order to reduce risks associated with their portfolios. Therefore, the results are consistent with the traditional concentration stability view.

Overall, in a more concentrated banking sector, few market participants are seen to hold higher capital buffers against external shocks, there is a higher return via credit rationing, and it is easier to monitor. These advantages can result in improved financial stability for each banking firm and indeed, for the entire banking system.

Regarding the concentration fragility hypothesis, the first argument is that in a concentrated banking system, fewer large banks are likely to obtain a government's safety net or subsidies. The presence of these public guarantees can also result in moral hazard problems that stimulates the larger banks' managers to engage in high-risk investments which, in turn, may destabilise the whole banking system (Uhde and Heimeshoff, 2009). Indeed, Weiß et al., (2014)

examine several financial crises, including Mexico (1994), Asia (1997), Long-Term Capital Management (1998), Dotcom crash (2000), subprime crisis and the default of Lehman Brothers (2008) in order to study the determinants of systemic risk across the globe. Empirical evidence suggests that the chief determinant of systemic risk worldwide is attributed to the regulatory system; for instance, government-owned banks and explicit deposit insurance schemes. In addition, Caminal and Matutes (2002) assert that higher loan interest rates provided by monopolistic banks might urge borrowers to take excessive risks in investment to counterbalance the greater repayments. Consequently, the probability of borrowers' default on their loans may increase, thereby generating a higher chance of bank collapses. Finally, bank size is blamed as a determinant for exposing banks to systemic risk within a concentrated banking system. This is because bank size is positively connected with organisational and procedural complexity (Beck et al., 2006). Increasing bank size permits banks to enlarge across numerous markets geographically, and in different lines of business in addition to employing complicated financial instruments; thereby resulting in reduced transparency. Indeed, Huang et al., (2012) explore systemic risk within a different financial structure from the eight nations in Asia and the Pacific, regarding bank size as a determinant for exposing banks to the slight increase of systemic risk. In the most recent study by Laeven et al. (2016), systemic risk is found to increase with bank size and this effect exists above and beyond the effect of bank size on standalone bank risk.

Empirical studies on the connection between financial fragility and banking market concentration are intensive. Initially, De Nicolo et al. (2004) highlight the positive connection between banking sector vulnerability and market

concentration, employing the Z-core methodology in their sample of the 500 largest banks and financial corporations globally in 90 countries. More specifically, larger and conglomerate corporations did not obtain substantially higher levels of profitability than smaller, more specialised companies. Furthermore, larger giant corporations with a broader range of financial activities were more leveraged and did not obtain lower return volatility compared with smaller and more specialised companies. Therefore, it proposes that the determinants creating the motivation for banks to take on more risk tend to outweigh the risk reductions expected from geographic and product diversification. Further empirical evidence by Schaeck et al. (2009) and Schaeck and Cihak (2012) also shows that more competitive banking systems are less exposed to systemic crises. These results indicate that banking supervisors and regulators should develop policies that enhance competition among banks to increase the stability of the whole financial system.

In conclusion, a banking sector with a high degree of concentration often leads to moral hazard problems, organisational and procedural complexity and contagion, due to high interconnectedness among banks. All these factors may have a destabilising effect on the entire banking system.

6.2.3 The effects of bank M&As on systemic risk

In the previous section, the two opposing views on the relationship between concentration as a state of the system and financial stability have been discussed in general. Hence, this section aims to present, more specifically, all theoretical and empirical evidence to date regarding the effects of bank M&As on systemic risk.

M&As are one of the most distinguished characteristics of the modern financial landscape. The formation of various large and complex financial firms has caused regulatory concerns, as well as the revision of banking regulations and supervision. This is due to the level of systemic risk within the banking system which may have increased unexpectedly. The first question to consider is whether bank consolidation activity and systemic risk are related. De Nicolo and Kwast (2002) address this question by first studying financial firm inter-dependencies, as measured by the correlation of stock returns, presented as an indicator of systemic risk potential for a sample of large and complex banking institutions in the U.S. between 1988 and 1999. They found a significant positive trend in stock return correlations, which suggests that the systemic risk potential in the banking sector seems to have increased during the period of study. Additionally, they link firms' return correlations to their M&A activities by computing measures of the consolidation elasticity of correlation. The results revealed that M&A activities within the same sample has had a positive effect on the degree of inter-dependency. Furthermore, this effect appears to be stronger among different institutions. This means that bank consolidation is one of the critical factors associated with systemic risk.

Moving onto the effect of bank mergers on systemic risk, on the one hand, it is generally believed that M&As broaden the scope of diversification in individual firms. Thus, M&As reduce each institution's idiosyncratic risk, which results in a reduction of the probability of default for individual firms and promotes financial soundness (De Nicolo and Kwast, 2002). Besides these advantages of functional diversification, Méon and Weill (2005) argue that large banks, undertaking cross-border M&As, may gain more scale and scope economies via

the geographical diversification of risk. Furthermore, M&A activities causes banks to gain more market power, thereby increasing their franchise value. As franchise value presents intangible assets that will only be secured if banking firms stay in business. These banks experience high opportunity costs when they fail, thereby becoming more hesitant in conducting risky transactions. Moreover, these banks have a tendency to hold more capital, have less risky portfolios and initiate smaller loan portfolios (Berger et al., 2009). By behaving more prudently, banks reduce their chance of difficulties and hence increase the stability of the whole banking system. Finally, by merging with many targets, an acquirer can become significantly larger, possess a more complex business model and thus become increasingly interconnected with a more substantial number of counterparts in the banking system. Accordingly, banks have better coordination and higher motivation to provide liquidity to other troubled banks, hence lowering the risk of financial contagion within interbank markets and enhancing banking stability (see Allen and Gale, 2000).

Empirical evidence from Berger et al. (2009) suggests that banks are more likely to hold higher capital buffers or to use other mechanisms to reduce risks in order to possess safer portfolios; thereby implying that bank M&As may produce safer banks overall. Chu (2015) investigates bank mergers and stability in Canada from the early period between 1867 and 1935, supporting the concentration-stability view. By employing numerous empirical methodology and procedures, they show that only one out of 27 bankruptcies during this period was the acquirer, while other acquiring banks grew significantly in market share and size. More specifically, geographic diversification is one of the leading factors that reducing risk for a bank and contributing to banking stability, as two-thirds of

33 consolidations were cross-province deals. Furthermore, other institutional factors, such as: barriers to entry produced by the legal requirements for banks' paid-up capital, the double-liability provision of bank shareholders and the absence of both central bank and an explicit deposit insurance scheme, are all factors that enhance the stability of the banking system. These determinants all operate collectively in order to encourage banks to protect their charter values by restricting them from excessive risk-taking, although how they interact and ensure banking stability still requires future research. The author, therefore, sees the merger waves in Canada as the emergence of a highly concentrated, but stable banking system.

Conversely, bank M&As are one of the critical causes of an increase in acquirers' contribution to systemic risk, which is defended by a number of recent empirical studies (see, e.g., Campa and Hernando, 2008; Kane, 2000; Uhde and Heimeshoff, 2009; Weiß et al., 2014). The first argument in support of this view is that a bank may pursue M&As to become TBTF and thereby, it is often more likely to obtain a government's safety net or subsidies. As discussed in the previous section, moral hazard problems may arise, which stimulate larger banks' managers to engage in high-risk investments which, in turn, may destabilise the whole banking system (Uhde and Heimeshoff, 2009). Next, Cetorelli et al. (2007) point out that larger banks, via M&As with a higher level of diversification, might lead to lower managerial efficiency, less effective internal company monitoring and higher control problems concerning the customer base and increasing operational risk. These managerial failures may increase the likelihood of an individual bank's collapse in addition to increasing the contribution to the systemic risk of acquirers. Under cross-border bank mergers, these problems are even

more severe, especially when it involves regulatory arbitrage. Banking firms can relocate their activities geographically, thereby shifting their poorly controlled risk to the taxpayers in other nations, which can destabilise the entire banking system (Weiß et al., 2014).

Empirical studies looking into international bank mergers tend to confirm the increase of systemic risk as a result of bank mergers. To begin with, Weiß et al. (2014) find that bank M&As increase bidders' contributions to systemic risk in their sample between 1991 and 2009. They support their hypotheses that the existence of banks owned by governments, the explicit deposit insurance, as well as the hubris of bank managements, are the primary determinants for the destabilising effect of bank M&As on the financial industry. Empirical evidence from European samples report the same consensus. Uhde and Heimeshoff (2009) study the consolidated balance sheet data over the EU-25 between 1997 and 2005 in order to investigate the relationship between consolidation within banking and financial stability in Europe. The results show that consolidation poses an adverse effect on European financial stability, as estimated by the Z-score method, while controlling for bank-specific, regulatory, institutional and macroeconomic factors. The negative connection between consolidation and stability is driven by the higher return volatility of larger banks in concentrated markets. Molyneux et al., (2014), on the other hand, study the systemic risk implications of banking institutions that are considered TBTF to capture safety net subsidy effects and evaluate their impact on systemic risk. Employing a sample of European bank mergers in 9 countries from 1997 to 2007, they reveal that safety net advantages obtained from merger activity have a significantly positive connection with governmental rescue probability, implying moral hazards

within banking systems. Besides this, substantial evidence is obtained confirming that merger premiums are paid to achieve safety net subsidies that have detrimental systemic risk implications. Lastly, they estimate traditional measures of systemic risk by investigating the connection between safety net subsidy effects and interdependency between TBTF banks post-merger. Unexpectedly, no significant connection has been found. This indicates that safety net subsidies are not associated with stock price return correlations for TBTF banks. This finding casts doubt on the competency of using stock-return correlations as an appropriate indicator of systemic risk within the banking industry. Furthermore, cross-border M&As within the EU may also complicate issues further, as uncertainties regarding the jurisdiction of national safety net arrangements and coordination problems between regulators may arise (Hagendorff et al., 2012).

In conclusion, as economic theory and empirical evidence are inconclusive regarding the impact of bank mergers on banking stability, it motivates this chapter to contribute to the debates and offer relevant, up-to-date advice to banking regulators and supervisors regarding the implications of bank M&As on the stability of the whole banking system.

6.2.4 Hypotheses Development

Given the debate regarding the effects of M&As on systemic risk, this section develops hypotheses on whether bank mergers affect acquiring banks' contribution to systemic risk, and on which deal characteristics influence the level of contribution to systemic risk within banks.

In Chapter 5 of this study, substantial evidence was found regarding the vital role of bank mergers in reducing bidding banks' default risk. The default risk-reducing effects are widespread among merger deals as 65.3% of deals

experience default risk reduction as a result of M&As. The reduction of individual bank default risk can lead to the stability of the whole banking system and reduce banks' contribution to systemic risk. The reason for this is related to contagion. The complex and robust links between financial firms can cause individual banks' failures to possibly transform into systemic shocks (for a more detailed discussion, see section 6.2.2.3). Indeed, empirical evidence from Fiordelisi and Marqués-Ibañez (2013) suggests that for listed banks, individual default risk contributes to increasing the systemic banking risk. Therefore, by reducing each bank's default risk through M&As, the systemic banking stability is enhanced. Therefore, the first hypothesis of this study is formulated as follows:

Hypothesis 6.1 Mergers and acquisitions reduce acquiring banks' contribution to systemic risk.

Next, it is examined whether product diversification plays a role in the changes of acquiring banks' contribution to systemic risk post-merger. The potential for risk-reducing in mergers is specifically noticeable for product-diversifying acquisitions, because this type of merger has the potential to significantly reduce the volatility of the profitability levels of bidding banks (Estrella, 2001; Boyd et al., 1993); it can achieve economies of scale and scope as well as employ costly and sophisticated risk management instruments in order to minimise their risk (Schaeck and Cihak, 2012). In addition, large conglomerates can conveniently invest in state-of-the-art technology as well as employ the best personnel and specialists; thereby minimising the risk that emerges from non-interest income activities, which may result in the reduction of banks' failures and reduce a bank's contribution to systemic risk (Köhler, 2014). Evidence from Chapter 5 also suggests that product diversification plays an

important role in reducing acquirers' default risk. Taken all of this into consideration, the second hypothesis will follow accordingly.

Hypothesis 6.2 Product-diversifying mergers can bring more systemic risk-reducing effects for acquiring banks post-merger rather than in focusing deals.

The next hypothesis is about the method of payment for the merger. First, Furfine & Rosen (2011) propose that deals which are fully paid for in cash are expected to raise acquiring banks' default risk, as acquirers are replacing safe liquid assets (cash) with a riskier balance sheet of the target bank; therefore increasing a bank's contribution to systemic risk. This is because the weaknesses in a portfolio of one bank can lead to the weaknesses of other banks' portfolios, due to the interbank market and the interconnected nature of banking firms. Therefore, high default risk is expected to contribute to an increased systemic risk. Second, from the bondholders' viewpoint, the employment of cash as a means of exchange in cross-border bank consolidations is expected to diminish the liquidity of bank, which consequently raises a bank's risk; this is indicated in a bank's higher yield spread post-merger (Choi et al., 2010). Finally, cash payments in bank mergers are usually related to severe changes in the target bank's management (Dutta et al., 2013), which could be damaging to the integration process, thus raising the risk of the combined banks. Hence, it is hypothesised that deals financed by cash only will have a risk-increasing effect on systemic risk.

Hypothesis 6.3 Cash-only payment has a higher risk-increasing effect on banks' contribution to systemic risk than other payment methods.

To test these hypotheses, the next part proposes methodologies to measure the changes in acquiring banks' contribution to systemic risk after

mergers alongside the determinants of the merger-related changes in acquirers' contribution to systemic risk.

6.3 Research Methodology

The overall objective of this section is to discuss and justify two systemic risk measurement methodologies used in this chapter to test the above three hypotheses. Moreover, it proposes the model of the determinants of merger-related changes in acquirers' contribution to systemic risk. Unlike other types of risk that banking firms face, systemic risk is much more noticeable for its effects rather than its causes. These features make it challenging to explain systemic risk distinctly. However, systemic risk can be recognised more easily when it appears. In other words, systemic risk is easier to measure *ex post* than *ex ante*. Researchers worldwide have attempted to measure, and to find, instruments to reduce it. Therefore, this section begins with a general discussion on different systemic risk measurement models proposed in the literature, followed by a detailed description of the concept, functions and estimation methods of the two models employed in this chapter.

6.3.1 Systemic risk measurement models

There are a comparable range of measurements and methodologies that focus on the different features of systemic risk. However, for categorising and examining them, it is suggested that there are two ways of measuring a bank's contribution to systemic risk. The first approach, or the Supervisory Approach, counts on firm-specific information, such as size, leverage, liquidity, interconnectedness, complexity and substitutability. This approach utilises data that banking firms provide to the regulators and policymakers who are solely responsible for enhancing financial stability every day. However, regulators and banking supervisors are obliged to keep this specific data confidential. For that reason, the most useful measures of systemic risk may be the ones that have yet

to be tested, as they involve private data that only banking supervisors and regulators can attain. Because such data is not made accessible to most academics, researchers must rely on the second approach with publicly available market data, for instance, stock returns, credit swap spreads (CDS) or option prices, as these can efficiently summarise all available information about the company. Among various examples of systemic risk measurements in the literature, Tables 6.1 and 6.2 below demonstrate several well-known, regularly employed and strong systemic measures of a firm's contribution to systemic risk regarding their methodology, as well as their advantages and disadvantages. A more detailed discussion regarding other significant systemic risk measurements in the literature as well as their merits and shortcomings can be found in Appendix F.

Table 16: Systemic Risk Measurement Models (Methodology)

	Conditional Value-at-Risk ΔCoVaR	SRISK	Marginal Expected Shortfall	Distress Insurance Premium	Aggregated Distance-to-Default
Systemic risk measure	Value-at-Risk	Expected Shortfall	Expected Shortfall	Expected Shortfall	Distance to default
Conditionality	Percentile of individual return	Threshold of capital adequacy	Threshold of capital adequacy	Percentage threshold of system return	
Dimensionality	Multivariate	Bivariate	Bivariate	Bivariate	Bivariate
Dependence measure	Linear, parametric	Parametric	Empirical	Parametric	Non-linear
Method	Panel quantile regression, multivariate GARCH-DCC model	GARCH-DCC and Monte Carlo simulation	GARCH-DCC	GARCH-DCC and Monte Carlo simulation	Iterative techniques
Data source	Equity prices and	Equity prices and	Equity prices and	Equity prices and	Equity prices,

	balance sheet information	balance sheet information	balance sheet information	CDS spreads	balance sheet, options prices
Data input	Quasi- asset returns	Quasi- asset returns	Quasi- asset returns	Equity returns and CDS- implied default probability	Equity returns, risk-free rates, liabilities, market caps
Reference	(Adrian and Brunnerme ier, 2016)	(Brownlees and Engle, 2017)	(Acharya et al., 2017)	(Huang et al., 2009)	(Saldías, 2013)

Table 17: Systemic Risk Measurement Models (Advantages and Disadvantages)

	Advantages	Shortcomings
1. MES Model	<ul style="list-style-type: none"> ▪ easy to calculate and implement as relied on observable market data and statistical techniques ▪ can be used as a fundamental for a systemic tax because a measurement of MES is logically consistent, expressed in natural units ▪ a good predictor of a firm's contribution to systemic risk ▪ this measure scales naturally with the size of the firm and is additive for mergers 	<ul style="list-style-type: none"> ▪ does not capture the true tails of the return distribution as it is computed from the moderately bad days of the market and not the worst performance of the market during an actual financial crisis. ▪ the data for this method is based on share returns only and exclude reference to a bank's size or its capital capacity which are considered as essential elements of systemic risk
2. Distressed Insurance Premium Model	<ul style="list-style-type: none"> ▪ the stress testing can be updated regularly ▪ robust and additional forecasting ability in anticipating the changes in correlations of asset return, in relation to term structure variables and equity market ▪ strong power to identify systemic important financial institutions ▪ analyses the influence of general market changes on the 	<ul style="list-style-type: none"> ▪ the accuracy of the model reduces when systemic losses are not sufficiently presented in the historical statistics. ▪ is not a very useful early warning indicator of systemic risk because it underestimates systemic risk during a period of market growth and boom

	performance of each bank, and simultaneously integrate the feedback effect from the banking scheme to the rest of the economy	
3. ΔCoVaR Model	<ul style="list-style-type: none"> ▪ emphasize the contribution of each firm to overall system risk ▪ general enough to study the risk spillovers from banks to banks throughout the entire financial system ▪ have out-of-sample predictive power for realised correlation in tail events, so can oversee the build-up of systemic risk in a forward-looking mode and potentially be used in macro-prudential policy applications ▪ reduces the effect of the arbitrary selection of a single level of confidence on expected losses 	<ul style="list-style-type: none"> ▪ provide individual measures that do not sum up to the total risk measure ▪ is over-susceptible to estimation errors than VaR; to be precise, the accuracy of CoVaR relies broadly upon the tail modelling accuracy ▪ unable to backtest the CoVaR model because the expected shortfall predictions cannot be validated via comparison with historical statistics
4. Aggregated Distance-to-Default Model	<ul style="list-style-type: none"> ▪ capture interdependence and joint risk of distress in systemically important banks ▪ provide early signal than conventional methods in the literature and other market-based approaches. ▪ provide at the same time signals that are long-run informative, undisturbed. Also, swift and accurate reaction to market shocks. ▪ incorporate extra information via option prices regarding tail risk and correlation breaks 	<ul style="list-style-type: none"> ▪ does not incorporate skewness and kurtosis, and stochastic volatility, which can account for implied volatility smiles of equity prices. ▪ the presented valuation model is subject to varying degrees of estimation uncertainty and parametric assumptions, which need to be considered when drawing policy conclusions ▪ could fail to capture some relevant economics that is needed to understand default risk fully, and, thus, could generate biased estimators of expected losses
5. SRISK Model	<ul style="list-style-type: none"> ▪ delivers useful rankings of systemically risky firms at various stages of the financial crisis ▪ a significant predictor of the capital injections performed by the Fed during the crisis 	<ul style="list-style-type: none"> ▪ the constant liabilities of the bank around the crisis time is presumed ▪ fails to measure the marginal contribution of a bank to simultaneous changes of both the

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- | | |
|--|---|
| <ul style="list-style-type: none"> ▪ the predictive ability of aggregate SRISK is stronger over longer horizons | <p>harshness of systemic risk and the dependence system over any combination of sample banks for any degree of statistical confidence and at any point in time because it does not employ multivariate density estimation does not employ multivariate density estimation</p> |
|--|---|
-

For the purpose of this study, MES and ΔCoVaR are the best models to measure acquirers' contribution to systemic risk. Indeed, various empirical studies have shown that both models are reliable, well-known and strong predictors of a firm's contribution to systemic risk (in contrast to the Distressed Insurance Premium Model). On the one hand, what makes MES particularly suitable for this study is that it scales consistently with the size of the bank and is additive for M&As. Moreover, it is seen to be easy for banking regulators to compute, and is usable as a basis for a systemic tax (Acharya et al., 2017). On the other hand, ΔCoVaR can capture the contribution of each bank to overall systemic risk, whereas other traditional risk measures such as the SRISK model fail to compute the marginal contribution of a firm to systemic risk. Furthermore, ΔCoVaR has the power to oversee the build-up of systemic risk in a forward-looking mode that can potentially be used in macro-prudential policy applications. In this instance, ΔCoVaR outweighs the Distressed Insurance Premium (DIP) model in the sense that the DIP model depends on various degrees of parametric assumptions and assessment uncertainty, thereby limiting reliability when making important regulatory and political decisions based on the DIP model.

Using both models can enhance the robustness of the results and can overcome the weaknesses of relying on the outcomes using only one model.

Moreover, both models complement each other's weaknesses as they are conceptually distinct. To be precise, the ΔCoVaR model investigates the system's stress, based on an individual bank's distress, meanwhile the MES model studies a bank's distress based on systemic stress. In the event of ranking individual banks' systemic risk, MES has the advantage in that the conditioning set (i.e. the presence of a financial crisis) is set constant for all banks, whereas, it is contrasting with ΔCoVaR (i.e. the conditioning set differs cross-sectionally based on a particular bank's stress) (Acharya et al., 2017). Still, these measures are likely to be refined and improved going forward, whilst other measures are still being developed. The methodology and estimation method of each model will be discussed in the next section.

6.3.2 Marginal Expected Shortfall

6.3.2.1. MES concept

Acharya et al., (2017) assert that each banking firm's contribution to systemic risk can be calculated by its systemic expected shortfall (SES), i.e., its tendency to be undercapitalised when the entire system is undercapitalised. SES is a model built under a specific theoretical framework including three measures to proxy it: (1) the result of stress tests performed by regulators, (2) the reduction in equity valuations of large financial corporations during crisis and (3) the widening of the credit default swap spreads of large financial corporations. Given these proxies, the authors produce key indicators, which project a firm's SES. These main indicators are marginal expected shortfall (MES) and leverage. The first advantage of this method is that MES is an explicit economic model where systemic risk measurement relies on observable market data and statistical techniques; therefore, it is simple to calculate and easy for banking supervisors

to implement. Second, MES and leverage are good predictors of a firm's contribution to a systemic crisis, unlike other standard measures of firm-level risks, such as VaR or volatility with no explanatory power or beta with modest explanatory power. Third, being model-based enhances the logical consistency of the measurement of MES and SES. Finally, this measures scales naturally with the size of the firm and is additive concerning mergers and spinoffs. These properties do not hold within many of the reduced form approaches.

It should be noted, however, that the definition and estimation of the MES do not capture the true tails of the return distribution as it is computed from the moderately bad days of the market and not from the worst performance of the market during a true financial crisis (Acharya et al., 2017). Moreover, the data for this method is based on share returns only and excludes reference to a bank's size or its capital capacity, which are considered important elements of systemic risk (Kupiec and Guntay, 2016).

6.3.2.2 MES functions

The SES and MES methods are used to identify systemically important financial institutions (SIFIs)¹⁷. Considering a financial system composed of n institutions, the financial system's global return (market return) is well-defined as the value-weighted average of all bank returns.

$$r_{mt} = \sum_{i=1}^n w_{it} r_{it} \quad (6.1)$$

r_{mt} denotes the aggregate return of the financial system on day t

r_{it} is the corresponding return of firm i on day t

¹⁷ The Financial Stability Board (2010) defines Systemically Important Financial Institutions as financial institutions 'whose disorderly failure, because of their size, complexity and systemic interconnectedness, would cause significant disruption to the wider financial system and economic activity.'

w_{it} is the weight of the i th firm in the financial system on day t

These weights are measured by the comparative market capitalisation of the financial firms. Let us presume that the financial system's cumulative risk is estimated by the conditional Expected Shortfall (ES). The ES is the expected market loss, based on the return being lower than the α quantile, i.e. the VaR. Furthermore, it could be expanded to a more common case, where a threshold C defines the distress event. The conditional ES (with regards to past information) on day t is formally given by

$$ES_{mt}(C) = -\mathbb{E}_{t-1}(r_{mt}|r_{mt} < C) \quad (6.2)$$

Given the ES of the whole financial system, MES represents the marginal contribution of each firm to the risk of the financial system. It corresponds to the change in ES_m engendered by an rise in the weight of the i th firm within the financial system (see Appendix D.1 for the derivation of this expression)

$$MES_{it}(C) = \frac{\partial ES_{mt}(C)}{\partial w_{it}} = \mathbb{E}_{t-1}(r_{it}|r_{mt} < C) \quad (6.3)$$

A bivariate GARCH model is considered for the demeaned return processes, which corresponds to a simple market model (CAPM) with time-varying conditional betas

$$r_t = H_t^{1/2} v_t \quad (6.4)$$

where $r_t = (r_{mt} r_{it})'$ denotes the vector of market and firm returns and where the random vector $v_t = (\varepsilon_{mt} \xi_{it})'$ is independently and identically distributed (*i.i.d*) shocks with zero mean and identity covariance matrix. The H_t matrix denotes the time-varying conditional variance-covariance matrix:

$$H_t = \begin{pmatrix} \sigma_{mt}^2 & \sigma_{it}\sigma_{mt}\rho_{it} \\ \sigma_{it}\sigma_{mt}\rho_{it} & \sigma_{it}^2 \end{pmatrix} \quad (6.5)$$

where σ_{it} and σ_{mt} denote the conditional standard deviations for the firm and the system

ρ_{it} the time-varying conditional correlation.

No particular assumptions are made regarding the bivariate distribution of the standardised innovations v_t , which is assumed to be unknown. It is only assumed that the time-varying conditional correlations ρ_{it} fully capture the dependence between firm and market returns. Formally, this assumption implies that the standardised innovations ε_{mt} and ξ_{it} are independently distributed at time t .

It is given that Equations (6.4) and (6.5), the MES can be expressed as a function of the firm's return volatility, its correlation with the market return, and the comovement of the tail of the distribution (See Appendix D.2 for the derivation of this expression):

$$MES_{it}(C) = \sigma_{it}\rho_{it}\mathbb{E}_{t-1}\left(\varepsilon_{mt}\middle|\varepsilon_{mt} < \frac{C}{\sigma_{mt}}\right) + \sigma_{it}\sqrt{1 - \rho_{it}^2}\mathbb{E}_{t-1}\left(\xi_{it}\middle|\varepsilon_{mt} < \frac{C}{\sigma_{mt}}\right) \quad (6.6)$$

Therefore, MES is a non-linear combination of four elements: volatility, correlation, tails expectations and the weight of the firm.

6.3.2.3 Estimation method

To compute the MES for each financial institution, the estimation method of Banulescu and Dumitrescu (2015) will be implemented and the model defined in Equations (6.4) and (6.5) will be used. The steps followed in developing the model are listed below.

Step 1: Also, conditional volatilities and standardised residuals for the market and each institution are obtained by modelling volatilities in a GJR-GARCH(1,1) framework (Glosten et al., 1993). The GJR-GARCH model equations for the volatility dynamics are:

$$\sigma_{it}^2 = \omega v_i + \alpha v_i r_{i,t-1}^2 + \gamma v_i r_{i,t-1}^2 I_{i,t-1}^- + \beta v_i \sigma_{i,t-1}^2 \quad (6.7)$$

$$\sigma_{mt}^2 = \omega v_m + \alpha v_m r_{m,t-1}^2 + \gamma v_m r_{m,t-1}^2 I_{m,t-1}^- + \beta v_m \sigma_{m,t-1}^2 \quad (6.8)$$

With $I_{i,t}^- = 1$ if $\{r_{it} < 0\}$ and $I_{m,t}^- = 1$ if $\{r_{mt} < 0\}$

The time-varying correlations of each couple ‘market-firm’ are modelled using a dynamic conditional correlation (DCC) model (Engle, 2001) as follows:

$$Cor(\chi_{it}) = R_t = \begin{bmatrix} 1 & \rho_{it} \\ \rho_{it} & 1 \end{bmatrix} = \text{diag}(Q_{it})^{-1/2} Q_{it} \text{diag}(Q_{it})^{-1/2} \quad (6.9)$$

In which $\chi_{it} = r_{it}/\sigma_{it}$

$$\chi_{mt} = r_{mt}/\sigma_{mt}$$

Q_{it} is the pseudo correlation matrix.

The DCC model then indicate the dynamics of the pseudo-correlation matrix Q_{it} as

$$Q_{it} = (1 - \alpha_{Ci} - \beta_{Ci})S_i + \alpha_{Ci} \begin{bmatrix} \chi_{i,t-1} \\ \chi_{m,t-1} \end{bmatrix} \begin{bmatrix} \chi_{i,t-1} \\ \chi_{m,t-1} \end{bmatrix}' + \beta_{Ci} Q_{i,t-1} \quad (6.10)$$

Where S_i is the unconditional correlation matrix of the company and market-adjusted returns. The parameters from this model are estimated by Quasi Maximum Likelihood (QML). It is because it produces reliable and asymptotically customary estimators under minor uniformity conditions; and does not make any distributional assumptions regarding the innovations process. More broad details on this modelling approach and estimation are specified in Engle (2009).

Step 2: Based on the *i.i.d.* (independently and identically distributed) property of the innovations, the next step proceeds to a non-parametric kernel estimation of the tail expectations $\mathbb{E}_{t-1}(\varepsilon_{mt} | \varepsilon_{mt} < \frac{c}{\sigma_{mt}})$ and $\mathbb{E}_{t-1}(\xi_{it} | \varepsilon_{mt} < \frac{c}{\sigma_{mt}})$ along the lines of (Scaillet, 2005):

$$\hat{\mathbb{E}}_{t-1}(\varepsilon_{mt} | \varepsilon_{mt} < k) = \frac{\sum_{t=1}^T \varepsilon_{mt} \phi(\frac{k - \varepsilon_{mt}}{h})}{\sum_{t=1}^T \phi(\frac{k - \varepsilon_{mt}}{h})} \quad (6.11)$$

$$\hat{\mathbb{E}}_{t-1}(\xi_{it}|\varepsilon_{mt} < k) = \frac{\sum_{t=1}^T \xi_{it} \phi\left(\frac{k-\varepsilon_{mt}}{h}\right)}{\sum_{t=1}^T \phi\left(\frac{k-\varepsilon_{mt}}{h}\right)} \quad (6.12)$$

where $k = C/\sigma_{mt}$ is the threshold

$\phi(\cdot)$ representing the normal c.d.f. (Gaussian Kernel function)

h is the bandwidth.

In the empirical application, C is set to VaR (5%) of the system as in Scaillet (2005). For formal proof, see Appendix D.3.

Step 3. the volatilities and correlations obtained in step 1 and tail expectations gained from step 2 will be applied back to equation (6.6) to calculate the Marginal Expected Shortfall of institution i at each day t .

In this empirical study, a test is run to check whether the differences between the banks' post-merger and pre-merger marginal expected shortfalls are, on average, different from zero. Day t is defined as belonging to the pre-merger period if it falls into the interval $[-180; -11]$ relative to the merger announcement. Similarly, day t is considered to belong to the post-merger period if it falls into the interval $[+11; +180]$ relative to the merger completion. To assess the proposition that the mean of the changes in the acquirers' MES are different from zero, a standard t-test is employed, using 5% as the risk level of the VaR.

$$\Delta MES_i^{5\%} = MES_{i,[+11;+180]}^{5\%} - MES_{i,[-11;-180]}^{5\%} \quad (6.13)$$

6.3.3 Conditional Value at Risk

6.3.3.1 $\Delta CoVaR$ concept

Adrian and Brunnermeier (2016) advise measuring systemic risk via the conditional value-at-risk ($\Delta CoVaR$) of the financial system, conditional on institutions being in a state of distress. A firm's contribution to systemic risk is

defined as the difference between the CoVaR of the firm being in distress and the CoVaR in the median state of the firm. The ΔCoVaR systemic risk measure can recognise the risk on the system by individually “systemically important” firms, which are so interconnected and large that they can cause negative risk spillover effects on others, as well as by smaller firms that are “systemic” when operating as part of a group. Moreover, ΔCoVaR is a measure that does not depend on contemporaneous price movements, and hence, can be used to predict systemic risk. The ΔCoVaR measure captures institutional externalities such as ‘too big to fail,’ “too interconnected to fail” and crowded trade positions.

There are several advantages associated with ΔCoVaR as a measure. First, while ΔCoVaR emphasises the contribution of each firm to overall system risk, conventional risk measures rely on the risk of individual firms. Banking regulations and policies based on the risk of firms in segregation may result in excessive risk-taking along with systemic risk measurements. Another benefit of this co-risk measure is that it is general enough to study the risk spillovers from bank to bank throughout the entire financial system. Furthermore, Adrian and Brunnermeier (2016) establish that the ‘forward- ΔCoVaRs ’ have out-of-sample predictive power for realised correlation in tail events. The forward- ΔCoVaR can be utilised to oversee the build-up of systemic risk in a forward-looking mode. This forward-looking measure can potentially be used in macro-prudential policy applications. Finally, it reduces the effect of the arbitrary selection of a single level of confidence on expected losses (Sum, 2016).

Nevertheless, a notable disadvantage of ΔCoVaR is that individual measures do not sum up the total risk measure (Li, 2015). In addition, it is more susceptible to estimation errors than VaR; to be precise, the accuracy of ΔCoVaR

relies broadly upon the tail modelling's accuracy. Furthermore, it is difficult to backtest the ΔCoVaR model due to its expected shortfall concept. This is because the expected shortfall predictions cannot be validated via comparison with historical statistics (Sum, 2016).

6.3.3.2 ΔCoVaR functions

This measure is based on the concept of Value-at-Risk, denoted $\text{VaR}(\alpha)$, which is the maximum loss within the $\alpha\%$ -confidence interval (see Jorion, 2007). Here, the CoVaR corresponds to the VaR of the market return obtained conditionally on some event $\mathbb{C}(r_{it})$ observed for firm i .

$$\Pr\left(r_{mt} \leq \text{CoVaR}_t^{m|\mathbb{C}(r_{it})} \middle| \mathbb{C}(r_{it})\right) = \alpha \quad (6.14)$$

r_{mt} denotes the aggregate return of the financial system on day t

r_{it} is the corresponding return of firm i .

α is the confidence interval (%)

threshold \mathbb{C} is the distress event

The ΔCoVaR of firm i is then defined as the difference between the VaR of the financial system, based on this particular firm being in financial distress and the VaR of the financial system conditional on firm i being in its median state. To define the distress of a financial institution (a condition when a bank could not meet, or has difficulty paying back its financial obligations to its creditors, (normally due to illiquid assets or high fixed costs), various definitions of $\mathbb{C}(r_{it})$ can be considered.

A more general approach would consist of defining the financial distress of firm i as a situation in which the losses exceed its VaR (see Girardi and Ergün, 2013), hence:

$$\Delta CoVaR_{it}(\alpha) = CoVaR_t^{m|r_{it} \leq VaR_{it}(\alpha)} - CoVaR_t^{m|r_{it} = Median(r_{it})} \quad (6.15)$$

In this theoretical framework, it is also possible to express $\Delta CoVaR$, defined for a conditioning event $\mathbb{C}(r_{it}): r_{it} = VaR_{it}(\alpha)$, as a function of the conditional correlations, volatilities, and VaR. Given Equations (6.14) and (6.15), the following result is obtained (see Appendix E.1 for the derivation of this expression):

$$\Delta CoVaR_{it}(\alpha) = \gamma_{it} [VaR_{it}(\alpha) - VaR_{it}(0.5)] \quad (6.16)$$

where $\gamma_{it} = \sigma_{mt}\rho_{it}/\sigma_{it}$ and the risk level of the VaR, $\alpha=0.05$. If the marginal distribution of the returns is symmetric around zero, $\Delta CoVaR$ is strictly proportional to VaR:

$$\Delta CoVaR_{it}(\alpha) = \gamma_{it} VaR_{it}(\alpha) \quad (6.17)$$

6.3.3.3 Estimation method

The multivariate GARCH estimation of $\Delta CoVaR$ will be performed based on the following three-step procedure:

Step 1: First, VaR of each institution i is computed by estimating the following univariate model:

$$r_{it} = \mu_{it} + \varepsilon_{it} \quad (6.18),$$

where $\mu_{it} = \omega_0 + \omega_1 r_{i,t-1}$ and $\varepsilon_{it} = \nu_{it} \sigma_{it}$ where ν_{it} is a vector of independently and identically distributed (*i.i.d*) shock with zero mean and unit variance and where the conditional variance has the standard GARCH (1,1) specification

$$\sigma_{it}^2 = \beta_0^i + \beta_1^i \varepsilon_{i,t-1}^2 + \beta_2^i \sigma_{i,t-1}^2 \quad (6.19)$$

Given a distributional assumption for ν and, hence, the q-quantile of the estimated conditional distribution, for each period, the VaR of each institution i is calculated.

Step 2: for each institution i , a bivariate GARCH model is estimated with Engle (2001) DCC specification for the returns of institution i and the financial system: $r_t = (r_{mt} r_{it})'$ whose joint dynamics is given by

$$r_t = \mu_t + \varepsilon_t \quad (6.20)$$

$$\varepsilon_t = H_t^{1/2} v_t \quad (6.21)$$

where $H_t^{1/2}$ is the (2×2) conditional covariance matrix of the error term ε_t and μ_t is the (2×1) vector of conditional means. The standardised innovation vector $v_t = H_t^{-1/2}(r_t - \mu_t)$ is independently and identically distributed (*i.i.d*) with $E(v_t) = 0$ and $Var(v_t) = I_2$. Also, for each deal, the market used is the country's market of acquiring bank.

D_t is defined to be the (2×2) diagonal matrix with the conditional variances σ_{mt}^2 and σ_{it}^2 along the diagonal so that $\{D_{mm}\}_t = \{H_{mm}\}_t$, $\{D_{ii}\}_t = \{H_{ii}\}_t$ and $\{D_{mi}\}_t = 0$. The conditional variances are modelled as GARCH (1,1)

$$\sigma_{mt}^2 = \phi_0^m + \phi_1^m \varepsilon_{m,t-1}^2 + \phi_2^m \sigma_{m,t-1}^2 \quad (6.22)$$

$$\sigma_{it}^2 = \phi_0^i + \phi_1^i \varepsilon_{i,t-1}^2 + \phi_2^i \sigma_{i,t-1}^2 \quad (6.23)$$

and the conditional covariance $\sigma_{mi,t}$ is

$$\sigma_{mi,t} = \rho_{mi,t} \sqrt{\sigma_{mt}^2 \sigma_{it}^2} \quad (6.24)$$

Let $C_t = D_t^{-1/2} H_t D_t^{-1/2} = \{\rho_{mi}\}_t$ be the (2×2) matrix of conditional correlations of ε_t . Following Engle (2001) the conditional correlation matrix will be as follows:

$$C_t = \text{diag}(Q_t)^{-1/2} * Q_t * \text{diag}(Q_t)^{-1/2} \quad (6.25)$$

$$Q_t = (1 - \delta_1 - \delta_2) \bar{Q} + \delta_1 (\lambda_{t-1} \lambda'_{t-1}) + \delta_2 Q_{t-1} \quad (6.26)$$

where \bar{Q} is the unconditional covariance matrix of $\lambda_t = \{\varepsilon_{mt}/\sigma_{mt}\}_m$ and $\text{diag}(Q_t)$ is the (2×2) matrix with the diagonal of Q_t on the diagonal and zeros off-diagonal.

Step 3: Once the bivariate density $pdf_t(r_{mt}r_{it})'$ pair is estimated in step 2, $\Delta CoVaR_{it}(\alpha)$ is obtained for each financial institution i and day t in equation (6.16).

In this empirical study, a test is run to check whether the differences between the banks' post and pre-merger $\Delta CoVaR$ are, on average, different from zero. As before, day t is defined as belonging to the pre-merger period if it falls into the interval $[-180; -11]$ relative to the merger announcement. Similarly, day t is considered as belonging to the post-merger period if it falls into the interval $[+11; +180]$ relative to the merger completion. To investigate the hypothesis that the mean of the changes in the acquirers' $\Delta CoVaR$ is different from zero, a standard t-test is employed. 5% is considered the risk level of the VaR.

$$\Delta(\Delta CoVaR_i^{5\%}) = \Delta CoVaR_{i,[+11;+180]}^{5\%} - \Delta CoVaR_{i,[-11;-180]}^{5\%} \quad (6.27)$$

6.3.4 Model of the determinants of the changes in acquirers' contribution to systemic risk

This section attempts to address the concern of how merger-related changes in acquirers' contribution to systemic risk can be explained in the cross-section by a group of bidders and deal characteristics, as well as variables on the acquiring banks' macroeconomic environment. Thus, a multivariate analysis of the determinants driving the changes in acquirers' contribution to systemic risk will be performed. The model, estimated via OLS with heteroskedasticity-consistent Huber–White standard errors, assumes the following specifications:

$$\Delta MES_i = \alpha_1 + \gamma'_1 DC_i + \theta'_1 AC_{i,t-1} + \varepsilon_i \quad (6.24)$$

where:

ΔMES_i is the merger-related change in marginal expected shortfall

$\gamma'_1 DC_i$ is a $(k \times 1)$ vector of merger characteristics, and

$\theta'_1 AC_{i,t-1}$ is a (j x 1) vector of bidder characteristics at the end of the fiscal year prior to the announcement of the deal

Also, for ΔCoVaR , the model is expressed as follow:

$$\Delta(\Delta\text{CoVaR})_i = \alpha_2 + \gamma'_2 DC_i + \theta'_2 AC_{i,t-1} + \varepsilon'_i \quad (6.25)$$

$\Delta(\Delta\text{CoVaR})_i$ is the merger-related change in ΔCoVaR

$\gamma'_2 DC_i$ is a (k x 1) vector of merger characteristics, and

$\theta'_2 AC_{i,t-1}$ is a (j x 1) vector of bidder characteristics at the end of the fiscal year prior to the announcement of the deal.

The vector of merger characteristics consists of the payment method, the status of target, deal size, relative size, cross-border dummy and product diversification. For the bidders' characteristics, measures of size and performance of acquirers (ROA), leverage, market to book, capital ratio, operating efficiency and high-risk banks before the acquisition, are taken into consideration. Regarding the acquirers' macroeconomic environment, the GDP real growth rate, the rule of law, political stability and the HHI is included in the model in order to evaluate the impact of country characteristics on the risk effects of acquisitions (Vallascas and Hagendorff, 2011). For consistency, this chapter uses the same dependent, independent and control variables as in chapter 4, where each variable has been carefully defined and justified (see section 4.2.3 of Chapter 4).

6.4 Empirical Findings

6.4.1 Bank merger and acquiring banks' contribution to systemic risk

It is well documented in literature that bank acquisitions generate opportunities to realise significant diversification benefits through risk pooling, provided that the asset returns of the merging banks are not perfectly correlated (Craig and Santos, 1997; Emmons et al., 2004). To the extent that bank merger enables enhanced profitability via increased market power and changes in the asset management of the merging firm, M&As may reduce acquirers' contribution to systemic risk even further. This part attempts to assess the effects of bank mergers on bidders' contribution to systemic risk in general, as well as for specific kinds of mergers, to test the chapter's hypotheses. Table 6.3 below reports the Marginal Expected Shortfall (MES) and ΔCoVaR of acquiring banks before and after mergers based on the global sample of 608 bank M&As.

Table 18: Merger-related Changes in MES and Δ CoVaR

Merger-induced changes in Marginal Expected Shortfall and Δ CoVaR. The table reports the pre- and post-merger value as well as changes in the bidding banks' Marginal Expected Shortfall (MES) and Δ CoVaR for a full sample of 608 bank mergers and for regional sub-samples. MES and Δ CoVaR before the merger is computed as the average of the MES and Δ CoVaR over the period from -180 days to -11 days relative to the announcement date (a), while the MES and Δ CoVaR after the completion date is computed as the average MES and Δ CoVaR over the period from +11 days to +180 days after the completion date (c). The change in the MES and Δ CoVaR is the difference between the post-effective date and the pre-announcement period, winsorised at the 1%-level. The statistical significance of the changes in the MES and Δ CoVaR is then tested by the use of a standard t-test. The p-values are denoted in parentheses.

Bidders' nations	N	(MES)			Δ CoVaR		
		Pre-merger MES	Post-completion MES	Δ MES	Pre-merger Δ CoVaR	Post-completion Δ CoVaR	Change in Δ CoVaR
U.S.	452	0.005 *** (0.000)	0.005 *** (0.000)	0.000 (0.621)	0.002 *** (0.000)	0.002 *** (0.000)	0.000 (0.206)
Europe	65	0.007 *** (0.000)	0.006 *** (0.000)	-0.001 (0.601)	0.004 *** (0.000)	0.003 *** (0.000)	-0.001 (0.126)
Asia	53	0.003 ** (0.040)	0.004 *** (0.000)	0.002 (0.311)	0.001 *** (0.000)	0.001 *** (0.000)	0.000 (0.939)
Others	38	0.007 *** (0.000)	0.005 *** (0.006)	-0.002 (0.169)	0.003 *** (0.000)	0.002 *** (0.006)	-0.001* (0.063)
Total	608	0.005 *** (0.000)	0.005 *** (0.000)	0.000 (0.788)	0.002 *** (0.000)	0.002*** (0.000)	0.000 (0.927)

**, * Denotes significance at 5%;10%

*** Denotes significance at 1%

To analyse whether mergers impact on the contribution to systemic risk of acquirers, the merger-related changes in MES and Δ CoVaR are tested to check if it is equal to zero. The findings of the full-sample analysis show that the changes in the bidding banks' MES and Δ CoVaR are both approximately zero in addition to not being statistically significant. At the regional level, it is seen that the increase in the bidding banks' MES is strongest for the mergers in the U.S. and Asia; nevertheless, the changes in MES of U.S. and Asian acquirers are not

statistically significant either. Moreover, the change in ΔCoVaR of acquirers from other countries is -0.001 and is statistically significant at 10% level. However, acquirers from other regions such as Africa, South America, Oceania and North America (excluding the U.S.) are not very liquid in the stock market as their share prices are often displayed in an irregular basis. Thus, it is very difficult to draw conclusion that acquirers from other regions experience systemic risk reduction as a result of M&As.

Overall, these results show that mergers do not produce a reduction in the acquiring banks' contribution to systemic risk in the whole sample. This finding contradicts with Weiß et al. (2014) as they found a significant increase in merging banks' contribution to systemic risk following mergers. The possible reason why their findings are not as optimistic as this finding is that their sample excludes mergers that involve insurance companies, loans or security bankers. Such a sample may not offer substantial diversification benefits or risk-reducing effects derived from product diversification. Moreover, our sample period extends beyond the 2007-09 global financial crisis; when banks may pursue M&As for healthy growth, expansion of business lines and locations or acquisitions of new customer bases; thereby increasing business profit and enhancing the stability of the banking system. Therefore, the first hypothesis that bank mergers coincide with a significant reduction in the bidding bank's contribution to systemic risk is rejected. Moreover, it is observed that the level of MES and ΔCoVaR of acquirers from the U.S. and Asia are lower in the pre-merger period than in the post-merger period. In contrast, for Europe and other regions, these figures are lower in the post-merger period compared to pre-merger.

For a more precise analysis, the sample is divided into nine sub-samples including deal value, different market types, geographic diversification, product diversification, relative size, payment method, total assets, ROA and acquirers' risk profile before the merger to analyse the changes in the bidding banks' contribution to systemic risk. Table 6.4 reports the investigation of the sub-samples based on (A) deal characteristics and (B) acquirer characteristics.

Table 19: Sub-sample Analysis

Sub-sample analysis. The table presents the changes in systemic risk (MES and ΔCoVaR) for the different sub-samples of acquirers. The sub-samples are built using the dummy variables for deal value, cross-border mergers, activity-diversifying mergers, relative size, payment method, acquirers' total assets and ROA as well as different markets and acquirers risk profile before merger. The statistical significance of the changes in the MES and ΔCoVaR are then tested by the use of a standard t-test. The p-values are denoted in parentheses

	N	ΔMES	Change in ΔCoVaR
<i>Panel A: Deal Characteristics</i>			
Deal value			
High deal value	203	0.000 (0.669)	0.000 (0.294)
Medium deal value	203	0.000 (0.816)	0.000 (0.704)
Low deal value	202	0.001 (0.467)	0.000 (0.448)
Geographic diversification			
Cross-border merger	50	0.001 (0.624)	0.000 (0.691)
Domestic merger	558	0.000 (0.880)	0.000 (0.849)
Product diversification			
Activity-diversifying merger	58	-0.001 (0.459)	0.000 (0.442)
Focusing merger	543	0.000 (0.578)	0.000 (0.841)
Relative size			
Low relative size	202	0.001* (0.058)	0.001 *** (0.005)
Medium relative size	203	0.000 (0.788)	0.000 (0.107)
High relative size	203	-0.001 (0.306)	0.000 (0.233)

Markets			
Emerging markets	55	0.002 (0.280)	-0.001 (0.142)
Developed markets	539	0.000 (0.818)	0.000 (0.650)
Frontier markets	14	0.002 (0.499)	0.000 (0.763)
Payment method			
Cash only	157	0.002 ** (0.045)	0.000 (0.181)
Others	451	0.000 (0.426)	0.000 (0.401)
<i>Panel B: Acquirer characteristics</i>			
Total asset			
High total assets	203	0.000 (0.837)	0.000 (0.314)
Medium total assets	203	0.001 (0.161)	0.000 (0.233)
Low total assets	202	0.000 (0.560)	0.000 (0.907)
Acquirers risk profile before merger			
High risk profile before merger	203	-0.001 (0.233)	0.000 (0.148)
Medium risk profile before merger	203	0.001 (0.248)	0.000 (0.609)
Low risk profile before merger	202	0.001 (0.198)	0.000 (0.140)
ROA			
High ROA	203	0.000 (0.457)	0.000 (0.735)
Medium ROA	203	0.000 (0.996)	0.000 (0.746)
Low ROA	202	0.000 (0.862)	0.000 (0.702)

******, * Denotes significance at 5%;10%

******* Denotes significance at 1%

Panel A of table 6.4 shows deal characteristics, differentiating first between high, medium, and low deal values. The results show that all the change in MES and ΔCoVaR for the bidding banks are statistically insignificant for all of the sub-samples based on the deal size. This finding interestingly contradicts

Mühlnickel and Weiß (2015) as they find that the larger the size of the merger, the more significant the incremental increase in the insurance acquirers' contribution to the probability of a crash of the insurance industry will be. These differing results may be because the authors measure extreme systemic risk by using lower tail dependence methodology as opposed to MES. Furthermore, the nature of the acquirers' markets is considered, differentiating between developing market, developed market and frontier market. As can be seen, bank M&As still do not produce any risk-reducing or risk-increasing effects for systemic risk.

In the next section, cross-border mergers and domestic deals, and focusing and product diversifying deals, are distinguished from one another. The results offer evidence that neither of the two forms of geographic and product diversification influence acquirers' contribution to systemic risk. These results are rather similar to the outcomes of Vallascas and Hagendorff (2011) as they find that European bank consolidations do not affect an acquiring bank's changes in default risk, regardless of the high potential for risk reduction displayed by product-diversifying or cross-border deals. This result raises doubt on the capability of bank consolidation, to make use of risk-decreasing and to stabilise effects on the banking sector.

Next, the relative deal value is employed, differentiating between high, medium, and low relative size. The results show that for deals where the target size is small compared to acquirers' market value, there is an increase in the MES and ΔCoVaR (statistically and economically significant at 10% level for MES and 1% level for ΔCoVaR). Specifically, the contribution to systemic risk of acquiring banks increases for deals with low relative size. To justify this finding, Acharya and Yorulmazer (2007) show in their theoretical setup that often, when

banks default, it is optimal for the regulator to bail out some or all of the banks in distress. However, when the number of failed banks is small, the failed banks will exit the market via the acquisition channel, making them the target of other predators. As a consequence, small banks are motivated to engage in M&As with larger banks to gain an implicit bailout guarantee, which in turn increases overall systemic risk. Moreover, similar to private targets, small banks are less transparent, thus creating an agency problem for the bidders.

The last specification in panel A distinguishes between mergers financed by cash only and mergers financed by other methods (shares only, shares and cash). There is an increase in the MES for cash-only deals (statistically and economically significant at 5%); thereby such deals contribute to the increase in acquirers' contribution to systemic risk. This constitutes preliminary evidence for the third hypothesis of this chapter. Indeed, Furfine & Rosen (2011) propose that deals which are fully paid for in cash are expected to raise acquiring banks' default risk, due to acquirers replacing safe liquid assets (cash) with a riskier balance sheet of the target, possibly leading to an increase in acquirers' contribution to systemic risk.

Panel B of Table 6.4 presents the results attained using acquirer characteristics. The first two specifications are based on the bidding banks' total assets and ROA. As evidenced, all of the changes in the MES and ΔCoVaR are statistically insignificant. It indicates that mergers do not alter the level of acquirers' contribution to systemic risk, regardless of their size or pre-merger profitability performance. The last specification in this panel divides the pre-merger default risk profile of acquirers into high risk, medium risk and low-risk

bidders. No statistically significant change in MES and ΔCoVaR are observed for this category in any of the sub-samples based on acquirers' risk profile.

Overall, results from the univariate test reveal that mergers and acquisitions do not influence the acquiring banks' contribution to systemic risk, regardless of the increased potential for risk diversification exhibited by cross-border and cross-industry bank mergers. However, for a group of deals, where target size is relatively small compared to acquirers' market value and deals that are financed by cash-only, mergers increase acquirers' contribution to systemic risk.

6.4.2 The determinants of the merger-related changes in acquirers' contribution to systemic risk

To assess the robustness of the univariate tests above, this part examines whether certain types of deal, acquirer characteristics, and country characteristics influence acquirers' contribution to systemic risk. The results of the multiple regressions of systemic risk effects around bank mergers focus on the determinants of merger-related changes on acquirers' MES presented in Table 6.5 and acquirers' ΔCoVaR in Table 6.6 below.

Table 20: Determinants of the Changes in MES

Determinants of the changes in MES: deal characteristics, acquirer characteristics and acquirers' macroeconomic environment. The dependent variable is the change in MES. The model is estimated via OLS with heteroskedasticity-consistent Huber–White standard errors. Model (1) uses all acquirers, model (2) uses the same acquirers but without country controls, model (3) uses US acquirers and model (4) uses non-US acquirers. All sources of variables and data are defined in chapter 4. Statistically significant coefficients are highlighted in bold type. The P-values are denoted in parentheses.

	(1) All banks	(2) All banks	(3) US banks	(4) Non- US banks
<i>Acquirers and deal characteristics</i>				
Product diversification	-0.0017 (0.2403)	-0.0019 (0.1984)	0.0018 (0.3459)	-0.0042 * (0.0630)
Payment method	0.0024 ** (0.0195)	0.0027 ** (0.0121)	0.0015 (0.2178)	0.0053 *** (0.0068)
Status of target	0.0032 (0.1974)	0.0026 (0.1540)	0.0012 (0.3681)	0.0048 (0.1960)
Deal size	0.0715 (0.9049)	0.1170 (0.8442)	0.2000 (0.5320)	1.2870 (0.4055)
Relative size	-0.0014 *** (0.0023)	-0.0012 *** (0.0050)	-0.0029 ** (0.0314)	-0.0014 ** (0.0232)
Cross-border	0.0006 (0.7231)	-0.0001 (0.9305)	0.0001 (0.9696)	-0.0005 (0.8557)
ROA	-0.0238 (0.7905)	-0.0001 (0.9986)	-0.0100 (0.9061)	0.0428 (0.7349)
Market to book	0.0596 (0.5175)	0.0797 (0.3367)	0.0009 (0.9919)	0.1568 (0.4921)
Leverage	-0.0063 (0.3162)	-0.0044 (0.4929)	-0.0064 (0.5627)	-0.0005 (0.9507)
Operating efficiency	-0.0577 (0.3085)	-0.0247 (0.6427)	-0.0500 (0.4954)	-0.0986 (0.2717)
Capital ratio	-0.0037 (0.8295)	-0.0010 (0.9517)	-0.0002 (0.9930)	-0.0334 (0.2958)
Acquirers' total assets	-0.0099 (0.9882)	-0.0699 (0.9172)	0.1000 (0.6920)	-1.1680 (0.4818)
High-risk banks	0.0015 (0.2216)	0.0013 (0.2588)	0.0018 * (0.0856)	0.0035 (0.1436)
<i>Country control</i>				
GDP	-0.0144			-0.0027

	(0.6250)			(0.9429)
HHI	-0.0086 *			-0.0038
	(0.0907)			(0.4800)
Political stability	-0.0013			-0.0031
	(0.2970)			(0.1940)
Rule of Law	-0.0015			-0.0008
	(0.2850)			(0.7445)
Constant	0.0019	-0.0029	-0.0008	0.0022
	(0.7291)	(0.5362)	(0.8632)	(0.8785)
R-squared	0.0436	0.0287	0.0261	0.1751
Adj. R-squared	0.0159	0.0073	-0.0029	0.0735
Number of observations	608	608	452	156

**, * Denotes significance at 5% and 10%

*** Denotes significance at 1%

Table 21: Determinants of the Changes in ΔCoVaR

Determinants of the changes in ΔCoVaR : deal characteristics, acquirer characteristics and acquirers' macroeconomic environment. The dependent variable is the change in ΔCoVaR . The model is estimated via OLS with heteroskedasticity-consistent Huber–White standard errors. Model (1) uses all acquirers, model (2) uses the same acquirers but without country controls, model (3) uses US acquirers and model (4) uses non-US acquirers. All sources of variables and data are defined in chapter 4. Statistically significant coefficients are highlighted in bold type. The P-values are denoted in parentheses.

	(1) All banks	(2) All banks	(3) US banks	(4) Non-US banks
<i>Acquirers and deal characteristics</i>				
Product diversification	-0.0005	-0.0006	0.0003	-0.0012
	(0.3186)	(0.2187)	(0.6807)	(0.1270)
Payment method	0.0007 *	0.0006 *	0.0001	0.0024 ***
	(0.0861)	(0.0978)	(0.7557)	(0.0019)
Status of target	0.0022 **	0.0022 ***	0.0003	0.0022
	(0.0251)	(0.0082)	(0.4651)	(0.1003)
Deal size	-0.0736	-0.1000	0.0728	0.4540
	(0.7364)	(0.5679)	(0.5832)	(0.3927)
Relative size	-0.0004 **	-0.0004 **	-0.0008 *	-0.0005 **
	(0.0241)	(0.0241)	(0.0857)	(0.0374)
Cross-border	0.0008	0.0004	0.0017	0.0004
	(0.2069)	(0.4714)	(0.1562)	(0.6481)
ROA	-0.0145	-0.0200	-0.0100	0.0004

	(0.6564)	(0.4149)	(0.6898)	(0.9940)
Market to book ratio	0.0010	0.0100	0.0090	-0.0430
	(0.9756)	(0.6604)	(0.7803)	(0.5675)
Leverage	-0.0014	-0.0012	-0.0028	0.0023
	(0.5639)	(0.6225)	(0.5257)	(0.4803)
Operating efficiency	-0.0003	0.0003	-0.0047	0.0012
	(0.9904)	(0.9898)	(0.8854)	(0.9714)
Capital ratio	-0.0001	0.0005	0.0034	-0.0213
	(0.9908)	(0.9421)	(0.7322)	(0.1220)
Acquirers' total assets	0.0952	0.0940	0.1000	-0.4320
	(0.6913)	(0.6972)	(0.1279)	(0.4189)
High-risk banks	0.0006	0.0005	0.0005	0.0013
	(0.1512)	(0.2233)	(0.2288)	(0.1555)
<i>Country control</i>				
GDP	-0.0016			0.0145
	(0.8955)			(0.2747)
HHI	-0.0019			0.0003
	(0.3732)			(0.8982)
Political stability	-0.0009 **			-0.0012
	(0.0275)			(0.1518)
Rule of Law	0.0008			0.0005
	(0.1034)			(0.6098)
Constant	-0.0030	-0.0023	-0.0016	-0.0007
	(0.1437)	(0.2144)	(0.3881)	(0.8636)
R-squared	0.0343	0.0244	0.0194	0.1472
Adj. R-squared	0.0063	0.0029	-0.0098	0.0421
Number of observations	608	608	452	156

**, * Denotes significance at 5% and 10%

*** Denotes significance at 1%

As shown, the results from both tables are quite similar. Therefore, these will be discussed at the same time. Regression (1) of Table 6.5 and Table 6.6 estimates the relationship between the changes in the acquirers' MES and ΔCoVaR using acquirer and deal characteristics as well as acquirers' macroeconomic environment for the full sample of mergers. The independent

variable, payment method in MES and ΔCoVaR regressions has positive and statistically significant coefficients at 5% and 1% level respectively. This finding is consistent with the univariate test in the previous section where mergers financed by cash only increase acquirers' contribution to systemic risk. This is likewise in line with the hypothesis that when safe liquid assets (cash) is replaced by a riskier balance sheet of targets, the bidders' default risk may increase which, in turn increases the bidder's contribution to systemic risk (Furfine and Rosen, 2011). Therefore, hypothesis 6.3, which predicts that cash-only mergers increase acquirers' contribution to systemic risk, cannot be rejected.

Other controlled variables, such as relative size, the status of target, HHI and political stability, also have significant coefficients. More specifically, relative size has negative and statistically significant coefficients (at 1% level in MES and 5% in ΔCoVaR regression). This indicates that the smaller the deal value compared to acquirers' market value, the more likely mergers will increase acquirers' contribution to systemic risk. This is consistent with the univariate test in the previous section. This effect may be explained by the fact that small banks are motivated to engage in M&A with larger banks in order to gain an implicit bailout guarantee from the government, which in turn increases overall systemic risk (Acharya and Yorulmazer, 2007). This result is somewhat consistent with the findings of Weiß et al. (2014) as they detect systemic risk increase, regardless of whether the relative size is small, medium or large. The status of target in regression (1) of Table 6.6 shows a positive and statistically significant coefficient. This means that private target is a determinant of the increase in acquirers' contribution to systemic risk, as expected. Indeed, mergers involved in private targets are projected to produce a risk-increasing effect for acquirers

because private firms are subject to lower disclosure requirements. Consequently, this restricts the acquirers' capabilities to evaluate the risks associated with private targets by themselves in addition to making acquirers' due diligence ineffective. Therefore, the acquisitions of hidden risks from target firms may contribute to the increase in acquirers' default risk as well as to their contribution to systemic risk. In the same regression, political stability witnesses a negative and statistically significant coefficient. This means that a macroeconomic environment with high political stability will help to decrease acquirers' contribution to systemic risk, which is again consistent with Weiß et al., (2014). Also, the bank concentration index HHI has a negative and statistically significant coefficient (at 10% level) in regression (1) of Table 6.5. It implies that the more concentrated a banking system is, the more acquirers' contribution to systemic risk will decrease, which is an initial signal of the 'concentration-stability hypothesis' as seen in Beck et al. (2006).

Moving onto regression (2) of Tables 6.5 and 6.6, the motivation for this specification is that acquirers and deals characteristics can solely drive the cross-sectional variation in the deal-related changes of acquiring banks' MES and ΔCoVaR . It continues to observe the positive and statistically significant coefficient of payment methods, affirming the findings in regression (1) of both tables. Results from regression (2) of both tables support the previous findings from regression (1) that other controlled variable such as the status of target and relative size are significant determinants of merger-related change in acquirers' MES and ΔCoVaR .

To understand what drives the baseline results, the sample is split between US and non-US deals. Results are presented in regressions (3) and (4)

respectively. As shown, statistically significant coefficients are observed for the independent variables, such as payment method and product diversification for non-US acquirers only. It indicates that the statistically significant coefficients of payment method from regression (1) and (2) for the whole sample of both tables are affected by the results of non-US acquirers. Furthermore, product diversification in regression (4) of Table 6.5 has a negative and statistically significant coefficient (at 10% level). This indicates that product-diversifying deals help to decrease non-US acquirers' contribution to systemic risk following a merger. This is consistent with results from the previous chapter, that product diversification reduces acquirers' default risk. However, it largely contradicts Mühlnickel and Weiß (2015) who find that diversification destabilises the insurance industry. Therefore, the second hypothesis of this chapter, which projects that product-diversifying deals produce more systemic risk-reducing effect for acquirers than focusing deals, cannot be rejected.

Conversely, in terms of controlled variables, the significant result for relative size, holds for both US and non-US acquirers, which is consistent to previous findings. Regression (3) of Table 6.5 also witnesses a positive and significant coefficient of TBTF motive (at 10% level). This finding indicates that in the U.S. the destabilising effect of bank mergers is caused by a bank's desire to become TBTF. It is also in line with results from Weiß et al., (2014) who find that TBTF motive is one of the main factors causing an increase in acquiring banks' contribution to systemic risk among large banks using MES model. The motivation to become SIFIs to exploit government safety nets and bailouts, urges banks to pursue even risky M&As or value-destroying merger deals, which in turn increases a bank's contribution to systemic risk.

Overall, the findings in all of the regressions support the results of the univariate analysis. First, for deals financed by cash only, the acquirers' contribution to systemic risk is increasing. Whereas, mergers involved in product diversification contribute to the decrease in systemic risk for non-US acquirers. Other controlled variables, such as status of target, relative size, TBTF motive, political stability, and HHI, all affect the changes in acquirers' contribution to systemic risk. As shown, the results of this study are consistent in both the univariate tests and in all specifications of regression using both systemic risk measures MES and ΔCoVaR . To further validate the robustness of the outcomes, a different estimation method of ΔCoVaR is conducted, based on the standard quantile regression as in Adrian and Brunnermeier (2016). It finds that all conclusions remain unchanged.

6.5 Conclusion

The banking sector plays a substantial role in every economy and is a key segment for the stability of financial systems. Consequently, banking supervisors and regulators aim to strengthen the financial system and reduce the frequency and severity of future potential financial vulnerability. Trustworthy indicators of the banking system welfare are of great importance. In this paper, the acquiring banks' contribution to systemic risk are assessed on a global sample of bank mergers from 1998 to 2015. Academic literature to date, has been debated with respect to the implications of bank mergers on acquirers' contribution to systemic risk and the determinants of the changes in bidders' systemic risk (see Bierth et al., 2015; Molyneux et al., 2014; Raffestin, 2014; Weiß et al., 2014). To the best of our knowledge, this is the first study to extend the literature by examining the risk effects of product diversification on bidders' contribution to systemic risk.

To measure systemic risk, this chapter employs two models, Marginal Expected Shortfall from Acharya et al., (2017) and ΔCoVaR from Adrian and Brunnermeier (2016) as they are the best models to measure acquirers' contribution to systemic risk. Various empirical studies have shown that both models provide a reliable, well-known and strong predictor of a firm's contribution to systemic risk. Using both models can enhance the robustness of the results and can overcome the limitations of relying on outcomes that use only one model. Moreover, both models can complement each other's weaknesses as they are conceptually distinct.

Overall, findings from the univariate test suggest that M&As do not impact on the acquiring banks' contribution to systemic risk, regardless of the increased potential for risk diversification exhibited by cross-border and cross-industry bank mergers. Therefore, the first hypothesis, which predicts that mergers generate systemic risk-reducing effect for acquiring banks, is rejected. When examining the influence of potential factors that are anticipated to have an impact on the change in bidding banks' contribution to systemic risk, payment method, product diversification, the status of target, relative size, TBTF motive, HHI and political stability, are all found to be significant determinants. In terms of independent variables, for deals financed by cash only, the acquirers' contribution to systemic risk will increase. These results support the view that deals which are fully paid for in cash are expected to raise acquiring banks' default risk, as acquirers are replacing safe liquid assets (cash) with a riskier balance sheet of the target; thereby increasing acquirers' contribution to systemic risk (Furfine and Rosen, 2011). Hypothesis three of this chapter therefore, cannot be rejected. Furthermore, product-diversifying deals decrease acquirers' contribution to

systemic risk for non-US acquirers. This largely contradicts Mühlnickel and Weiß (2015) who find that diversification destabilises the insurance industry. The second hypothesis of this chapter, thus, cannot be rejected.

Among other controlled variables, private targets prevent acquirers from realising the systemic risk-reduction effect. Indeed, the literature supports the notion that merger deals involved in private targets are expected to generate risk-increasing effect for acquirers because private firms are subject to lower disclosure requirements. Consequently, this limits the acquirers' capabilities to evaluate the risks associated with private targets themselves, in addition to causing bidders' due diligence to become ineffective. Furthermore, the smaller the deal size in comparison with acquirers' market value, the more likely it is that mergers will increase acquirers' contribution to systemic risk. This effect may be explained as small banks are motivated to engage in M&A with larger banks in order to gain an implicit bailout guarantee from the government. This in turn increases overall systemic risk (Acharya and Yorulmazer, 2007). Further, TBTF is a motive for U.S. acquirers in exploiting safety net and government bailouts, which in turn increase acquirers' contribution to systemic risk. Regarding the macroeconomic environment of bidders, the more stable a political environment in an acquirer' country, the higher the reduction of bidders' contribution to systemic risk will be. Finally, a more-concentrated banking system may help acquirers' contribution toward decreasing systemic risk.

The findings of this chapter lead to interesting implications and recommendations for banking supervisors and policymakers. Overall, the results convey a critical view of the risk-reduction potential of bank M&As. Bank mergers, on average, are risk neutral. Nevertheless, some deals such as cash-only

mergers, mergers involved in private targets, as well as mergers involved high-risk acquirers pre-merger, should undergo a stricter merger approval process by banking regulators as these deals are particularly prone to destabilising the banking sector. Therefore, it is necessary for banking supervisors to consider the aspect of financial stability as a further important criterion within the approval process for bank mergers. Moreover, bank size is often considered to be associated with negative externalities caused by TBTF institutions. The results from this chapter, however, suggest an opposing view. Specifically, the smaller the size of targets compared to bidders, the more the increase in acquirers' contribution to systemic risk will be. This means that mergers that create very large banks are not associated with larger systemic risk. Rather, mergers involving smaller targets, which are usually not paid much attention by regulators, should be concerned because they add to the detrimental effect on systemic risk.

Chapter 7: How Default Risk Relates to Systematic Risk, Systemic Risk and Idiosyncratic Risk? An Investigation Under the Context of Bank Merger

7.1 Introduction

The overall aim of this chapter is to examine whether default risk is systematic, systemic and/or idiosyncratic in banking under the context of M&As. It is widely accepted within existing literature that M&A activities alter the risks of acquiring banks, particularly the risks of large banks whose credit or liquidity problems may affect many other institutions (Casu et al., 2015; Laeven et al., 2016; Vallascas and Hagendorff, 2011; Weiß et al., 2014). When the risk of a merged bank is higher, this raises the probability that the bank will fail or become illiquid before settling all of its payment obligations. It also exposes other institutions directly to risks as payees, or indirectly through contributing to panic runs or securities market problems. On the one hand, the benefits of bank M&As include potential diversification gains and cross-selling opportunities, which can help to diversify profits by realising new revenue streams; thereby reducing a bank's idiosyncratic risk and default risk (Emmons et al., 2004, Hughes et al., 1999, van Lelyveld & Knot, 2009). On the other hand, default risk may increase during post-merger because of the acquisition of risks from bidders, e.g. idiosyncratic risk, liquidity risk (Billett et al., 2004); managerial compensation at the expense of risk increase (Harford and Li, 2007) or the increase in bidders' leverage post mergers, both theoretically in Morellec & Zhdanov (2008) and empirically in Ghosh & Jain (2000). Furthermore, a possible downside is that merged banks, through becoming more similar to each other, now face common shocks, which raises the systematic and systemic risk of a bank (Wagner, 2010).

Therefore, it can be said that M&As not only affect an acquiring bank's idiosyncratic risk and default risk, but also its contribution to systemic and systematic risk.

This leads to the natural empirical question of how M&As affect the interactions between the following three pairs of risk: default risk versus idiosyncratic risk, default risk versus systemic risk and default risk versus systematic risk. The evidence from literature so far has been mixed with regards to whether default risk is systematic or idiosyncratic (for instance Asquith and Gertner, 1994; Campbell et al., 2008; Denis and Denis, 1995; Dichev, 1998; Lang and Stulz, 1992; Opler and Titman, 1994). Existing evidence on the relationship between default risk and systematic risk is frequently varied: Denis and Denis (1995), Lang and Stulz (1992) and Vassalou and Xing (2004) find that default risk is predominantly related to aggregate elements. It infers that default risk can be positively associated with systematic risk. For instance, Lang and Stulz (1992) confirm that when a company announces bankruptcy, this leads to competitive and contagion effects on other companies within the same industry. Furthermore, Denis and Denis (1995) find that post-recapitalised economic and regulatory developments (systematic risk) are a central cause of financial distress (default risk) in their sample firms.

In contrast, Asquith and Gertner (1994), Dichev (1998) and Opler and Titman (1994) assert that industries' default risks are typically associated with idiosyncratic factors. For example, Asquith and Gertner (1994) observe that asset sales are one way for financially distressed firms to avoid bankruptcy. Meanwhile secured private debt and public debt increase the possibility for distressed firms to file for bankruptcy. This means that default risk is idiosyncratic (i.e.

diversifiable). This mixed evidence is perhaps due to the variety of indicators used to measure default risk. Namely, default risk has been estimated using accounting models (Dichev, 1998; Griffin and Lemmon, 2002) in addition to information from bond (Dichev and Piotroski, 2001; Hand et al., 1992) and equity markets (Campbell et al., 2008; Vassalou and Xing, 2004). Accordingly, the relative question of whether default risk is systematic or idiosyncratic has not been satisfactorily answered. In addition, this chapter builds on other studies that have investigated the relationship between default risk and systemic risk (Battiston et al., 2012; Fiordelisi and Marqués-Ibañez, 2013; Souza et al., 2016). Fiordelisi and Marqués-Ibañez (2013) find that increases in indicators of bank default risk do have an effect on the banking industry (increasing its systemic risk). However, a remarkable body of empirical literature on stress-testing in financial systems debated that the default of an individual institution was typically unable to trigger a domino effect (see Elsinger et al., 2006; Furfine, 2003); therefore, default risk is not systemic in nature¹⁸.

Overall, there are several gaps in the current literature regarding default risk and its relationship to other risks. Firstly, most of the earlier work on whether default risk is systematic, systemic or idiosyncratic did not distinguish between banking and non-banking firms (Campbell et al., 2008; Vassalou and Xing, 2004). This distinction is very important because systemic risk is found to be significantly larger in the banking sector. It is because common factors mainly drive interdependencies within the banking industry, while in other industries, they are generally driven by idiosyncratic factors. Secondly, the question of how the

¹⁸ For detailed discussions regarding why default risk can be systematic, systemic or idiosyncratic, see literature review 7.2.2.

change in default risk of acquirers following a merger affects the variations in their idiosyncratic risk, systemic risk and systematic risk remains unsolved in previous empirical studies. Answering these questions is very crucial in terms of the regulators' point of view, given the fact that M&As have lately been granted additional incentive by the global financial crisis of 2007-2009. Indeed, regulators have highlighted the role of M&As as a tool to avoid banking firms' failures and costly bailouts for the TBTF (Group of Thirty, 2009). In an attempt to resolve the 1997 Asian financial crisis, policy-makers have become committed to reducing over-competition among a number of banks in the market. One strategies is for regulators to seemingly favour bank mergers (Shih, 2003). For example, in 1998, the governor of the central bank of the Philippines stated, "The central bank favours mergers as a way to keep the number of bank failures to a minimum..." Meanwhile, the Malaysian government urged banks to merge into a total of only six banks (which later became 10). Soon after, Taiwan's president announced the so-called 'Second Phase of Financial Reform' in an attempt to encourage banks to consolidate, or form strategic alliances, with foreign financial institutions. The objectives of bank mergers, to reduce bankruptcy risk, are the same across these countries. Hence, the number M&As was booming in Asia during this time (Shen and Lin, 2011). Nevertheless, the situation is in fact more complicated than this, assuming that consolidated banks might be safer after the merger. However, the literature is still inconclusive with regards to whether a reduction in default risk following a merger might result in a reduction in acquirers' systemic risk or systematic risk. A recent study from Nijskens and Wagner (2011) shows that banks use credit risk transfer activities in order to reduce individual risk (lower idiosyncratic risk), but in turn, pose a greater systemic risk to the financial system

whilst at the same time increasing beta and return correlations across banking firms. This creates a challenge for financial regulations, which have typically focused on individual institutions. Therefore, if M&As do reduce an individual bank's default risk (which has been proven in Chapter 5), but simultaneously increase the bank contribution to the volatility of the banking system, this will raise the question of whether bank mergers should or should not be encouraged by banking regulators and supervisors.

Overall, the primary aim of this chapter is to analyse whether the changes in acquiring bank's default risk as a result of M&As will influence acquirers' own idiosyncratic risk; or whether this extends to other banks (systemic risk) or all listed companies (systematic risk). Therefore, examining the risk profiles of banks during the pre-merger period (without M&As), and the change in risk profiles of acquirers between post-completion and pre-merger period (under the influence of M&As), enables this chapter to create an in-depth investigation into the relationship between default risk and the other risks of acquirers. As a result, it adds further insights into existing literature. However, the challenge associated with this research objective is that there is no previous study exploring these interactions between the changes in default risk and the other risks that acquirers may face as a result of M&As. Therefore, this chapter combines two separate works of literature regarding (1) whether default risk is systematic or idiosyncratic, and relationship between default risk and systemic risk and (2) the effects of bank mergers on these relationships.

In line with these gaps in literature, the contribution of this chapter is fourfold. Unlike previous studies (Li and Zinna, 2014; Qi et al., 2014), to the best of the author's knowledge, this study is the first to examine the interactions

between acquiring bank's default risk and their idiosyncratic risk, systematic risk as well as systemic risks within the banking sector, under the context of bank mergers, thereby recognizing the specific features of this industry. Second, it provides supporting evidence on these relationships in the pre-M&A period. Third, it offers broader results regarding the effects of acquirers' characteristics and their home country's macroeconomic factors on the changes in acquirers' systematic risk, systemic risk and idiosyncratic risk post-merger, thereby unfolding the risk effects of bank mergers. Finally, it provides further evidence of the impact of bank size in addition to the level of income diversification on banking risks.

The findings emerging from this study suggest that, in general, during a pre-merger period (without M&As), acquiring banks' default risk influence their contribution to systemic risk (MES)¹⁹ and idiosyncratic risk. This result is particularly pronounced for non-US acquirers. It indicates that the risk of default on any individual bank does not only affect a bank's stockholders but also extends to other banks within the banking system, causing the banking industry to become fragile and volatile. This is consistent with many studies, such as (Asquith and Gertner, 1994; Dichev, 1998; Fiordelisi and Marqués-Ibañez, 2013; Opler and Titman, 1994). In contrast, no relationship is found between default risk and beta. Other factors such as income diversification, capitalisation, GDP and HHI, play important roles in explaining acquirers' pre-merger systematic risk, systemic risk and idiosyncratic risk.

¹⁹ Acquirers' contribution to systemic risk is also referred as MES (Marginal Expected Shortfall)

Next, with regards to the effect of bank mergers, no relationships were found between Δ default risk and Δ MES or between Δ default risk and Δ beta, which suggests that M&As do not affect these relationships in general. However, acquirers with the highest default risk before mergers witness their increase in MES as a result of M&As. This result is specifically pronounced for U.S. acquirers more than non-U.S. acquirers. Besides, the changes in acquiring bank's default risk as a result of M&As have a positive direct impact on the change in their' own idiosyncratic risk. It is however, of significant interest that bank mergers are proven to reduce the default risk of acquiring banks as shown in Chapter 5 of this study. Therefore, it is possible to conclude that the reduction in acquirers' default risk following a merger also results in the reduction of their idiosyncratic risk, which means that M&As lead to safer banks individually. Other variables, such as cost-income ratio, income diversification, capitalisation and GDP, are all important drivers of the change in acquirers' idiosyncratic risk post-merger.

The remaining part of the chapter proceeds with a summary of the existing body of literature regarding the concept of systematic risk and idiosyncratic risk²⁰, followed by a detailed discussion on the effects of default risk on systemic risk, systematic risk and idiosyncratic risk. The research methodology is proposed in the third section and the cross-sectional analysis is provided in section four. The last section offers a concluding remark for the whole chapter.

²⁰ The concepts and definitions of default risk and systemic risk are discussed in section 5.2.1 of Chapter 5 and section 6.2.1 of Chapter 6 respectively.

7.2 Literature Review

The current section begins by discussing the concept of systematic risk and idiosyncratic risk. Next, it also examines critically the existing evidence on the paired relationships, between default risk and systematic risk; default risk and idiosyncratic risk; and default risk and systemic risk before proposing the research hypotheses of this chapter.

7.2.1 The concept of systematic risk and idiosyncratic risk

The fundamental ground of the CAPM is that the volatility of an asset can be split into two parts: a systematic risk and a firm-specific risk (idiosyncratic risk)²¹. The systematic risk is the risk of being affected by general market movements. For instance, an increase in interest rates will cause some new issued bonds to increase in value, whilst causing some company stocks to fall in price, as investors perceive executive teams to be cutting back on spending. It represents the part of a firm or an asset's volatility that is precisely, positively or negatively correlated with the market. The specific risk, however, is specific to each asset or firm. It represents the remaining part of an asset's volatility that is not correlated to the market. When investors form portfolios, the systematic risk parts of individual assets are merely added up to give the systematic risk of the whole portfolio. This risk is non-diversifiable and will be present in all portfolios. The specific risk parts do not add up; however, they tend to compensate each other, mainly when the assets are considered as negatively correlated. This is the impact of diversification. Hence, in a well-diversified portfolio, each asset's

²¹ The terms firm-specific risk and idiosyncratic risk will be used interchangeably in this chapter.

specific risk should be eliminated by diversification, to ensure that the total portfolio's specific risk becomes insignificant (Lhabitant, 2004).

Systematic risk in the banking sector can arise from macroeconomic factors such as inflation, changes in interest rates, fluctuations in currencies, recessions and wars. For instance, when interest rates increase unexpectedly, a bank's cost of funds may increase, and the value of its longer-term, illiquid assets may fall, leading to the reduction of both the bank's profitability (net interest margin) and the market value of the bank's equity. Examples of idiosyncratic risk within banking include: poor earnings, changes in cash flow position, strikes by employees, computer system failures and poor managerial expertise (Berger et al., 2015).

7.2.2 The effect of default risk on systematic risk, idiosyncratic risk and systemic risk

7.2.2.1 Is default risk systematic or idiosyncratic?

Literature on default risk modelling is vast and continues to grow (Agarwal and Taffler, 2008; Bellalah et al., 2016; Lawrence et al., 2015). Most of this literature focuses on credit risk management and the pricing of corporate debt and a variety of credit derivatives. Researchers tend to pay less attention to the relationships between default risk and systematic risk and between default risk and various idiosyncratic factors. In the banking industry, default risk can also become systematic when the failure of a single bank affects, not only that single company but spills over to other institutions, either financial or non-financial. This increase in overall financial risk, which cannot be diversified away from, is projected to lead to a greater premium charged by investors for enduring such a risk (Campbell et al., 2008). Compared to other sectors, there are theoretical

reasons to expect that the systematic component of default plays a particularly important role in the banking industry. First, the failure of either a large number of banks, or the failure of a small number of large banks, could set off a chain reaction that may undermine the stability of the financial system. Public information regarding the condition of individual banks is highly imperfect. Therefore, when many banks fail, it may be difficult to identify whether the cause is due to idiosyncratic shocks to individual banks or to a more widespread shock that threatens many other banks. Thus, the news that some banks have failed may create destructive panic runs by uninsured creditors on other solvents, but illiquid banks as these creditors might feel insecure on whether or not the shock might influence their banks. Moreover, as interbank transactions are significant, variable, and difficult for outsiders to monitor, interbank markets might be another means through which the shocks of one bank are spread speedily to other banking firms (Berger et al., 1995).

In contrast, idiosyncratic bank risk primarily affects a single banking firm, and therefore should be trivial in diversified bank portfolios. However, idiosyncratic risk is said to influence default risk, which may lead to contagion effects within the banking industry. Contagion effects often happen in the event of bankruptcy, when market participants are uncertain about the cause of failure or unsure of the effective exposures in asset portfolios across banks, or when bank assets or liabilities contain common elements. Overall, these relationships emphasise the importance of differentiating and analysing both systematic and idiosyncratic components of bank default risk (Bessler et al., 2015).

However, as discussed in the introduction, empirical evidence in the literature is associated with the no consensus on whether default risk is

systematic or idiosyncratic. Some studies suggest that if default risk is correlated with systematic risk, it should have size effect and book-to-market effect. Moreover, there should be a positive relationship between risk and return. Therefore, the effects of firm size and market-to-book, are probably the two most potent predictors of stock returns and could be related to some firm default risk factors. For example, Chan and Chen (1991) discover that the small firm effect are sometimes driven by inefficient companies, with cash flow issues and high leverage. Fama and French (1992) estimate that the risk of bankruptcy can affect the market-to-book effect. Besides, Chan et al. (1985) show that a default element can be used to explain much of the size effect, estimated as the distinction between low-grade and high-grade bond returns. Meanwhile, Chen et al. (1986) and Fama and French (1992) find that a similarly defined default factor is significant in explaining stock returns. A study by Dichev (1998) presents more direct and comprehensive evidence regarding the relationship between default risk and systematic risk. His measures of default risk are derived from existing models of default prediction, (Z-index in Altman, 1968 and Ohlson, 1980), which have been extensively employed in both practice and other research studies (Brown et al., 2015; Fu et al., 2014; Kim et al., 2016; Lawrence et al., 2015). His methodology entails classifying the USA stocks into ten portfolios, based on their default risk indicators and estimated returns. He finds that the portfolio with the highest default risk has the lowest returns. When default risk is not rewarded by higher returns, it is, therefore, not systematic.

Likewise, in a sample of the Thailand market, Byström et al., (2005) do not uncover substantial confirmation that bankruptcy risk is associated with the book-to-market ratio. Furthermore, market participants would believe that higher

default risk will be compensated by higher stock returns, should default risk is systematic. Nevertheless, in their sample, the level of default risk of a company is insufficient to justify for its successive realised returns either, before, during or after the 1996-98 Asian crisis. They, therefore, reject the hypothesis that default risk is systematic. In a similar vein, using the Chinese stock markets data from 2000 to 2006 and the iteration approach, Lin and Chen (2008) estimate the default risk implied in stock price using the structure model and examine whether default risk is a systematic risk of the Chinese stock market. The univariate, bivariate and multivariate portfolio analysis, as well as regression analysis, show that the expected returns from stocks are not affected by the implied default risks. In addition, there is no significant difference between portfolios with a high default risk and low default risk, even when other factors, such as size and book-to-market ratio are controlled. In summary, default risk is not a systematic risk factor of the Chinese stock market.

Contrary to Dichev (1998), Vassalou and Xing (2004) employ the option pricing model (market-based model) to test the impact of implied default risk on asset returns. The empirical results show that default risks are strongly related to size and book-to-market. The returns from portfolios with high default risks are much higher than those with low default risks. Therefore, default risk is perceived to be systematic. Interestingly, however, Altman and Hotchkiss (2006) find that the bonds of the most distressed firms (defined as high-yielding bonds) earn lower than subsequent average returns, consistent with bankruptcy risk being negatively related to systematic risk.

In one of the recent empirical studies, Qi et al., (2014) conduct a thorough analysis of the role played by the unobserved systematic risk factor in default

prediction. Using a sample of firms covered by the Moody's Corporate Default Risk Service database from 1979 to 2010, they found that, firm-level risk factors are the predominant drivers of default risk. This finding suggests that a default model, or a model used to derive the unobserved systematic risk factor, has to incorporate firm-level factors. As such, the unobserved systematic risk factors backed out by Koopman et al., (2011) may reflect the observed firm-level risk characteristics that were omitted from their model. Second, after controlling for firm-level risk characteristics, default risk appears to be more driven by the unobserved systematic risk factor than the observed systematic risk factors. Despite the observed systematic risk factors being statistically significant, incorporation of these factors cannot significantly improve the model's ability to rank ordering firms by default risk or noticeably boost default predictive accuracy. The unobserved systematic risk factor better captures the systematic risks in the default process, and furthermore, incorporating this latent factor improves the in-sample default predictive accuracy. This outcome proposes that it might be beneficial to consider the unobserved systematic risk factor when simulating portfolio credit losses, in order to capture the incremental risk and comprehensive risk under the requirements of the new Basel market risk rules.

One of the most exciting findings presented recently, is by Fiordelisi and Marqués-Ibañez (2013). Their study examines the impact of commonly used measures of individual bank default risk on systematic risks in 15 European countries (e.g. Austria, France, UK, Spain, Sweden). The focus on the banking sector is essential, due to the potential systemic nature of this industry. Their empirical sample builds on a unique dataset of listed banks, which includes commonly used measures of risk-based accounting bank data, as well as bond

and equity capital markets' information. They also differentiate between systematic and idiosyncratic risk components. They find that, for listed banks, individual banks' default risk (independent of how they measure) increases the banks' idiosyncratic risk and systematic risk. In summary, evidence shows that increases in indicators of bank default risk do affect a firm's shareholders or the level of risk taken within the banking industry and the financial system as a whole. Their results are in line with findings presented by Asquith and Gertner (1994), Dichev (1998) and Opler and Titman (1994), who found that industry default risks are mostly due to idiosyncratic factors.

In general, existing debates in the literature on whether default risk is systematic or idiosyncratic remain ambiguous. Altman and Hotchkiss (2006), Shumway (1996) and Vassalou and Xing (2004) found portfolio returns are strongly associated with default risk, suggesting that the risk of default is systematic. In contrast, Dichev (1998), Byström et al., (2005) and Lin and Chen (2008) do not observe any relationship between the expected returns from stocks and the implied default risks, thereby concluding that default risk is not systematic, but is somehow, due to idiosyncratic factors. This mixed evidence is perhaps due to the difference in choices of default risk measure. Namely, default risk has been estimated using accounting data and models (Dichev, 1998; Griffin and Lemmon, 2002) and information from bond markets (Dichev and Piotroski, 2001; Hand et al., 1992) and equity markets (Campbell et al., 2008; Vassalou and Xing, 2004). This emphasises the necessity for further studies on how market-based default measures, such as Merton's distance to default, are linked to systematic risks and to returns and other particularities (e.g. size, market-to-book ratio) of individual firms.

7.2.2.2 Relationship between default risk and systemic risk

As discussed in the introduction, the reason default risk can be systemic in banking is related to contagion or risk diversification practices among banks due, for instance, to securitisation. A conventional approach to measure contagion is by analysing the correlation coefficients across markets or asset returns, and contagion will be realised whenever there is an increase in correlation (Broto and Pérez-Quirós, 2014; Corsetti et al., 2005; Forbes and Rigobon, 2002). A recent study by Ballester et al. (2016) examine contagion among banks and banking firms in different nations and regions, throughout a phase of extended financial distress. They find supporting evidence of contagion in banking markets, which indicates an increase in co-movement in the Credit Default Swap returns. It also signifies that the default risk of an individual bank does positively affect its systemic risk. As mentioned previously, Fiordelisi and Marqués-Ibañez (2013) examine the relationship between the individual bank default risk and the systemic risk of a European banking sample. They confirm their study hypothesis that an increase in default risk of a single bank does increase the probability of widening systemic banking risks, suggesting that individual bank problems regularly affect the overall banking sector. This result holds robust, even under different measures of an individual bank's default risk. Similarly, Huang et al., (2012) find that the throughout the financial crisis 2007-09, the raise in systemic risk in the U.S. banking industry was firstly driven by increased default and liquidity risk premiums, and subsequently by the worsening in actual default risk. Moreover, a bank's contribution to the systemic risk indicator appears to be linearly related to its default risk, but highly nonlinear for institution size and asset correlation.

In contrast, a remarkable body of empirical literature on stress-testing in financial systems confirmed that the default of an individual institution was typically not able to trigger contagion in the banking sector (Boss et al., 2006; Elsinger et al., 2006; Furfine, 2003). Thereby, it is concluded that default risk is not systemic. For instance, Elsinger et al. (2006) studied the contribution of contagion to systemic risk by decomposing insolvencies into cases that resulted from domino effects (contagious defaults) and cases that did not (fundamental defaults). From the results of their analysis, they found that between the two driving sources of systemic risk, the correlation in exposures is far more critical than financial linkages, and more specifically, that the correlated portfolio exposure of banks is the primary source of systemic risk and that domino effects occur only rarely. While they do not know the reason for the high correlation of the banks' asset portfolios, it may be the result of cumulative risk shifting, as theorised by Acharya et al., (2017). Moreover, if bankruptcy costs are low and an effective crisis resolution strategy is in place, a contagion of insolvencies is only a minor problem. Similarly, Furfine (2003) examines the degree to which the failure of one bank causes the succeeding breakdown of other banking firms. The author estimates the exposures of the magnitude of mutual federal fund, employing exclusive data on interbank payment flows. Through these exposures, the effects of numerous bankruptcy scenarios are simulated, and it is found that the risk of contagion is economically low. However, it stills delivers further evidence on the relation between systemic risk and default risk.

7.2.3 Hypotheses Development

Given the above debates on the interactions between default risk and the three remaining risks, this section develops the original research hypotheses on

the relationships between these risks in the context of bank M&As. As a preliminary analysis of the sample, it is suggested to first check how these risk relationships hold in a normal, non-M&A setting.

Previous studies show that the failure of numerous banks or the failure of a few large banks could set off a chain reaction that could destabilise the safety and soundness of the financial sector. Public information about the health of individual banking firms is imperfect. Therefore, when many banks fail, it can be challenging to identify whether the cause is due to idiosyncratic shocks to individual banks (e.g. due to fraud) or to a more widespread shock that threatens many other banks. Consequently, the news that some banks failed could generate devastating 'panic' runs on another solvent but illiquid banks by uninsured creditors who are uncertain whether the shock may distress their banks (Bhattacharya and Thakor, 1993). Interbank markets may be another channel via which the shocks of one bank are transmitted swiftly to other banks, since interbank transactions are large, flexible, and difficult for outsiders to control (Berger et al., 1995). Furthermore, the contagious default of banks may be due to the correlation in the banks' exposures. The exposure of banks to macroeconomic risk (systematic risk) determines the risk potential concealed within the network of mutual credit exposures among banks (Elsinger et al., 2006). Accordingly, it is reasonable to anticipate that a bank's default risk directly influences their idiosyncratic risk, systematic risk and systemic risk. Indeed, in the banking industry, the default risk can also become systemic and systematic when the failure of a single bank does not only affect that single bank alone, but spills over to other banking institutions and to the broader stock market, as proven

in Fiordelisi and Marqués-Ibañez (2013). Thus, the hypotheses of the preliminary analysis will be formulated as follows:

Hypothesis 7.1. An increase in the default risk of a single bank raises the probability of increasing banking systemic risk, indicating that individual bank troubles often influence the whole banking sector.

Hypothesis 7.2. An increase in the default risk of a single bank augments the probability of increasing systematic risk, indicating that individual bank troubles regularly influence the overall economy.

Hypothesis 7.3. An increase in bank default risk will raise the idiosyncratic risk of the bank.

The next three hypotheses stipulate that M&As within the financial sector should strengthen these relationships. The literature shows that M&A activities alter the risk profiles (e.g. default risk, credit risk, idiosyncratic risk, systemic risk, liquidity risk) of acquirers (Méon and Weill, 2005; Mühlnickel and Weiß, 2015; Sakawa and Watanabel, 2016). Bank mergers can either decrease an acquiring bank's default risk through the reduction of a bank's idiosyncratic risk (see Furfine and Rosen, 2011; Koerniadi et al., 2015) or can increase an acquirer's contribution to systemic risk when the acquiring bank's level of default risk is high pre-merger (Weiß et al., 2014). Therefore, it is equitable to predict that when a merger impacts the default risk of the acquiring bank (whether up or down), it also impacts, in the same direction, the bank's contribution to systemic risk, its systematic risk and its idiosyncratic risk. Hence our main hypotheses are as follows:

Hypothesis 7.4. After a merger, an increase (decrease) in the acquirer's default risk is associated with an increase (decrease) in its contribution to systemic risk.

Hypothesis 7.5. After a merger, an increase (decrease) in the acquirer's default risk is associated with an increase (decrease) in its systematic risk.

Hypothesis 7.6. After a merger, an increase (decrease) in the acquirer's default risk is associated with an increase (decrease) in its idiosyncratic risk.

7.3 Research Methodology

7.3.1 Estimations of systematic risk and idiosyncratic risk

To test this chapter's research hypotheses, the dependent and independent variables are modelled. For the calculation of acquirers' default risk, the Merton Distance-to-Default methodology, as in Vallascas and Hagendorff (2011), is used (see Chapter 5 for more details). For the estimation of systemic risk, a reliable, well-known and robust approach: Marginal Expected Shortfall as in Acharya et al., (2017), is applied (see Chapter 6 for more details) to compute acquirers' contribution to systemic risk.

For the acquirers' systematic risk and idiosyncratic risk, the single market model is estimated in equations 7.1 is proposed. The total firm return can be decomposed into a systematic and a firm-specific component:

$$R_{i,t} = \alpha + \beta_{i,t}R_{m,t} + e_{i,t} \quad (7.1)$$

Where

α is the intercept

$R_{i,t}$ represents the returns on the individual firm i at time t .

$R_{m,t}$ represents the returns on the market m at time t .

$\beta_{i,t}$ is a measure of the firm's systematic risk (its market beta) for company i at time t

$e_{i,t}$ is a firm-specific shock of firm i at time t .

Given that $R_{m,t}$ and $e_{i,t}$ are orthogonal by construction, the total variance $\sigma_{i,t}^2$ of firm i at time t is given by:

$$\sigma_{i,t}^2 = \beta_{i,t}^2 \sigma_{m,t}^2 + \sigma_{e,t}^2 \quad (7.2)$$

where $\sigma_{m,t}$ represents market volatility at time t .

and $\sigma_{e,t}$ represents firm-specific (idiosyncratic) volatility at time t .

Generally, this chapter studies systematic (or market) risks via the well-known β (beta) coefficient. Beta has played a vital role since the introduction of the capital asset pricing model (CAPM) for portfolio management by Sharpe (1964). Simply stated, the CAPM beta combines covariance and volatility, measuring the sensitivity of asset returns to market returns in addition to the correlated relative volatility (Tsai et al., 2014). The CAPM beta uses the following formula to estimate

$$\beta_{i,t} = \frac{\text{Covariance}(R_{i,t}, R_{m,t})}{\text{Variance}(R_{m,t})} = \rho_{i,m} * \frac{\sigma_{i,t}}{\sigma_{m,t}} \quad (7.3)$$

where $\rho_{i,m}$ is the correlation between firm i and the market

$\sigma_{m,t}$ represents market volatility at time t .

$\sigma_{i,t}$ represents firm i volatility at time t .

Hence, it is suggested to substitute for $\beta_{i,t}$ in Equation (7.2) by the estimation of $\beta_{i,t}$ in Equation (7.3) and solve for $\sigma_{e,t}^2$ to get:

$$\sigma_{e,t}^2 = \sigma_{i,t}^2 (1 - \rho_{i,m}^2) \quad (7.4)$$

Therefore, the firm's idiosyncratic risk, $\sigma_{e,t}$, will be estimated by

$$\sigma_{e,t} = \sqrt{\sigma_{i,t}^2 (1 - \rho_{i,m}^2)} \quad (7.5)$$

A fund that changes in harmony with the market is said to have a beta of 1. Therefore, if the market goes up 10%, the fund is expected to go up 10%. If the beta of a fund is less than 1, it should move less in price than the market in general. Conversely, if a fund has a beta higher than 1, it should change more in price than the market in general. Therefore, beta estimates the risk of a fund by how much its market price moves in comparison to the moves in the overall stock market. A fund with a beta of less than 1 has a tendency to be less risky than the market, meanwhile a fund with a beta of more than 1 is riskier (Lhabitant, 2004).

7.3.2 Models of Cross-sectional Analysis

In this section, first, the paired relationships between acquiring banks' default risk and systemic risk, systematic risks and idiosyncratic risk pre-merger are investigated using OLS regression within a cross-sectional framework, with heteroskedasticity-consistent Huber-White standard errors. The equations are formulated following the approach of Fiordelisi and Marqués-Ibañez (2013). Equation 7.6 is formulated in order to study whether a cross-sectional variation in bank default risk is statistically linked to a variation in the bank's contribution to systemic risk, enabling to test Hypothesis 7.1 of this chapter. Equation 7.7 tests whether variations in bank default risk are statistically linked to variations in the sensitivity of the bank to the broad stock market (systematic risk), enabling to test Hypothesis 7.2. Equation 7.8 is run to test the third hypothesis 7.3 of this chapter that considers whether a variation in bank default risk will change the idiosyncratic risk of the bank, i.e. the firm-specific volatility of bank stock returns. Control variables (including cost-income ratio, income diversification, capitalisation, high-risk banks, HHI and GDP growth) are added in all equations as they potentially impact these paired relationships. The variables used in this chapter are cautiously defined and justified in section 4.2.4 of Chapter 4.

$$SYSTEMICRISK_i = \alpha_1 + \omega_1 * DEFAULTRISK_i + \sum_{j=1}^6 \gamma'_j * CONTROLVARIABLES_{j,i} + \varepsilon'_i$$

(7.6)

$$SYSTEMATICRISK_i$$

$$= \alpha_2 + \omega_2 * DEFAULTRISK_i + \sum_{j=1}^6 \gamma''_j * CONTROLVARIABLES_{j,i} + \varepsilon''_i$$

(7.7)

$IDIOSYNCRATICRISK_i$

$$= \alpha_3 + \omega_3 * DEFAULTRISK_i + \sum_{j=1}^6 \gamma'''_j * CONTROLVARIABLES_{j,i} + \varepsilon'''_i$$

(7.8)

Where $SYSTEMICRISK_i$ is the average contribution to systemic risk of acquirers in the pre-merger period

$SYSTEMATICRISK_i$ is the average systematic risk of acquirers in the pre-merger period

$DEFAULTRISK_i$ is the average default risk of acquirers in the pre-merger period

$IDIOSYNCRATICRISK_i$ is the average idiosyncratic risk of acquirers in the pre-merger period

$CONTROLVARIABLES_{j,i}$ include Cost–Income Ratio, Income diversification, Capitalization, Herfindahl–Hirschman Index (HHI), GDP growth and high-risk banks dummy.

Following this, the main hypotheses of this chapter are formulated, i.e. investigating the impact of bank mergers on the paired risk relationships. It is therefore proposed to look at the impact of a post-merger change in acquirer's default risk on the post-merger change in each other type of risk, using OLS regression within a cross-sectional framework. The formulations of the following equations are the same as Equations 7.6, 7.7, 7.8 above, with heteroscedasticity-consistent Huber-White standard errors:

$\Delta SYSTEMICRISK_i$

$$= \phi_1 + \lambda_1 * \Delta DEFAULTRISK_i + \sum_{j=1}^6 \phi'_j * CONTROLVARIABLES_{j,i} + \varepsilon_{1,i}$$

(7.9)

$$\Delta SYSTEMICRISK_i$$

$$= \phi_2 + \lambda_2 * \Delta DEFAULTRISK_i + \sum_{j=1}^6 \phi_j'' * CONTROLVARIABLES_{j,i} + \varepsilon_{2,i}$$

(7.10)

$$\Delta IDIOSYNCRATICRISK_i$$

$$= \phi_3 + \lambda_3 * \Delta DEFAULTRISK_i + \sum_{j=1}^6 \phi_j''' * CONTROLVARIABLES_{j,i} + \varepsilon_{3,i}$$

(7.11)

Where $\Delta SYSTEMICRISK_i$ is the difference of average contribution to systemic risk of acquirers between post-completion and pre-merger period.

$\Delta SYSTEMICRISK_i$ is the difference of average systematic risk of acquirers between post-completion and pre-merger period.

$\Delta DEFAULTRISK_i$ is the difference of average default risk of acquirers between post-completion and pre-merger period.

$\Delta IDIOSYNCRATICRISK_i$ is the difference of average idiosyncratic risk of acquirers between post-completion and pre-merger period.

$CONTROLVARIABLES_{j,i}$ include Cost–Income Ratio, Income diversification, Capitalization, Herfindahl–Hirschman Index (HHI), GDP growth and high-risk banks dummy.

It should be noted that while ω_1 , ω_2 and ω_3 provide information regarding the relationship of acquirers' default risk to the remaining risks in the period without M&As (pre-merger), λ_1 , λ_2 and λ_3 offer information about the relationships between the change in acquirers' default risk and the change in the remaining risks in the period affected by the M&As activity.

7.4 Cross-sectional Analysis

In this section, the analysis is presented on whether the default risk of acquiring banks has a direct impact on their idiosyncratic risk, systematic risk and systemic risk surrounding a merger. In order to investigate these relationships, acquiring banks' risks are divided into subsets: pre-merger period and the change in acquirers' risks between post-completion and pre-merger periods. Furthermore, the sample is segmented into three subsamples: full sample of mergers, US acquirers and non-US acquirers.

7.4.1 Analysis in the Context of No Mergers

Table 7.1 below reports the results of the preliminary analysis, i.e. whether acquiring banks' default risk is linked to their MES, beta and idiosyncratic risk (Hypotheses 7.1, 7.2, 7.3).

Table 22: OLS regression pre-merger

The OLS regressions model with heteroskedasticity-consistent Huber–White standard errors. The dependent variable is Pre-merger MES, Pre-merger systematic risk and Pre-merger idiosyncratic risk for the full sample, US acquirers and non-US acquirers. All variables, data sources and statistics are defined in Chapter 4. Statistically significant coefficients are highlighted in bold type. The P-values are denoted in parentheses.

	Full sample			US only			Non-US countries		
	(1) Pre-merger MES	(2) Pre-merger systematic risk	(3) Pre-merger idiosyncratic risk	(4) Pre-merger MES	(5) Pre-merger systematic risk	(6) Pre-merger idiosyncratic risk	(7) Pre-merger MES	(8) Pre-merger systematic risk	(9) Pre-merger idiosyncratic risk
<i>Distance to default</i>									
Pre-merger default risk	0.0007** (0.0105)	-0.0109 (0.3646)	0.0043*** (0)	0.0005 (0.1668)	-0.0136 (0.4074)	0.0044*** (0)	0.0016*** (0.0019)	0.0192 (0.2128)	0.0039*** (0)
<i>Acquirers characteristics</i>									
Cost-income ratio	0.0004 (0.2273)	0.0248 (0.1076)	-0.0001 (0.4029)	0.0007 (0.1105)	0.0362 (0.1011)	-0.0003 (0.1968)	-0.0007 (0.3293)	-0.0278 (0.1628)	0.0005 (0.1236)
Income diversification	-0.0002 (0.7423)	-0.0275 (0.2962)	0.0008** (0.0187)	-0.0002 (0.7835)	-0.0232 (0.6146)	0.0008 (0.1454)	0.0013 (0.2716)	0.0509 (0.1556)	4.04E-05 (0.9293)
Capitalisation	0.001*** (0.0001)	0.0406*** (0.0001)	0.0002 (0.2574)	0.0012*** (0.0001)	0.0615*** (0)	0.0002 (0.4771)	0.0008 (0.1777)	0.0251 (0.1468)	0.0002 (0.6689)
Pre-merger high risk banks	-0.0008 (0.3576)	-0.0834** (0.0267)		0.0029*** (0.002)	0.2472*** (0)		-0.0004 (0.8263)	-0.0176 (0.7669)	
<i>Country control</i>									
GDP	-0.0017***	-0.0745***	0.0003***				-0.0008***	-0.0203**	0.0001

	(0.0000)	(0.0000)	(0.0039)				(0.0017)	(0.0177)	(0.3314)
HHI	0.0049	0.0053	-0.0028				0.0109**	0.3265*	-0.0042
	(0.2618)	(0.9810)	(0.2830)				(0.0128)	(0.0693)	(0.1465)
Constant	0.0063***	0.1898**	0.0326***	-0.0021	-0.2641***	0.0344***	0.0059	0.1244	0.0324***
	(0.0013)	(0.0273)	(0)	(0.3277)	(0.008)	(0)	(0.1994)	(0.348)	(0)
R-squared	0.1454	0.1382	0.5827	0.0625	0.1001	0.5866	0.1669	0.1087	0.5486
Adj. R-squared	0.1354	0.1281	0.5785	0.052	0.09	0.5828	0.1277	0.0668	0.5306
Number of observations	608	608	608	452	452	452	156	156	156
	Full sample			US only			Non-US countries		
	(1) Pre-merger MES	(2) Pre-merger systematic risk	(3) Pre-merger idiosync-ratic risk	(4) Pre-merger MES	(5) Pre-merger systema-tic risk	(6) Pre-merger idiosync-ratic risk	(7) Pre-merger MES	(8) Pre-merger systema-tic risk	(9) Pre-merger idiosync-ratic risk

******, * Denotes significance at 5% and 10%

******* Denotes significance at 1%

Regressions (1), (4) and (7) estimate the relationships between pre-merger acquirers' MES and their pre-merger default risk using acquirer characteristics in addition to acquirers' relevant macroeconomic factors as controlled variables for the full sample of mergers, U.S. acquirers and non-US acquirers. The statistically positive coefficients of pre-merger default risk (at 5% level of confidence for the full sample and 1% for non-US acquirers) in regressions (1) and (7) respectively, indicate that there is a positive relationship between acquirers' default risk and MES when M&As are not yet taken into consideration. In other words, banks with a higher default risk also exhibit a higher contribution to systemic risk, suggesting that individual bank problems regularly affect the overall banking sector. This is in line with banking theory as the banking sector has a systemic nature driven by the complicated system of exposures among banking firms, and possibly other financial intermediaries, via the interbank money market, wholesale payment and security settlement systems (Folkerts-Landau, 1991). Therefore, the complex and robust linkages among financial firms can cause the default risk of individual banks or other areas of the financial scheme to transform into systemic shocks, which could potentially cause the whole system to collapse (a more detailed discussion of systemic nature of the banking sector can be found in section 6.2.2 in Chapter 6). This finding is very much consistent with Fiordelisi and Marqués-Ibañez (2013), as they found that the default of a single bank has a direct impact on European banking systemic risk, due to a substantial degree of interconnectedness among European banking institutions.

Interestingly, default risk is not significant in regression (4), although 'high risk banks' witnesses a significant positive coefficient. This means that the strong

positive relationship between default risk and MES is only observed in pre-merger high-risk U.S. acquiring banks. This result provides a substantial contribution to the literature because, aside from this chapter, most of the earlier work (Campbell et al., 2008; Vassalou and Xing, 2004) has not distinguished between banking and non-banking firms and no previous study has ever looked at the relationship between default risk and systemic risk for acquiring banks in the U.S.

Variable capitalisations in regressions (1) and (4) have significantly positive coefficients, suggesting that the more equity capital an acquiring bank holds, the higher contribution to systemic risk that bank may face. Indeed, the systemic consequence of the failures of larger players may be more severe, spreading problems to more counterparties, particularly for banks that are heavily involved in clearing and settlement functions. Larger banks may also tend to fund themselves in ways that increase their reliance on intraday credit, which could in turn increase the demand for intraday credit and increase systemic exposures. Similarly, Huang et al., (2012) explore systemic risk in a different financial structure from eight nations within Asia and the Pacific, and regard bank size as a determinant for exposing banks to the slight increase in systemic risk. In the most recent study by Laeven et al. (2016), systemic risk is found to increase with bank size and this effect exists above and beyond the effect of bank size on standalone bank risk. GDP as a proxy for business cycles in regressions (1) and (7) has a negative and statistically significant coefficient (at 1% level), indicating that when the economy is growing, there will be more significant possibility of a reduction in acquirers' contribution to systemic risk. Furthermore, the pre-merger concentration in acquirers' home countries, as proxied by the HHI, has a significant positive coefficient (at 1% confidence level). Expressly, as a banking

sector becomes more concentrated, the contribution of individual banks to systemic risk increases. This finding is consistent with the concentration-fragility hypothesis, which suggests that banks may pursue M&As in order to become 'too big to fail' and thereby, are often more likely to obtain a government's safety net or subsidies. The presence of these public guarantees can also result in moral hazard problems that stimulates larger banks' managers to engage in high-risk investments which, in turn, may destabilise the whole banking system (Uhde and Heimeshoff, 2009; Weiß et al., 2014; Carbo-Valverde et al., 2012).

Regressions (2), (5) and (8) of Table 7.1 estimate the relationships between default risk and beta, also using acquirer characteristics as well as acquirers' countries as controlled variables for the full sample of mergers, U.S. acquirers and non-US acquirers respectively. Overall, the results from all of these specifications clarify that an increase or decrease in default risk of acquirers does not have any impact on their systematic risk. However, regressions (2) and (5) also reveal interesting relationships between acquirers with high pre-merger default risk and beta. Specifically, the negative relationship in regression (2) implies that the banks with the highest default risk pre-merger witness less systematic risk. In other words, high-risk banks bring less volatility to the overall markets widespread (including both financial and non-financial sectors). This is somewhat consistent with Altman and Hotchkiss (2006), who find that the bonds of the most distressed firms, defined as high-yielding bonds, earn lower than subsequent average returns, consistent with the default risk being negatively related to systematic risk. However, this relationship is observed to be positive under U.S. acquirers. The result provides evidence that U.S. banks with high default risk pre-announcement increase their systematic risk. This finding is

consistent with a number of studies in literature, which tend to find that the returns of the portfolios with high default risks are much higher than the portfolios with low default risks; thereby confirming that default risk is a systematic one (Fiordelisi and Marqués-Ibañez, 2013; Shumway, 1996; Vassalou and Xing, 2004).

Other acquirers' characteristics, such as capitalisation and GDP, are important drivers of acquirers' beta. In regressions (2) and (5), capitalisation is positively related to pre-merger systematic risk, suggesting that larger acquiring banks contribute to the increase in their beta. This is in line with Casu et al. (2015) who find that the importance of bank size is noted as the primary contributor to systematic risk. This is because bank size is positively connected with organisational and procedural complexity (Beck et al., 2006). The growing bank size permits banks to enlarge across numerous markets geographically, and across different business lines whilst employing complicated financial instruments; thereby resulting in reduced transparency.

In regressions (3), (6) and (9), significant positive relationships are found between acquirers' default risk and idiosyncratic risk (at 1% level of confidence). This indicates that banks with a higher default risk also have a higher idiosyncratic risk, which is in line with results presented by Asquith and Gertner (1994), Dichev (1998) and Opler and Titman (1994). This finding is also consistent with Fiordelisi and Marqués-Ibañez (2013), as they show that increases in bank default risk across European listed banks are also associated with a greater likelihood of an increase in banks' idiosyncratic risk.

Regression (3) also shows that apart from acquiring banks' default risk level, there are other drivers of acquirers' idiosyncratic risk, including income

diversification and acquirers' country GDP. The income diversification variable is statistically significant at 5% level with a positive coefficient. This indicates that the more proportion of non-interest income is, in comparison to operating income, the higher idiosyncratic risk banks will have to bear. This is consistent with claims that an overreliance on non-interest income can produce a risk-increasing effect for acquiring banks (Baele et al., 2007; Stiroh and Rumble, 2006). Indeed, it is riskier for banks to have more non-interest income than traditional interest income. This is because, for instance, retail banks tend to be consistently less exposed to systemic risk as a high fraction of their total assets are made of core deposits and loans.

To summarise, results from all specifications support the view that banks' default risk has a direct impact on MES in the non-M&A period. This result is particularly pronounced for non-US acquirers. Similarly, default risk is also positively related to idiosyncratic risk. This indicates that the risk of default on any individual bank does not only affect this bank's stockholders, but also extends to other banks in the banking system, causing the banking industry to become fragile and volatile. Therefore, hypotheses 7.1 and 7.3 are supported. In contrast, no relationship is found between default risk and beta. Thus, hypothesis 2 is rejected. However, it is also revealed that banks with the highest default risk pre-merger witness less systematic risk in general. Conversely, U.S. acquirers with high default risk pre-announcement, are associated with higher systematic risk, suggesting that high-risk banks' distress affects the U.S. economy as a whole. Other factors, such as income diversification, capitalisation, GDP and HHI, play important roles in explaining acquirers' pre-merger MES, beta and idiosyncratic risk.

7.4.2 Analysis in the Context of Bank Mergers

Table 7.2 below reports the results of tests carried out to show if acquiring banks' Δ default risk is linked to their Δ MES, Δ beta and Δ idiosyncratic risk between post-completion and the pre-merger period (Hypotheses 7.4, 7.5, 7.6).

Table 23: OLS model under the context of bank mergers

The OLS regressions model with heteroskedasticity-consistent Huber–White standard errors. The dependent variable is Δ MES, Δ systematic risk and Δ idiosyncratic risk for the full sample, US acquirers and non-US acquirers. All variables, data sources and statistics are defined in Chapter 4. Statistically significant coefficients are highlighted in bold type. The P-values are denoted in parentheses.

	Full sample			US only			Non-US countries		
	(1) Δ MES	(2) Δ systematic risk	(3) Δ idiosyncratic risk	(4) Δ MES	(5) Δ systematic risk	(6) Δ idiosyncratic risk	(7) Δ MES	(8) Δ systematic risk	(9) Δ idiosyncratic risk
<i>Distance to default</i>									
Δ default risk	0.002 (0.7847)	-0.272 (0.3156)	0.0336*** (0.000)	0.0088 (0.2497)	-0.0364 (0.8864)	0.0469*** (0.000)	-0.0046 (0.7176)	-0.4297 (0.3083)	0.0154 (0.2037)
<i>Acquirers characteristics</i>									
Cost-income ratio	0.0003 (0.3550)	0.0051 (0.6531)	0.00056** (0.0302)	0.0002 (0.6965)	0.0079 (0.5577)	0.0005* (0.0599)	0.0006 (0.3479)	-0.0133 (0.5109)	0.0007 (0.317)
Income diversification	-0.0006 (0.4161)	-0.0190 (0.3699)	-0.0015*** (0.0007)	-0.0005 (0.6422)	-0.0294 (0.3753)	-0.0017** (0.0124)	-0.0008 (0.4849)	0.0206 (0.5319)	-0.0013* (0.0557)
Capitalisation	0.0002 (0.5251)	-0.0053 (0.6075)	0.0007** (0.0135)	0.0003 (0.5089)	-0.0093 (0.463)	0.0011*** (0.0008)	0.0004 (0.5628)	0.0241 (0.2431)	5.52E-05 (0.9226)
Pre-merger high risk banks	0.0012 (0.3883)	0.0607 (0.2404)		0.0019** (0.0481)	-0.0035 (0.9318)		0.0049* (0.0908)	0.1635* (0.075)	
<i>Country control</i>									
GDP	0.0001 (0.6930)	0.0018 (0.8423)	0.0005** (0.0117)				0.0004 (0.1778)	0.0153 (0.1142)	0.0005* (0.0503)

HHI	-0.0054 (0.3203)	-0.1295 (0.5425)	-0.0008 (0.8351)				-0.0047 (0.43)	-0.0096 (0.9662)	0.0021 (0.6383)
Constant	-0.0014 (0.5144)	0.0508 (0.5034)	-0.0034* (0.0694)	-0.0014 (0.5263)	0.1004 (0.2297)	-0.0039* (0.0581)	-0.0056 (0.3291)	-0.3016* (0.0964)	-0.0009 (0.8587)
R-squared	0.0080	0.0065	0.0871	0.0098	0.0045	0.1327	0.0481	0.0446	0.0458
Adj. R-squared	-0.0036	-0.0050	0.0779	-0.0013	-0.0066	0.1249	0.0034	-0.0002	0.0076
Number of observations	608	608	608	452	452	452	156	156	156
	Full sample			US only			Non-US countries		
	(1) Δ MES	(2) Δ systematic risk	(3) Δ idiosyncratic risk	(4) Δ MES	(5) Δ systematic risk	(6) Δ idiosyncratic risk	(7) Δ MES	(8) Δ systematic risk	(9) Δ idiosyncratic risk

**, * Denotes significance at 5% and 10%

*** Denotes significance at 1%

Specifications (1), (4) and (7) constitute the baseline regression to examine the relationship between Δ default risk and Δ MES, using acquirer characteristics and acquirers' countries as controlled variables for the full sample of mergers, U.S. acquirers and non-US acquirers. As can be seen, no relationships were found between Δ default risk and Δ MES, which suggests that M&As do not affect that relationship in general. Therefore, Hypothesis 7.4 is rejected. However, the coefficients of pre-merger high-risk banks in specifications (4) and (7) (at 5% and 10% level respectively) are positive and significant. It indicates that acquirers with the highest default risk before mergers, witness their increase in Δ MES as a result of M&A activity. The adjusted R-squared for models (1) and (4) is negative, suggesting that Δ default risk, other acquirers' characteristics and macroeconomic factors possess no power for explaining Δ MES under the M&A context.

In regressions (2), (5) and (8), we observe that Δ default risk, acquirers' characteristics and macroeconomic factors do not have any direct impact on Δ beta. Hence, Hypothesis 7.5 is also rejected. However, regression (8) witnesses a positive coefficient of pre-merger high-risk banks at 10% level of confidence. This reveals that among non-US acquirers with high default risk profile before a merger, Δ beta tends to increase as a result of M&As. This result, nevertheless, is in contrast to that found by Casu et al., (2015), who indicate that for low-risk banks, a merger is positively associated with higher beta in Bank-Agency and Bank-Security deals. The adjusted R-squared for models (2) and (5) is negative and considered the lowest among the three, suggesting that Δ default risk,

acquirers characteristics and macroeconomic factors, possess no power for explaining $\Delta\beta$ for the full sample and for the sample of U.S. acquirers.

Regressions (3), (6) and (9) demonstrate the relationship between $\Delta\text{default risk}$ and $\Delta\text{idiosyncratic risk}$. $\Delta\text{default risk}$ shows a positive and direct impact on $\Delta\text{idiosyncratic risk}$ (significant at 1% level) in regressions (3) and (6). This indicates that the changes in an acquiring bank's default risk as a result of M&A activities have a direct impact on the change in an acquirer's own idiosyncratic risk, suggesting that bank merger plays a vital role in this relationship. Thus, Hypothesis 7.6 of this chapter is verified. Apart from $\Delta\text{default risk}$, other variables such as cost-income ratio, income diversification, capitalisation and GDP, all play an important role in explaining acquirers' $\Delta\text{idiosyncratic risk}$ post-merger. More specifically, the income diversification variables in regressions (3), (6) and (9) show negative and statistically significant coefficients at 1%, 5% and 10% level respectively. This indicates that the more non-interest income to total operating income a bank possesses, the higher the probability is for them to reduce their idiosyncratic risk post-merger. Indeed, banking acquirers involved in non-interest income businesses (investment banks, insurance, securities) may have a lower volatility of profitability level compared to traditional banks with mainly interest income; thereby decreasing their level of idiosyncratic risk (Estrella, 2001; Boyd et al., 1993). The positive and significant coefficient of a cost-income ratio of specifications (3) and (6) indicates that inefficient banks (high cost-income ratio) are expected to have a lower franchise value, thus, resulting in the risk-increasing effect on acquiring banks post-merger.

The capitalisation of acquirers in regressions (3) and (6) have significant positive coefficients, indicating that the more capital a bank holds before a

merger, the higher the probability is of their idiosyncratic risk increasing after a merger. This finding is consistent with previous literature (Berger et al., 1995; Besanko and Kanatas, 1996; Boyd and De Nicoló, 2006) on bank capital regulation which suggests that higher capital levels may induce banks to increase asset portfolio risk; thereby increasing their idiosyncratic risk. An increase in asset portfolio risk may happen when equity is relatively expensive; risk-averse bank owners might elect to take part of their loss from a higher equity requirement by choosing a higher point on the risk-expected return frontier; thereby increasing risk. The positive and statistically significant coefficient of GDP (at 5% level of confidence) in regression (3) indicates that more the GDP growth rate of an acquirer's country is before a merger, the larger the increase in an acquirer's idiosyncratic risk will be, due to a merger.

Overall, no relationships were found between Δ default risk and Δ MES or between Δ default risk and Δ beta, which suggests that M&As do not affect these relationships in general. Therefore, Hypothesis 7.4 and 7.5 are both rejected. Nevertheless, acquirers with the highest default risk before mergers witness their increase in MES post-merger, as a result of M&As. This result is specifically pronounced for U.S. acquirers. Moreover, it is found that for non-US acquirers with a high default risk profile before a merger, beta tends to increase post-merger as a result of M&As. Additionally, the changes in acquiring bank's default risk as a result of M&As have a positive direct impact on the change in their' own idiosyncratic risk. Hence, Hypothesis 7.6 is approved. It is significantly interesting to note that bank mergers are proven to reduce the default risk of acquiring banks in Chapter 5 of this study. Therefore, it is possible to conclude that the reduction in acquirers' default risk following a merger also results in the reduction of their

idiosyncratic risk, but not in systematic risk or in their contribution to systemic risk, which is also consistent with Chapter 6 of this study.

7.5 Conclusion

This chapter examines whether the changes in acquiring bank's default risk as a result of M&As have an influence on acquirers' own idiosyncratic risk; or whether it extends to other banks (systemic risk) and all listed companies (systematic risk) on a global sample of bank mergers. It utilises direct measures of default risk: the Distance to Default proposed by Vallascas & Hagendorff (2011); systemic risk: Marginal Expected Shortfall (MES), as in Acharya et al., (2017), and systematic risk and idiosyncratic risk: the single index model. Employing the most up to date, comprehensive global sample of bank M&As from 1998 to 2015, this study provides new insight into the phenomenon, with findings that lead to various implications for policymakers and for broader academic literature.

Academic literature has so far debated whether default risk is systematic or idiosyncratic, in addition to whether default risk is systemic. The findings from this study suggest that during a pre-merger period (without M&As), banks' default risk positively and directly affects their MES and idiosyncratic risk. This result is particularly pronounced for non-US acquirers. It indicates that the risk of default on any individual bank does not only affect a bank's stockholders but also extends to other banks within the banking system, causing the banking industry to become fragile and volatile. This is consistent with many studies, such as (Asquith and Gertner, 1994; Dichev, 1998; Fiordelisi and Marqués-Ibañez, 2013; Opler and Titman, 1994). In contrast, no relationship is found between default risk and beta. Other factors such as income diversification, capitalisation, GDP and HHI, play important roles in explaining acquirers' pre-merger systematic risk, systemic risk and idiosyncratic risk.

Next, with regards to the effect of bank mergers, no relationships were found between Δ default risk and Δ MES or between Δ default risk and Δ beta, which suggests that M&As do not affect these relationships in general. However, acquirers with the highest default risk before mergers witness their increase in MES as a result of M&As. This result is specifically pronounced for U.S. acquirers more than non-U.S. acquirers. Besides, the changes in acquiring bank's default risk as a result of M&As have a positive direct impact on the change in their' own idiosyncratic risk. It is however, of significant interest that bank mergers are proven to reduce the default risk of acquiring banks as shown in Chapter 5 of this study. Therefore, it is possible to conclude that the reduction in acquirers' default risk following a merger also results in the reduction of their idiosyncratic risk, which means that M&As lead to safer banks individually. Other variables, such as cost-income ratio, income diversification, capitalisation and GDP, are all important drivers of the change in acquirers' idiosyncratic risk post-merger.

The first prudential regulatory implication from the findings of this chapter is that M&A activities create safer banks individually; they reduce acquirers' default risk and hence idiosyncratic risk, and should therefore, be encouraged. However, M&As do not play any role in enhancing the stability of the whole banking system, which is consistent with Chapter 6 of this study, or with the economy-wide system. Instead, during the period without M&As, the default risk of banks was positively related to their contribution to systemic risk. The reason behind this relationship is beyond this study and will be left for future research. Furthermore, acquiring banks with a high default risk profile before mergers are associated with a higher contribution to systemic risk post-merger. Therefore, it highlights the need for banking regulators and supervisors to strengthen the

support for macro-prudential regulations, for instance, by imposing more stringent regulatory requirements upon the merger approval process involved with high default risk banking firms, in order to enhance the stability of the whole banking system.

Finally, this study reveals the presence of any significant and positive bank size effect in relation to acquirers' systemic risk and systematic risk during a period without M&As. In literature, bank size is observed as one of the key contributors to systematic risk (Casu et al., 2015). Therefore, it leads to a policy implication where a high level of regulatory requirements should be imposed on larger banks, for example, in the form of enhanced risk-based capital, leverage and liquidity requirements, contingent capital requirements and resolution plans (Krainer, 2012)

Chapter 8: Conclusion

The ways in which banking corporations can operate has drastically changed over several decades, due to numerous causes. The prospect for greater profitability, provided by technological and financial advances and the growing popularity of capital markets, has led to a structural evolution in the conventionally fragmented functions of banking institutions. Following a chain of delayed reactions between regulations, circumvention and deregulation, the formation and consolidation of very big, multi-product financial institutions, operating internationally, are presently the norm rather than the exception. These significant banking M&As have resulted in the emergence of the TBTF and financial conglomerates. De Nicolo and Kwast (2002) and De Nicolo, et al. (2004) argue that consolidation and conglomeration activities that create very large financial firms are vital determinants of the increase in systemic risk. Indeed, empirical studies that examine systemic risk issues related to bank or insurance M&A activities, either by looking at a firm's expected short fall in an undercapitalized market or information on a firm's stock and market index, indicate that systemic risk has increased in recent years due to consolidation trends (Lim et al., 2015; Mühlnickel and Weiß, 2015; Weiß et al., 2014). Additionally, the aftermath of the global financial crisis 2007-09 has resulted in revived attention on the degree of interconnectedness among banking firms, alongside inefficiency of the current supervisory system to hinder the systemic effects of what was initially a mere banking crisis.

The extant literature on the effects of M&As on bidders' risk in the banking industry revolves around theoretical contributions that consider the causes, benefits and concerns of this M&As trend. Furthermore, empirical investigations

have been conducted, in order to provide answers to the issues raised in former studies. Proponents of this trend cite numerous benefits of diversification on reducing bidders' risk, such as the reduction in idiosyncratic risk, diversification of loan portfolio, a bank's assets, and operations that result in higher capital buffers and lowered cash flow variability, thereby decreasing risk for acquiring banks. In contrast, opponents call for attention due to serious public policy issues as a result of M&As, such as increased systemic risk and default risk, monopolistic powers and mega-firms' access to government subsidies. Moreover, empirical studies have examined the effects of M&As on various types of bidding banks' risk, including default risk, systemic risk, systematic risk, idiosyncratic risk and liquidity risk. Interestingly, the results in all cases are mixed, perhaps, due to sample or methodological differences.

Therefore, the prolonged debates in literature, coupled with the mixed results on the effects of M&As on bank risks, serve as the motivation for this study to shed light on the effects of bank M&As on acquiring banks' default risk and their contribution to systemic risk. In this respect, the current study extends the extant literature accordingly. First, the most comprehensive sample of global bank M&As is used, between the period of 1998 and 2015. This characterises the most active period with respect to financial conglomerates and bank-nonbank partnerships, and hence, contains the largest and most significant deals of these types. Second, to the best of the author's knowledge, this is the first to study various risk implications of bank mergers on a global sample which allows for experimentation with rich variation in the level of changes in bidders' risks, witnessed across deals within different countries; thereby extending literature. Third, it categorises deals between focusing and product-diversifying mergers

(product diversification) as well as deals between in-country and cross-border mergers (geographic diversification). This is to acknowledge the differentiation in the risk effects of M&As when banks merge with different types of targets and when banks engage in different geographical deals. Therefore, this study diverges from various studies in literature that do not make these significant distinctions. Fourth, this study provides original evidence on the determinants of these merger-related changes in acquiring banks' default risk, systemic risk, systematic risk and idiosyncratic risk. Finally, this is the first time the coupled relationships surrounding a merger activity between default risk and systemic risk, systematic risk and idiosyncratic risk, are examined.

In Chapter 5, with regards to the impact of bank M&As on bidders' default risk; the findings show that bank mergers reduce the default risk of acquiring banks and supported Hypothesis 5.1. Furthermore, evidence from multivariate analysis indicates that not all forms of diversification exert an equal effect on the reduction of bidders' default risk. Product diversification is found to pose a positive effect on bidding banks' default risk (lower risk), which is in line with broader literature concerned with the diversification benefits of reducing bank default risk, as demonstrated by van Lelyveld & Knot, 2009 and Wall et al., 2007. Thereby, the second Hypothesis 5.2 is proven. Conversely, geographic diversification does not have a statistically significant relationship to the reduction in default risk for acquiring banks; therefore, the third Hypothesis 5.3 is rejected. Finally, the status of target, deal size, return on asset ratio (ROA), leverage and political stability, which are included as control variables, are all found to play different roles in explaining the changes in bidders' default risk.

Chapter 6 examines the effects of bank M&As on acquirers' contribution to systemic risk, predicting that mergers also produce the same risk-reducing effects. First, the findings suggest that M&As, on average, do not impact on acquiring banks' contribution to systemic risk. The first Hypothesis 6.1 of this chapter, which predicts that mergers generate systemic risk-reducing effect for acquiring banks, is therefore rejected. In addition, payment method and product diversification are hypothesised as potential determinants that have impact on the changes in bidding banks' contribution to systemic risk. In fact, the results show that product-diversifying deals lead to a reduction in acquirers' contribution to systemic risk for non-US acquirers only. Therefore, the second Hypothesis 6.2 of this chapter, which projects that product diversification brings risk-reducing benefits for banks, cannot be rejected. It also transpires that with deals financed by cash only, the acquirers' contribution to systemic risk will increase. Hence, the third Hypothesis 6.3 of this chapter cannot be rejected. In addition, other control variables determining the reduction in acquirers' contribution to systemic risk include a concentrated banking system (HHI) and a stable political environment. In contrast, the factors that contribute to the increase in systemic risk include private targets, a small relative deal size to acquirers' value and TBTF motive.

Finally, Chapter 7 examines whether the changes in acquiring bank's default risk as a result of M&As have an influence on their own idiosyncratic risk; or whether it extends to other banks (systemic risk) and all listed companies (systematic risk). The findings from this study suggest that, in general, during a pre-merger period (without M&As), acquiring banks' default risk influence their contribution to systemic risk. This result is particularly pronounced for non-US acquirers. Similarly, acquirers' pre-merger default risk is also positively related to

their pre-merger idiosyncratic risk. This indicates that the risk of default on any individual bank does not only affect this bank's stockholders, but also extends to other banks within the banking system, causing the banking industry to become fragile and volatile. In contrast, no relationship is found between acquirers' pre-merger default risk and their pre-merger systematic risk. However, the results also show that banks with the highest default risk pre-merger witness less systematic risk in general. Therefore, Hypotheses 7.1 and 7.3 of this chapter are certified whereas Hypothesis 7.2 is rejected.

This study also investigates the changes in acquirers' default risk, acquirers' contribution to systemic risk, acquirers' idiosyncratic risk and acquirers' systematic risk, between the pre and post-merger period. Overall, the results show no relationship between Δ default risk and Δ MES or between Δ default risk and Δ beta, which suggests that, in general, M&As do not affect these relationships. Nevertheless, acquirers with the highest default risk before mergers witness an increase in MES post-merger as a result of M&As. This result is specifically more pronounced for U.S. acquirers than non-U.S. Furthermore, there is weak evidence that, as a result of M&As, beta tends to increase post-merger for non-US acquirers who have a high default risk profile pre-merger. In addition, Δ default risk of acquirers has a direct positive impact on the change in their own idiosyncratic risk (Δ idiosyncratic risk), suggesting that bank mergers play an important role in this relationship. It is significant to note that bank mergers are proven to reduce the default risk of acquiring banks in Chapter 5 of this study. Therefore, it is possible to conclude that the reduction in acquirers' default risk following a merger, also results in the reduction of their idiosyncratic risk, which means that M&As lead to safer banks in general. Other control

variables, such as cost-income ratio, income diversification, capitalisation and GDP, are found to be important drivers of Δ idiosyncratic risk. In short, Hypothesis 7.6 of this chapter is approved meanwhile Hypotheses 7.4 and 7.5 are rejected.

The outcomes of this study not only extend the body of literature but also have useful application in the banking industry and can be employed by bank managers, stockholders, bondholders, supervisors and policymakers at both corporate level and at country level. Specifically, bank mergers can be used as a mechanism to reduce risk exposures of institutions (reduction in idiosyncratic risk and default risk). However, regulators and banking supervisors should examine the characteristics of each deal, and acquirers, in order to determine whether or not to provide incentives for it. For instance, deals involving bidders with higher ROA pre-merger and product diversification should be motivated as they are associated with default risk reduction for the combined banks. However, deals involving private target and higher acquirers' leverage compared to other peers in the industry should be approved with extra care as these types of mergers might increase default risk for acquirers. Furthermore, the presence of a significant and negative deal size effect leads to the policy implication that mega-mergers in the banking industry should be subject to greater regulatory scrutiny, for instance, higher leverage and liquidity requirements, contingent capital requirements and resolution plans for the combined entity (Krainer, 2012). It is also necessary for banking supervisors to consider the aspect of financial stability as a further important criterion within the approval process for bank mergers, paying extra attention to deals that lead to systemic vulnerability, such as cash-financing deals, deals that have a smaller deal size in comparison with acquirers'

market value and also deals involved with private targets and high-risk bidders pre-merger.

In conclusion, along with many studies in literature, there are some drawbacks regarding analysis and the results presented above. One potential limitation of this study is that it does not take into consideration the characteristics of targets. One can argue that when bidders acquire high-risk targets, their risk position might increase, thereby adding more determinants to the changes in acquirers' risks. This remains an area for future research. Moreover, because the study sample is international, it is essential to include variables on banking regulations and supervisions in different countries of acquirers, as they are potentially the cause of the changes in bidders' risk. However, since the data for worldwide surveys on bank regulations and supervision in Barth et al. (2013) are only available until 2012 from the World Bank website, a further study may examine the risk effects of bank mergers on bidding banks, taking the regulatory variables into account.

APPENDIX A: MERGER WAVES AND CHARACTERISTICS

Wave	First	Second	Third	Fourth	Fifth	Sixth	Seventh
Years	1897–1904	1922–1929	1960–1969	1981–1989	1991–2001	2003–2008	2010?
Scope	USA	USA	USA, UK	USA, UK, EU	Global	Global	Global
Nature	Horizontal	Horizontal	Conglomerate	Hostile	Strategic	Strategic	Strategic
Outcome	Monopolies	Oligopolies	Conglomerate	Break-ups	Globalization	Globalization	Globalization
Strategy	Focus	Focus	Diversification	Focus	Focus	Focus/Speculative	Focus
Industries	Hydraulic, textiles, iron	Steam engines, steel, railways	Electricity, chemicals, combustion engines	Petrochemicals, aviation, electronics, communications	Communications and information technology	Communications, finance and information technology	To be announced – TBA
Key Events	US Steel; Standard Oil; General Electric	Samuel Insull	LTV; ITT; Litton Industries; Gulf and Western;	RJR Nabisco MBO; Beecham Group (UK); Campeau	AOL Time Warner; Vodadone AirTouch; Exxon Mobil	ABN-Amro RBS; KLM AirFrance	TBA
Payment	Cash	Equity	Equity	Debt	Equity	Cash	TBA
Began with	Economic expansion; industrialization; new corporate legislation; NYSE changes; technological progress	Economic recovery after the market crash and the First World War; anti-monopoly law	Economic recovery after the Second World War; tightening of antitrust regime in the 1950s	Economic recovery; antitrust; financial services deregulation; financial innovation; technological progress	Economic and financial markets boom; globalization; technological innovation; deregulation and privatization	Historically low interest rates, private equity speculation	TBA
Ended With	Stock market crash; economic stagnation; the First World War	Stock market crash; beginning of the Great Depression	Stock market crash; oil crisis; economic slowdown	Stock market crash	Stock market crash; 9/11 terrorist attacks	Stock market crash; financial crisis	TBA
Driven By	Technological and process innovation; legislation	Technological and process innovation; legislation	Financial innovation; management science; legislation	Financial and technological innovation; hostile raiders; legislation	Financial and technological innovation; globalization; legislation	Low interest rates; speculative players	TBA

APPENDIX B: THE U.S. BANK REGULATION

The U.S. financial regulation from the 19th century restrained the opportunity of financial institutions to enlarge geographically to other states, along with their capability to consolidate with other kinds of financial institutions, such as security companies, insurance firms and investment banks. Due to these legislative obstacles, banking institutions in the U.S. could not benefit from merger-related advantages, such as product and geographical diversification, or economies of scale and scope. The primary legal obstacles amongst banks and non-banking businesses were imposed by Section 24 of the 1864 National Banking Act, whereby specific “incidental” powers were authorised, in order to allow operating subsidiaries of national banks to become involved in activities outside the limitations of the bank. Therefore, banks were forbidden to carry out activities deemed ‘non-incidental’.

Later, the United States observed a severe economic downturn following the Wall Street Crash of 1929. Benston (1990) blamed banks for the utter confusion within the financial market, which at that time was due to the fact that they were involved in excessively risky activities via their security subsidiaries. This situation led to 40% of US banks either becoming bankrupt or falling under pressure to merge with one another. The Banking Act of 1933 was then enacted, in response to concerns that the transactions of commercial banks and payment schemes were suffering losses from the volatile stock exchange. Sections 16, 20, 21 and 32 of the Act were labelled as the Glass-Steagall Act; hence the Banking Act of 1933 was also officially recognised as the Glass-Steagall Act. Section 20 of the Act proposed stability and gained public confidence in the financial

structure by efficiently separating the activities between the investment banks that usually handled and underwrote securities and the commercial banks that received deposits and granted loans. The two different banks were prohibited from having connections or engaging with each other, such as in overlapping administrations or having shared control. The constraint on the combination of investment and commercial banks was done purposely in an attempt to diminish the conflicts of interest between them when functioned by a single organisation.

However, the study of Ramirez (1999) supports the view that the Glass-Steagall Act of 1933 fundamentally destroyed a functioning financial scheme, as it proposed ineffectual costs to the banking sector; hence negatively influencing its financial structure. Furthermore, while attempting to yield justification for the segregation between investment and commercial banks, the studies of Kroszner and Rajan (1994) and Puri (1994) demonstrate that the assumption that commercial banks were methodically deceiving shareholders into purchasing deficient quality stocks is rejected. They detect that the failure percentage of bonds placed by an investment bank was not in any way higher than that placed by a banking affiliate.

During the 1950s, banks realised that they were able to form a bank holding company to circumvent the existing regulations created by, the National Banking Act (1864) and the Glass-Steagall Act (1933), in which only entirely owned banking subsidiaries were subject to comply with bank regulations. In other words, bank holding companies were not banned from holding insurance firms, investments or commercial banks. In an attempt to control the situation caused by policymakers, a bank holding company became specified as a company owning at least 25% of the voting security of bank subsidiary under the

Banking Holding Company Act of 1956. The Act was indeed designed to promote the prosperity of the bank holding company, while in the meantime still imposing restrictions on their activities by providing them legal status. The new scheme forbade a bank holding company to deal with activities not related to banking or certain other financial transactions, such as securities, although, it was allowed to expand its activities into non-financial bank businesses, such as mortgages, investment consultancy and card operations (Heffernan, 2005). Later, policymakers announced the launch of a division called the Douglas Amendment in the Bank Holding Company Act of 1956, which allowed bank holding companies to acquire banks out of states, but only if that state did not forbid it.

However, while companies in other industries were involved in mergers and acquisitions at a velocious pace, the financial sector found itself vastly disintegrating and, as companies were unable to develop, they took advantage of consolidation activities. For the time being, the increasing fierce competitions caused financial services to call for drastic action on regulators, to remove the restrictions that were restraining them in the acquisition process. Policymakers progressively had to respond to these pressures by enforcing a new regulation, as described below.

At the end of April 1987, three giant banks, J.P. Morgan, Bankers Trust and Citicorp, were permitted by the Federal Reserve Bank (Fed) to become involved in restricted underwriting and trading in a series of stocks, such as commercial papers, mortgage-related stocks and municipal revenue bonds. The Fed deemed that if subsidiaries received less than 5% of their gross revenues from forbidden underwriting and trading within two-years, they would not be primarily participating in underwriting activities. Over the years, the Fed made

several attempts to increase the cap on gross revenue to 10%, and finally 25%, whilst permitting bank holding companies to engage in corporate debt and equity underwriting. For the first time since the enactment of the Glass-Steagall Act of 1933, banks were liberalised to take part in underwriting.

One of the significant characteristics of the US banking industry during the 1980s was the increasing number of bank failures. It is estimated that 1,600 banks either collapsed or accepted financial support from the Federal Deposit Insurance Corporation (FDIC) from 1980 to 1994. The cause of these failures could only be explained by specific factors, for example, large national elements, such as financial, economic, regulatory and legislative, that formed the prerequisite for the massive amount of bankruptcy. This could also be due to the sequence of a harsh sector and regional downturns that knocked banks within various banking markets. Finally, few banks within these markets took high risks while being inadequately monitored by supervisory authorities. When the banking crisis was almost over in 1994, the Congress was required to revise the overly painful regulations on the banking sector and hence introduced the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994. This Act provided uniform branching and interstate consolidation requirements for all states, whereby banks were now allowed to expand into other states without restrictions (Federal Deposit Insurance Corporation).

A significant milestone in the US financial regulatory history was the passage of the Financial Services Modernization Act (FSMA) of 1999 (or the Gramm-Leach-Bliley Act). This deregulatory event was a result of the intense pressure and lobbying by the financial services sector. Indeed, the merger between Citicorp and Travelers was announced in 1998, despite the fact that the

remaining provisions of the Glass-Steagall Act still prohibited banks from consolidating with insurance underwriters. This merger somewhat challenged existing regulations and paved the way for the Gramm-Leach-Bliley Act in 1999. Most of the regulatory obstacles dictated on the finance sectors by the National Banking Act of 1864, the Banking Act of 1933 and the Bank Holding Company Act of 1956, were eliminated under FSMA 1999. Explicitly, the Act voided the barriers on commercial and investment banks, consolidating with security companies and insurance firms, as written in sections 20 and 32 of Glass-Steagall Act. It established a new financial holding firm in section 4 of the Bank Holding Company Act of 1956, which permitted involvement in securities and insurance underwrites and merchant bank transactions, but not in non-financial transactions of such holding firm, which was limited to 15% (US Senate Committee on Banking, Housing and Urban Affairs).

Following the banking crises in the 1980s and early 1990s, the financial crisis of 2007-09 could be considered as the most significant and most extreme financial incident since the economic depression of the 1930s that transformed the landscape of the global finance and banking sector. This financial crisis drove the global economies, banking sectors and financial market into severe disaster and took massively financed bailouts from taxpayers in order to bolster the sector. A courageous response from the U.S regulatory authorities, considering the immense damage caused by the financial crisis, was the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010. The Act intended to set up a sound economic foundation to boost employment, protect customers, control Wall Street and Big Bonuses, cease bailouts and the 'too-big-to-fail,' in order to avoid another financial crisis. Under the Dodd-Frank Act, the Volcker Rule, finalised on

December 2013, aimed to minimise the risks incurred by US banking entities. It prohibited them from becoming involved in proprietary transactions, acquiring or holding partnerships, equities, or other possessions in a hedge fund or private equity fund, or from acting as a promoter for a hedge fund or private equity fund.

APPENDIX C: BANK RISKS

Banks exist in order to take on the risks of their clientele. By providing risk management products and services to its customers; many risks are added with each operation. These products and services are priced accordingly, based on the estimation of the expenses of managing the risks inherent in each transaction. Indeed, banking organisations' major expertise comes from their capability to measure and control the exposure of risk for the welfare of both themselves and their customers, either via the development of financial market products to shift risks, or via the absorption of their customers' risk into their inventory of risk on the bank's balance sheets. Since banks are risk intermediaries, they retain an inventory of risk that should be measured responsibly in order to guarantee that the risk exposure does not intimidate the bank's solvency. The broad classes of financial risks exposed by banks: are credit risk, market risk, liquidity risk and interest rate risk; these are divided into subclasses, relative to the specific events that trigger losses.

First, banks are exposed to market risk, including interest rate risk and foreign exchange risk. Market risk is the risk of losses due to adverse market movements depressing the value of the positions held by market players. Foreign exchange risk, however, is the risk of incurring losses due to the fluctuation of exchange rates. Interest rate risk is the risk of decline in net interest income, or interest revenues minus interest cost, due to the movement of interest rates (Bessis, 2015). One example of market risk is where the interest rates rise unpredictably, the banking firm's cost of funds may rise, and the value of its

longer-run, illiquid assets may drop, resulting in the loss of both its profitability and market value of the bank's equity.

Second, banks are exposed to credit risk. In the bank's balance sheet, the most significant asset classification consists of loans (whether to businesses, residential households, or even sovereign governments), banking firms confront the risk of failure or deterioration in a borrower's credit quality. Since many subprime mortgages within the pools initiated between 2005 and 2006 started to demonstrate default one year or less after initiation, concerns were raised in the market regarding the default risk exposure of stocks, despite their AAA or AA credit ratings. In the simplest of terms, credit risk is defined as 'the potential that a bank borrower or counterparty will fail to meet its obligations in accordance with agreed terms' (Basel Committee on Banking Supervision, 1999, p.1). As such, measuring credit risk relies upon the probability of the default of a company to fulfil its contractual obligation, and upon the extent of loss if a default occurs. In the event of default, the Basel Committee provides clear guidance that 'a default is considered to have occurred with regards to a particular obligor when either or both of the two following events have taken place: (1) the bank considers that the obligor is unlikely to pay its credit obligations to the banking group in full, without recourse by the bank to actions such as realising security (if held) and/or (2) the obligor is past due more than 90 days on any material credit obligation to the banking group. Overdrafts will be considered as being past due once the customer has breached an advised limit or been advised of a limit smaller than current outstanding.' Default risk is defined as a risk in which borrowers fail to comply with their debt obligations. Default triggers a total or partial loss of the amount lent to the counterparty (Bessis, 2015). As defined, Golin & Delhaise

(2013) suggest that credit risk and default risk are virtually synonymous; therefore, they will be used interchangeably in this paper. The Banking Supervision Basel Committee highlighted that because the exposure to credit risk continues to be the dominant source of problems within banking organisations globally, it is essential for banking firms and supervisory authorities to learn valuable lessons from several previous financial crises. Banking firms should address themselves to the need for identification and to estimate, monitor and oversee credit risk; whilst at the same time, ensuring that banks hold enough capital buffer against these risks and that they are sufficiently compensated for the risks incurred. Banking supervisors, on the other hand, should stimulate sound practices for managing credit risk at an international level. The effective credit risk management is a crucial element of a thorough approach to risk management and is vital to the long-run success of any banking firm (Basel Committee on Banking Supervision, 1999).

Third, liquidity risk is another source of risk, reported in the context of the 2007-2009 credit crisis. Liquidity risk is broadly defined as the risk of not being able to raise cash when needed (Bessis, 2015). Banking firms alter short-run, liquid liabilities (e.g. demand deposits) into longer-run, illiquid assets (e.g. loans). If the demand for liquidity unexpectedly increases, it is impossible for banks to satisfy all withdrawal calls, as selling an illiquid portfolio at firesale prices is very costly. Liquidity risks consist of market liquidity risk and funding liquidity risk. The funding liquidity risk is driven by the probability that over a particular horizon the banking institution will be no longer able to settle their payment duties immediately. Market liquidity risk, on the other hand, is the loss incurred when a bank wants to perform a trade or to liquidate a position instantly meanwhile the

best price cannot be reached. Normally, funding liquidity risk leads to market liquidity risk.

As far as this is concerned, banks are also exposed to operational risks. Operational risks include the malfunction of information systems, of reporting systems, of internal risk monitoring rules and of procedures designed to take corrective actions on a timely basis (Bessis, 2015). Banks engage in clearing and custodial transactions on behalf of their clients. For example, to protect their reputation banks may be responsible for compensating their customers' losses in the case of mismanagement, fraud, human error or computer failure.

The last source of risk in the broad terms of financial risk, is solvency risk. Solvency risk is the risk of being unable to absorb losses with the available capital. Based on the principle of capital adequacy promoted by regulators, a minimum capital base is required to absorb unexpected losses potentially arising from the current risks of a firm. Solvency issues arise when the unexpected losses exceed the capital level, as happened during the 2008 financial crisis for several firms. This capital buffer sets the default probability of the bank; the probability that potential losses exceed the capital base.

Given the impact of the recent global financial crisis 2007-08 on the world economy, discussed so far, is the area of banks and their contributions to systemic risk. The perception of systemic risk is fundamentally essential to enhance the soundness and stability of the financial system (for a detailed discussion, see 6.2.3). However, it is difficult to arrive at an accepted definition of systemic risk. There is an excellent discussion about the definition of systemic risk in DeBandt & Hartmann (2000, p.10,11) which covers almost all other definitions explicitly and implicitly provided to date. First, they define a systemic

event in a narrow perception as an event where the announcement of 'bad news' regards a firm, or its collapse, or the breakdown of financial market results in substantial negative influences on one or more firms or markets, for instance, their collapse or crash. Based on this wording, a systemic crisis (in a narrow or broad perception) can be defined as 'a systemic event that affects a considerable number of financial institutions or markets in a strong sense, thereby severely impairing the general well-functioning (of an important part) of the financial system.' Therefore, 'systemic risk (in the narrow and broad sense) can then be defined as the risk of experiencing systemic events in the strong sense.' In a more up-to-date version, Schwarcz (2008, p.198) attempts to encompass a number of existing definitions of systemic risk and arrives at a general systemic risk definition: 'the risk that (i) an economic shock such as market or institutional failure triggers (through a panic or otherwise) either (x) the failure of a chain of markets or institutions or (y) a chain of significant losses to financial institutions, (ii) resulting in substantial financial-market price volatility (which price volatility may well reflect increases in the cost of capital or decreases in its availability).'

This brief survey of risk exposures emphasises the significance of continuous measurement of the level of risk within a bank's risk inventory. Therefore, risk measurement is a crucial part of risk management. One of the most vital and influential economic theories regarding finance and investment is the modern portfolio theory by Markowitz, (1952). This investment theory builds on the idea that risk-averse investors can form portfolios to enhance or amplify expected return, based on a given level of market risk, highlighting that risk is an inherent component of higher return. Modern portfolio theory measures the advantages of diversification, also known as 'not putting all eggs into one basket.'

In essence, information on expected returns, standard deviations of returns and correlations between returns, for every probable pair of financial shares, are needed to measure the efficient frontier in a mean-variance world.

Later, Sharpe (1963) as well as Mossin (1968) adopted a simplified assumption for the portfolio theory and it became a model regularly applied in financial risk management practice. Specifically, total risk can be split into two components: systematic (market risk) and idiosyncratic risk (the residual, company-specific risk). Systematic risk represents the effect of unexpected changes in macroeconomic and financial market conditions on the performance of borrowers. Borrowers may differ in their degree of sensitivity to systematic risk, but few firms are entirely indifferent to the broader economic conditions in which they operate. Therefore, the systematic component of portfolio risk is unavoidable and only partly diversifiable. Meanwhile, idiosyncratic risk (company-specific risk) represents the effects of risks that are particular to individual borrowers. As a portfolio becomes more fine-grained, in the sense that the most significant individual exposures account for a smaller share of total portfolio exposure, idiosyncratic risk is diversified away at the portfolio level (Lutkebohmert, 2009).

The Capital Asset Pricing Model stems from the hypothesised assumption that only undiversifiable market risk is significant for share pricing, only the market risk measurement β is essential, therefore substantially decreasing the necessary statistics inputs. Nevertheless, β is problematically evidenced as being weakly connected to actual stock returns, thus raising concerns on β 's description as the right risk management. In search of market practitioners for a replacement risk measure that was both accurate and somewhat economical to estimate, Value at Risk (VAR) has been widely adopted. One of the compelling reasons for the

adoption of VAR, was the determination of J.P. Morgan to produce a transparent VAR measurement model, RiskMetrics.' An openly available databank, comprising the crucial data input to compute the model, was created to support RiskMetrics. Another reason for the adoption of VAR was that in 1998, the Bank for International Settlements (BIS) introduced the international bank capital requirements, which permit comparatively sophisticated banks to compute their capital requirements via internal models such as VAR. The VAR model can be used to measure market risk, credit risk and operational risk (Allen and Saunders, 2015).

Besides VAR, there are many other risk measurement models that have been adopted and developed in order to measure bank's contribution to systemic risk, such as Marginal Expected Shortfall and Lower Tail dependence (Weiß et al., 2014), to measure default risk such as Distance to Default (Gropp et al., 2006; Hillegeist et al., 2004; Vallasca and Hagendorff, 2011), Expected Default Frequency (Furfine and Rosen, 2011) and Z-score (Craig and Santos, 1997). These methodologies will be discussed in more detailed in the empirical Chapters 5 and 6 respectively, regarding the effects of M&As on acquiring banks' default risk and acquirers' contribution to systemic risk.

In conclusion, the crisis of 2007-09 demonstrates that there is still much to learn about risk measurement and risk management. However, no system will be efficient if financial institutions ignore the warning signals flashed by their risk measurement models, in their rush to compete in the latest market frenzy, whether it be subprime mortgage-backed securities or high-tech. Risk measurement and management requires a steady eye and a firm hand, as well

as efficient quantitative and analytical tools as suggested by the Basel Committee.

APPENDIX D: MARGINAL EXPECTED SHORTFALL

D1. Derivation of Equation 6.3 in section 6.3.2.2

Following Scaillet (2005), it start with the expression for the expected loss of the financial system at time t

$$ES_{mt}(C) = -\mathbb{E}_{t-1}(r_{mt}|r_{mt} < C) \quad (D1.1)$$

Following Scaillet (2005), it is shown that the first order derivative for the weight associated with the i th asset, i.e. MES, is given by

$$\frac{\partial ES_{mt}(C)}{\partial w_i} = \mathbb{E}_{t-1}(r_{it}|r_{mt} < C) \quad (D1.2)$$

Then \check{r}_{mt} is defined as as the return for the financial system except for the contribution of the i th asset, where $\check{r}_{mt} = \sum_{j=1, j \neq i}^n w_j r_{jt}$ and $r_{mt} = \check{r}_{mt} + w_i r_{it}$ (D1.3)

Besides, the threshold C is not restricted to be a scalar. It is assumed to depend on the distribution of the market returns and hence on the weights and the specified probability to be in the tail of the distribution p , as in the case of the VaR (Gourieroux et al., 2000), thus providing a general proof for equation (D1.2). It follows that:

$$ES_{mt}(C) = \mathbb{E}_{t-1}(\check{r}_{mt} + w_i r_{it} | \check{r}_{mt} + w_i r_{it} < C(w_i, p)) = \frac{1}{p} \int_{-\infty}^{\infty} \left(\int_{-\infty}^{C(w_i, p) - w_i r_{it}} \check{r}_{mt} + w_i r_{it} \right) f(\check{r}_{mt}, r_{it}) d\check{r}_{mt} dr_{it} \quad (D1.4)$$

where $f(\check{r}_{mt}, r_{it})$ stands for the joint probability density function of the two series of returns. Consequently,

$$\frac{\partial ES_{mt}(C)}{\partial w_i} = \frac{1}{p} \int_{-\infty}^{\infty} \left(\int_{-\infty}^{C(w_i, p) - w_i r_{it}} \check{r}_{it} \right) f(\check{r}_{mt}, r_{it}) d\check{r}_{mt} dr_{it} + \frac{1}{p} \int_{-\infty}^{\infty} \left(\frac{\partial C(w_i, p)}{\partial w_i} - r_{it} \right) C(w_i, p) f(C(w_i, p) - w_i r_{it}, r_{it}) dr_{it} \quad (D1.5)$$

However, the probability of being in the left tail of the distribution of the market return is constant, i.e. $\Pr(\check{r}_{mt} + w_i r_{it} < C) = p$

A direct implication of this fact is that the first order derivative of this probability is null. To put it differently, using simple calculus rules for cumulative distribution functions, it can be shown that $\left(\frac{\partial C(w_{it}, p)}{\partial w_{it}} - r_{it}\right) f(C(w_{it}, p) - w_{it}r_{it}, r_{it}) = 0$ (D1.6)

Therefore Equation (D1.5) can be written compactly as

$$\frac{\partial ES_{mt}(C)}{\partial w_{it}} = \frac{1}{p} \int_{-\infty}^{\infty} \left(\int_{-\infty}^{C(w_{it}, p) - w_{it}r_{it}} \tilde{f}(\tilde{r}_{it}) f(\tilde{r}_{mt}, r_{it}) d\tilde{r}_{mt} \right) dr_{it} =$$

$$\mathbb{E}_{t-1}(r_{it} | \tilde{r}_{mt} + w_{it}r_{it} < C(w_{it}, p)) = \mathbb{E}_{t-1}(r_{it} | r_{mt} < C) \quad (D1.7)$$

which completes the proof.

D2. Derivation of Equation 6.6 in section 6.3.2.2

Let consider the Cholesky decomposition of the variance-covariance matrix H_t :

$$H_t^{1/2} = \begin{pmatrix} \sigma_{mt} & 0 \\ \sigma_{it}\rho_{it} & \sigma_{it}\sqrt{1 - \rho_{it}^2} \end{pmatrix} \quad (D2.1)$$

Given Equation (6.4) in section 6.3.2.2, the market and firm returns can be expressed as:

$$r_{mt} = \sigma_{mt}\varepsilon_{mt} \quad (D2.2)$$

$$r_{it} = \sigma_{it}\rho_{it}\varepsilon_{mt} + \sigma_{it}\sqrt{1 - \rho_{it}^2}\xi_{it} \quad (D2.3)$$

For any conditioning event C:

$$MES_{it}(C) = \mathbb{E}_{t-1}(r_{it} | r_{mt} < C) = \sigma_{it}\rho_{it}\mathbb{E}_{t-1}\left(\varepsilon_{mt} \middle| \varepsilon_{mt} < \frac{C}{\sigma_{mt}}\right) +$$

$$\sigma_{it}\sqrt{1 - \rho_{it}^2}\mathbb{E}_{t-1}\left(\xi_{it} \middle| \varepsilon_{mt} < \frac{C}{\sigma_{mt}}\right) \quad (D2.4)$$

which completes the proof.

D3. Tail expectations in section 6.3.2.3

The tail expectations $\mathbb{E}_{t-1} \left(\varepsilon_{mt} \middle| \varepsilon_{mt} < \frac{c}{\sigma_{mt}} \right)$ and $\mathbb{E}_{t-1} \left(\xi_{it} \middle| \varepsilon_{mt} < \frac{c}{\sigma_{mt}} \right)$ can be easily estimated in a non-parametric kernel framework by elaborating on (Scaillet, 2005).

For ease of notation, let denote the systemic risk event $\frac{c}{\sigma_{mt}}$ by k . The tail expectation on the market returns $\mathbb{E}_{t-1} \left(\varepsilon_{mt} \middle| \varepsilon_{mt} < \frac{c}{\sigma_{mt}} \right)$ becomes $\mathbb{E}_{t-1}(\varepsilon_{mt} | \varepsilon_{mt} < k)$. (D3.1)

Using the definition of the conditional mean, (D3.1) is rewritten as a function of the probability density function f

$$\mathbb{E}_{t-1}(\varepsilon_{mt} | \varepsilon_{mt} < k) = \int_{-\infty}^k \varepsilon_{mt} f(u | u < k) du \quad (\text{D3.2})$$

where the conditional density $f(u | u < k)$ can be stated as

$$\frac{f(u)}{\Pr(u < k)} \quad (\text{D3.3})$$

To complete the proof, the numerator and denominator in (D3.3) are computed. For this, the standard kernel density estimator of the density f at point u was given by

$$\hat{f}_u = \frac{1}{Th} \sum_1^A \phi\left(\frac{u - \varepsilon_{mt}}{h}\right)$$

where h stands for the bandwidth parameter, and A is the sample size (Silverman, 1986).

Second, the probability of being in the tail of the distribution can be defined as the integral of the probability density function over the domain of definition of the variable u , i.e. $p = \Pr(u < k) = \int_{-\infty}^k f(u) du$. Consequently, by replacing \hat{f}_u with the kernel estimator, the following is obtained

$$\hat{p} = \frac{1}{Th} \sum_{t=1}^T \phi\left(\frac{k - \varepsilon_{mt}}{h}\right)$$

The expectation in (D3.1) hence takes the form

$$\hat{\mathbb{E}}_{t-1}(\varepsilon_{mt} | \varepsilon_{mt} < k) = \frac{\sum_{t=1}^T \varepsilon_{mt} \phi\left(\frac{k - \varepsilon_{mt}}{h}\right)}{\sum_{t=1}^T \phi\left(\frac{k - \varepsilon_{mt}}{h}\right)} \quad (\text{D3.4})$$

Similarly, it can be shown that

$$\hat{\mathbb{E}}_{t-1}(\xi_{it} | \varepsilon_{mt} < k) = \frac{\sum_{t=1}^T \xi_{it} \phi\left(\frac{k - \varepsilon_{mt}}{h}\right)}{\sum_{t=1}^T \phi\left(\frac{k - \varepsilon_{mt}}{h}\right)} \quad (\text{D3.5})$$

APPENDIX E: CoVaR

E1. Derivation of equation 6.16 in section 6.3.3.2

Considering two cases: a general case with $\rho_{it} \neq 0$ and a special case with $\rho_{it} = 0$. Given Equations (6.14) and (6.15), $\rho_{it} \neq 0$ then the market return can be expressed as:

$$r_{mt} = \frac{\sigma_{mt}}{\sigma_{it}\rho_{it}} r_{it} - \frac{\sigma_{mt}\sqrt{1-\rho_{it}^2}}{\rho_{it}} \xi_{it} \quad (\text{E1.1})$$

For each conditioning event form $\mathbb{C}(r_{it}): r_{it} = C$, CoVaR is defined as follows:

$$Pr(r_{mt} \leq CoVaR_t^{m|r_{it}=C} | r_{it} = C) = \alpha \quad (\text{E1.2})$$

or equivalently:

$$Pr\left(\xi_{it} \leq \frac{\rho_{it}}{\sigma_{mt}\sqrt{1-\rho_{it}^2}} \left(\frac{\sigma_{mt}}{\sigma_{it}\rho_{it}} C - CoVaR_t^{m|r_{it}=C}\right) | r_{it} = C\right) = 1 - \alpha \quad (\text{E1.3})$$

In the special case where the conditional mean function of ξ_{it} is linear in r_{it} , the first two conditional moments of ξ_{it} given $r_{it} = C$ can be expressed as:

$$\mathbb{E}(\xi_{it} | r_{it} = C) = \frac{cov(\xi_{it}, r_{it})}{\sigma_{it}^2} * C = \frac{\sigma_{it}\sqrt{1-\rho_{it}^2}}{\sigma_{it}^2} * C = \frac{\sqrt{1-\rho_{it}^2}}{\sigma_{it}} * C \quad (\text{E1.4})$$

$$\mathbb{V}(\xi_{it} | r_{it}) = \mathbb{V}(\xi_{it}) - \mathbb{V}(r_{it}) \left[\mathbb{E}(\xi_{it} | r_{it}) \right] = \mathbb{V}(\xi_{it}) * \left[1 - \left(\frac{cov(\xi_{it}, r_{it})}{\sigma_{it}^2} \right)^2 \sigma_{it}^2 \right] = \rho_{it}^2 \quad (\text{E1.5})$$

Consider $G(\cdot)$ the conditional (location-scale) demeaned and standardized cdf of ξ_{it} such that:

$$\mathbb{E} \left[\frac{1}{\rho_{it}} \left(\xi_{it} - \frac{\sqrt{1-\rho_{it}^2}}{\sigma_{it}} * C \right) | r_{it} = C \right] = 0 \quad (\text{E1.6})$$

$$\mathbb{V} \left[\frac{1}{\rho_{it}} \left(\xi_{it} - \frac{\sqrt{1-\rho_{it}^2}}{\sigma_{it}} * C \right) | r_{it} = C \right] = 1 \quad (\text{E1.7})$$

Thus, Equation (E.17) is expressed as:

$$\frac{1}{\rho_{it}} \left(\frac{\rho_{it}}{\sigma_{mt}\sqrt{1-\rho_{it}^2}} \left(\frac{\sigma_{mt}}{\sigma_{it}\rho_{it}} C - CoVaR_t^{m|r_{it}=C} \right) - \frac{\sqrt{1-\rho_{it}^2}}{\sigma_{it}} * C \right) = G^{-1}(1 - \alpha) \quad (\text{E1.8})$$

By rearranging these terms, we write the general expression of the CoVaR:

$$CoVaR_t^{m|r_{it}=C} = -\sigma_{mt}\sqrt{1-\rho_{it}^2}G^{-1}(1-\alpha) + \frac{\rho_{it}\sigma_{mt}}{\sigma_{it}}C \quad (E1.9)$$

The CoVaR defined for the conditioning event

$\mathbb{C}(r_{it}): r_{it} = Median(r_{it})$ has a similar expression:

$$CoVaR_t^{m|r_{it}=Median(r_{it})} = -\sigma_{mt}\sqrt{1-\rho_{it}^2}G^{-1}(1-\alpha) + \frac{\rho_{it}\sigma_{mt}}{\sigma_{it}}F^{-1}(0.5) \quad (E1.10)$$

where $F(\cdot)$ denotes the marginal cdf of the firm return. Then, for each conditioning event form $\mathbb{C}(r_{it}): r_{it} = C$, the $\Delta CoVaR$ is defined as:

$$\Delta CoVaR_{it}(C) = CoVaR_t^{m|r_{it}=C} - CoVaR_t^{m|r_{it}=Median(r_{it})} = \frac{\rho_{it}\sigma_{mt}}{\sigma_{it}} * [C - Median(r_{it})] \quad (E1.11)$$

$$= \gamma_{it} * [C - Median(r_{it})] \quad (E1.12)$$

where $\gamma_{it} = \sigma_{mt}\rho_{it}/\sigma_{it}$ denotes the time-varying linear projection coefficient of the market return on the firm return. If the marginal distribution of r_{it} is symmetric around zero, then $F^{-1}(0.5) = 0$, and we have:

$$\Delta CoVaR_{it}(C) = \frac{\rho_{it}\sigma_{mt}}{\sigma_{it}} * C = \gamma_{it} * C \quad (E1.13)$$

As in Adrian and Brunnermeier (2016), $\Delta CoVaR$ denoted $\Delta CoVaR_{it}(\alpha)$ and defined for a conditioning event $\mathbb{C}(r_{it}): r_{it} = VaR_{it}(\alpha)$ is:

$$\Delta CoVaR_{it}(\alpha) = \gamma_{it}[VaR_{it}(\alpha) - VaR_{it}(0.5)] \quad (E1.14)$$

or

$$\Delta CoVaR_{it}(\alpha) = \gamma_{it}VaR_{it}(\alpha) \quad (E1.15)$$

if the marginal distribution of the firm return is symmetric around zero.

Considering the case where $\rho_{it} = 0$ and the bivariate process becomes:

$$r_{mt} = \sigma_{mt}\varepsilon_{mt} \quad (E1.16)$$

$$r_{it} = \sigma_{it}\xi_{mt} \quad (E1.17)$$

$$(\varepsilon_{mt}, \xi_{mt}) \sim D \quad (E1.18)$$

where $v_t = (\varepsilon_{mt}, \xi_{mt})'$ satisfies $\mathbb{E}(v_t) = 0$ and $\mathbb{E}(v_t v_t') = I_2$ and D denotes the bivariate distribution of the standardized innovations. It is straightforward to show that:

$$\Pr\left(r_{mt} \leq CoVaR_t^{m|r_{it}=VaR_{it}(\alpha)} \middle| r_{it} = VaR_{it}(\alpha)\right) = \Pr\left(r_{mt} \leq CoVaR_t^{m|r_{it}=VaR_{it}(\alpha)}\right) = \alpha \quad (E1.19)$$

Hence, we have $CoVaR_{it}(\alpha) = \sigma_{mt} F_m^{-1}(\alpha)$ and $\Delta CoVaR_{it}(\alpha) = 0$ where $F_m(\cdot)$ denotes the c.d.f of the marginal distribution of the standardised market return.

APPENDIX F: SYSTEMIC RISK MEASUREMENT MODELS

F1. Distressed Insurance Premium (DIP) Model

The Distressed Insurance Premium (DIP) model is perceived as an ex-ante systemic risk metric by Huang et al. (2009). It represents a hypothetical insurance premium against systemic financial distress, defined as total losses that exceed a given threshold of, for example, 15%, of total bank liabilities. This methodology is general and can be applied to any pre-selected group of firms with publicly tradeable equity and CDS contracts. Each institution's marginal contribution to systemic risk is a function of its size, probability of default (PD) and asset correlation. The last two components need to be estimated from market data. The framework includes the following primary mechanisms. First, Huang et al. (2009) estimate the probability of default and the asset return correlation, in order to determine the risk profile of a portfolio. Second, they construct the price of insurance against significant losses of the banking sector, which is an indicator of the systemic financial risk, based on the forward-looking PDs and correlations for the next period. Third, for stress testing purposes they examine the dynamic linkages between default risk factors and many macro-financial factors. An integrated micro-macro model framework enables them to investigate the two-way linkages between the banking sector and the macroeconomy. Lastly, they define stress testing scenarios and explore their implications for the stability of the banking system.

This method shows several benefits compared to other methods. First, both the credit default swap (CDS) spreads, and the equity prices of individual banks are available daily, in real time; therefore the stress testing can be updated

regularly. This approach does not rely on the balance sheet or accounting information that may be available only quarterly or on a longer time-frequency, with a significant reporting lag. In addition, the new indicator reflects the various degrees of importance of different banks contributions to systemic risk, in that banks are treated differently based on their relative size, thus enhancing the power to identify systemically important financial institutions. More importantly, they find that realised correlations in the short-term horizon provide strong and additional predicting power in forecasting the movement in asset return correlations, relative to equity market and term structure variables. Finally, the adopted integrated micro-macro model does not only examine the impact of general market developments on the performance of individual banks, but simultaneously incorporates the feedback effect from the banking system to the rest of the economy.

Regarding the model's shortcomings, its current method uses the size of losses around the period when many banks are distressed at the same time. Even though this method might appear to capture systemic risk, it only works when systemic losses are sufficiently presented in historical statistics. However, around the stage of rapid financial innovation, newly interconnected segments of the financial structure may not witness simultaneous losses, despite the fact that systemic risk is often associated with interconnectedness among banks. For instance, before the global financial crisis 2007-09, great losses among mono-line insurance firms did not correspond with similar losses among hedge funds invested in mortgage-backed securities, as both fields had only recently been connected via insurance contracts on collateralised debt commitments; hence it reduces Distressed Insurance Premium model accuracy in measuring systemic

risk. Second, the model is not a very useful early warning indicator of systemic risk because the probability-based model regularly relies upon market volatility, and around the times of market growth and boom, volatility is usually less than in the stage of distress. It indicates under-estimation of systemic risk until volatility fierce happens (Billio et al., 2012).

F2. Aggregated Distance-to-Default

Based on contingent claims analysis, Saldías (2013) develops a method to monitor systemic risk in the European banking system. In his study, aggregated Distance-to-Default series are generated using option priced information from systemically important banks (SIBs) and the STOXX Europe 600 Bank's Index. Contingent claims analysis (CCA) is a framework that combines market-based and balance sheet information to obtain a comprehensive set of company financial risk indicators, for instance: Distance-to-Default, probabilities of default, risk-neutral credit risk premia and expected losses on senior debt. Based on the Merton (1974) approach to default risk, CCA has three principles: (1) the economic value of liabilities is derived and equals the economic value of assets (which reflect the present value of future income); (2) liabilities in the balance sheet have different priorities (i.e. senior and junior claims) and associated risk; and (3) the company assets distribution follows a stochastic process.

These indicators provide methodological advantages in monitoring vulnerabilities within the banking system over time. First, they capture interdependence and joint risk of distress in SIBs. Besides this, heir forward-looking features endow them with early signalling properties, compared to traditional approaches within literature and other market-based indicators. Moreover, they produce simultaneously smooth and informative long-term

signals and quick and precise reactions to market distress. Lastly, they incorporate additional information through option prices about tail risk and correlation breaks, in line with recent findings in the literature.

One of the main weaknesses of this model is that this specification of option price-based expected losses does not incorporate skewness and kurtosis, and stochastic volatility, which can account for implied volatility smiles of equity prices. It is also important to note that the presented valuation model is subject to varying degrees of estimation uncertainty and parametric assumptions, which need to be taken into account when drawing policy conclusions. The option pricing model (given its specific distributional assumptions, the derivation of both implied assets and asset volatility, and assumptions about the default barrier) could fail to capture some relevant economics, which are needed to understand default risk thoroughly, and, thus, could generate biased estimators of expected losses (Jobst, 2014).

F3. SRISK Model

One of the most recent systemic risk measurements is the SRISK index, introduced in (Brownlees and Engle, 2017), to measure the systemic risk contribution of a financial firm. The index associates systemic risk to the capital shortfall a financial institution is expected to experience based on a severe market decline. SRISK is a function of the firm's size, its degree of leverage and its expected equity loss based on a market downturn. The sum of SRISK across all firms is used to measure the degree of undercapitalization of the whole financial system.

One of the most important benefits of SRISK is that SRISK delivers useful rankings of systemically risky firms at various stages of the financial crisis.

Moreover, regression results show that SRISK is a significant predictor of the capital injections performed by the Fed during the crisis. Also, outcomes demonstrate that an increase in SRISK predicts future declines in industrial production and increases in the unemployment rate, and that the predictive ability of aggregate SRISK is stronger over longer horizons. Finally, the empirical analysis shows that SRISK has significantly higher predictive power than SES (Brownlees and Engle, 2017).

The main drawback of SRISK is that it incorporates considerable frequency market information (market capitalisation and daily share prices) and low-frequency statistics from the balance sheet (leverage). Therefore, it is forced to presume the constant liabilities of the bank around the crisis time (Banulescu and Dumitrescu, 2015). Moreover, this model fails to measure the marginal contribution of a bank to simultaneous changes of both the harshness of systemic risk and the dependence system, over any combination of sample banks, for any degree of statistical confidence, and at any point in time, because it does not employ multivariate density estimation or multivariate density estimation.

GLOSSARY

Terms	Definitions
Abnormal returns	The returns produced by a given stock or portfolio across a period of time that is distinctive from the projected rate of return
Activity-diversifying merger	Where acquirer is a bank and target can be non-bank financial firm such as insurance company, securities company, financial services company
Agency motive	Under the agency motive, Jensen (1986) proposes the agency costs of free cash flow theory which, among many theories, can relevantly explain M&As. The free cash flow theory anticipates that mergers and acquisitions are more likely to demolish, rather than to create value. As such, the conflict of interest between managers and shareholders is present.
Asymmetric information	Referred to as information failure, is present whenever one party to an economic transaction possesses greater material knowledge than the other party
Banking Concentration	A few largest banks control the whole economy of a country (opposite to banking competition)
Banking crisis	Banking crisis indicates the crisis of liquidity and insolvency of more banking firms in the financial system
Bidder/acquirer	The firm purchasing another firm for a specific price
Capital buffer	Compulsory capital that financial firms are obliged to hold along with other minimum capital requirements
Coefficient	A number in front of a variable
Conglomerate	A combination of two and more firms operating in wholly different industries under one corporate umbrella
Consolidation	The action or process of merging numerous things into a single more efficient whole.
Contagion	The spread of market changes from one market to others
Correlations between returns	A statistical measure that computes the strength of relationship between the comparative movements of the two variables
Credit ratings	An evaluation of the capability of a person or firm to meet their commitments, established on previous transactions
Credit rationing	Refers to any situation in which lenders are not willing to provide additional funds to a borrower even at a higher interest rate

Cross-border merger	Acquirer from one country acquires target from other countries
Deposit insurance scheme	A measure executed in many nations to protect bank depositors, in full or in part, from losses caused by a bank's failure to pay its obligations when due
Deregulation	The elimination of regulations or restrictions, especially in a particular industry.
Derivative transaction	Involves contract between parties whose value is based on an agreed-upon underlying financial assets (securities, bonds, commodities, interest rates currencies, market indexes)
Diversification	The process of a company expanding or diverging its variety of products or field of operation.
Domestic merger	M&A deal that acquirer and target are in the same country
Dummy variable	Take the value of 0 or 1 to show the absence or presence of some categorical effect that may be projected to alter the results
Economies of scale	A proportional saving in costs obtained by a greater level of production
Economies of scope	A proportional saving obtained by producing two or more different products, when the cost of doing so is smaller than that of producing each good individually.
Focusing merger	Where acquirer and target are both banks
Geographic diversification	Firms expand their activities geographically
Globalisation	The process by which firms develop global influence or begin operating on an international scale.
Housing bubble	A run-up in housing prices fueled by demand, assumption and enthusiasm
Hubris	The theory of managerial hubris (Roll, 1986) suggests that managers may have good intentions in increasing their firm's value but, being overconfident, they overestimate their abilities to create synergies.
Interbank market	Exclusive financial market where banks borrow short-run funds from other banks having surplus liquidity.
Interconnectedness	Banks can be connected to each other in numerous ways. Higher interconnectedness means shocks can spread more swiftly and extensively over the financial sector.
Liquidity	Liquidity is a measure of the capacity and easiness with which assets can be converted to cash

Macroprudential policy	The policies or actions to avoid risks affecting the whole or substantial parts of the financial system rather than individual financial firms, or becoming systemic
Mega-merger	A term used to describe the joining of two very large firms, usually involving a transaction value worth billions of dollars
Merger and acquisition	The buying and selling of firms
Moral hazard	Lack of motivation to protect against risk where one is protected from its consequences
Multicollinearity	A stage of very high intercorrelations among the independent variables, hence it is a kind of disturbance in the data which any conclusions from the data unreliable
Non-conglomerate bank merger	Merger between bank and bank
Price volatility	Used to describe price fluctuations of a commodity
Privatisation	The transfer of a business, sector, or service from public to private ownership and monitor.
Product diversification	Firms add new products/services to their range or new products in new markets
Safety net subsidies	The subsidy provided by government's desire to prevent financial crises
Simulation	Simulation approaches allowed researchers to evaluate the effects of banking institutions' expansion within these banned activities. The assumptions of such a hypothetical acquisition approach are relatively simple. The authors presume that the combined entity is the sum of two single companies. The companies are combined based on their book values.
Standard deviations of returns	Standard deviation is applied to the annual rate of return of an investment to measure the investment's volatility
Sub-prime mortgage	A kind of loan approved to people with poor credit scores, who, due to their unsatisfactory credit histories, cannot obtain a traditional mortgage
Synergy	In M&As context, synergy explains the capability of a combined entity to be more profitable than the single parts of the two corporations that were merged.
Target	The firm who is purchased by another firm
Universal banking	A banking system in which banks provide a variety of financial services, including commercial banking and investment services

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