The Determinants of Bank Failures in Normal and Crisis Times and the Resolution of Failed Banks

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Abstract

This thesis is structured around three empirical analyses, which are based on bank failures that occurred in the US between 1984 and 2013.

The first analysis tests whether financial crises contribute to removing the most inefficient banks from the market and to liberating resources for more efficient use (cleansing effect), or whether they destroy banks regardless of their efficiency (scarring effect). The results show that the nature of bank failures during financial crises are not fully aligned with either a cleansing or a scarring effect. While efficiency helps banks survive over the full sample period, financial crises do not amplify the removal of inefficient institutions. Additional tests show that financial crises contribute to producing a scarring effect via the increase in the failure rate of young banks regardless of their efficiency but also generate a cleansing effect by liberating resources that are more efficiently used by new entry banks.

The second set of empirical analyses investigates the long-term post-acquisition performance of failed bank acquirers. The results show that after an acquisition failed bank acquirers' performance deteriorated significantly, with an exception being the deals completed during the global financial crisis, during which no performance changes were evident. This result is likely caused by the loss-sharing agreements included in most of the latter transactions. Further analysis shows that although no benefit in terms of performance materializes for the acquiring banks, they are less likely to disappear from the market through either an acquisition or outright failure.

The final analysis examines the relation between failed bank resolution costs and the competitive pressures in the market. The results show that when restrictions on competition are relaxed, large (small) targets become more (less) desirable, and the associated costs to resolve them reduce (increase). This finding, however, is merely evident during normal times.

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List of Abbreviations

AFT	Accelerated Failure Time
BHC	Bank Holding Company
BIF	Bank Insurance Fund
CRS	Constant Return to Scale
DEA	Data Envelopment Analysis
FDIC	Federal Deposit Insurance Corporation
FDICIA	Federal Deposit Insurance Corporation Improvement Act
Fed	Federal Reserve System
FHLBB	Federal Home Loan Bank Board
GNP	Gross National Product
LSA	Loss Sharing Agreement
M&A	Mergers and Acquisitions
OCC	Office of Comptroller and Currency
OLS	Ordinary Least Squares
P&A	Purchase and Assumption
PH	Proportional Hazard
pp	percentage point
PS	Parametric Survival
ROA	Return on Assets
ROE	Return on Equity
S&L	Savings and Loans
SFA	Stochastic Frontier Analysis
TARP	Troubled Asset Relief Program
US	United States
VRS	Variable Return to Scale

Chapter 1. Introduction

1.1. Introduction

Throughout its history, the banking industry in the US has faced numerous bank failures, which have mainly clustered around periods of economic distress. Due to the negative consequences associated with episodes of high numbers of bank failures, the US financial system and the regulatory framework has been shaped in a way to reduce the number and the extent of these episodes and to resolve troubled and insolvent banks in the least disruptive manner to the economy and the least costly to the federal system.

By analysing bank failures in the period between 1984 and 2013, this thesis is aimed to provide further insight into the management of insolvent banks in the US. At the first step, an empirical investigation is conducted to test whether the episodes of financial crises benefited the financial system by displacing the least efficient banking firms and allowing new entrants to take over the released resources and to employ them more effectively. This potential benefit of financial crises would, therefore, justify a more limited government intervention to reduce the short-term impact of crises on bank failures, whereas a lack of evidence to support this notion would warrant a wider use of bailout policies in order to reduce the short-term effects of crises on bank failures and improve the long-term prospects for the banking industry.

The second and third steps of this thesis are concerned with the analysis of the individual failed bank resolutions that are managed by the Federal Deposit Insurance Corporation (FDIC). In the first step, empirical analysis is conducted to investigate potential benefits to healthy banks that occur via the transfer of failed banks' assets and liabilities. Better use of the assets in the hands of successors would help the FDIC promote such transfers to the private sector and reduce the costs associated with failed bank resolutions. In addition, it would boost confidence of the failed bank depositors, preventing a run on the failing bank prior its closing. However, if the gains on the acquiring institutions' performance are not evident, alternative resolution design methods should be considered.

The final empirical investigation of this thesis, and the second step, is the analysis of the relation between the competitive pressures in local banking markets and failed bank resolution costs. Specifically, an examination is conducted to evaluate how the shift in competition, caused by individual state branching deregulation, affected losses incurred by the FDIC from resolving failed banks. Understanding this relation would help the FDIC advertise and manage failed bank resolutions in a more cost-efficient manner and, in turn, help reduce the losses incurred by the insurance fund.

The aforementioned empirical investigations are presented in three empirical chapters. The next section discusses in more detail the research questions, main findings and the contribution of each empirical chapter.

1.2. Research Questions, Main Findings and Contribution

1.2.1. Do Financial Crises Clean or Scar? Evidence from Bank Exits and Entries

While the negative effects stemming from financial crises have been widely acknowledged in the existing literature, chapter 3 raises an alternative view of the effects that financial crises may have. Specifically, by looking into bank failures in the US, empirical analysis is conducted

to test whether financial crises that occurred in the US helped clean out inefficient banks from the market ("cleansing effect"), or diminished the financial industry by obliterating banks regardless their productivity ("scarring effect").

To answer these questions, a data sample of 20,524 (from which 1672 failed) unique bank quarterly balance sheet data has been collected for the period between 1984 and 2013. Five separate crisis events have been identified to occur in the observed timeframe, which belong to two banking crisis episodes and three market crises.

The analysis conducted in this first empirical chapter is aimed to answer three main questions:

The first question raised is how the likelihood of a bank failing is dependent on crises given different levels of bank efficiency; and consecutively how bank efficiency affects bank probability of failure in crises and normal times. In accordance to the existing view that market and banking crises might have different consequences for the banking industry, this analysis is further replicated by splitting the crisis periods into market and banking crises. Finally, as the recent global financial crisis had the most severe effects on the banking industry since the Great Depression, empirical tests are conducted to test how the interaction between efficiency and the global financial crisis as well as the interaction between efficiency and other crises affect the likelihood of a bank failing.

The results show that while efficiency helps banks survive at all times, this was not the case during the global financial crisis. In fact, the probability of failing increased during this crisis regardless the levels of bank efficiency. It is further shown the marginal effect of other crises on bank probability of failure was not different from the effect of normal times. Overall, the findings are in support of a scarring view stemming from financial crises, and this effect was mainly evident during the global financial crisis.

The second question raised in this chapter is whether the scarring or the cleansing effect materializes when bank age is controlled for. The grounds for the notion that bank age may be an important element in determining which effect of crises prevails, stem from the fact that young banks may be more vulnerable to crises, although their full potential has not yet been reached. To answer this question, tests are conducted to evaluate how the likelihood of bank failure is dependent on the interplay between crises, efficiency and bank age.

The results only partly support the scarring view of crises in the banking industry. Specifically, it is shown that while crises increase the probability of failure of old inefficient banks, a higher failure rate is also associated with young banks, regardless their efficiency levels. In summary, while the previous analysis suggests that the scarring effect of crises prevails in the US banking industry, after controlling for bank age, the results neither fully support the cleansing nor the scarring view of the dynamics of bank failures during crisis periods.

The final question raised in this chapter is aimed to evaluate whether any benefit from crises materializes when considering bank entry. Following the notion of the proponents of the "cleansing view", this final analysis tests whether banks that enter during periods of economic distress achieve higher efficiency levels by taking over the resources of failed banks.

The results provide evidence that some gains stemming from financial crises emerge when considering new bank entry. It is shown that new bank entrants achieve higher efficiency levels and this is especially the case, when they enter during periods of economic distress. As for efficiency gains stemming from entry during banking crises and market crises, new banks achieve even higher levels of efficiency when entering during the latter. It,

therefore, seems that although market crises do not exhibit any signs of either cleansing or the scarring view, the banks that fail during market crises liberate resources for the new banks to take over and use more efficiently.

Overall, the findings in this chapter do not fully support either the cleansing or the scarring view. On the one hand, in line with the scarring view is the evidence that the least efficient banks are not more likely to fail during crisis periods than the most efficient banks are. In addition, crises tend to penalize young banks, which have not yet reached their full potential, regardless of their efficiency levels. On the other hand, in support of the cleansing view are the findings that crises affect the least efficient old banks, and has no effect on the most efficient old banks. Furthermore, as implied by the cleansing view, banks that enter the market during periods of financial distress achieve higher levels of efficiency. Although neither the cleansing nor the scarring view in the banking industry can be fully supported in the presence of market crises, this result is mostly pronounced during the latter periods.

This chapter contributes to the existing literature in a number of ways. First, it contributes to the cleansing/scarring debate by examining banking firms. Second, it evaluates whether the cleansing or scarring effect is dependent on the type of financial crisis. The third contribution of this chapter is the inclusion of firm age, when evaluating the cleansing/scarring effect. Finally, it contributes to the studies on bank efficiency and bank entry by examining whether new banking firms achieve higher efficiency levels when entering during crisis periods, which, as implied by the cleansing view, liberate resources from failed institutions for the new firms to take over and use more efficiently.

1.2.2. The Long-Term Effects of Failed Bank Acquisitions on Acquirer Performance

Failed banks in the US are mainly resolved using Purchase and Assumption (P&A) transactions, where a healthy institution purchases some or all of the failed bank's assets and assumes some or all of the institution's liabilities. While these transactions have been considered to be the least disruptive for local communities and failed bank customers, as well as the least costly for the FDIC (the institution responsible for resolving failed banks), this empirical chapter analyses the long-term effects these acquisitions have on the acquiring firms.

Based on a sample of 486 failed bank acquisitions in the period between 1985 and 2010, this chapter first analyses the pre- and post-acquisition profitability, efficiency, capital adequacy and asset quality measures of the acquiring firms. Findings show that in the three years following an acquisition failed bank acquirers deteriorate significantly, however, remain significantly more profitable and with better quality of assets than an average bank in the industry.

In the second stage of the empirical investigation, analysis is conducted to check whether the impact on the acquiring institutions differs depending on the timing the acquisition took place. Initially, two main acquisition periods are investigated: crisis periods and normal times. The crisis periods are further split into market and banking crises and finally, a separate analysis is conducted for the acquisitions that occurred during the recent global financial crisis. Apart from the recent global financial crisis, the results are in line with the initial analysis, i.e. failed bank acquirers' accounting-based measures deteriorate significantly after an acquisition. However, the acquisitions during the recent global financial crisis, with an exception of ROA, do not show any significant changes to the acquirers' performance.

The second part of the empirical analysis in this chapter is aimed to investigate the potential factors that influence the changes in the long-run performance. Specifically, the pre-acquisition characteristics of the acquirer (together with some additional conventional controls) and their effects on the acquirers' long-run performance changes are analysed. The findings, however, do not present a clear pattern that allows to identify a specific type of acquirer that improves the performance after a failed bank is acquired.

Due to the lack of evidence of gains to acquirers from failed bank acquisitions, the final step of this chapter is the investigation of other potential benefits for the acquirers that might emerge from these acquisitions. Specifically, it is examined whether the increase in size after an acquisition helps the acquirers survive in the market. To this end, the probability of exit via outright failure and acquisition is examined for institutions that acquired a failed bank. The results show that the probability to survive in the market increased significantly for those banks that acquired a failed bank in the preceding four and eight quarters.

Overall, the analysis in this chapter does not show any accounting-based long-run performance gains for failed bank acquirers. In fact, apart from the acquisitions that took place during the recent global financial crisis, the performance measures of failed bank acquirers deteriorated significantly. However, in spite of evidence on performance gains, failed bank acquirers have been found to be less likely to fail, or become acquisition targets themselves.

This empirical chapter contributes to the existing literature in several ways. First, apart from the study by Peristiani (1997), this is the first investigation to test the long-term effects produced by failed bank acquisitions on the acquiring institutions. The analysis of Peristiani (1997) is extended by analysing the impact of failed bank acquisitions on a wider range of acquirers' characteristics. In addition, the analysis in this chapter is conducted for

acquisitions over a 26-year period, which allows to further examine the effects the P&A transactions have on banks that acquired in normal times and crisis periods.

Second, this chapter adds to the existing literature by studying the potential factors that help explain the performance changes after an acquisition. Third, it complements the studies that focus on the immediate market reaction stemming from a failed bank acquisition announcement. Finally, it contributes to the general debate on the long-term performance gains of ordinary deals.

1.2.3. Competitive Pressure Effects on Failed Bank Resolution Costs

Since the establishment in 1933, the FDIC has resolved over 2,500 failed banks and thrifts, which cost the insurance funds over $118.5 billion. The recent global financial crisis and the wave of failures that occurred in the period have depleted the deposit insurance funds to a record high negative balance of -$20.9 billion (Davison and Carreon, 2010) and has brought back the debate amongst regulators, academics and practitioners as to how the costs associated with failed bank resolutions could be minimised.

The third empirical chapter of this thesis contributes to the debate on the determinants of failed bank resolution costs by evaluating the relation between the competitive pressures in the banking markets and the losses incurred by the FDIC from individual failed bank resolutions. The notion that failed bank resolution costs are dependent on the competitive dynamics in banking markets emerges from the set of studies that have identified the value of a failed bank's charter as a determinant of failed bank resolution costs (see, for instance, Giliberto and Varaiya, 1989; James, 1991). Meanwhile, the value of the charter has been by and large associated with competition, i.e. the stricter the competition, the higher the value of a firm's charter (see, for instance, Buser et al, 1981; Keeley, 1990; Repullo, 2004).

The analysis is based on 1,040 failed bank P&A transactions selected for the period between 1986 and 2013 and is aimed to answer two main questions. First, by employing state bank branching deregulation through M&As as an instrument to test the shift in competitive pressures of individual states, it is analysed how the relaxation of state branching restrictions affected failed bank resolution costs and how this effect was dependent on the relative size of the survived banks in the market and the size of the failed bank.

The results show that failed bank resolution costs reduced significantly after deregulation for those failed banks that were relatively similar by size to an average survived bank, whereas increased the costs for the relatively smallest failed banks. This finding has a sensible economic interpretation: when the restrictions to merge freely were lifted, due to the anticipation of consolidation process, the competitive pressure to gain market share prompted acquisitions of larger targets. Therefore, it is likely that more and higher bids were offered in failed bank auctions, which reduced the costs to the FDIC. Smaller targets, however, were likely to be less desirable targets, especially when healthy banks were given the opportunity to merge freely with other, healthy, firms in the market.

While the first analysis conducted in this empirical chapter is based on the full sample period, the second question raised in this chapter is whether the effect of deregulation was dependent on the timing the acquisition took place. Specifically, it is hypothesized that the effects of deregulation were only evident in normal times and eliminated in times of crises. Essentially, the results are in line with the expectations and show that while the benefit of deregulation in terms of reduced failed bank resolution costs is evident in normal times, it disappears in times of economic distress.

This empirical chapter contributes to the literature in several ways. First, it adds to the existing study of James (1991) - which is the only study known to date to test the direct

relation between branching deregulation and failed bank resolution costs – by analysing a longer time period, which allows including additional state deregulation cases, more crisis events and a bigger sample of resolutions in the analysis. In addition, the analysis is extended by including two additional contributors to the deregulation effect on failed bank resolution costs – the relative size variable and the time period factor. It finally contributes to the general debate on factors that help explain the losses incurred by the FDIC from failed bank resolutions.

1.3. Structure of the Thesis

The rest of the thesis is structured as follows. First, in the Institutional Framework chapter (chapter 2), the major episodes of financial crises in the history of US banking are discussed and the role of the Federal Deposit Insurance Corporation is depicted. Chapters 3, 4, and 5 present respectively the three empirical investigations conducted for this thesis. The final chapter (chapter 6) draws conclusions, outlines the limitations of the empirical analyses conducted, and offers suggestions for future research.

Chapter 2. Institutional Framework

2.1. Introduction

In its history, the US banking industry has faced numerous bank failures, which have mainly occurred in waves caused by severe economic downturns. These episodes of bank failures had a great impact on the US economy and the shaping of the banking industry that exists today. One of the major events that highly influenced how troubled financial institutions were handled and the failed ones resolved was the creation of the Federal Deposit Insurance Corporation (FDIC) in 1933. Having handled a total of 2,764 institutions in the period between 1934 and 2015, the FDIC saved all of the insured deposits, mitigated serious bank runs and prevented escalation of the worsening conditions in the banking industry during periods of distress.

The aim of this chapter is to depict the main episodes of financial distress and their effects on the banking system in the US, and to introduce the FDIC – the institution that has become a crucial element in the US banking system.

The rest of this chapter is structured as follows. The next section describes the financial panics from the establishment of the first bank in 1781 to the passage of the Federal Reserve Act in 1913. Section 2.3 presents the Great Depression and introduces the the FDIC and its creation. Sections 2.4 and 2.5 present respectively the S&L crisis together with the Credit Crunch and the Stock Market Crash and the Recent Global Crisis, as well as includes

the evolution of the FDIC and presents failed bank resolution methods. The final section concludes.

2.2. The US Banking Industry Growth and Panics: 1781-1913

The beginning of the US banking industry can be traced back to 1781[1] – the year when the first bank, the Bank of North America, was established by the Continental Congress, and chartered by the state of Pennsylvania (Wilson, 1942). In the following four decades, many more banks opened up as a consequence of the Industrial Revolution, which fostered the need for capital, and by 1819 more than 420 banks were operating in the US (FDIC, 2014a).

2.2.1. The Panic of 1819

In 1819 the US faced its first major financial crisis – the Panic of 1819. As in the case of many other future crises, the Panic of 1819 was preceded by an economic boom in the aftermath of the War of 1812. Confronted with a vastly growing economy and the increasing number of banks, the US government was not prepared: "the monetary system was not highly developed", there was no uniformity in currency, and control over banks was lax (Rothbard, 1962).

The significant need for government finance resulted in monetary expansion as numerous banks opened up and the issue of currency grew rapidly (Rothbard, 1962). However, soon the non-existence of sole currency led to depreciation of individual bank's notes, and the need for a nationwide uniform currency emerged (Rothbard, 1962). As a result, the Congress authorized the opening of the Second Bank of the United States (Rothbard, 1962), which was the second attempt at a central bank (FDIC, 2014a). The Bank was expected to stabilize the sitituation; however, rather than implementing contractionary

[1] In the historical timeline, provided by the FDIC, the establishment of the Bank of North America is documented to be in 1782, which is the year, when the bank began its operations (Bradbury, 1972)

policy, it further spurred the growth in the economy by acting as a profit seeking institution and further expanding note issue (Rothbard, 1962).

Many suggestions were offered as a response to resolve the Panic that burst in 1819 (for a discussion on proposals to resolve the issues regarding the Panic, see Rothbard, 1962), however, most of the legislations were at the state level (Rothbard, 1962). The Panic of 1819 caused many banks to fail, and in 1820 there were 300 banks that were operating in the US[2] (a significant drop from just the previous year).

2.2.2. The Panic of 1837

Not long after the the Panic of 1819 did another boom form, spiked by inflated commodity prices (Bordo and Wheelock, 2004). The boom was occuring in land sales, the stock market, as well as canal and railroad building projects (Bordo and Wheelock, 2004). The final straw in the overheated economy were the monetary policy actions: federal funds were removed from the New York City banks to those in other states and use of specie (gold and silver) were required for public land purchases (Bordo and Wheelock, 2004; FDIC, 2014a). Exhausted reserves in the New York City banks left them exposed to shocks and when the bubble in inflated markets burst, in the five years following 194 out of 729 banks failed, which, together with the losses occurred from loans, reduced the total value of state chartered banks' assets by 45 % (Rousseau, 2002).

2.2.3. The Panic of 1857

The following crisis in the US was the Panic of 1857. Prior to 1857 yet another boom was emerging – the expansion in railroad construction coupled with increased land sales, required for the building of new railways, resulted in increasing speculative behaviour in the stock market (Calomiris and Schweikart, 1991), as well as "overextension by banks to finance

[2] FDIC, 2014a.

construction" (FDIC, 2014a). As the bubble burst, speculators started defaulting on their debts and banks started failing. The extent of the Panic and the negative effects on banks, however, varied widely across states, depending on the coordination behaviour, as well as branching opportunities (Calomiris and Schweikart, 1991). Specifically, Calomiris and Schweikart (1991) show that in states with statewide branching the coordination of banks was stronger, the response to the crisis was more succesful and the recovery was faster.

2.2.4. The National Banking Era

The decade following the Panic of 1857 was of a great importance to the banking industry in the US – a national currency was established, a dual banking system was created and the Office of the Comptroller of the Currency was established (FDIC, 2014a). To understand the creation and evolution of laws and regulations in the 1860s, it is important to understand the pre-existing conditions and the structure of the banking industry.

First, the period between 1835 and 1885 can be generally described as a period of economic growth: the population increased nearly four times, national income was growing at an average annual rate of 3.5-4 % and the national wealth increased approximately ten times (Warburton, 1958). To support the growing economy the number of state banks was increasing at a rapid pace and as there was no uniform national currency, 7,000 different bank notes and coins were circulating in 1862 (FDIC, 2014a). There was great confusion in the market regarding the specific value of the notes, as well as whether the bank that issued the notes was still in existence (Grossman, 2008).

Second, after the charter of Second Bank in the United States expired in 1836, there was no central bank or a uniform regulator for financial institutions. There were great disagreements across states regarding a federal role in financial system regulation (Komai and Richardson, 2011) and the banking industry was left in chaos: each bank issued its own

notes and coins, approximately half of the opened banks failed, the banks were short lived, i.e. an average bank's life span was five years, and "state governments left bank regulation to market forces" (Komai and Richardson, 2011).

The first important legislations to be enacted were the National Currency Act of 1863 (renamed as the National Banking Act in 1864) and the National Banking Act of 1864. These acts established national currency, i.e. the dollar, and created a dual banking system by establishing national banks, created the Office of the Comptroller of the Currency (OCC), and "inititate[d] the system of bank examinations" (FDIC, 2014a). This Act authorized the newly established national banks to issue national currency, which was backed by the US Treasury securities and depended on the banks' capital and the bonds deposited with the OCC, and imposed taxes on the notes issued by state banks, which ultimately banished them from circulation (Grossman, 2008).

2.2.4.1. THE PANIC OF 1873

The first crisis to occur in the National Banking Era that began in 1863 was the Panic of 1873. Similarly to the Panic of 1857, the Panic of 1873 was preceded by a boom in railroad construction. In fact, in the period between 1867 and 1873 more than 30,000 miles of roads were constructed (FDIC, 2014a). The initial shock to the whole economy occurred when Vienna and Berlin suspended their funds for completion of railroad construction (Kindleberger and Aliber, 2005). As a result, several banking houses, which were heaviliy invested in railroad securities, as well as Jay Cooke & Co bank (associated with the railroad projects) failed (Kindleberger and Aliber, 2005), triggering a run on banks (Shachmurove, 2011). 44 banks failed in 1873 alone and in the following five years, another 265 banks suspended their operations (Grossman, 2008).

2.2.4.2. THE PANIC OF 1893

The final, yet the most severe crisis in the 19th century, was the Panic of 1893. Not having yet reached its full stability after the previous Panic, the US economy was once again struck by a panic, fuelled by the expansion in money supply, over-investment in railroad construction and high indebtedness in farm mortgages (Sprague, 1910; Kindleberger and Aliber, 2005). When a railroad declared bankruptcy, the stock market fell sharply, the economy slowed down and as the panic heightened, a run on banks (for the first time outside New York City) befell the banking industry (FDIC, 2014a). In 1893 alone, 326 banks failed, from which 65 were national bank failures. "Claims against all failed banks amounted to $14,434,105, and $9,778,449 was paid" (Sprague, 1910). In the following five years, an additional 568 banks failed, with a total of over $117 million in assets. What is surprising is that although followed by the highest number of bank failures in the National Banking Era (Grossman, 2008), the Panic of 1893 did not lead to any changes in banking methods or legislation (Sprague, 1910).

2.2.4.3. THE PANIC OF 1907

The first major financial crisis that occurred in the 20th century was the Panic of 1907. Although not as severe as some of the earlier crises (Moen and Tallman, 1992), the Panic of 1907 was of a great importance to the history of the US banking as it formed the foundations for America's central bank (Tallman and Moen, 1990).

Three main events have been considered as the catalyst of the Panic of 1907: the seasonal demand in money markets (see, for instance Tallman and Moen, 1990), the international gold flow (see, for instance, Odell and Weidenmier, 2004; Bordo and Haubrich, 2010), as well as the run on trust companies, triggered by a failed attempt to corner the copper market (see, for instance, Tallman and Moen, 1990; Moen and Tallman, 1992; Bordo and Haubrich, 2010; Shachmurove, 2011).

During the National Banking Era, the New York money markets were highly exposed to seasonal changes in interest rates and liquidity. These changes were a result of seasonal fluctuations in agriculture, specifically, during the months of September and October, a high demand for money to finance crop shipments left the New York City money markets drained of cash. This high demand for money resulted in increased interest rates in autumn. Whilst the demand for money was seasonal, the money supply was not adjusted for these demand fluctuations. In other words, the money supply was 'inelastic' (Tallman and Moen, 1990) and in times of elevated demand for money, it left New York City banks sensitive to shocks.

The next trigger for the Panic of 1907 was the halted gold flow to the US. In 1906 the US money markets experienced a sharp increase in gold imports due to two main reasons. First, the US Treasury Department implemented policies to stimulate gold imports by using finance bills, which led to a $50 million gold inflow in merely a month's time (Tallman and Moen, 1990). Second, in April of 1906 an earthquake struck San Francisco, causing damage equal to 1% of GNP; and although centralized, this disaster had an international effect as gold started flowing into the country from foreign insurers (Odell and Weidenmier, 2004). As a response to the sudden and severe export of gold, the Bank of England (together with other European central banks (Odell and Weidenmier, 2004)), in order to protect its financial markets, raised its discount rate (Tallman and Moen, 1990; Odell and Weidenmier, 2004). In addition, the bank of England pressured the US to pay for the finance bills upon maturity, without extension; and as a result, finance bills were suspended throughout 1907 (Tallman and Moen, 1990). "These actions practically cut off gold exports to the United States, ... pushed the United States into a recession and made New York markets susceptible to a financial panic" (Odell and Weidenmier, 2004).

The final trigger to the Panic of 1907 was the failed attempt to corner the copper market (see, for instance, Tallman and Moen, 1990; and Komai and Richardson, 2011). Augustus Heinze was a businessman highly involved in banking. He served prominent positions in many banks, whose assets totalled to $71 million – a substantial amount, as compared to all banks' $2 billion in New York City. When A. Heinze's attempt to corner the copper market failed, fear spread in the market regarding the solvency of the banks, where A. Heinze held prominent positions. And when A. Heinze was forced to resign from his presidency in the Mercantile National Bank, a run on this bank began (Tallman and Moen, 1990).

As the New York City money market was drained of cash, the stock market, preceded by a speculative boom, faced a major decline and a run on banks and trust companies began (Shachmurove, 2011; FDIC, 2014a). The run was most severe on trust companies, which played a major role in the New York financial market. In fact, in the decade preceding 1907, assets in New York State trusts grew 244%, whereas assets in national banks in new York grew 97% and assets in state banks in New York grew by 82%; and by the end of 1907 New York City trusts held $1.364 billion in assets, national banks held $1.8 billion, and state banks held $541 million (Moen and Tallman, 1992).

When the run on trusts began, Knickerbocker Trust Company, one of the largest trusts in New York City, failed and several other trusts were suffering from severe deposit withdrawals (Moen and Tallman, 1992). As the situation worsened several trust company presidents sought to resolve the issue by offering financial aid to troubled trusts, however, the cash they collected was not enough, and they turned to J.P. Morgan for help (Tallman and Moen, 1990). Soon financial aid, led by J.P. Morgan, was provided to banks and trusts,

and the panic was mitigated, however, only after convertibility was suspended did the panic come to an end (Bordo and Haubrich, 2010).

The Panic of 1907 exposed the flaws in the US financial system: the money supply was inelastic (Tallman and Moen, 1990), the regulation of banks and trusts was uneven (Moen and Tallman, 1992) and there was no lender of last resort (although the New York City Clearinghouse had some functions of a central bank, its legal authority was not explicit, and not directly available for trusts (Tallman and Moen, 1990)). Following the Panic of 1907, in order to stabilize the financial markets, the Federal Reserve Act of 1913 was passed and the Federal Reserve System was created (FDIC, 2014a).

2.2.5. Summary

In general, the Panics of the 19th century were of similar origins. Specifically, preceded by speculative behaviour of market participants, booms in specific industries, the growing number of banks and high levels of indebtedness, the Panics erupted as the created bubbles burst. The effects these crises had on the banking industry were severe, and highlighted the need for the supervision of financial institutions at the national level, as well as the need for a lender of last resort (Shachmurove, 2011). However, not until another crisis struck – the Panic of 1907 – and the weaknesses of the financial system were once again exposed, were actions taken at the Federal level.

2.3. The Great Depression

Similar to previous crises, the Great Depression was followed by a period of economic boom in the 1920s, also known as the "roaring twenties". Although followed by a short crisis, the First World War did not affect the US society directly, and people quickly started an era of consumerism, which was stimulated by vastly booming production in numerous industries.

To keep up with the growing demands for goods, manufacturers invested in new technologies, employed more people and the economy started booming.

The vastly growing demand fuelled high levels of borrowing and increased the use of the stock markets to finance firms' growth. As a consequence, the stock market experienced a six fold increase in the years between 1921 and 1929, indebtedness was rising and bank lending standards were slowly eroding (Bovenzi, 2015).

When the bubble burst, the Dow Jones Industrial fell 39 % between October 23rd and November 13th in 1929, a total of $16 billion was lost in the stock market in October alone and by mid-1932 the stock prices were 85 % to 90 % lower than they were at their peak in 1929 (Bovenzi, 2015). What followed was the beginning of the Great Depression: a race to sell, panic-enticed run on banks, fire sales of assets and numerous bank closures. "There were no taxpayer bailouts. Instead, there were suicides, bankruptcies, and massive levels of poverty and unemployment" (Bovenzi, 2015).

In the years 1932 and 1933 the Great Depression reached its height: in 1932 unemployment reached 25 %, national income dropped 50 % and bank runs and closures were common (FDIC, 2014a). In fact, the loss of confidence in financial institutions was one of the major reasons for the financial collapse; and the ratio of bank failures to the total number of operating banks in the years between 1930 and 1933 was 5.6%, 10.5%, 7.8%, and 12.9%, respectively (Bernanke, 1983).

To deal with the numerous bank runs just a day after his inauguration in 1933, President Roosevelt declared a four-day bank holiday to prevent more bank runs and in the meantime to liquidate the insolvent banks and reorganize others. In the same year three pivotal acts were signed, including the Emergency Banking Act of 1933, The Securities Act of 1933 and The Banking Act of 1933, which were designed to regain the public's confidence

in the banking system, ensure transparency and better disclosure of companies' financial statements, and protect bank depositors (FDIC, 2014a). Passed in the Banking Act was also the Glass-Steagall Act, which separated commercial and banking activities, and created the FDIC, which in the period between 1934 and 2015 has handled over 2,700 failure and assistant transactions[3].

2.3.1. The Creation of the FDIC

The FDIC was established by the Congress as an independent agency to maintain stability and public confidence in the nation's financial system. The main tasks include deposit insurance, supervision of financial institutions, management of receiverships, and resolution of financial institutions (FDIC, 1998).

At the beginning of its operations, the FDIC used two main resolution methods to deal with insolvent banks: deposit payoffs and purchase and assumption transactions. In the case of a deposit payoff, the FDIC was responsible for assuming the insolvent institution's assets and liabilities and paying off the insured deposits (FDIC, 1998). In a case of a P&A transaction, a healthy institution was allowed to acquire all of the deposits of the failed bank. As shown in Figure 2-1, in the period between 1934 and 1942 deposit payoffs were used a total of 240 times, and purchase and assumption transactions were used to resolve 150 insolvent institutions. These methods were later further developed and supplemented by additional resolution strategies.

2.4. The Late 1980s to mid-1990s: The Stock Market Crash, S&L Crisis, and the Credit Crunch

In the 1970s yet another boom was forming in financial markets. Strict banking regulation made depositing money in banks and S&Ls unattractive and as people started searching for

[3] Calculations are based on the failed bank list, provided by the FDIC. https://www5.fdic.gov/hsob/SelectRpt.asp?EntryTyp=30&Header=1

better places to invest, money started flowing out of the banking system, leaving businesses and consumers with difficult access to credit and very expensive loans (Bovenzi, 2015). Soon deregulation started, controls on interest rates were relaxed, financial markets were accelerating and the oversight of negligent borrowing was diluting (Bovenzi, 2015). To deal with the inflation Paul Volcker, who was then the chairman of the Federal Reserve, increased interest rates to over 20 %, which led to severe distress in the banking system (Bovenzi, 2015).

As the interest rates sky-rocketed banks faced a great mismatch between the interest rates they had to pay for the depositors, and the interest they received from loans. At the time, most S&Ls, which were regulated by the Federal Home Loan Bank Board (FHLBB), had issued long-term mortgages of 30-year fixed-rate terms, and soon they started losing money. The FHLBB that stood to supervise the savings and loans industry did not have enough money to close the insolvent S&Ls, therefore, it loosened regulation in the hope of their recovery. However, lack of supervision and the depletion of capital encouraged S&Ls to take on extraordinary risks, as they had nothing to lose. "It was worth the gamble. Heads, they'd win; tails, the federal government would lose" (Bovenzi, 2015).

The monetary policy by the Fed was eased in the years between 1984 and 1987, however, partly due to the rising prices in the stock market, the Fed started increasing the inflationary pressure again (Greenspan, 2004). Although the potential negative effect to the stock market, which was experiencing a boom, was realized, no one had anticipated such a traumatic experience (Greenspan, 2004) and when the stock market crashed on the 19th of October of 1987, also known as Black Monday, the Dow Jones Industrial Average Index plummeted by 23% in just one day (FDIC, 2014a). After the stock market crash, in order to keep the financial markets stable, large amounts of liquidity were injected into the markets and the easing continued until 1988 (Greenspan, 2004).

Fed tightening began again in December of 1988, and was followed by a credit crunch in the early 1990s (Bordo and Haubrich, 2010). The credit crunch was caused by a capital drop associated with severe loan losses in the late 1980s (Peek and Rosengren, 1995) and increased capital requirements (Berger and Bouwman, 2013). This fall in lending made the economic recovery slow as access to credit for businesses was diminished (Bernanke, 1983). The credit crunch slowly lifted as the policies eased, and the fund rate dropped to 3% in September 1992, which restored profitability, and eventually the capital of banks (Bernanke, 1983).

The S&L crisis, the stock market crash together with the credit crunch had severe implications for the banking industry as well as the insurance funds responsible for the industries. In the period of 1980s together with the first half of the 1990s, over 2,900 banks and S&Ls became insolvent, and the S&L deposit insurance fund went bankrupt (Bovenzi, 2015). By the end of the year 1991, the insurance fund of the FDIC reached a deficit of $7 billion (FDIC, 2014a). In total, bank failures cost the BIF (bank insurance fund) over $30 billion, and "[t]he total cost to taxpayers was $125 billion" (Bovenzi, 2015).

As a response to the crisis as well as the $7 billion deficit that the BIF reached at the end of the year 1991, the Congress passed the Federal Deposit Insurance Corporation Improvement Act (FDICIA), which widely changed the bank insurance model, as well as the way troubled institutions were handled and the failed ones resolved. The FDICIA is depicted in more detail in section 2.6.1.

2.5. The Global Financial Crisis

The Global Financial Crisis that erupted in 2007 was the most severe economic downturn since the Great Depression (Laeven and Valencia, 2013). As in the case of previous crises, it was preceded by an economic boom, which was mainly pronounced in the housing market.

The housing bubble was a consequence of lax interest rate policy led by the Federal Reserve, as well as large capital inflows from abroad (Brunnermeier, 2009; Allen and Carletti, 2010). The cheap and easy access to credit contributed to the bubble that burst in 2007 (Allen and Carletti, 2010). However, there were other factors that played a significant role in exacerbating the extent of the crisis: the high number of subprime mortgages, weak regulatory oversight and high levels of debt in financial institutions (Allen and Carletti, 2010).

The increasing demand for credit to fund real estate purchases was accompanied by increased levels of mortage approvals. The traditional banking model, where banks hold on to the mortgages until they are repaid, was replaced by an 'originate to distribute' model, where banks sold off the mortgages via the securitization process (Brunnermeier, 2009; Allen and Carletti, 2010). Although seemingly advantageous to the banking system due to the shifting of risk from loan originators to those who wished to bear the risks (Brunnermeier, 2009), this transformation destroyed the incentives to carefully screen the creditworthiness of the borrowers and created a system where banks were rewarded for the amount rather than the quality of mortgages approved (Allen and Carletti, 2010).

The trigger to the crisis was the increase in the number of default on subprime mortgages that was first noted in February of 2007 (Brunnermeier, 2009). What followed was a downgrade of a number of tranches of subprime deals, which put stress on the credit markets, and hedge funds started having troubles meeting margins calls (Brunnermeier, 2009). Home sales started declining and house prices started to drop (Brunnermeier, 2009).

Uncertainty hovered the financial markets, and on 9th of August of 2007 an "illiquidity wave" began in the interbank market (Brunnermeier, 2009). To deal with the frozen interbank lending market, the Federal Reserve followed the European Central bank and injected $24 billion in the interbank market, reduced the discount rate and eased the

conditions for banks to borrow at the discount window (Brunnermeier, 2009). Although the liquidity injections by the Fed seemed to be effective, in November 2007 the estimate of $200 billion loss in the mortgage markets was an underestimation. The Fed further reduced the discount rate and the federal funds rate; however, the liquidity crunch was too severe for these policies to be effective.

The consequences were severe. Several hundred billion dollars of bad loans were written off, and the loss in stock market capitalization of the major banks was twice the amount (Brunnermeier, 2009). The stock market experienced an $8 trillion decline in wealth between the all-time high in October 2007 and October 2008 (Brunnermeier, 2009). The high interconnectedness across financial institutions had a severe chain reaction when some of the institutions defaulted.

The first major financial institution that ran into trouble was Bear Stearns – one of the largest investment banks in the US (Bovenzi, 2015). Realizing the danger of contagion the default of Bear Stearns could create, the Federal Reserve arranged its takeover by JPMorgan Chase, providing $30 billion to support the transaction (Bovenzi, 2015). Not long after, more institutions started defaulting: IndyMac was taken under the ownership of the FDIC, Fannie Mae and Freddie Mac, with an outstanding debt and guarantees of $5 trillion were taken over by the federal government, Lehman Brothers failed, after becoming too weak, "Merrill Lynch sold itself to Bank of America", AIG, an insurance company with $500 billion in financial firm insurance, was bailed out (Bovenzi, 2015).

The costs of the crisis were immense. The Troubled Asset Relief Program (TARP) – a bailout package set up by the Treasury – amounted to $700 billion (Berger and Bouwman, 2013). Between 2008 and 2011, almost 400 FDIC-insured banks failed, depleting the insurance funds to a record low deficit of $20.9 billion (Davison and Carreon, 2010). The

global economy was at a halt due to the uncertainty over the real value of assets that had been inflated for some time, therefore, it was difficult for market participants to make long term decisions, as the future prices of assets were highly uncertain, both in the short and in the long run (Allen and Carletti, 2010). As a consequence of the Fed allowing exchange of wide range of securities to Treasuries, the Federal Reserve's balance sheet nearly tripled (Allen and Carletti, 2010).

As a response to the crisis, the US Congress passed the Dodd–Frank Wall Street Reform and Consumer Protection Act, with the aim "[t]o promote the financial stability of the United States by improving accountability and transparency in the financial system, to end "too big to fail", to protect the American taxpayer by ending bailouts, to protect consumers from abusive financial services practices, and for other purposes" (Dodd-Frank Wall Street Reform and Consumer Protection Act).

2.6. The Resolution of Failed Banks

Given the large number of crises, associated with bank failure waives, critical for financial stability and trust in the financial services industry was the implementation of a smooth system for failed bank resolutions. This section presents the development of failed bank resolution strategies employed by the FDIC, explains the resolution methods used and, using the data provided by the FDIC, presents some summary statistics on the failed bank resolution methods for the period between 1934 and 2015.

2.6.1. The Development of the Resolution Methods

Since the establishment in 1933, the resolution practises employed by the FDIC have changed significantly and have been shaped in a way to minimise the costs to the insurance fund and to reduce the disruption to the communities (FDIC, 1998). The major event that triggered the change in the resolution strategies employed by the FDIC was the wave of bank

failures in the 1980s, and the subsequent enactment of the FDICIA. Its main provisions include risk-based premiums, prompt corrective action, least-cost resolution, too big to fail and borrowing authority.

Before the FDICIA, the FDIC was by statute required to charge a flat rate for deposit insurance, i.e. every bank was charged equally for deposit insurance (FDIC, 1998). The FDICIA, however, required the FDIC to charge the banks according to the risks it posed to deposit insurance funds. This provision was implemented on 1st January, 1993 (FDIC, 1998).

The prompt corrective action resolution required all institutions to be placed under one of the five capital zones, ranging from well capitalized to critically undercapitalized (FDIC, 1998). Critically undercapitalized institutions were the ones, whose tangible equity fell below 2% of total assets (FDIC, 1998). These institutions faced closure if the capital levels were not restored in a 90-day period (FDIC, 1998). The reasoning behind early closure was the expectations that it would mitigate the losses incurred by the insurance funds (FDIC, 1998). In addition, in 1991, the FDIC was granted the authority to close an institution if it was critically undercapitalized, and did not have adequate plans for restoring the equity to the required levels; if the institution had "substantial dissipation of assets due to a violation of law, operated in an unsafe or unsound manner, engaged in a deliberate violation of a cease and desist order, concealed records, or ceased to be insured" (FDIC, 1998). Before the FDICIA, the power to close an insured bank rested on the state or the Office of Comptroller and Currency (OCC) (depending on which was the chartering authority) (FDIC, 1998).

The least-cost resolution provision requires the FDIC to choose the least costly resolution method when resolving a failed institution (FDIC, 1998). Previously, the FDIC could have chosen any method if it was proven to be less costly than an insured deposit payoff and asset liquidation (FDIC, 1998). Under the least cost resolution requirement, the

FDIC must evaluate the present value of the costs of alternative resolution methods, documenting the underlying assumptions, and including the "forgone federal tax revenues as part of the cost" (Carpenter and Murphy, 2008). Although minimizing the costs was always an important factor, there were several other considerations that the FDIC took on prior 1991 to choose the resolution method. Deposit payoffs, for instance, were discouraged due to the adverse effects it may have had in smaller communities, i.e. it may have reduced local available banking services in small communities (FDIC, 1998). It also looked at the effects on banking stability, shareholders and creditors; specifically, the FDIC aimed to discourage insured institutions from excessive risk-taking (FDIC, 1998). Finally, the FDIC considered the increase in the inventory level of loans serviced by the FDIC (FDIC, 1998). After 1991, the FDIC was required to choose the least costly resolution method, regardless any other factors, unless there was a threat to systemic risk (FDIC, 1998).

Under the too big to fail provision, the least cost resolution could be waived if the institution was proven to be of systemic importance (FDIC, 1998). This waiver of the least cost resolution provision has to be determined by the Secretary of Treasury ("in consultation with the President"), and recommended by the FDIC and the Board of Governors of the Federal Reserve System (Carpenter and Murphy, 2008). Specifically, it has to be approved with a 2/3's vote from each (Carpenter and Murphy, 2008).

The borrowing authority provision increased the amount the FDIC is allowed to borrow from the Treasury in order to cover the insurance losses (FDIC, 1998). Specifically, the FDICIA increased the amount that the FDIC was eligible to borrow from the Treasury from $5 billion to $30 billion (FDIC, 1998).

2.6.2. Failed Bank Resolution Methods

In general, the FDIC uses three methods to resolve a failing institution: open bank assistance, deposit payoff, or purchase and assumption (P&A) transactions. The remaining part of this section explains each of the resolution methods in more detail. Figure 2-1 and Figure 2-2 show respectively the total number of resolutions, as well as the distribution of transaction methods used in the period between 1934 and 2015.

2.6.2.1. OPEN BANK ASSISTANCE

In the case of an open institution assistance, the FDIC provides assistance to a troubled institution to return to its normal operations and remain open (Carpenter and Murphy, 2008). The financial assistance has several forms: the FDIC can either give a loan, place deposits, purchase assets or securities, or assume liabilities of the troubled insured institution (FDIC, 1998; Carpenter and Murphy, 2008). If it is possible, the troubled institution is expected to repay the loans made by the FDIC in an open bank assistance (FDIC, 1998).

Apart from several instances, open bank assistance was most widely used during the S&L crisis in the 1980s and early 1990s. Specifically, from the 154 open bank assistance transactions provided between the years 1934 and 2015, it was used 137 times in the period between 1980 and 1992.

In order to provide assistance, the FDIC has to prove, among other things, that the deterioration of the capital of the troubled institution was not caused by the management's abuse or incompetence (Carpenter and Murphy, 2008). Nevertheless, the FDIC often required a new management team to take over the institution (FDIC, 1998). In addition, the Corporation made sure that the interests of shareholders were reduced to a nominal amount, and sought capital from the private sector (FDIC, 1998). Although shareholders were required to reduce their ownership interests, the major criticism regarding open bank assistance was in fact that shareholders benefited from such resolutions (FDIC, 1998).

2.6.2.2. DEPOSIT PAYOFFS

Deposit payoffs are used when the FDIC is unable to find an acquirer for the failed institution's assets and liabilities (Carpenter and Murphy, 2008) or when the bids received are more costly than a deposit payoff (FDIC, 1998). Most of the times, deposit payoffs were used for small failed institutions, when there was little interest from the healthy institutions regarding the banking franchise (FDIC, 1998). In the case of a deposit payoff the FDIC may either pay for the insured deposits directly to each customer (straight deposit payoff), or make these funds available to customers by transferring the insured deposit accounts together with an equivalent amount of cash to a healthy institution (insured deposit transfer) (FDIC, 1998; Carpenter and Murphy, 2008).

In a straight deposit payoff, the FDIC evaluates the amount of all insured depositors and pays it directly to depositors, and all other liabilities as well as the assets remain with the FDIC, which is responsible for all the costs associated with liquidating those assets (Bennett, 2001).

In a case of an insured deposit transfer, a healthy institution acts as an agent to the FDIC, and receives insured deposits and secured liabilities from the failed institution (FDIC, 1998). Insured deposit transfers are considered to be a less disruptive resolution strategy and more consumer-friendly than straight deposit payoffs, therefore, they were used whenever practicable (FDIC, 1998). It saves the FDIC overhead expenses and also provides an opportunity for the acting agent to introduce and provide services to potential new customers (FDIC, 1998).

Deposit payoffs have been used considerably less than purchase and assumption transactions. Specifically, from 1934 through 2015, 637 failed banks have been resolved using deposit payoffs, whereas P&A transactions have been used in 1,973 cases. From the total deposit payoff transactions, insured deposit transfers were used in 179 cases, whereas straight

payoffs occurred 458 times. However, the first insured deposit transfer occurred in 1983, after which it was the preferred choice over the straight deposit payoff (from the two resolution methods, insured deposit transfer was used 56% of the time).

2.6.2.3. PURCHASE AND ASSUMPTION TRANSACTIONS

In the case of a P&A transaction, a healthy institution buys some of the closed institutions assets, and assumes some of its liabilities (Carpenter and Murphy, 2008). There are several types of P&A transactions:

1) Basic P&A transaction. In a basic P&A transaction, a healthy institution assumes insured deposits, and buys cash (and cash equivalent) assets. In the case the bid is high enough, the healthy institution also assumes uninsured deposits as well as bank premises (Carpenter and Murphy, 2008).
2) Loan purchase P&A transaction. In this transaction, a healthy institution buys a portion of the loan portfolio of the closed institution (Carpenter and Murphy, 2008).
3) Whole bank P&A transaction. In the case of a whole bank P&A transaction, a healthy institution buys all of the closed institution's assets and assumes all of its liabilities (Carpenter and Murphy, 2008).

The enactment of the FDICIA in 1991 also introduced loss sharing P&A transactions. In this case, the institution assumes the failed institution's deposit liabilities, and the FDIC transfers the fixed pool of assets to the acquirer at a discounted price (Carpenter and Murphy, 2008). The FDIC also agrees to share the future losses that the acquirer may experience from taking over the fixed pool of assets (Carpenter and Murphy, 2008).

Throughout the history of the FDIC, most of the times P&A transactions have been the most widely used resolution method. To date (end of 2015), P&A transactions have been used for 71% of the total failed bank resolutions. There are several benefits associated with

using P&A transactions over other resolution methods. First, it is considered to be the least disruptive resolution method for local communities (FDIC, 2014b). Second, usually the acquirers pays a premium for the deposits assumed, which in turn reduces the costs for the FDIC (FDIC, 1998). Third, it is the most convenient resolution method for depositors. Finally, as opposed to deposit payoffs, the charter value of the failing institution is preserved.

2.6.3. Summary

The FDIC has become one of the most important institutions in the US financial system. Having resolved a total of 2,764 institutions in the period between 1934 and 2015, it has saved all of the failed banks' insured deposits, mitigated serious bank runs and prevented escalation of the worsening conditions in the banking industry during periods of distress. The effective resolution practices have been proven to limit the negative effects failed financial institution failures have on the economy, financial system, and depositors. Finally, "[F]or more than 80 years, the FDIC has carried out its mission of maintaining public confidence and stability in the nation's financial system"[4].

2.7. Concluding Remarks

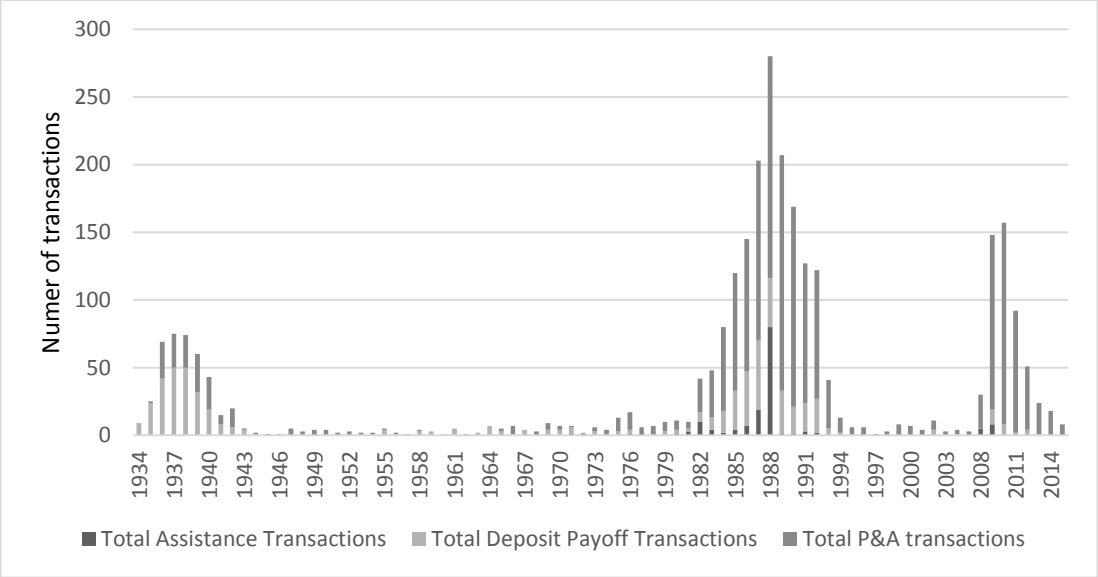
The financial crises in the history of the US share certain similarities: preceded by a booming economic period, bubble in asset prices, and overextension of credit, the periods of distress came unexpectedly and with harsh consequences. The Panics that occurred before the Great Depression, however, were distinctly different in terms of how the distress in the financial system was dealt with. Not having a deposit insurer in the system, bank failures were mainly a result of uncertainty and fear of loss of deposits, which caused contagious bank runs. When the Congress established the FDIC in 1933 as a response to the Great Depression, bank runs were largely mitigated and all the insured deposits were saved.

[4] From the *Message from the Chairman* in the 2014 Annual Report, available at https://www.fdic.gov/about/strategic/report/2014annualreport/chairman.html.

The Global Financial Crisis, however, was of a different scale, and touched a great variety of financial institutions, including commercial banks, investment banks, insurance companies, various investment funds, and many others. It was also "an opaque web of interconnected obligations", as suggested by Brunnermeier (2009), that made this crisis different from the previous episodes of distress. Although the FDIC, which had great past experience in handling failing institutions, helped mitigate the damages of the crisis, the responsibility of the large institution failures, which mainly were not covered by deposit insurance, fell into the hands of the Treasury and the Federal Reserve, which did not have such experience (Bovenzi, 2015). As a result "[t]hey were forced to improvise, relying on bailouts or the bankruptcy process, neither being a good course of action for handling large failing financial institutions" (Bovenzi, 2015).

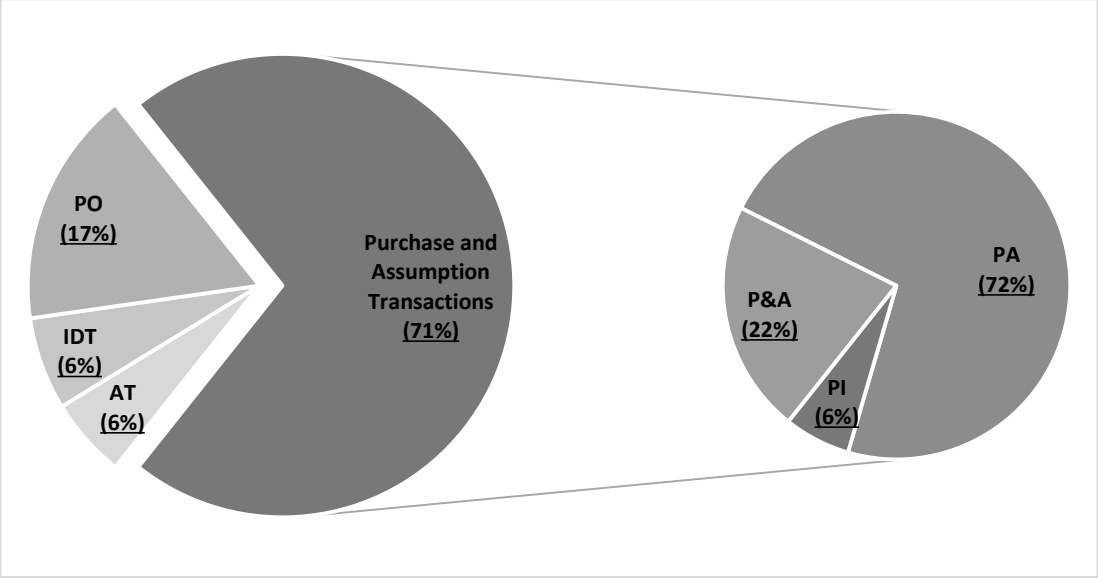
2.8. Figures

FIGURE 2-1
NUMBER OF FAILURES AND ASSISTANCE TRANSACTIONS BY YEAR



Source: FDIC, https://www.fdic.gov/bank/individual/failed/banklist.html

FIGURE 2-2
DISTRIBUTION OF FAILED BANK RESOLUTIONS BY RESOLUTION TYPE, 1934-2014



NOTES: PO – deposit payoffs; IDT – insured deposit transfers; AT – assistance transactions; P&A – purchase of some or all assets and assumption of some or all of the liabilities; PI – purchase and assumption of insured deposits only; PA – purchase and assumption of insured and uninsured deposits, and certain other liabilities, as well as a part of the assets.

Source: FDIC, https://www.fdic.gov/bank/individual/failed/banklist.html

Chapter 3. Do Financial Crises Clean or Scar? Evidence from Bank Exits and Entries

3.1. Introduction

Numerous studies have highlighted the substantial costs stemming from financial crises in terms of financial instability and the decline of economic growth (see, for instance, Dell' Ariccia et al., 2008; Reinhart and Rogoff, 2014). These negative effects have been confirmed by the recent turmoil in the financial industry (erupting in the second half of 2007) that has required costly bank bailouts to restore confidence and has led to episodes of severe economic recession in several countries (Brunnermeier, 2009; Zhang et al., 2015). While the costs of financial crises are indisputable, more controversial is the possibility that some benefits might follow from episodes of financial distress when the focus is on firm exit and entry. In this respect, the literature has proposed two alternative views – cleansing or scarring - that have substantially different policy implications for the management of financial crises (Hallward-Driemeier and Rijkers, 2013). The empirical analysis in this chapter evaluates whether these two alternative views explain the nature of bank failures, and the related effect on bank entry, in the US banking industry during episodes of financial crises that have occurred between 1984 and 2013.

The cleansing view implies that unproductive firms are more likely to fail during crises and are likely to be replaced by more productive entities with an overall positive effect at the industry level (see, for instance, Bresnahan and Raff, 1991; Hallward-Driemeier and Rijkers, 2013). The idea that crisis periods may have a "cleansing" effect is not new, dating back to Schumpeter (1939) and his concept of creative destruction. Studies by Bresnahan and Raff (1991) and Caballero and Hammour (1994) support this notion by concluding that productivity-improving techniques increase during periods of economic distress, and the firms, that do not keep up with innovations, eventually fail.

The scarring view suggests instead that rather than cleaning up the market, crises might destroy firms, regardless of their productivity, as they amplify market imperfections (Barlevy, 2002, 2003; Blalock et al., 2008; Hallward-Driemeier and Rijkers, 2013; Ouyang, 2009). For instance, Hallward-Driemeier and Rijkers (2013) fail to find any evidence that the Indonesian crisis in the second half of the nineties induced the exit of relatively unproductive firms. Similarly, Casacuberta and Gandelman (2012) show that the banking crisis in Uruguay diminished the nexus between a lack of productivity and firm exit.

In general, the studies above have tested for the presence of a cleansing or scarring effect for non-financial corporations by focusing on a single crisis episode. However, there is a lack of empirical evidence as to whether a cleansing or a scarring effect emerges in the banking industry as a consequence of the eruption of financial crises and as to whether different types of financial crises produce a similar cleansing or scarring effect. These appear to be important omissions for at least two reasons.

First, the different policy implications for crisis management related to each of the two effects appear extremely important to design regulatory interventions for the banking industry with the purpose of limiting the short-term costs of bank failures. Specifically, the

presence of a cleansing effect would motivate more limited government interventions to reduce the short-term impact of crises on bank failures. In contrast, the prevalence of a scarring effect would justify a wider use of bailout policies to minimize the short-term effects of crises on bank failures and maximize the long-term prospects for the banking industry. Second, an understanding of which effect prevails for banks is not only relevant for the long-term influence of financial crises on the productivity of the banking industry, but also for the impact of crises on the real economy. In fact, market imperfections that can lead to a scarring effect for non-financial firms are normally linked with frictions in the credit markets and consequently with bank behaviour (Barlevy, 2003; Hallward-Driemeier and Rijkers, 2013).

This chapter contributes to the cleansing/scarring debate and the banking literature in several ways. In particular, it is the first to provide empirical tests on whether financial crises accelerate the removal of unproductive banking firms. To this end, the unproductive banks are identified by computing measures of bank cost efficiency (quantifying how effectively a bank uses its resources to produce its outputs) and its components – allocative and technical efficiency.[5]. While some studies of banks have examined the nexus between efficiency and the likelihood of bank failure (see, for instance, Cebenoyan et al., 1993; Hermalin and Wallace, 1994; Luo, 2003; Wheelock and Wilson, 2000), or more broadly how bank efficiency affects bank risk (Fiordelisi et al., 2011; Sun and Chang, 2011), to date no evidence has been offered on whether the importance of efficiency for bank survival differs between normal and crisis periods. Overall, this chapter shows that while more efficient banks are less likely to fail over the full sample period, the removal of inefficient institutions

[5] Allocative efficiency measures the ability of banks to choose the correct mix of inputs given their prices while technical efficiency quantifies the ability of banks to use a minimum level of inputs to achieve a given level of output (Isik and Hassan, 2002; Havrylchyk, 2006; Fethi and Pasiouras, 2010).

is not amplified by the eruption of financial crises. In essence, at a general level there is a lack of support for the presence of a cleansing effect in the banking industry and this conclusion does not vary with the definition of bank efficiency employed in the empirical tests or with changes in the model specification.

The second contribution of this chapter is the evaluation of whether the occurrence of a cleansing or scarring effect depends on the type of financial crisis that affects the banking industry. The initial conjecture is that especially when banks are affected by an extremely severe crisis, such as those originating within the banking industry with a consequent larger number of failures, any cleansing effect is unlikely to materialize. This conjecture finds support in the set of studies suggesting that severe crises might affect healthier institutions by generating panic amongst uninformed depositors (see, for instance, Chari and Jagannathan, 1988; Saunders and Wilson, 1996; Chen, 1999; Iyer and Puri, 2012) or by amplifying contagion risk via the interbank market (Dasgupta, 2004).

Two steps are taken to conduct this additional test. Initially, by following Berger and Bouwman (2013) two types of crises are distinguished: the crises that have originated within the banking sector (henceforth banking crises), and that consequently are expected to have a more severe impact on banks, and the crises that erupted in the stock market (henceforth market crises) and that are generally expected to have a milder impact on banks. For instance, in the sample, while the annualized bank failure rate during episodes of banking crisis is equal to 0.95%, it drops to about half of this in the presence of a market crisis. This initial analysis suggests that the general conclusion of a lack of any cleansing effect holds for crises that originate within the banking sector (namely, efficiency has little bearing on bank failure), whereas the findings show that market crises do not exhibit any signs of either the cleansing or the scarring view. Overall, the findings reported in this chapter show that although

efficiency helps banks survive at all times, banking crises, namely crises that show higher average bank failure rates, increase probability of failure at all levels of efficiency as postulated by the scarring view. Market crises, interestingly, do not exhibit any significantly different effects on bank probability of failure than normal times.

In a second step, it is shown that the conjecture, that severe crises are unlikely to lead to a cleansing effect, is also confirmed when the focus is drawn on the global turmoil that erupted in the second half of 2007. In essence, efficiency did not help banks survive during this crisis, and the effect of the crisis was not different at any levels of bank efficiency.

The third contribution of this chapter is the examination of the interplay between the impact of financial crises and the role played by bank age in ensuring the survival of efficient banks. The point of departure of this analysis is the set of studies that have highlighted how the interpretation of firm exit during periods of crises requires a consideration of firm age (Nishimura et al., 2005; Ouyang, 2009). Periods of economic downturn may be especially detrimental for young firms as they are prevented from reaching their full potential. Therefore, a higher number of failures amongst inefficient but young banks is not necessarily supportive of the cleansing view of crises. While the findings show that financial crises help remove inefficient old banks, they also generate a high failure rate of young banks, regardless of their efficiency levels. In summary, these additional tests show that neither the cleansing nor the scarring effect can fully explain the dynamics of bank failures during periods of financial crisis when bank age is controlled for.

The final contribution of this chapter is the examination of whether new entry banks achieve higher levels of efficiency than competing banks if they enter the banking industry after financial crises that are expected to liberate resources via the waves of bank failures. Existing studies have generally tested for the presence of an efficiency gap between

incumbent banks and new entrants without focusing on the importance of the timing of entry. For instance, DeYoung and Hassan (1998) study the profit efficiency of US banks that received charters between 1980 and 1994, and find that while profit efficiency increases rapidly for new banks, it takes on average nine years to reach the profit efficiency levels of existing banks. In contrast, Canhoto and Dermine (2003) find that, after the implementation of the deregulation process de novo Portuguese banks were more efficient than the established banks.

The results of this chapter are consistent with the presence of higher efficiency gains for banks entering the market during crises as implied by the cleansing view and this conclusion holds for the various measures of bank efficiency employed in the empirical tests. Next, it is examined whether the different impact on firm exit played by banking and market crises is mirrored in the entry effect. In line with the results for the exit effect, the analysis shows that efficiency gains for new entry banks are less pronounced when banks enter in the aftermath of banking crises than when they enter during market crises. This is not entirely surprising as banking crises include the recent global financial crisis, which shows signs of scarring effect, whereas market crises are not in line with either view. It, therefore, seems that regardless their efficiency, banks that fail during market crises liberate resources for the new institutions to take over and employ more efficiently.

Overall, the findings in this chapter suggest that the nature of bank failures during financial crises are more aligned with the scarring view. However, this result is fully confirmed only when evaluating the global banking crisis. Furthermore, as postulated by the scarring view, a key detrimental effect of any financial crisis appears to be the removal of young (relatively efficient) banking firms.

The rest of this chapter is organized as follows. Section 3.2 introduces related research and presents the testable hypotheses. Section 3.3 describes the data and the methodology, while section 3.4 offers the empirical results on the effect of bank efficiency on bank survival during crisis and normal times. Section 3.5 examines how the results depend on bank age and section 3.6 presents tests on the cleansing and scarring effects in terms of bank entry. The final section draws conclusions and offers final remarks.

3.2. Related Research and the Development of Hypotheses

3.2.1. Firm Exit and Financial Crises

The impact of financial crises on firm survival has been generally described as a selection process that should penalize specific types of entities (Hallward-Driemeier and Rijkers, 2013; Knott and Posen, 2005). In this respect, the literature has focused on the impact of crises on the least productive firms in an industry with conflicting theoretical views (Hallward-Driemeier and Rijkers, 2013).

A first view can be linked to the Schumpeterian (1939) process of creative destruction. Advocates of this view argue that crises accelerate the "cleansing" process of low productivity firms, with only high productivity firms (with a competitive advantage) being likely to survive. In essence, this selection effect would lead to the disappearance of firms that are far from the best practice entities in an industry with an overall beneficial effect at the industry level. This effect is generally incorporated in macro-models such as those proposed by Caballero and Hammour (1994) and Gomes et al. (2001).

Against this view, however, other studies highlight the presence of potential scarring effects associated with crisis periods (Barlevy, 2002, 2003; Blalock et al., 2008; Ouyang, 2009; Hallward-Driemeier and Rijkers, 2013). In essence, crises might jeopardize the performance of market participants as they amplify market imperfections. It follows that rather than

cleaning up the market, crises might destroy firms, regardless of their efficiency. For instance, Hallward-Driemeier and Rijkers (2013) fail to find any evidence that the Indonesian crisis in the second half of the nineties led to the exit of relatively unproductive firms. Similarly, Casacuberta and Gandelman (2012) show that the banking crisis in Uruguay diminished the nexus between low productivity and firm exit.

Additional studies have also highlighted that the interpretation of firm selection during periods of crisis under the cleansing or the scarring views requires the consideration of firm age. Ouyang (2009) suggests that periods of economic downturn are detrimental, especially for young firms with the effect of preventing them from reaching their full potential. Hence, the removal of young unproductive institutions from the market is not necessarily perceived as a good outcome stemming from financial crises, as these institutions might not have had sufficient time to exploit their full potential. It follows that an effective cleansing effect should lead to the failure of unproductive firms, especially when they are old. From this perspective, Nishimura et al. (2005) find that the 1996-1997 banking crisis in Japan led to the exit of some young and relatively efficient institutions.

The analyses discussed above have been conducted on non-financial firms and on a single crisis episode. There is a lack of empirical tests on whether a cleansing or a scarring effect emerges in the banking industry as a consequence of financial crises. The importance of such an analysis of banks is, however, highlighted by the fact that the cleansing and the scarring views have substantially different policy implications for the management of banking crises.

While the manifestation of a cleansing effect would motivate more limited government interventions to reduce the short-term impact of crises on bank failures, a scarring effect would justify a wider use of bailout policies to minimize the short-term effects

of crises on bank failures and maximize the long-term prospect for the banking industry. Yet, an understanding of which effect prevails for banks is not only relevant for the long-term influence of financial crises on the productivity of the banking industry but also for its impact on the real economy. In fact, market imperfections that can lead to a scarring effect for non-financial firms are normally linked with frictions in the credit markets and consequently with bank behaviour (Barlevy, 2003; Hallward-Driemeier and Rijkers, 2013).

Despite the importance of such analysis for banks, the existing banking studies have generally examined how bank productivity- measured in terms of efficiency - influences bank survival without a specific focus on crisis periods. The conclusion achieved by this group of studies is that inefficient banks are more likely to fail (Cebenoyan et al., 1993; Hermalin and Wallace, 1994; Wheelock and Wilson, 2000; Luo, 2003; Knott and Posen, 2005; Koetter and Poghosyan, 2010), and are generally riskier (Berger and DeYoung, 1997; Fiordelisi et al., 2011). Furthermore, while a second group of studies has identified several drivers of bank survival in periods of financial distress (see, for instance, Jin et al., 2011; Berger et al., 2012; Cole and White, 2012; Berger and Bouwman, 2013; DeYoung and Torna, 2013), none of them test how the likelihood of failure during crises varies with bank efficiency and how it compares with normal times.

This chapter extends the existing studies on non-financial corporations by testing two hypotheses for the US banking sector that refer to the selection effect of banks during crises and to its interplay with bank age. More specifically, the first hypothesis focuses on the impact that financial crises are expected to exercise on inefficient (unproductive) banks and is formulated as follows:

Hypothesis 1: The likelihood of bank survival is lower for inefficient banks during periods of financial crises than in normal times.

Essentially, the validation of Hypothesis 1 would imply the presence of a cleansing effect associated with financial crises that hit the banking industry with the consequence of generating (long-term) potential gains at the industry level. In contrast, its rejection would be in line with the scarring view of financial crises.

The second hypothesis refers to the age effect and its interplay with the selection mechanism of financial crises. Specifically, this chapter tests whether inefficient banking firms are more likely to be removed from the banking market if old. In short, the following is postulated:

Hypothesis 2: Old inefficient banks are more likely to be removed from the market during financial crises than Young banks.

Evidence in favour of Hypothesis 2 would imply that inefficient institutions removed from the market are especially those with a lack of potential as implied by the cleansing effect. In contrast, the predominant removal of young banks would be in line with the scarring view and the failure of firms with the potential to show longer-term potential.

3.2.2. Firm Entry and Financial Crises

The effect of financial crises in terms of firm selection is only one of their possible outcomes on industry structure. Several analyses have also emphasized a potential impact in terms of the entry of new firms (see Bresnahan and Raff, 1991; Caballero and Hammour, 1994; Knott and Posen, 2005). For instance, under the cleansing view, since outdated production units become unprofitable and the incentives to undertake productivity-improving activities increase, new entry firms should show improved levels of innovation and achieve a higher degree of productivity. In this respect, Fiol and Lyles (1985) argue that some types of 'crises' are associated with a higher-level of entrepreneurial learning that improves the long-term survival prospects of new entrants. More broadly, a similar beneficial effect on firm entry

has been associated with failures independently of their nexus with episodes of financial crises or economic recession (Pe'er and Vertinsky, 2008).

The banking literature, however, also lacks analyses of the potential entry effect of financial crises. More generally, existing studies have dedicated much attention to the degree of efficiency achieved by new entry banks without a distinction between normal times and periods of crisis. Canhoto and Dermine (2003) find that new Portuguese banks were more efficient than the established banks after the deregulation process. However, DeYoung and Hasan (1998) find that while profit efficiency of de novo banks in the US increases rapidly throughout the first three years after establishment, it takes on average nine years to reach the levels of the incumbent banks. Furthermore, Knott and Posen (2005) focus on the entry effect of bank failure and suggest that due to a selection effect aggregate cost decreases because firms with less efficient endowments are replaced with more efficient ones.

The final test in this chapter, therefore, aims at evaluating the impact of financial crises on bank entry and its interplay with bank efficiency. In particular, the following hypothesis is formulated:

Hypothesis 3: If crisis periods help to liberate resources for more efficient use, banks that enter the market during crises will achieve higher levels of efficiency than incumbent banks and banks that enter in normal times.

To validate Hypothesis 3 and to identify potential long-term benefits from financial crises two conditions should be observed. First, banks entering the market in periods characterized by a financial crisis should achieve (on average) a higher degree of efficiency than incumbent banks. Second, the degree of efficiency of these banks should also be higher than the degree of efficiency of banks entering in other time periods.

3.3. Sample, Definition of Financial Crises and Methodology

3.3.1. Sample

For the population of US commercial and savings banks, the quarterly data between 1984:Q2 and 2013:Q4 is obtained from the Consolidated Reports of Condition and Income, provided by the FDIC (for data after the first quarter of 1993), and the Federal Reserve Bank of Chicago (for data before the first quarter of 1993).

The list provided by the FDIC is then used to identify failed banks (Liu and Ngo, 2014). In this list, failed institutions are categorized into two broad groups: 1) banks whose charter has been terminated; 2) banks whose charter survives.[6] The definition provided by the FDIC is used to identify entry banks during the sample period. Specifically, the FDIC uses the date when a bank begins its operations as the date of establishment. Hence, an entry bank is defined as a banking firm with operations starting in the period between 1984 and 2013.

[Table 3-1 here]

The initial data set consisted of 22,009 banks (of which 2055 failed, and 4813 are entry banks), and 2,149,996 quarterly observations between 1984:Q2 and 2013:Q4. Then consistent time series according to the data manual, provided by Den Haan et al. (2002), are formed, and observations, for which a clear reporting error is identified and with missing values[7], are removed. Furthermore, as detailed in section 3.3.4, a two quarter lag for the explanatory variables are chosen to reduce potential endogeneity problems in the

[6] The first group consists of banks that cease to exist and their assets are auctioned off. The second group includes banks that were reprivatized (management takeover followed by a sale, not dependent on whether there was assistance for the takeover) or subject to an assisted transaction (either open assistance transaction or the assistance was provided for an acquiring institution). For a full definition of failure and assistance transactions, visit http://www2.fdic.gov/hsob/help.asp#BF1TT.

[7] For instance, if there are negative entries in the Call Report, and these entries do not belong to the several exceptions that are allowed to be negative, it is a clear reporting error (Den Haan et al., 2002).

econometric analysis with the consequence that the failures occurring in the first two quarters of the sample period are removed from the empirical tests[8]. Finally, an additional 2014:Q1 is added to the dataset to incorporate bank failures that occurred in this quarter and had accounting data available at the third quarter of 2013. The applications of the criteria described above lead to a final sample of 1,160,804 quarterly observations belonging to 20,524 unique banks (of which 1,672 are failed banks, and 4,218 are entry banks) between 1984:Q4 and 2014:Q1. From the 20,524 banks, 18,227 are commercial banks (from which 5,504 are federally chartered and 12,723 are state chartered) and 2,266 are savings banks (hereinafter, banks)[9]. To conduct the tests of bank failure a dummy is then constructed that equals to one for banks that failed in a given quarter and zero otherwise (**Fail**). The summary statistics of the variable Fail are reported in Panel A of Table 3-1.

3.3.2. The Identification of Financial Crises

To identify financial crises, the definition provided by Berger and Bouwman (2013) is followed. More specifically, crisis periods include two banking crises, the 1990s credit crunch between 1990:Q1 and 1992:Q4, as well as the global financial crisis that took place between 2007:Q3 and 2009:Q4. Furthermore, additional episodes of financial distress embrace market crises such as the stock market crash in 1987:Q4, the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4, and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3.

[8] Before removing the observations due to the two-quarter lag used in the empirical tests, the sample consisted of 1,216,290 observations, according to which some of the explanatory variables (Efficiency variables, Young and M_share) were computed to avoid potential selection bias. These variables are introduced in the following sections.

[9] The remaining 31 banks have relinquished FDIC insurance before the third quarter of 1992 and do not offer further specification on the charter class.

It is worth noting that in the empirical setting, the periods involving financial crises are identified with dummies that take a value of one not only in the dates described above but also for the following four quarters. The purpose is to control for the possibility that bank failures originating from financial crises materialize with a lag compared to the eruption of the shock. However, as the choice of four quarters is to a degree arbitrary, additional tests are conducted where to the period identified above the following two and eight quarters are added, and where the periods of the exact date of the crises and the following four quarters are analysed separately. The results of these additional tests are reported in the section *Additional Figures and Tables* (section 3.8.1).

[Figure 3-1 here]

Panel B of Table 3-1 reports summary statistics for the crisis dummy and separately for banking and market crises, while Figure 3-1 presents the distribution of entry and failure rates of banks throughout the sample period at quarterly intervals. The Figure shows that bank failures cluster in three key periods: normal times between 1984:Q2 and 1993:Q1, and the two banking crises between 1990:Q1 and 1992:Q4, and 2008:Q1 and 2014:Q1, with 56.01% of the total bank failures occurring in the periods that have been identified as being linked to a financial crisis. Further, as predicted, the failure rate appears larger when crises originate within the banking sector rather than in the stock market. In terms of the entry rate, an upward trend can be observed in bank entry during normal times, and a downward trend throughout periods of crisis.

3.3.3. The Estimation of Bank Efficiency

The choice of using cost efficiency to measure bank productivity has been based on the following. Although the change in productivity does not necessarily imply improved efficiency, but rather a technical change or increase in scale economies (or a combination of

the three) (Coelli et al, 2005), the technical change in the banking sector has been largely associated with external factors, such as deregulation (see, for instance, Berg et al, 1992; Mukherjee et al, 2001)[10]. In addition, productivity focuses on physical quantities and technical relations and does not incorporate input prices (Coelli et al, 2005). In essence, the behavioural element of a banking firm may be lost when focusing merely on productivity, whereas cost efficiency allows the incorporation of management choice in terms of input mix given their prices. As a result, cost efficiency is better aligned with the managerial goals of cost minimisation. Finally, in their study Berg et al. (1992) have identified efficiency growth as the major sources of productivity growth in the banking sector.

The literature has proposed both parametric approaches (the Stochastic Frontier Analysis (SFA), the Thick Frontier Approach and the Distribution Free Approach) and non-parametric approaches (the Data Envelopment Analysis (DEA) and the Free Disposal Hull (Berger and Humphrey, 1997) to estimate different types of bank efficiency. In this thesis DEA is employed to estimate banks' cost efficiency that reflects a bank's ability to effectively utilize resources. The distance from the efficient frontier reflects the resources that have been wasted. This estimation method further allows decomposing cost efficiency into the product of technical and allocative efficiency. The former measures a bank's ability to use a minimum level of inputs to produce a given level of outputs, and the latter shows how adequately the mix of inputs are selected regarding the input prices (Havrylchyk, 2006).

In contrast to parametric techniques, DEA does not require the use of a specific function, defining a constant relationship between the inputs and outputs used by banks. This is particularly important in evaluating the efficiency of financial institutions, as they do

[10] It, therefore, can be argued that technical progress should allow the whole population of banks to achieve higher levels of productivity, with the ones that do not exploit the technological advancement declining in terms of efficiency scores.

not operate using a specific, "well defined production function" (Holod and Lewis, 2011). In addition, while the major concern about non-parametric techniques is that they do not take into account the existence of a random error (Berger and Humphrey, 1997), the study of Ruggiero (2007) suggests that the random error in parametric techniques such as SFA is assumed to have a specific distribution, and this assumption undermines the potential advantages of SFA over DEA[11]. More formally, cost efficiency levels are estimated by using the following input-oriented variable returns to scale (VRS) DEA model developed by Banker et al (1984) [12]:

$$\begin{aligned} \text{minimize} \quad & \partial \textstyle\sum_k \lambda_k z_{ik} \leq \partial z_{i0}\,, where\ i = \overline{1,m}; \\ \text{subject to} \quad & \textstyle\sum_k \lambda_k y_{rk} \geq y_{r0}\,, where\ r = \overline{1,s}; \\ & \sum \lambda_k = 1 \lambda_k \geq 0\,, where\ k \in \overline{1,n.} \end{aligned} \tag{3.1}$$

Here y_{ik} and z_{rk} represent the amounts of *i'th* output and *r'th* input for bank *k*, respectively. Critical for the estimation process of bank efficiency is, therefore, the choice of bank inputs and outputs. Following the majority of the studies documented in Berger and Humphrey (1997), total deposits, premises and fixed assets, and the number of employees are employed as inputs. The related input prices are the interest paid on deposits scaled by total deposits, expenses of premises and fixed assets divided by total premises and fixed assets, and salaries and employee benefits, scaled by the number of employees, respectively. Outputs include total securities and total gross loans and leases. Summary statistics for

[11] Specifically, by following Ondrich and Ruggiero (2001), he argues that as the overall error in the SFA is perfectly correlated with the conditional estimator, the latter cannot "usefully decompose overall error into the efficiency and statistical noise components".

[12] Other bank efficiency studies favor the VRS model over the constant return to scale (CRS) model, as the latter is appropriate when firms operate at an optimum scale - an assumption that does not fit the banking industry (Fethi and Pasiouras, 2010).

inputs, input prices and outputs are provided in section *Additional Figures and Tables* (section 3.8.1) Table A3-1.

The input-oriented VRS DEA model selects the banks that use the minimum amount of inputs to produce the maximum level of outputs. Efficiency values equal to 100% are then assigned to the banks that form the efficient frontier to which other banks are compared.[13]

The measures of bank efficiency are estimated by size groups and separately for each quarter. The estimation by size allows to control for differences in bank technology depending on bank production scale and is conducted for the following five categories of banks: very small banks (less than $50 million in assets), small banks (between $50 and $100 million in assets), medium banks (between $100 and $500 million in assets), large banks (between $500 million and $1 billion in assets) and very large banks (over $1 billion in assets). The estimation of efficiency by quarters removes concerns over a potential forward-looking bias in the econometric tests. Essentially, the aim is to avoid assessing the degree of efficiency of a bank in a given quarter by using accounting information that will be available only in future quarters.

Panel C of Table 3-1 provides definitions and descriptive statistics of the three types of efficiency measures used in the empirical models. The average cost efficiency is 41.20%, which is lower than what has been reported in other US based studies (see, for instance, Aly et al., 1990; Berger and Humphrey, 1997). The estimates in this chapter, however, focus only on the cross-sectional dimension of bank efficiency to remove forward looking bias and on

[13] An alternative to the input-oriented approach is the output-oriented approach. Nevertheless, while an input oriented approach is considered to be more likely a reflection of factors under the influence of managers (Fethi and Pasiouras, 2010), an output-oriented approach, is also likely to reflect more generally variations in economic conditions not under full managerial control such as changes in the demand for loans.

a significantly larger number of banks with relatively fewer banks forming an efficient frontier, and a higher proportion of banks operating inefficiently. In line with Aly et al. (1990), Berger and Humphrey (1991) and Isik and Hassan (2002), most of the efficiency achieved by banks can be attributed to allocative efficiency rather than to technical efficiency. Hence, banks seem to be more successful in selecting the appropriate mix of inputs rather than using the appropriate quantities of inputs.

The time series trends of the average efficiency measures used in this thesis are provided in Figure A3-1. The summary statistics of efficiency measures are further decomposed according to the time period, i.e. normal times, market and banking crisis periods, and are further presented in Table A3-2.

3.3.4. Parametric Survival Model for Bank Failures

As in Calomiris and Mason (1997) and Schaeck et al. (2009), a parametric Survival (PS) model is employed for estimating bank survival probabilities. The PS model is fitted by maximizing the following likelihood function:

$$L_j(\beta_x, \theta) = \frac{S\left(t_j \middle| \boldsymbol{X}_j \boldsymbol{\beta}_x, \boldsymbol{\theta}\right)}{S\left(t_{0j} \middle| \boldsymbol{X}_j \boldsymbol{\beta}_x, \boldsymbol{\theta}\right)} \{h\left(t_j \middle| \boldsymbol{X}_j \boldsymbol{\beta}_x, \boldsymbol{\theta}\right)\}^{Fail_j} \tag{3.2}$$

where *h(.)* is the hazard function of the assumed distribution; *S(.)* is the corresponding survivor function; $Fail_j$ is the failure indicator for each observation *j* (*j = 1, 2, …, N*), and t_j denotes the failure or censoring time for each observation *j* (*j = 1, 2, …, N*). $\boldsymbol{\theta}$ are the ancillary parameters required for the assumed distribution. Whether an observation represents failure or censoring depends on whether a bank failed or survived at time t_j. Finally, $\boldsymbol{X}_j$ is the vector

of covariates (reported in Panel D of Table 3-1), and $\boldsymbol{\beta}_x$ is the corresponding vector of coefficients on $\boldsymbol{X}_j$.[14]

Critical for the estimation of a parametric survival model is the selection of the distributional form (exponential, Weibull, or Gompertz) underpinning the proportional hazard function $h(t)$. To this end the Akaike information criterion is employed to select the distribution that offers the lower value of this statistic; namely, the Gompertz distribution is selected. The Gompertz hazard function for the PH model has the following form:

$$h(t|\boldsymbol{X}_j) = \exp(\gamma t)\exp(\beta_0 + \boldsymbol{X}_j\boldsymbol{\beta}_x), \tag{3.3}$$

where $\exp(\gamma t)\exp(\beta_0)$ is the baseline hazard of a Gompertz model, and γ is the ancillary parameter.

Thus, the survivor function in the PH metric with a Gompertz baseline hazard has the following form:

$$S(t|\,\boldsymbol{X}_j) = \exp\left[-\gamma^{-1}\exp(\beta_0 + \boldsymbol{X}_j\boldsymbol{\beta}_x)\{\exp(\gamma t) - 1\}\right] \tag{3.4}$$

To test the Hypotheses the baseline specification is extended with the addition of interaction terms between measures of bank efficiency and the crises dummies. This extended specification allows to evaluate how efficiency effects differ across normal and crisis periods, and how the effects of crises vary given different levels of bank efficiency. Nevertheless, as the sign or magnitude of the interaction terms are not very informative in non-linear models (Berger and Bouwman, 2013), marginal effects are used to test how efficiency affects banks' probability of failure under different economic conditions.

[14] Parametric survival models can be categorized into two main types: accelerated failure time (AFT) or proportional hazards (PH). The former assumes that the effects of covariates are to accelerate or decelerate the survival time by a constant, and the latter assumes that a one unit change in a covariate affects the hazard rate by some constant. While the AFT models report the coefficients in an accelerated failure time metric, the PH models report the coefficients in a proportional hazard metric. The PH metric is chosen, because the interest is in how covariates affect the hazard rates rather than the time to failure.

Furthermore, in the following Tables the coefficients are presented in terms of hazard rates. It follows, therefore, that a value larger (lower) than one indicates that a covariate increases (reduces) the probability of bank failure.

Panel D of Table 3-1 describes the set of control variables employed in the survival model including bank-specific characteristics, as well as the state-macroeconomic environment. Following Liu and Ngo (2014), the former consists of bank **Size** (measured by the natural logarithm of assets), **ROA** (measured by net income to total assets), **NPL** (the ratio of non-performing loans to total loans), and **M_Share** (measured as a bank's assets to total state banks' assets). As Liu and Ngo (2014) a too many to fail (**TMTF**) variable is also included, that measures the average capital ratio of other banks that operate in the same state. A **Leverage** ratio, measured as the ratio between assets and equity, is included as in Adrian and Shin (2010). Finally, a dummy variable **Young** is included that equals one if bank age is lower than the first quartile of the banks' age in the sample[15]. All independent variables apart from Crises and Young are lagged by two quarters to avoid possible endogeneity[16].

Similar to Cole and White (2012), there are no a priori expectations for the bank size and failure relationship. Liu and Ngo (2014) find a lower probability to fail in large US banks reflecting the fact that large banks have a more diversified investment opportunity set. In contrast, Jin et al. (2011) find an opposite result and suggest larger banks are more likely to engage in riskier lending and securitization. Higher ROA, lower leverage ratio (the inverse of capital ratio) and lower levels of non-performing loans are expected to decrease banks' probability of failure (see Cole and White, 2012; Berger and Bowman, 2013). A high bank

[15] The first quartile of a bank's age in the sample is 25.5 years, and the average age of the first quartile is 11.06 years, which is close to the number of years required for a bank to reach the performance of existing banks reported in DeYoung and Hassan (1998).

[16] The correlation matrix for all explanatory variables used is presented in *Additional Figures and Tables* section (section 3.8.1) Table A3-3.

market share can instead reflect the presence of a too-big-to-fail status and thus reduce the probability of failure (Liu and Ngo, 2014). However, previous studies find a higher likelihood of failure associated with this variable but they also show that this effect is motivated by the inclusion of government assisted banks in the group of failed banks. In a similar manner to Liu and Ngo (2014) the expectation is that a higher too many to fail indicator is associated with a higher probability of failure, as governments are more likely to assist a bank and protect it from failure when the whole banking sector is weak (Brown and Dinc, 2011). As for the dummy variable Young, the literature normally suggests that young banking firms are more exposed to adverse economic environments and are more likely to exit the market (Wheelock and Wilson, 2000; DeYoung, 2003). Finally, controls for local economic conditions (**Growth**) are included to measure the quarterly change of personal income in a State where the bank operates. The expectation is that better local economic conditions should reduce the likelihood of bank failures.

3.3.5. Regression Analysis for Entry Banks

To test the third hypothesis, it is analysed whether crisis periods help liberate resources for new banks to use more efficiently. To this end, two dummy variables are constructed, **Enter_norm** and **Enter_cr**, that take values equal to 1 if a bank has entered the banking market over the sample period during normal or crisis periods, respectively. These dummy variables are then employed as explanatory variables in the following econometric model that is estimated by OLS and with clustered standard errors at the bank level:

$$EFF_{i,t} = a_0 + a_1 * Enter\_norm_i + a_2 * Enter\_cr_i + \mathbf{K}_1 \boldsymbol{X}_{i,\,t-2} + a_3 * Time_t + \varepsilon_{i,\,t} \quad (3.5)$$

where $EFF_{i,t}$ is one of the measures of efficiency computed for bank i at quarter t. $\boldsymbol{X}_{i,t-2}$ is a vector of control variables including the set of characteristics described in the previous section. The expectation is that ROA, M_share, TMTF, Size, Growth and Young have a

positive effect on efficiency, and NPL and Leverage have a negative effect on efficiency. Furthermore, quarterly time fixed effects are controlled for. Definitions and summary statistics of the entry dummies are presented in Panel E of Table 3-1.

To verify Hypothesis 3, two conditions need to be satisfied. First, **Enter_cr** should enter the regression models with a positive and significant coefficient; namely, it should have a positive effect on all efficiency measures. Second, **Enter_norm** should either show a positive sign but a lower magnitude than **Enter_cr**, or a negative sign. In the first case, entrants would be more efficient than failed and incumbent banks regardless of the timing of entry, thus supporting the presence of a more general innovation effect characterizing new firms. Nevertheless, financial crises can amplify this innovation effect. In the second case, entry banks are more efficient than failed and incumbent banks only when they enter during disturbed market conditions, thus providing even stronger evidence of the potential benefits of financial crises.

3.4. Do Crises Clear out Inefficient Banks?

3.4.1. The Impact of Bank Efficiency on the Probability of Bank Failure

Table 3-2 reports the regression results of the impact of different types of bank efficiency on the likelihood of bank survival. The initial estimates are benchmark specifications to test whether more efficient banks are more likely to survive, as suggested by the results reported in Wheelock and Wilson (2000), Knott and Posen (2005), and Koetter and Poghosyan (2010). The validity of the first hypothesis - whether the importance of bank efficiency for bank survival increases during periods of financial crises - is then evaluated by including in the baseline models interaction terms between the measures of bank efficiency and the crisis dummy.

The initial tests show that more efficient banks are, in general, more likely to survive, confirming the view that crises can generate a cleansing effect in the banking industry (Knott

and Posen, 2005). Furthermore, the results do not vary with the way bank efficiency is measured: all three measures of bank efficiency significantly lower the hazard rate.

[Table 3-2 here]

The impact of bank efficiency on bank survival appears also economically relevant. For instance, by using the estimation results reported in column (1) it is found that a ten percentage point[17] (pp) increase in cost efficiency reduces the hazard of failure by 8% per quarter, or 32 % per annum. Furthermore, extending the analysis to the two cost efficiency components, the results suggest that a ten pp increase in technical inefficiency has a lower impact in terms of the decline of the bank hazard of failure (-7% per quarter and -28% per year) than a similar increase in allocative efficiency (-8 % per quarter and -32% per year). This suggests that for banks the efficiency in the allocation of resources is more important than the efficiency in the overall utilization of inputs. This is not entirely surprising given that managers' choices to alter the input mix according to their prices show their ability to adapt to regulatory changes and market prices (Isik and Hassan, 2002; Havrylchyk, 2006).

Moving onto the analysis of the remaining variables, a number of significant determinants of the probability of bank failure are found: higher ROA, lower amount of assets and lower leverage, as well as lower levels of non-performing loans help banks survive. Furthermore, banks are less likely to survive during financial crises and when the economy is weaker. Finally, market share does not show any significant effect on bank probability of failure.

[17] The use of percentage points (pp) rather than percent (%) refers to an actual instead of a relative change (or difference) of percentages. For instance, if bank efficiency reduces from 60 % to 50 %, it is a 10 pp change (60 – 50 = 10), whereas this drop would represent a 16.67 % decline (((50-60)/60)*100 = -16.67%) in efficiency.

The last three columns show the results of the direct test of Hypothesis 1) on the effect of bank efficiency on the probability of failure during financial crises with the use of interaction terms between bank efficiency and the crisis dummy. To ease the interpretation of the results, and given interaction terms in non-linear models, such as parametric survival models, cannot be understood by simply relying on their sign, magnitude or significance levels of the reported coefficients (Berger and Bouwman, 2013), the marginal effects are presented in Table 3-3.

The findings suggest that an increase in bank efficiency reduces the hazard rate of bank failure in both normal and distress periods. Further tests, reported in Panel B, on the equality between the marginal effects in normal and crisis periods show that the effects during financial crises are not more pronounced than in the rest of the sample period. More importantly, Panel B shows that financial crises do not increase the likelihood of removing inefficient institutions as compared to normal times. Furthermore, additional tests, reported in Panel D highlight that the likelihood of surviving a financial crisis is essentially similar for more and less inefficient banks.

[Table 3-3 here]

Overall, the results are not consistent with the presence of a cleansing effect: the results do not show that inefficiency matters more during financial crises than normal times and that more inefficient banks are more likely to fail during disturbed market conditions than in normal times. Overall, financial crises do not seem to accelerate the removal of inefficient institutions from the market.

3.4.2. Additional Tests

To assess the robustness of the findings additional tests are conducted. First the validity of the definition of financial crises is tested. Specifically, as including four quarters following a

crisis is to a degree arbitrary, additional analysis is conducted to test whether the results are robust when extending the crisis periods, defined by Berger and Bouwman (2013), by two and eight quarters. In line with the previous findings the results show that efficiency, in general, helps banks survive with no significant differences between crisis and normal periods. The effects of crises on banks probability of failure are positive and significant, with no significant difference between more and less efficient banks. The results are provided in Table A3-4 and Table A3-5 for including post-crisis periods as two and eight quarters, respectively.

One possible concern related to the estimation of bank efficiency at quarterly intervals, is the possibility of capturing noise. In essence, under the estimation approach employed, a bank can show a temporary inefficiency in a given quarter despite achieving higher levels of efficiency over a longer time period. Therefore, the quarterly value of bank efficiency in the models is replaced with its average over a three-quarter period. Again, findings suggest that inefficient banks are more likely to fail but this effect is not amplified by financial crises. The results are provided in Table A3-6.

Although in the econometric analyses bank size and market share are controlled for, it has been widely accepted that due to their systemic importance in the economy, large financial institutions are different, and their probability of failing is not dependent directly on their performance (see, for instance, Berger et al., 2012; Berger and Bouwman, 2013; Cole and White, 2012; DeYoung and Torna, 2013; Liu and Ngo, 2014). In order to test, whether the results are driven by the inclusion of systemically important banks, as in Berger and Bouwman (2013) additional tests are performed excluding the 19 largest banks in each quarter. Again, the results, reported in Table A3-7 basically replicate those shown in Tables 3-2 and 3-3.

Further, a different distributional assumption is employed to evaluate whether the results hold. Specifically, as in Schaeck et al. (2009) the exponential distribution is employed to estimate the survival model. Once again, the results provided in Table A3-8 remain qualitatively similar to those of the initial analysis.

In the final robustness check, a different bank exit mechanism in the empirical setting is employed. Specifically, the study by Wheelock and Wilson (2000) is followed and an additional analysis is conducted to test whether exit via acquisitions presents similar findings[18]. To be relevant for the initial analysis, both main explanatory variables, efficiency and crises, should have the same sign on the probability of banking exiting via an acquisition. Presented in the first three columns of Panel A of Table A3-9, the results show that while the effect of efficiency is in line with the initial analysis, the probability of a bank being acquired reduces significantly during times of crisis. The marginal effects of efficiency, provided in Panel B of Table A3-9, are further in line with the initial analysis, whereas the opposite from the initial analysis marginal effect of crises are presented in Panel C of Table A3-9. Specifically, the results show that crises reduced bank probability of being acquired and this effect was not different for any level of bank efficiency.

These findings, therefore, show that for the purpose of the analysis presented in this chapter, the exit mechanism via acquisitions should not be investigated in conjunction with outright bank failures.

[18] For the purpose of this test, the dataset of 1,216,290 observations (before the removal of observations due to lagged variables introduced) is employed. The model used is the same as the one described in section 3.3.4, where the dependent variable is changed into the probability of a bank being acquired. Specifically, the dependent variable **Acq** acquires a value of one if a bank was acquired in that quarter, and zero otherwise. Acquired banks and the dates of the acquisition are identified using the dataset provided in https://catalog.data.gov/dataset/fdic-institution-directory-id-insured-insitution-download-file. Explanatory variables are the same as in the initial analysis in this chapter.

3.4.3. Banking Crises versus Market Crises

The definition of financial crises includes periods of distress that differ in nature and it is widely believed that banking crises might differ from market crises in different aspects (see, for instance, Berger and Bouwman, 2013). In particular, during banking crises the destruction of the banking sector tends to be more pronounced than during market crises as proved by a much larger number of bank failures (Berger and Bouwman, 2013). In essence, the severity of banking crises might then undermine the potential benefits associated with higher bank efficiency thus affecting also relatively efficient banks. This is in line with the view that a severe crisis might lead to panic amongst bank creditors that impacts on healthier institutions via uninformed depositors (see, for instance, Chari and Jagannathan, 1988; Saunders and Wilson, 1996; Chen, 1999; Iyer and Puri, 2012) or via the interbank market (Dasgupta, 2004).

In contrast, market crises tend to have a milder effect on the banking sector with the consequence of increasing the chances that greater bank efficiency might lead to greater bank survival. For instance, in the sample, while the annualized bank failure rate during episodes of banking crisis is equal to 0.95%, it drops to about half of this in the presence of a market crisis.

This possibility is evaluated in Table 3-4, where the survival model with dummies that separately identify market and banking crises is presented. The two dummies are then interacted with the measures of bank efficiency and the related marginal effects are shown in Table 3-5.

[Table 3-4 here]

[Table 3-5 here]

While the sign, significance and magnitude of efficiency measures and control variables are similar to those reported in the previous section, the analysis of the marginal

effects reported in Panel A of Table 3-5 suggests that an increase in the degree of efficiency decreases the probability of bank failure during normal times and market crises. Efficiency, nevertheless, seems to also be important during banking crises, as the results show that apart from technical efficiency, it helps banks survive.

Furthermore, Panels B and C present the marginal effects of banking and market crises on the probability of failure at different levels of bank efficiency. The results indicate that banking crises tend to increase banks' probability of failure more than normal times, regardless of the value of bank efficiency. Market crises, however, do not show any different effect on bank probability of failure than normal times at any levels of bank efficiency.

Overall, the results show that an increase in all measures of efficiency reduces the likelihood of failure during normal times and during both types of crises. It, therefore, cannot be concluded that efficiency is more important during market crises that exhibit a milder effect on the banking industry. Compared to normal times, the eruption of banking crises, generally, increases the probability of bank failure at all levels of efficiencies, while shocks stemming from market crises do not affect the probability of failure at any level of efficiency more than in normal times. In overall, the findings are more in line with the presence of a scarring effect stemming from banking crises, whereas market crises do not exhibit any different effect on the probability of bank failure than normal times.

3.4.4. The Global Financial Crisis versus Other Financial Crises

The key assumption of the previous tests is that banking crises are more disruptive than market crises for the banking sector and this leads to a reduction in the potential benefits of having a high degree of efficiency. This notion is confirmed by the insignificant marginal effect of market crises and the significant effect of banking crises as compared to normal times on banks' likelihood of failure. Efficiency, nevertheless, seems to help banks survive

during all times. In this section, additional analysis for this argument is provided by comparing the effects of efficiency during the latest financial crisis with those associated with the other crises. In essence, as it is widely agreed that the turmoil of the banking sector erupted in the second half of 2007 led to the most severe banking crisis since the great depression (Laeven and Valencia, 2013), to further test the findings of the previous section a lack of any significant role played by bank efficiency during the recent crisis should be observed.

To conduct these additional tests a dummy equal to one for the periods identifying the global financial crisis (**GFC**) and a dummy equal to one for the remaining crises (**Other_crises**) are constructed. The baseline specifications are then re-estimated with the addition of interaction terms between the two crisis dummies and the measures of bank efficiency.

[Table 3-6 here]

[Table 3-7 here]

The regression results are presented in Table 3-6 and, more importantly, the related marginal effects for different types of financial crises are shown in Table 3-7. Panel A, where the marginal effects of bank efficiency during normal periods, the global financial crisis and other crises are reported, suggests that while the probability of bank failure is reduced by increases in efficiency, this was not the case for the global financial crisis. In other words, under a very severe financial crisis an increase in bank efficiency is not important for bank survival. The equality tests between the effects of efficiency in different periods are presented in Panel B, and further support the findings, as suggested by the significantly more important role of efficiency in normal times and other crisis periods than in global financial crisis.

More importantly, Panels C and D show that the marginal effects of the global financial crisis on the likelihood of failure was significant at any level of bank efficiencies, whereas other crises (apart from allocative efficiency) did not have a stronger effect on bank probability of failure than normal times.

Overall, the results reported in this section suggest that efficiency does not help banks to survive when the banking sector is hit by an extremely severe shock; whereas, in terms of milder financial crises, efficiency has a positive impact on the survival of banking firms.

3.5. Crisis, Bank Efficiency and Bank Age

In this section the Hypothesis 2 is tested; namely, that bank age plays a moderating effect on how financial crises impact on the survival of banks with different degrees of efficiency. To test this hypothesis the dummy variable Young is interacted with Crisis and Efficiency and with the product between Crisis and Efficiency.

Panel A of Table 3-8 shows the parametric survival model results, and, more importantly, Panels B and C show the marginal effects of efficiency and crises for young and old banks separately. While the analysis presented in Panel A, in general, confirms the findings of the previous models, Panels B and C of Table 3-8 do not support the hypothesis that old inefficient banks are more likely to be removed from the market during financial crises than young banks. In other words, although crises seem to contribute to removing only the least efficient old banks, they appear to exercise a much stronger impact on the probability of failure of young banks independently of their efficiency levels. In fact, efficiency does not seem to play a role in helping young banks survive crises at all. This is highlighted by the results in Panel B showing that an increase in bank efficiency does not influence the probability that young banks fail during financial crises. This conclusion holds

for all the different measures of bank efficiency employed in the empirical tests. In contrast, an increase in efficiency reduces the probability of failure during crises in the group consisting of the oldest banking firms.

Overall, the results discussed in this section do not support Hypothesis 2 whereas they appear more in line with the presence of a scarring effect produced by financial crises. In essence, during financial crises, young banks fail regardless of their efficiency levels with the consequence of being incapable of achieving their full potential. Furthermore, while there is some evidence that financial crises penalize more mature banks when they are less efficient, the impact of financial crises appear more pronounced for young banks even when they are relatively more efficient.

[Table 3-8 here]

3.6. Do Crises Liberate Resources for New Banks to Use More Efficiently?

In this section the validity of Hypothesis 3 is tested; namely, that crises help liberate resources for new banks to take over and employ more efficiently. To this end, the model described in section 3.3.5 is employed. Hence, the initial focus is on the effect of the timing of bank entry on the degree of bank efficiency.

The regression results reported in the first three columns of Panel A of Table 3-9 are generally supportive of Hypothesis 3. More precisely, the results show that entry banks tend to achieve (on average) higher levels of cost and technical efficiency than failed and incumbent banks and this effect is significantly higher for banks that enter during periods of financial distress. The higher levels of efficiency for new entry banks are, therefore, consistent with the findings reported by Canhoto and Dermine (2003). However, the results show that new entrants achieve better performance than the remaining banks in terms of

technical efficiency more than in terms of allocative efficiency; this is not, however, entirely surprising. Technical efficiency rather than allocative efficiency is related to innovation and as suggested by Geroski (1995) firm entry is positively related to increases in efficiency via innovation.

[Table 3-9 here]

More importantly, in the context of the analysis, is the result shown in Panel B of Table 3-9, that increases in efficiencies produced by entering during crisis periods are significantly larger than the increases observed when banks enter in normal times. This finding is, therefore, consistent with the view that financial crises might help innovation via new entry banks.

It is evaluated further whether the results depend on the type of financial crisis. The dummy that identifies bank entry during crises is separated into a dummy for banking crises and a dummy for market crises. The results of these additional tests, shown in the last three columns of Table 3-9, highlight that new entry banks in the aftermath of financial crises achieve higher levels of efficiency than incumbent banks independently of the type of crises. However, in Panel B the results show that the effect on bank efficiency is even higher when banks enter during market crises.[19]

Overall, the results of this section and the evidence provided by the previous analysis show that the concept of creative destruction materializes in the banking industry via a bank entry channel rather than by amplifying the importance of bank efficiency for bank survival

[19] Moving onto the analysis of the control variables, higher ROA, higher capital levels (with the exception of allocative efficiency), bigger market share, higher capitalization of other banks and longer survival time increase efficiency levels. Two exceptions from the general consensus are the effects of personal income growth (decreases cost and technical efficiency levels, and has no effect on allocative efficiency), and size (although higher market share increases efficiency levels, the size of a bank reduces efficiency). As expected, non-performing loans reduce efficiency; the effect is, however, significant only for allocative efficiency.

during crises as compared to normal times. In short, financial crises have the potential benefit of liberating resources for more efficient use. In line with the previous findings, this effect is weaker for crises that materialize within the banking sector and stronger for market crises. It, therefore, seems that although market crises do not exhibit different marginal effects on bank failure probability as compared to normal times, banks that fail during market crises liberate resources for new banks to use more efficiently.

3.7. Conclusions

Based on quarterly US commercial and savings bank data between 1984 and 2013, this chapter shows that neither the cleansing nor the scarring view can fully explain the nature of bank failures during financial crises. On the one hand, in contrast to a cleansing effect, it is found that crises that are extremely severe and originate within the banking sector, as was the case with the global banking crisis that erupted in the second half of 2007, do not tend to accelerate the removal of inefficient banks compared to normal times. On the other hand, other crises do not exhibit any signs of either the cleansing or the scarring view, as they do not show any different effect on bank probability of failure as compared to normal times. Overall, it is found that the severity of the crisis plays a crucial role in determining the scarring effect that emerges in the banking industry.

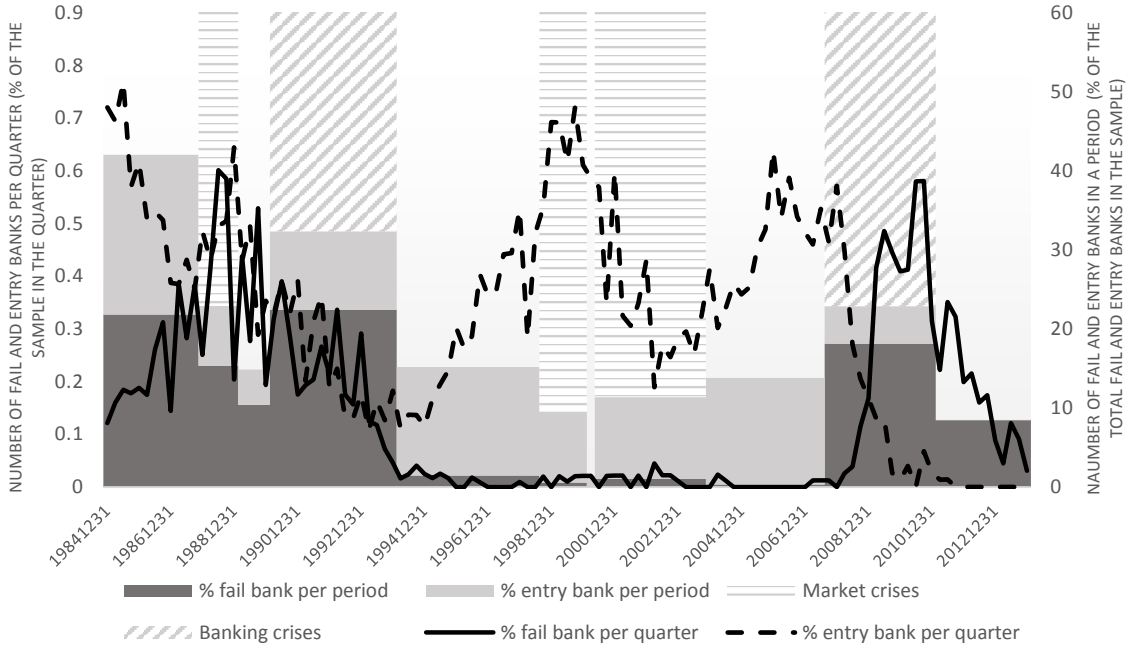
Further evidence aligned with the scarring perspective of crises emerges when the analysis is extended to incorporate the impact of bank age. While the results show that a cleansing effect materializes for older banks – that is, the least efficient are more likely to be removed from the market - such an effect is not found to be present for young banks. In this latter case, the results suggest that an increase in efficiency does not reduce the risk of failing during financial crises. Indeed, the occurrence of financial crises seems to accelerate also the removal of the relatively efficient young institutions.

Furthermore, although the analysis suggests that the presence of a cleansing effect via the removal of the most inefficient banks is at best controversial, additional tests show that some benefits of crises emerge via an entry effect. Essentially, banks that enter during crises, and especially during market crises, are able to achieve higher levels of efficiency than the competing banking firms. As a result, bank failures seem to liberate resources for a more efficient use by de-novo banks.

Overall, the fact that during severe crises, banks are affected regardless of their level of efficiency highlights the importance of ex-ante mechanisms for crisis management (such as the establishment of resolution funds) to moderate the effects of severe banking crises and avoid the need to rely on costly ex-post bailout policies.

3.8. Figures and Tables

FIGURE 3-1
FAILED AND ENTRY BANKS IN THE SAMPLE BETWEEN 1984 AND 2013



NOTES: This figure shows the distribution of fail and entry banks in the sample between 1984 and 2013. The definitions of fail and entry banks have been obtained from the FDIC. Fail bank is defined as a bank that failed or received government assistance in a given quarter, and entry bank is defined as a bank that began its operations in a given quarter. The solid and dash lines show the amount of fail and entry banks in a quarter, respectively, as a percentage of total number of banks in that quarter. The dark grey and light grey columns show the amount of fail and entry banks in time period, respectively, as a percentage of total fail and entry banks in the sample. The horizontal and diagonal shaded areas present market and banking crises, respectively, and the unshaded areas present normal times. The crises dating is as in Berger and Bouwman (2013) for the crises dating. The three market crises are the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3. The two banking crises are the 1990s credit crunch between 1990:Q1 and 1992:Q4; and the global financial crisis that took place between 2007:Q3 and 2009:Q4.

TABLE 3-1
SUMMARY STATISTICS

Symbol	Description	N	mean	p50	St. dev.	p1	p99
	Panel A: Main dependent variable for PS model						
Fail	Fail is a dummy variable, equal 1 if a bank failed in a particular quarter, and 0 otherwise. For full definition of failed bank, see section 3.1.	1,160,804	0.001	0.000	0.038	0.000	0.000
	Panel B: Crisis dummies for PS models						
Crises	Crises is a dummy equal to 1 for the quarters of crisis periods and the following quarters, and 0 otherwise.	1,160,804	0.460	0.000	0.498	0.000	1.000
Banking Crises	Banking Crises is a dummy equal to 1 for the quarters of a banking crisis and the following four quarters, and 0 otherwise.	1,160,804	0.246	0.000	0.431	0.000	1.000
Market Crises	Market Crises is a dummy equal to 1 for the quarters of a market crisis and the following four quarters, and 0 otherwise.	1,160,804	0.214	0.000	0.410	0.000	1.000
	Panel C: Efficiency variables						
CE	Cost efficiency measured by using DEA (%).	1,160,804	41.201	41.300	19.643	4.900	90.500
TE	Technical efficiency measured by using DEA (%).	1,160,804	49.504	50.500	20.379	8.100	100.000
AE	Allocative Efficiency measured by using DEA (%).	1,160,804	81.689	86.300	15.315	31.600	99.500
	Panel D: Main control variables						
Size	Log(assets) ($US000s) adjusted using implicit price deflator, provided by the Federal Reserve Bank of St. Louis.	1,160,804	11.561	11.425	1.231	9.208	15.691
ROA	Net income divided bank total assets (%).	1,160,804	0.416	0.400	0.530	-1.903	1.810
Leverage	Total assets divided to book equity (%).	1,160,804	11.149	10.990	3.354	4.136	23.621
NPL	Non-performing loans over total loans (%).	1,160,804	0.932	0.418	1.380	0.000	7.721
M_Share	Bank's assets over total banking assets in the State where the bank is chartered (%).	1,160,804	0.481	0.101	2.407	0.004	8.116
TMTF	Average capital ratio of other banks in the same State (%).	1,160,804	7.941	7.893	2.284	4.497	12.979
Growth	Quarterly change of personal income growth in the State where the bank is chartered (%).	1,160,804	1.306	1.346	1.129	-2.034	4.293
Young	Young is a dummy variable that equals 1 if a bank is younger than the first quartile of the sample, and 0 otherwise.	1,160,804	0.245	0.000	0.430	0.000	1.000
	Panel E: Entry variables and Age variable for OLS regressions						
Enter_norm	Enter_norm is a dummy variable equal 1 if a bank began its operation during normal times, and 0 otherwise	1,160,804	0.080	0.000	0.272	0.000	1.000
Enter_cr	Enter_cr is a dummy variable equal 1 if a bank began its operations during crisis period, and 0 otherwise	1,160,804	0.054	0.000	0.227	0.000	1.000

NOTES: This table presents descriptions and summary statistics of the key variables used in this chapter. Panel A presents definitions and summary statistics of the dependent variable **Fail** used in the PS models. The average of 0.001 shows that the average probability of a bank failing in a quarter is equal to 0.10%. Panel B presents descriptions and summary statistics of the efficiency variables, cost efficiency (**CE**), technical efficiency (**TE**), and allocative efficiency (**AE**). Efficiency values are reported as percentages, and can acquire a value between 0 and 100. Panel C presents the time dummy variables used in the PS models. The time dummies include **Crises**, **Banking Crises** and **Market Crises**. Crisis periods are two banking crises (the 1990s credit crunch between 1990:Q1 and 1992:Q4; and the global financial crisis that took place between 2007:Q3 and 2009:Q4) and three market crises (the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3), and include four quarters of post-crisis periods. Panel D presents definitions and summary statistics of the control variables employed in the econometric models: **Size**, **ROA**, **Leverage**, **NPL**, **M_share**, **TMTF**, **Growth**, and **Young**. Variables ROA, NPL, M_share, TMTF and Growth are reported as percentages, Leverage is reported as a ratio, Size is reported as the natural log in $US000s, and Young is a dummy variable equal to one if a bank is young, and zero otherwise. Young is defined as a bank, which is younger than the first quartile of the whole sample. Entry variables **Enter_norm** and **Enter_cr**, used in the OLS regressions, are presented in Panel E.

TABLE 3-2
THE EFFECTS OF BANK EFFICIENCY ON THE BANK PROBABILITY OF FAILURE

	(1) CE	(2) TE	(3) AE	(4) CE	(5) TE	(6) AE
Efficiency$_{t-2}$	**0.992*** **	**0.993*** **	**0.992*** **	**0.992*** **	**0.994*** **	**0.990*** **
	(-5.192)	**(-4.736)**	**(-4.821)**	**(-3.146)**	**(-2.896)**	**(-4.181)**
Crises	**1.432*** **	**1.414*** **	**1.445*** **	**1.452*** **	**1.450*** **	**1.087**
	(7.441)	**(7.177)**	**(7.601)**	**(3.301)**	**(2.968)**	**(0.351)**
Efficiency$_{t-2}$*Crises				1.000	0.999	1.004
				(-0.137)	(-0.218)	(1.213)
ROA $_{t-2}$	0.257***	0.255***	0.258***	0.257***	0.255***	0.257***
	(-33.754)	(-33.926)	(-33.416)	(-33.755)	(-33.922)	(-33.443)
Size $_{t-2}$	1.066***	1.073***	1.077***	1.066***	1.073***	1.077***
	(2.635)	(2.921)	(3.064)	(2.633)	(2.916)	(3.072)
Leverage $_{t-2}$	1.084***	1.084***	1.086***	1.084***	1.084***	1.086***
	(9.793)	(9.688)	(10.000)	(9.792)	(9.686)	(10.001)
NPL $_{t-2}$	1.207***	1.206***	1.209***	1.207***	1.206***	1.209***
	(13.415)	(13.330)	(13.620)	(13.398)	(13.310)	(13.647)
M_Share $_{t-2}$	1.003	1.003	1.002	1.003	1.003	1.002
	(0.164)	(0.190)	(0.092)	(0.161)	(0.186)	(0.114)
TMTF $_{t-2}$	0.702***	0.700***	0.700***	0.702***	0.700***	0.702***
	(-6.802)	(-6.852)	(-6.798)	(-6.792)	(-6.850)	(-6.729)
Growth $_{t-2}$	0.900***	0.902***	0.901***	0.900***	0.902***	0.900***
	(-4.122)	(-4.047)	(-4.056)	(-4.114)	(-4.046)	(-4.111)
Young	1.343***	1.357***	1.349***	1.343***	1.358***	1.350***
	(6.019)	(6.285)	(6.158)	(6.034)	(6.304)	(6.168)
Constant	0.001***	0.001***	0.490	0.001***	0.001***	0.001***
	(-17.973)	(-18.261)	(-1.551)	(-17.851)	(-18.117)	(-15.740)
Observations	1,160,804	1,160,804	1,160,804	1,160,804	1,160,804	1,160,804

NOTES: This table shows the results of how bank cost efficiency (**CE**), technical efficiency (**TE**) and allocative efficiency (**AE**) affect banks' probability of failure. The method employed is a parametric survival (PS) model, with a Gompertz proportional hazard function. The dependent variable, **Fail**, is a dummy that equals one if a bank failed or received government assistance in a given quarter, and zero otherwise. **Crises** is a dummy that equals one for periods of financial distress and the following four quarters. Crisis periods are two banking crises (the 1990s credit crunch between 1990:Q1 and 1992:Q4; and the global financial crisis that took place between 2007:Q3 and 2009:Q4) and three market crises (the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3). **ROA** is the ratio between bank net income and bank total assets, **Size** is the log of bank total assets measured in thousands of US dollars and in real terms, **Leverage** is the ratio between bank total assets and bank book value of equity, **NPL** is the ratio between non-performing loans and total loans, **M_Share** is the ratio between bank total assets and the volume of bank total assets in the State where the bank is chartered, **TMTF** is the average capital ratio of the other banks in the same State, **Growth** is the quarterly change of personal income growth in the State where the bank is chartered, and **Young** is a dummy variable that equals one if a bank is young, and zero otherwise. Young is defined as a bank, which is younger that the first quartile of the banks' age in the sample. All independent variables apart from Crises and Young are lagged by two quarters to avoid possible endogeneity. The coefficients presented are hazard rates, which show how much a one unit change in the independent variable increases (decreases) the probability of a bank's failure. z values are provided in parentheses; values below one indicate a decline in bank probability of failure, and values above one indicate an increase in the dependent variable. All models are estimated with robust standard errors clustered by bank. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

TABLE 3-3
MARGINAL EFFECTS OF BANK EFFICIENCIES AND CRISES ON BANKS' PROBABILITY OF FAILURE

Panel A: Marginal effects of cost, technical and allocative efficiencies on banks' probability of failure during crisis periods and normal times			
	CE	TE	AE
Normal times	**-0.0073****	**-0.0062****	**-0.0065****
	(-2.08)	**(-2.05)**	**(-2.26)**
Crises	**-0.0098****	**-0.0086***	**-0.0053***
	(-2.02)	**(-1.95)**	**(-1.80)**
Panel B: Equality tests between the effects of efficiency variables during normal times and crisis periods			
	CE	TE	AE
Efficiency effect at normal times = efficiency effect at crisis periods	0.51	0.49	0.59
Panel C: Marginal effects of crisis periods as opposed to normal times, given different levels of efficiency			
	CE	TE	AE
p25	**0.4159***	**0.4212***	**0.2790***
	(1.90)	**(1.88)**	**(1.84)**
p50	**0.3629***	**0.3705***	**0.2841***
	(1.90)	**(1.89)**	**(1.88)**
p75	**0.3199***	**0.3319***	**0.2856***
	(1.82)	**(1.83)**	**(1.88)**
Panel D: Equality tests between the effects of entry variables on banks' efficiency levels			
Crisis effect at 25th percentile of efficiency=crisis effect at 75th percentile of efficiency	0.97	0.87	0.03

NOTES: This table shows the marginal effects of efficiencies and crises on banks' probability of failure. The dependent variable, **Fail**, is a dummy that equals one if a bank failed or received government assistance in a given quarter, and zero otherwise. The efficiencies employed include cost efficiency (**CE**), technical efficiency (**TE**) and allocative efficiency (**AE**). **Crises** is a dummy that equals one for periods of crises and the following four quarters. Crisis periods are two banking crises (the 1990s credit crunch between 1990:Q1 and 1992:Q4; and the global financial crisis that took place between 2007:Q3 and 2009:Q4) and three market crises (the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3). Panel A shows the results of marginal CE, TE and AE effects on banks' probability of failure during normal and crisis periods; and Panel C shows the results of marginal Crises effects on banks' probability of failure given the first (p25), second (p50) and third (p75) quartile of the sample efficiencies. The equality tests of the marginal CE, TE and AE effects between normal and crisis periods, and the equality tests of the marginal Crises effects between the last and first quartile of sample efficiencies are presented in Panel B and Panel D, respectively. The coefficients presented in Panels A and B show how a one unit change in the independent variable increases (decreases) the hazard rates computed using a parametric survival model. For Panel A and Panel C z values are provided in parentheses. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

TABLE 3-4
THE EFFECTS OF BANK EFFICIENCY, BANKING AND MARKET CRISES ON BANKS' PROBABILITY OF FAILURE

	(1) CE	(2) TE	(3) AE
Efficiency$_{t-2}$	**0.992*** **	**0.994*** **	**0.989*** **
	(-3.363)	**(-2.964)**	**(-4.606)**
Banking crises	**1.495*** **	**1.474*** **	1.121
	(3.224)	**(2.823)**	(0.442)
Market crises	**1.369** **	**1.452** **	1.083
	(2.052)	**(2.170)**	(0.233)
Banking crises*Efficiency $_{t-2}$	1.003	1.002	1.005
	(0.752)	(0.646)	(1.560)
Market crises*Efficiency $_{t-2}$	0.994	0.994	1.001
	(-1.347)	(-1.564)	(0.139)
ROA $_{t-2}$	0.260***	0.257***	0.261***
	(-33.430)	(-33.600)	(-33.092)
Size $_{t-2}$	1.063**	1.070***	1.067***
	(2.430)	(2.770)	(2.615)
Leverage $_{t-2}$	1.084***	1.083***	1.086***
	(9.762)	(9.656)	(9.994)
NPL $_{t-2}$	1.211***	1.210***	1.213***
	(13.623)	(13.511)	(13.912)
M_share $_{t-2}$	1.003	1.003	1.002
	(0.138)	(0.163)	(0.099)
TMTF $_{t-2}$	0.711***	0.707***	0.713***
	(-6.684)	(-6.755)	(-6.579)
Growth $_{t-2}$	0.907***	0.909***	0.907***
	(-3.800)	(-3.716)	(-3.789)
Young	1.335***	1.351***	1.344***
	(5.890)	(6.170)	(6.077)
Constant	0.001***	0.001***	0.001***
	(-17.918)	(-18.319)	(-15.499)
Observations	1,160,804	1,160,804	1,160,804

NOTES: This table shows the results of how bank cost efficiency (**CE**), technical efficiency (**TE**) and allocative efficiency (**AE**) affect banks' probability of failure. The method employed is a parametric survival (PS) model, with a Gompertz proportional hazard function. The dependent variable, **Fail**, is a dummy equals to one if a bank failed or received government assistance in a given quarter, and zero otherwise **Banking crises** is a dummy that equals 1 for periods of banking crisis and the following four quarters; and **Market crises** is a dummy that equals one for periods of market crisis and the following four quarters. The two banking crises are the 1990s credit crunch between 1990:Q1 and 1992:Q4; and the global financial crisis that took place between 2007:Q3 and 2009:Q4; and the three market crises are the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3. **ROA** is the ratio between bank net income and bank total assets, **Size** is the log of bank total assets measured in thousands of US dollars and in real terms, **Leverage** is the ratio between bank total assets and bank book value of equity, **NPL** is the ratio between non-performing loans and total loans, **M_Share** is the ratio between bank total assets and the volume of bank total assets in the State where the bank is chartered, **TMTF** is the average capital ratio of the other banks in the same State, **Growth** is the quarterly change of personal income growth in the State where the bank is chartered, and **Young** is a dummy variable that equals one if a bank is young, and zero otherwise. Young is defined as a bank, which is younger that the first quartile of the banks' age in the sample. All independent variables apart from Crises and Young are lagged by two quarters to avoid possible endogeneity. The coefficients presented are hazard rates, which show how much a one unit change in the independent variable increases (decreases) the probability of a bank's failure. z values are provided in parentheses; values below one indicate a decline in bank probability of failure, and values above one indicate an increase in the dependent variable. All models are estimated with robust standard errors clustered by bank. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

TABLE 3-5
MARGINAL EFFECTS OF BANK EFFICIENCIES, BANKING AND MARKET CRISES ON BANKS' PROBABILITY OF FAILURE

Panel A: Marginal effects of cost, technical and allocative efficiencies on banks' probability of failure at normal times, banking and market crises			
	CE	TE	AE
Normal times	**-0.0080****	**-0.0065****	**-0.0065****
	(-2.14)	**(-2.09)**	**(-2.30)**
Banking Crises	**-0.0083***	-0.0066	**-0.0053***
	(-1.76)	(-1.57)	**(-1.70)**
Market crises	**-0.0132****	**-0.0125***	**-0.0062***
	(-1.96)	**(-1.95)**	**(-1.67)**
Panel B: Marginal effects of Banking crises as opposed to normal times, given different levels of efficiencies			
	CE	TE	AE
p25	**0.5785****	**0.5977***	0.2860
	(1.97)	**(1.90)**	(1.09)
p50	**0.5623****	**0.5879****	0.3290
	(1.98)	**(1.97)**	(1.47)
p75	**0.5451***	**0.5771****	**0.3565***
	(1.91)	**(1.97)**	**(1.74)**
Panel C: Marginal effects of Market crises as opposed to normal times, given different levels of efficiencies			
	CE	TE	AE
p25	0.1774	0.2636	0.1018
	(1.39)	(1.45)	(0.38)
p50	0.0772	0.1377	0.0949
	(0.93)	(1.28)	(0.54)
p75	0.0083	0.0465	0.0884
	(0.09)	(0.54)	(0.77)

NOTES: This table shows the results of efficiencies, banking and market crises marginal effects on banks' probability of failure. The efficiencies employed include cost efficiency (**CE**), technical efficiency (**TE**) and allocative efficiency (**AE**). The dependent variable, **Fail**, is a dummy that equals one if a bank failed or received government assistance in a given quarter, and zero otherwise. **Banking crises** is a dummy that equals one for periods of banking crises and the following four quarters; and **Market crises** is a dummy that equals one for periods of market crises and the following four quarters. Banking crises are the 1990s credit crunch between 1990:Q1 and 1992:Q4; and the global financial crisis that took place between 2007:Q3 and 2009:Q4; and three market crises are the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3. Panel A shows the results of marginal CE, TE and AE effects on banks' probability of failure during normal, banking and market crisis periods; Panel B and Panel C show respectively the results of marginal Banking crises and Market crises effects on banks' probability of failure given the first (p25), second (p50) and third (p75) quartile of the sample efficiencies. The equality tests of the marginal CE, TE and AE effects between normal, banking and market crisis periods, and the equality tests of the marginal Banking crises and Market crises effects between the last and first quartile of sample efficiencies are insignificant and excluded to save space. The coefficients presented in Panel A, Panel B and Panel C show how a one unit change in the independent variable increases (decreases) the hazard rates computed using a parametric survival model. z values are provided in parentheses. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

TABLE 3-6
THE EFFECTS OF BANK EFFICIENCY, GLOBAL FINANCIAL CRISIS AND OTHER CRISES ON BANKS' PROBABILITY OF FAILURE

	(1) CE	(2) TE	(3) AE
Efficiency$_{t-2}$	**0.990*** **	**0.994*** **	**0.985*** **
	(-4.021)	**(-2.929)**	**(-6.014)**
GFC	**2.299*** **	**2.649*** **	0.646
	(4.560)	**(4.680)**	(-1.223)
Other crises	**1.266***	**1.368****	0.815
	(1.956)	**(2.345)**	(-0.776)
GFC*Efficiency $_{t-2}$	1.009**	1.003	1.021***
	(2.027)	(0.710)	(4.640)
Other crises*Efficiency $_{t-2}$	0.998	0.996	1.005
	(-0.586)	(-1.227)	(1.515)
ROA $_{t-2}$	0.268***	0.265***	0.267***
	(-32.044)	(-32.264)	(-31.845)
Size $_{t-2}$	1.059**	1.064**	1.069***
	(2.364)	(2.574)	(2.754)
Leverage $_{t-2}$	1.085***	1.085***	1.087***
	(9.827)	(9.711)	(10.075)
NPL $_{t-2}$	1.204***	1.202***	1.205***
	(13.181)	(13.055)	(13.477)
M_share $_{t-2}$	1.002	1.002	1.003
	(0.124)	(0.133)	(0.188)
TMTF $_{t-2}$	0.661***	0.659***	0.659***
	(-7.807)	(-7.830)	(-7.821)
Growth $_{t-2}$	0.949**	0.949**	0.947**
	(-2.025)	(-2.007)	(-2.070)
Young	1.333***	1.359***	1.339***
	(5.890)	(6.346)	(6.065)
Constant	0.001***	0.001***	0.002***
	(-16.293)	(-16.723)	(-13.574)
Observations	1,160,804	1,160,804	1,160,804

NOTES: This table shows the results of how bank cost efficiency (**CE**), technical efficiency (**TE**) and allocative efficiency (**AE**) affect banks' probability of failure. The method employed is a parametric survival (PS) model, with a Gompertz proportional hazard function. The dependent variable, **Fail**, is a dummy that equals one if a bank failed or received government assistance in a given quarter, and zero otherwise. **GFC** is a dummy that equals 1 for periods of the global financial crisis and the following four quarters; and **Other crises** is a dummy that equals one for periods of other crises and the following four quarters. The global financial crisis took place between 2007:Q3 and 2009:Q4; and other crises include the 1990s credit crunch between 1990:Q1 and 1992:Q4; the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3. **ROA** is the ratio between bank net income and bank total assets, **Size** is the log of bank total assets measured in thousands of US dollars and in real terms, **Leverage** is the ratio between bank total assets and bank book value of equity, **NPL** is the ratio between non-performing loans and total loans, **M_Share** is the ratio between bank total assets and the volume of bank total assets in the State where the bank is chartered, **TMTF** is the average capital ratio of the other banks in the same State, **Growth** is the quarterly change of personal income growth in the State where the bank is chartered, and **Young** is a dummy variable that equals one if a bank is young, and zero otherwise. Young is defined as a bank, which is younger that the first quartile of the banks' age in the sample. All independent variables apart from Crises and Young are lagged by two quarters to avoid possible endogeneity. The coefficients presented are hazard rates, which show how much a one unit change in the independent variable increases (decreases) the probability of a bank's failure. z values are provided in parentheses; values below one indicate a decline in bank probability of failure, and values above one indicate an increase in the dependent variable. All models are estimated with robust standard errors clustered by bank. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

TABLE 3-7
MARGINAL EFFECTS OF BANK EFFICIENCIES, GLOBAL FINANCIAL CRISIS AND OTHER CRISES ON BANKS' PROBABILITY OF FAILURE

Panel A: Marginal effects of cost, technical and allocative efficiencies on banks' probability of failure at normal times, GFC and other crisis periods			
	CE	TE	AE
Normal times	**-0.0059****	**-0.0043****	**-0.0043****
	(-2.18)	**(-2.05)**	**(-2.28)**
GFC	-0.0005	-0.0013	0.0012
	(-0.37)	(-0.88)	(1.05)
Other crises	**-0.0088****	**-0.0084****	**-0.0036***
	(-2.08)	**(-2.05)**	**(-1.87)**
Panel B: The equality tests of the marginal CE, TE and AE effects between normal, GFC and other crisis periods			
Efficiency effect at normal times = efficiency effect at GFC	**3.77***	2.28	**3.73***
Efficiency effect at other crises = efficiency effect at GFC	**3.94****	**3.96****	**2.91***
Panel C: Marginal effects of GFC as opposed to normal times, given different levels of efficiencies			
	CE	TE	AE
p25	**1.1437****	**1.2747****	**0.6452****
	(2.08)	**(2.06)**	**(2.06)**
p50	**1.1932****	**1.2321****	**0.7647****
	(2.09)	**(2.08)**	**(2.06)**
p75	**1.2291****	**1.1955****	**0.8331****
	(2.06)	**(2.05)**	**(2.05)**
Panel D: Marginal effects of other crisis periods as opposed to normal times, given different levels of efficiencies			
	CE	TE	AE
p25	1.222	0.1361	0.0561
	(1.58)	(1.58)	(1.52)
p50	0.0878	0.0832	**0.0652***
	(1.49)	(1.36)	**(1.70)**
p75	0.0628	0.0467	**0.0690***
	(1.14)	(0.83)	**(1.73)**

NOTES: This table shows the results of efficiencies, global financial crisis and other crises marginal effects on banks' probability of failure. The dependent variable, **Fail**, is a dummy that equals one if a bank failed or received government assistance in a given quarter, and zero otherwise. The efficiencies employed include cost efficiency (**CE**), technical efficiency (**TE**) and allocative efficiency (**AE**). **GFC** is a dummy that equals 1 for periods of the global financial crisis and the following four quarters; and **Other crises** is a dummy that equals 1 for periods of all other crises and the following four quarters. global financial crisis took place between 2007:Q3 and 2009:Q4; and other crises include the 1990s credit crunch between 1990:Q1 and 1992:Q4; the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3. Panel A shows the results of marginal CE, TE and AE effects on banks' probability of failure during normal, GFC and other crisis periods; Panel B shows the equality tests of the marginal CE, TE and AE effects between normal and GFC and other crisis periods and GFC; Panel C and Panel D show respectively the results of marginal GFC and Other crises effects on banks' probability of failure given the first (p25), second (p50) and third (p75) quartile of the sample efficiencies. The equality tests of the marginal GFC and Other crises effects between the last and first quartile of sample efficiencies are insignificant and excluded to save space. The coefficients presented in Panel A, Panel B and Panel C show how a one unit change in the independent variable increases (decreases) the hazard rates computed using a parametric survival model. z values are provided in parentheses for Panels A, C and D. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

TABLE 3-8
THE EFFECTS OF BANK EFFICIENCY, BANK YOUTH AND CRISES ON BANKS' PROBABILITY OF FAILURE

Panel A: PS model results			
	(1) CE	(2) TE	(3) AE
Efficiency$_{t-2}$	**0.989*** **	**0.991*** **	**0.989*** **
	(-3.427)	**(-3.046)**	**(-3.783)**
Crises	**1.619*** **	**1.628*** **	1.366
	(3.037)	**(2.723)**	(0.988)
Young	0.995	0.998	1.068
	(-0.029)	(-0.011)	(0.186)
Crises*Efficiency $_{t-2}$	0.994	0.994	1.000
	(-1.529)	(-1.507)	(-0.066)
Young*Crises	0.816	0.813	0.632
	(-0.886)	(-0.823)	(-0.963)
Young*Efficiency $_{t-2}$	1.006	1.005	1.002
	(1.112)	(1.055)	(0.375)
Young*Crises*Efficiency $_{t-2}$	1.012*	1.010*	1.008
	(1.850)	(1.765)	(1.327)
ROA $_{t-2}$	0.260***	0.258***	0.257***
	(-33.670)	(-33.721)	(-33.473)
Size $_{t-2}$	1.050**	1.059**	1.073***
	(1.962)	(2.331)	(2.905)
Leverage $_{t-2}$	1.084***	1.084***	1.086***
	(9.736)	(9.673)	(9.946)
NPL $_{t-2}$	1.210***	1.209***	1.209***
	(13.502)	(13.420)	(13.599)
M_share $_{t-2}$	1.002	1.003	1.001
	(0.109)	(0.162)	(0.067)
TMTF $_{t-2}$	0.702***	0.700***	0.700***
	(-6.804)	(-6.882)	(-6.748)
Growth $_{t-2}$	0.900***	0.901***	0.900***
	(-4.094)	(-4.062)	(-4.102)
Constant	0.001***	0.001***	0.001***
	(-16.380)	(-16.748)	(-14.305)
Observations	1,160,804	1,160,804	1,160,804

Panel B: Marginal effects of efficiency on banks probability of failure for young and old banks at normal and crisis periods						
	CE		TE		AE	
	Young banks	Old banks	Young banks	Old banks	Young banks	Old banks
Normal times	-0.0072	**-0.0051****	-0.0061	**-0.0045****	-0.0097	**-0.0041****
	(-1.21)	**(-2.17)**	(-1.19)	**(-2.13)**	(-1.57)	**(-2.27)**
Crises	-0.0011	**-0.0086****	-0.0012	**-0.0080****	-0.0026	**-0.0046***
	(-0.23)	**(-2.04)**	(-0.26)	**(-2.02)**	(-0.55)	**(-1.82)**

Panel C: Marginal effects of financial crises on bank probability of failure for young and old banks given different levels of efficiency						
	CE		TE		AE	
	Young banks	Old banks	Young banks	Old banks	Young banks	Old banks
p25	**0.6579***	**0.1759***	**0.7170***	**0.1682***	**0.5646***	**0.1257***
	(1.82)	**(1.75)**	**(1.83)**	**(1.69)**	**(1.74)**	**(1.65)**
p50	**0.7441***	0.0984	**0.7905***	0.0939	**0.6405***	**0.1093***
	(1.87)	(1.58)	**(1.88)**	(1.50)	**(1.75)**	**(1.68)**
p75	**0.8168***	0.0477	**0.8485***	0.0469	**0.6796***	**0.1009***
	(1.83)	(0.98)	**(1.85)**	(0.90)	**(1.74)**	**(1.64)**

NOTES: This table shows the results of how banks probability of failure is affected by bank efficiencies (the efficiencies employed include cost efficiency (**CE**), technical efficiency (**TE**) and allocative efficiency (**AE**)), youth and crises. Panel A shows the results of the parametric survival (PS) model, with a Gompertz proportional hazard function. The dependent variable, **Fail**, is a dummy that equals one if a bank failed or received government assistance in a given quarter, and zero otherwise. **Banking crises** is a dummy that equals one for periods of banking crisis and the following four quarters; and **Market crises** is a dummy that equals one for periods of market crisis and the following four quarters. The two banking crises are the 1990s credit crunch between 1990:Q1 and 1992:Q4; and the global financial crisis that took place between 2007:Q3 and 2009:Q4; and the three market crises are the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3. **Young** is a dummy variable that equals one if a bank is young, and zero otherwise. Young is defined as a bank, which is younger that the first quartile of the banks' age in the sample. **ROA** is the ratio between bank net income and bank total assets, **Size** is the log of bank total assets measured in thousands of US dollars and in real terms, **Leverage** is the ratio between bank total assets and bank book value of equity, **NPL** is the ratio between non-performing loans and total loans, **M_Share** is the ratio between bank total assets and the volume of bank total assets in the State where the bank is chartered, **TMTF** is the average capital ratio of the other banks in the same State, **Growth** is the quarterly change of personal income growth in the State where the bank is chartered. All independent variables apart from Crises and Young are lagged by two quarters to avoid possible endogeneity. The coefficients presented are hazard rates, which show how much a one unit change in the independent variable increases (decreases) the probability of a bank's failure. z values are provided in parentheses; values below one indicate a decline in bank probability of failure, and values above one indicate an

increase in the dependent variable. All models are estimated with robust standard errors clustered by bank. Panel B presents marginal efficiency effects on banks probability of failure for young and old banks at normal and crisis periods, and Panel C presents Marginal crises effects on bank probability of failure for young and old banks given the first (p25), second (p50) and third (p75) quartile of the sample efficiencies. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

TABLE 3-9
OLS REGRESSION RESULTS

Panel A: OLS regression results						
	(1) CE	(2) TE	(3) AE	(4) CE	(5) TE	(6) AE
Enter_norm	**4.331*** **	**4.627*** **	**0.673*** **	**4.339*** **	**4.633*** **	**0.681*** **
	(13.418)	**(13.228)**	**(2.883)**	**(13.444)**	**(13.245)**	**(2.917)**
Enter_cr	**7.103*** **	**6.997*** **	**2.279*** **			
	(19.074)	**(17.661)**	**(7.899)**			
Enterbcr				**5.540*** **	**5.915*** **	**0.858***
				(10.325)	**(10.564)**	**(1.873)**
Entermcr				**7.860*** **	**7.521*** **	**2.967*** **
				(17.975)	**(16.115)**	**(8.935)**
ROA_{t-2}	2.527***	2.080***	1.630***	2.536***	2.086***	1.639***
	(19.960)	(15.686)	(15.418)	(20.036)	(15.732)	(15.516)
$Size_{t-2}$	-6.607***	-6.502***	-2.921***	-6.605***	-6.500***	-2.919***
	(-85.850)	(-79.261)	(-56.993)	(-85.797)	(-79.217)	(-56.948)
$Leverage_{t-2}$	-0.585***	-0.724***	0.038**	-0.586***	-0.725***	0.036**
	(-24.363)	(-28.802)	(2.550)	(-24.421)	(-28.833)	(2.463)
NPL_{t-2}	-0.137***	-0.054	-0.154***	-0.136***	-0.053	-0.153***
	(-2.734)	(-1.002)	(-4.078)	(-2.714)	(-0.988)	(-4.054)
M_share_{t-2}	0.687***	0.741***	0.157***	0.688***	0.742***	0.158***
	(9.027)	(10.590)	(3.950)	(9.042)	(10.601)	(3.974)
$TMTF_{t-2}$	0.680***	0.855***	-0.027	0.669***	0.848***	-0.037
	(5.206)	(6.245)	(-0.345)	(5.148)	(6.214)	(-0.462)
$Growth_{t-2}$	-0.367***	-0.294***	-0.202***	-0.368***	-0.295***	-0.202***
	(-12.218)	(-9.170)	(-9.347)	(-12.237)	(-9.181)	(-9.370)
Young	-6.782***	-5.928***	-3.161***	-6.783***	-5.929***	-3.161***
	(-33.020)	(-26.632)	(-22.960)	(-33.027)	(-26.636)	(-22.968)
Time dummy	YES	YES	YES	YES	YES	YES
Constant	134.589***	138.628***	124.708***	134.629***	138.656***	124.744***
	(115.106)	(111.792)	(172.669)	(115.354)	(112.000)	(172.695)
Observations	1,159,652	1,159,652	1,159,652	1,159,652	1,159,652	1,159,652
R-squared	0.27	0.23	0.24	0.27	0.23	0.24
Panel B: Equality tests between the effects of entry variables on banks' efficiency levels						
	CE	TE	AE	CE	TE	AE
Enter_norm=Enter_cr	**49.36*** **	**32.02 *** **	**27.29*** **			
Enter_norm=Enterbcr				**4.72** **	**4.96** **	0.14
Enter_norm=Entermcr				**59.70*** **	**35.33*** **	**43.15*** **
Enterbcr=Entermcr				**13.91*** **	**6.14** **	**16.13*** **

NOTES: This table shows the results of how entry during normal times (**Enter_norm**), crisis periods (**Enter_cr**), banking crises (**Enterbcr**) and market crises (**Entermcr**) affect banks' cost efficiency (**CE**), technical efficiency (**TE**) and allocative efficiency (**AE**). The method employed is an ordinary least squares (OLS) regression. The dependent variables are CE, TE and AE that present respectively banks' cost, technical and allocative efficiencies. Enter_norm is a dummy that equals one if a bank entered the market during normal times, Enter_cr is a dummy that equals one if a bank entered the market during crisis periods, Enterbcr is a dummy that equals one if a bank entered the market during a banking crisis, and Entermcr is a dummy that equals one if a bank entered the market during a market crisis. Crisis periods are two banking crises (the 1990s credit crunch between 1990:Q1 and 1992:Q4; and the global financial crisis that took place between 2007:Q3 and 2009:Q4), and three market crises (the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3). Entry is defined as the beginning of a bank's operations in the sample period. **ROA** is the ratio between bank net income and bank total assets, **Size** is the log of bank total assets measured in thousands of US dollars and in real terms, **Leverage** is the ratio between bank total assets and bank book value of equity, **NPL** is the ratio between non-performing loans and total loans, **M_Share** is the ratio between bank total assets and the volume of bank total assets in the State where the bank is chartered, **TMTF** is the average capital ratio of the other banks in the same State, **Growth** is the quarterly change of personal income growth in the State where the bank is chartered, and **Young** is a dummy variable that equals one if a bank is young, and zero otherwise. Young is defined as a bank, which is younger that the first quartile of the banks' age in the sample. All independent variables apart from Crises and Young are lagged by two quarters to avoid possible endogeneity. The coefficients presented show how much a one unit change in the independent variable increases (decreases) the efficiencies. Panel B presents equality tests between the effects of entry variables on banks' efficiency levels. z values are provided in parentheses. All models are estimated with robust standard errors clustered by bank. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

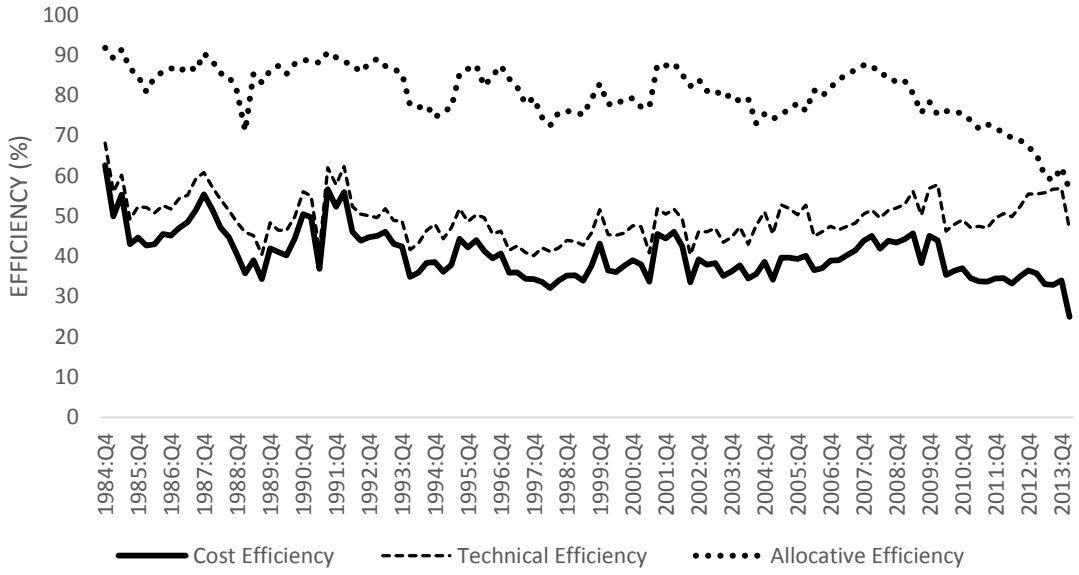
3.8.1. Additional Figures and Tables

TABLE A 3-1
SUMMARY STATISTICS OF THE VARIABLES USED FOR BANK EFFICIENCY ESTIMATION

	N	mean	p50	St. dev.	p1	p99
INPUTS						
Total deposits	1,214,969	430,955.700	60,620.000	8,708,278.000	5,647.000	3,955,689.000
Premises and fixed assets	1,214,969	6,917.480	1,079.000	97,828.200	21.000	64,645.000
Number of employees	1,214,969	148.534	30.000	2,145.925	4.000	1,462.000
OUTPUTS						
Total securities	1,214,969	119,270.800	16,519.000	2,292,085.000	250.000	1,167,583.000
Loans and leases	1,214,969	365,091.400	40,265.000	6,611,377.000	2544.000	3,619,609.000
INPUT PRICES						
Price of deposits	1,214,969	0.024	0.020	0.112	0.001	0.071
Price of premises and fixed assets	1,214,969	0.369	0.161	43.097	0.024	1.961
Price of labour	1,214,969	24.770	20.587	27.065	4.625	82.929

NOTES: This table presents summary statistics of inputs, outputs, and input prices used for cost, technical and allocative efficiency estimation. The inputs are Total deposits, which include demand deposits, money market deposits, other savings deposits, time deposits and deposits in foreign offices, Premises and fixed assets, which include bank premises, furniture and fixtures, equipment and other assets representing bank premises (including capitalized leases) owned by the institution and Number of employees, which represent the number of full-time employees on the payroll of the bank and its subsidiaries at the end of the quarter. The outputs include Total securities that show total investment securities, excluding securities held in trading accounts and Total loans and leases that show bank total loans and lease financing receivables, including unearned income. Input prices are Price of deposits, measured by the expenses for total deposits divided to Total deposits, Price of premises and fixed assets measured by the expenses of premises and fixed assets divided to Premises and fixed assets, Price of labour, measured by total labour expenses divided to the Number of employees.

FIGURE A 3-1
TIME SERIES TRENDS OF BANKS' COST, TECHNICAL AND ALLOCATIVE EFFICIENCIES IN THE SAMPLE BETWEEN 1984 AND 2013



NOTES: This figure shows the time series trends of banks' average cost, technical and allocative efficiency measures in the sample between 1984 and 2013. The efficiency measures have been obtained using DEA and can acquire the values between 0 and 100, with banks that have an efficiency measure of 100 % forming the efficient frontier, according to which, other bank efficiency levels are determined.

TABLE A 3-2
EFFICIENCY MEASURES ACROSS NORMAL TIMES, BANKING AND MARKET CRISES

Symbol Description	N	mean	p50	St. dev.	p1	p99
Panel A: Cost Efficiency						
Full sample						
Normal Times	626979	39.969	39.700	19.703	5.200	90.000
Market Crises	248319	40.699	41.200	20.136	4.200	90.100
Banking Crises	285506	44.345	44.400	18.714	5.000	91.600
Panel B: Technical Efficiency						
Full sample						
Normal Times	626979	49.120	50.200	20.718	8.700	100.000
Market Crises	248319	48.224	49.100	20.336	6.500	100.000
Banking Crises	285506	51.460	52.400	19.513	8.400	100.000
Panel C: Allocative Efficiency						
Full sample						
Normal Times	626979	79.972	84.700	16.087	29.200	99.500
Market Crises	248319	81.891	86.700	15.289	33.400	99.600
Banking Crises	285506	85.287	88.900	12.753	37.600	99.600

NOTES: This table presents summary statistics of the efficiency variables across different time periods used in this chapter. Panel A presents summary statistics of the cost efficiency variable during Normal Times, Market Crises and Banking Crises. Panel B and Panel C present respectively the summary statistics of the two cost efficiency components, technical and allocative efficiency, across different time periods. Efficiency values are reported as percentages, and can acquire a value between 0 and 100. The time periods include Normal Times, Market Crises and Banking Crises. Normal Times are when no crisis takes place; Market Crises include the stock market crash in 1987:Q4, the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4 and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3; and the Banking Crises include the 1990s credit crunch between 1990:Q1 and 1992:Q4 and the global financial crisis that took place between 2007:Q3 and 2009:Q4. Crisis periods include also four quarters of post-crisis periods.

TABLE A 3-3
CORRELATION MATRIX

	Crises	Banking crises	Market crises	CE	TE	AE	ROA	Size	Leverage	NPL	M_Share	TMTF	Growth	Young	Enter_norm	Enter_cr
Crises	1.000															
Banking crises	**0.619**	1.000														
Market crises	**0.565**	-0.298	1.000													
CE	0.068	0.091	-0.013	1.000												
TE	0.020	0.055	-0.033	**0.916**	1.000											
AE	0.122	0.134	0.007	**0.573**	**0.244**	1.000										
ROA	-0.055	-0.073	0.010	0.028	0.019	0.017	1.000									
Size	0.002	-0.006	0.009	-0.409	-0.365	-0.267	0.096	1.000								
Leverage	0.007	0.029	-0.022	-0.150	-0.189	0.017	-0.251	0.127	1.000							
NPL	-0.044	-0.009	-0.044	0.059	0.043	0.060	-0.287	-0.144	-0.108	1.000						
M_Share	0.003	0.001	0.002	-0.074	-0.060	-0.067	0.028	0.377	-0.035	0.007	1.000					
TMTF	0.036	0.038	0.005	-0.151	-0.042	-0.243	0.120	0.275	0.275	-0.284	0.060	1.000				
Growth	-0.100	-0.113	-0.004	0.001	-0.019	0.026	0.037	-0.042	-0.042	-0.016	0.002	-0.152	1.000			
Young	0.004	0.008	-0.003	-0.094	-0.074	-0.065	-0.185	-0.022	-0.082	0.010	-0.021	-0.023	0.024	1.000		
Enter_norm	**0.034**	**0.025**	**0.015**	**-0.049**	**-0.021**	**-0.069**	-0.125	0.012	0.025	-0.045	-0.008	0.116	-0.012	0.504	1.000	
Enter_cr	**0.009**	**0.015**	**-0.005**	**-0.026**	**0.002**	**-0.058**	-0.092	0.055	0.053	-0.067	0.000	0.186	-0.026	0.414	-0.071	1.000

NOTES: This table shows the correlation matrix for all explanatory variables used in this chapter. The correlation values in **bold** represent the variables that have not been used jointly in an analysis. **Crises** is a dummy that equals one for periods of financial distress and the following four quarters. Crisis periods are two **Banking crises** (the 1990s credit crunch between 1990:Q1 and 1992:Q4; and the global financial crisis that took place between 2007:Q3 and 2009:Q4) and three **Market crises** (the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3). **CE**, **TE** and **AE** are cost, technical and allocative efficiency measures, respectively, estimated using DEA. **ROA** is the ratio between bank net income and bank total assets, **Size** is the log of bank total assets measured in thousands of US dollars and in real terms, **Leverage** is the ratio between bank total assets and bank book value of equity, **NPL** is the ratio between non-performing loans and total loans, **M_Share** is the ratio between bank total assets and the volume of bank total assets in the State where the bank is chartered, **TMTF** is the average capital ratio of the other banks in the same State, **Growth** is the quarterly change of personal income growth in the State where the bank is chartered, and **Young** is a dummy variable that equals one if a bank is young, and zero otherwise. Young is defined as a bank, which is younger that the first quartile of the banks' age in the sample. **Enter_norm** and **Enter_cr** are dummy variables that equal one if a bank entered during normal or crisis periods, respectively, and zero otherwise.

TABLE A 3-4
ALTERNATIVE MEASURES OF CRISES

Panel A. PS model results

	(1) CE	(2) TE	(3) AE	(1) CE	(2) TE	(3) AE
Efficiency$_{t-2}$	**0.992*** **	**0.993*** **	**0.992*** **	**0.989*** **	**0.992*** **	**0.990*** **
	(-5.073)	**(-4.769)**	**(-4.539)**	**(-4.664)**	**(-4.349)**	**(-4.819)**
Crises	**1.194*** **	**1.177*** **	**1.201*** **	1.000	1.001	0.714
	(3.630)	**(3.334)**	**(3.744)**	(0.001)	(0.007)	(-1.381)
Efficiency$_{t-2}$*Crises				1.005*	1.004	1.007**
				(1.741)	(1.416)	(2.166)
ROA $_{t-2}$	0.257***	0.255***	0.257***	0.257***	0.255***	0.256***
	(-33.679)	(-33.857)	(-33.324)	(-33.740)	(-33.873)	(-33.438)
Size $_{t-2}$	1.067***	1.073***	1.077***	1.068***	1.074***	1.079***
	(2.643)	(2.910)	(3.077)	(2.690)	(2.961)	(3.130)
Capital $_{t-2}$	1.084***	1.084***	1.086***	1.084***	1.084***	1.086***
	(9.771)	(9.667)	(9.966)	(9.781)	(9.677)	(9.960)
NPL $_{t-2}$	1.202***	1.201***	1.203***	1.202***	1.202***	1.203***
	(13.062)	(12.982)	(13.247)	(13.108)	(13.023)	(13.275)
M_share $_{t-2}$	1.005	1.005	1.003	1.005	1.005	1.004
	(0.254)	(0.280)	(0.185)	(0.284)	(0.308)	(0.216)
TMTF $_{t-2}$	0.686***	0.684***	0.683***	0.688***	0.685***	0.687***
	(-7.103)	(-7.142)	(-7.113)	(-7.060)	(-7.141)	(-7.006)
Growth $_{t-2}$	0.895***	0.897***	0.897***	0.894***	0.896***	0.893***
	(-4.270)	(-4.203)	(-4.196)	(-4.318)	(-4.209)	(-4.311)
Young	1.347***	1.359***	1.355***	1.340***	1.354***	1.355***
	(6.079)	(6.321)	(6.258)	(5.985)	(6.247)	(6.255)
Constant	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(-17.326)	(-17.613)	(-15.979)	(-17.044)	(-17.311)	(-15.298)
Observations	1,160,804	1,160,804	1,160,804	1,160,804	1,160,804	1,160,804

Panel B. Marginal efficiency effects on banks probability of failure at normal and crisis periods

	CE	TE	AE
Normal times	**-0.0076****	**-0.0064****	**-0.0054****
	(-2.20)	**(-2.20)**	**(-2.24)**
Crises	**-0.0046***	**-0.0041***	-0.0024
	(-1.76)	**(-1.67)**	(-1.36)

Panel C. Marginal crises effects on bank probability of failure given different levels of efficiency

	CE	TE	AE
p25	0.1160	0.1163	0.0962
	(1.47)	(1.45)	(1.57)
p50	**0.1607***	**0.1518***	**0.1304***
	(1.73)	**(1.68)**	**(1.74)**
p75	**0.1921***	**0.1758***	**0.1475***
	(1.73)	**(1.68)**	**(1.76)**

NOTES: This table shows the results of how bank cost efficiency (**CE**), technical efficiency (**TE**) and allocative efficiency (**AE**) affect banks' probability of failure. The method employed is a parametric survival (PS) model, with a Gompertz proportional hazard function. The dependent variable, **Fail**, is a dummy that equals one if a bank failed or received government assistance in a given quarter, and zero otherwise. **Crises** is a dummy that equals one for periods of financial distress and the following **two** quarters. Crisis periods are two banking crises (the 1990s credit crunch between 1990:Q1 and 1992:Q4; and the global financial crisis that took place between 2007:Q3 and 2009:Q4) and three market crises (the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3). **ROA** is the ratio between bank net income and bank total assets, **Size** is the log of bank total assets measured in thousands of US dollars and in real terms, **Leverage** is the ratio between bank total assets and bank book value of equity, **NPL** is the ratio between non-performing loans and total loans, **M_Share** is the ratio between bank total assets and the volume of bank total assets in the State where the bank is chartered, **TMTF** is the average capital ratio of the other banks in the same State, **Growth** is the quarterly change of personal income growth in the State where the bank is chartered, and **Young** is a dummy variable that equals one if a bank is young, and zero otherwise. Young is defined as a bank, which is younger that the first quartile of the banks' age in the sample. All independent variables apart from Crises and Young are lagged by two quarters to avoid possible endogeneity. The coefficients presented are hazard rates, which show how much a one unit change in the independent variable increases (decreases) the probability of a bank's failure. z values are provided in parentheses; values below one indicate a decline in bank probability of failure, and values above one indicate an increase in the dependent variable. All models are estimated with robust standard errors clustered by bank. Panel B presents marginal efficiency effects on banks probability of failure during normal and crisis periods, and Panel C presents Marginal crises effects on bank probability of failure given the first (p25), second (p50) and third (p75) quartile of the sample efficiencies. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

TABLE A 3-5
ALTERNATIVE MEASURES OF CRISES (1)

Panel A. PS model results

	(1) CE	(2) TE	(3) AE	(1) CE	(2) TE	(3) AE
Efficiency$_{t-2}$	**0.993*** **	**0.994*** **	**0.993*** **	0.997	1.000	**0.995***
	(-4.841)	**(-4.381)**	**(-4.385)**	(-0.999)	(-0.144)	**(-1.732)**
Crises	**1.556*** **	**1.541*** **	**1.569*** **	**1.900*** **	**2.124*** **	**1.935** **
	(7.504)	**(7.316)**	**(7.666)**	**(4.806)**	**(5.031)**	**(2.436)**
Efficiency$_{t-2}$*Crises				0.994*	0.993**	0.997
				(-1.672)	(-2.356)	(-0.789)
ROA $_{t-2}$	0.257***	0.255***	0.258***	0.258***	0.255***	0.258***
	(-33.674)	(-33.846)	(-33.331)	(-33.646)	(-33.861)	(-33.188)
Size $_{t-2}$	1.068***	1.075***	1.078***	1.065***	1.070***	1.078***
	(2.701)	(2.975)	(3.124)	(2.592)	(2.805)	(3.095)
Capital $_{t-2}$	1.084***	1.084***	1.087***	1.085***	1.084***	1.087***
	(9.917)	(9.816)	(10.104)	(9.933)	(9.841)	(10.095)
NPL $_{t-2}$	1.209***	1.208***	1.210***	1.209***	1.208***	1.210***
	(13.498)	(13.422)	(13.687)	(13.469)	(13.416)	(13.658)
M_share $_{t-2}$	1.003	1.004	1.002	1.003	1.004	1.002
	(0.190)	(0.211)	(0.119)	(0.193)	(0.214)	(0.114)
TMTF $_{t-2}$	0.735***	0.732***	0.733***	0.736***	0.736***	0.732***
	(-5.972)	(-6.027)	(-5.986)	(-5.949)	(-5.958)	(-5.994)
Growth $_{t-2}$	0.878***	0.880***	0.878***	0.878***	0.880***	0.879***
	(-5.145)	(-5.051)	(-5.112)	(-5.123)	(-5.061)	(-5.091)
Young	1.336***	1.349***	1.342***	1.342***	1.357***	1.343***
	(5.937)	(6.187)	(6.074)	(6.032)	(6.309)	(6.079)
Constant	0.000***	0.000***	0.001***	0.000***	0.000***	0.001***
	(-18.491)	(-18.754)	(-17.142)	(-18.379)	(-18.701)	(-16.171)
Observations	1,160,804	1,160,804	1,160,804	1,160,804	1,160,804	1,160,804

Panel B. Marginal efficiency effects on banks probability of failure at normal and crisis periods

	CE	TE	AE
Normal times	-0.0044	-0.0007	**-0.0064***
	(-1.06)	(-0.15)	**(-1.85)**
Crises	**-0.0171** **	**-0.0173***	**-0.0131***
	(-1.97)	**(-1.94)**	**(-1.80)**

Panel C. Marginal crises effects on bank probability of failure given different levels of efficiency

	CE	TE	AE
p25	**0.8857***	**1.0216***	**0.6859***
	(1.81)	**(1.80)**	**(1.71)**
p50	**0.6753***	**0.7441***	**0.5944***
	(1.81)	**(1.78)**	**(1.74)**
p75	**0.5070***	**0.5328***	**0.5459***
	(1.71)	**(1.68)**	**(1.74)**

NOTES: This table shows the results of how bank cost efficiency (**CE**), technical efficiency (**TE**) and allocative efficiency (**AE**) affect banks' probability of failure. The method employed is a parametric survival (PS) model, with a Gompertz proportional hazard function. The dependent variable, **Fail**, is a dummy that equals one if a bank failed or received government assistance in a given quarter, and zero otherwise. **Crises** is a dummy that equals one for periods of financial distress and the following **eight** quarters. Crisis periods are two banking crises (the 1990s credit crunch between 1990:Q1 and 1992:Q4; and the global financial crisis that took place between 2007:Q3 and 2009:Q4) and three market crises (the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3). **ROA** is the ratio between bank net income and bank total assets, **Size** is the log of bank total assets measured in thousands of US dollars and in real terms, **Leverage** is the ratio between bank total assets and bank book value of equity, **NPL** is the ratio between non-performing loans and total loans, **M_Share** is the ratio between bank total assets and the volume of bank total assets in the State where the bank is chartered, **TMTF** is the average capital ratio of the other banks in the same State, **Growth** is the quarterly change of personal income growth in the State where the bank is chartered, and **Young** is a dummy variable that equals one if a bank is young, and zero otherwise. Young is defined as a bank, which is younger that the first quartile of the banks' age in the sample. All independent variables apart from Crises and Young are lagged by two quarters to avoid possible endogeneity. The coefficients presented are hazard rates, which show how much a one unit change in the independent variable increases (decreases) the probability of a bank's failure. z values are provided in parentheses; values below one indicate a decline in bank probability of failure, and values above one indicate an increase in the dependent variable. All models are estimated with robust standard errors clustered by bank. Panel B presents marginal efficiency effects on banks probability of failure during normal and crisis periods, and Panel C presents Marginal crises effects on bank probability of failure given the first (p25), second (p50) and third (p75) quartile of the sample efficiencies. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

TABLE A 3-6
ALTERNATIVE MEASURE OF BANK EFFICIENCY

Panel A. PS model results

	(1) CE (averaged over 3 quarters)	(2) TE (averaged over 3 quarters)	(3) AE (averaged over 3 quarters)	(1) CE (averaged over 3 quarters)	(2) TE (averaged over 3 quarters)	(3) AE (averaged over 3 quarters)
Efficiency$_{t-2}$	**0.990*** **	**0.992*** **	**0.990*** **	**0.987*** **	**0.991*** **	**0.985*** **
	(-6.020)	**(-5.239)**	**(-5.303)**	**(-4.880)**	**(-3.709)**	**(-5.963)**
Crises	**1.506*** **	**1.474*** **	**1.504*** **	**1.307** **	**1.418** **	0.754
	(8.187)	**(7.752)**	**(8.168)**	**(2.164)**	**(2.482)**	(-1.053)
Efficiency$_{t-2}$*Crises				1.004	1.001	1.009***
				(1.252)	(0.297)	(2.623)
ROA $_{t-2}$	0.251***	0.248***	0.251***	0.251***	0.248***	0.250***
	(-31.544)	(-31.597)	(-31.235)	(-31.545)	(-31.586)	(-31.256)
Size $_{t-2}$	1.073***	1.083***	1.089***	1.074***	1.083***	1.090***
	(2.788)	(3.161)	(3.420)	(2.845)	(3.178)	(3.481)
Capital $_{t-2}$	1.081***	1.081***	1.084***	1.081***	1.081***	1.083***
	(9.028)	(8.927)	(9.222)	(9.033)	(8.929)	(9.216)
NPL $_{t-2}$	1.202***	1.200***	1.202***	1.202***	1.200***	1.202***
	(12.401)	(12.273)	(12.535)	(12.417)	(12.268)	(12.561)
M_share $_{t-2}$	1.002	1.003	1.001	1.002	1.003	1.001
	(0.102)	(0.145)	(0.050)	(0.122)	(0.150)	(0.081)
TMTF $_{t-2}$	0.706***	0.704***	0.704***	0.708***	0.704***	0.710***
	(-6.473)	(-6.512)	(-6.465)	(-6.407)	(-6.500)	(-6.309)
Growth $_{t-2}$	0.899***	0.901***	0.901***	0.898***	0.901***	0.898***
	(-4.078)	(-3.967)	(-3.967)	(-4.105)	(-3.965)	(-4.116)
Young	1.376***	1.392***	1.388***	1.371***	1.391***	1.387***
	(6.336)	(6.616)	(6.574)	(6.274)	(6.609)	(6.567)
Constant	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(-17.235)	(-17.546)	(-15.645)	(-17.069)	(-17.443)	(-14.803)
Observations	1,097,002	1,097,002	1,097,002	1,097,002	1,097,002	1,097,002

Panel B. Marginal efficiency effects on banks probability of failure at normal and crisis periods

	CE	TE	AE
Normal times	**-0.0109** **	**-0.0085** **	**-0.0075** **
	(-2.13)	**(-2.10)**	**(-2.17)**
Crises	**-0.0099** **	**-0.0100***	**-0.0041***
	(-1.99)	**(-1.94)**	**(-1.64)**

Panel C. Marginal crises effects on bank probability of failure given different levels of efficiency

	CE	TE	AE
p25	**0.4131***	**0.4648***	**0.2442***
	(1.86)	**(1.85)**	**(1.80)**
p50	**0.4100***	**0.4240***	**0.2759***
	(1.89)	**(1.86)**	**(1.84)**
p75	**0.4000***	**0.3916***	**0.2898***
	(1.84)	**(1.80)**	**(1.83)**

NOTES: This table shows the results of how bank cost efficiency (**CE**), technical efficiency (**TE**) and allocative efficiency (**AE**) affect banks' probability of failure. CE, TE and AE are averaged over 3 quarters. The method employed is a parametric survival (PS) model, with a Gompertz proportional hazard function. The dependent variable, **Fail**, is a dummy that equals one if a bank failed or received government assistance in a given quarter, and zero otherwise. **Crises** is a dummy that equals one for periods of financial distress and the following four quarters. Crisis periods are two banking crises (the 1990s credit crunch between 1990:Q1 and 1992:Q4; and the global financial crisis that took place between 2007:Q3 and 2009:Q4) and three market crises (the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3). **ROA** is the ratio between bank net income and bank total assets, **Size** is the log of bank total assets measured in thousands of US dollars and in real terms, **Leverage** is the ratio between bank total assets and bank book value of equity, **NPL** is the ratio between non-performing loans and total loans, **M_Share** is the ratio between bank total assets and the volume of bank total assets in the State where the bank is chartered, **TMTF** is the average capital ratio of the other banks in the same State, **Growth** is the quarterly change of personal income growth in the State where the bank is chartered, and **Young** is a dummy variable that equals one if a bank is young, and zero otherwise. Young is defined as a bank, which is younger that the first quartile of the banks' age in the sample. All independent variables apart from Crises and Young are lagged by two quarters to avoid possible endogeneity. The coefficients presented are hazard rates, which show how much a one unit change in the independent variable increases (decreases) the probability of a bank's failure. z values are provided in parentheses; values below one indicate a decline in bank probability of failure, and values above one indicate an increase in the dependent variable. All models are estimated with robust standard errors clustered by bank.

Panel B presents marginal efficiency effects on banks probability of failure during normal and crisis periods, and Panel C presents Marginal crises effects on bank probability of failure given the first (p25), second (p50) and third (p75) quartile of the sample efficiencies. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

TABLE A 3-7
EXCLUDING LARGEST BANKS

Panel A. PS model results						
	(1) CE	(2) TE	(3) AE	(1) CE	(2) TE	(3) AE
Efficiency$_{t-2}$	**0.992*** **	**0.993*** **	**0.992*** **	**0.992*** **	**0.994*** **	**0.990*** **
	(-5.446)	**(-4.917)**	**(-4.927)**	**(-3.046)**	**(-2.809)**	**(-4.073)**
Crises	**1.435*** **	**1.416*** **	**1.447*** **	**1.504*** **	**1.497*** **	1.143
	(7.454)	**(7.184)**	**(7.604)**	**(3.628)**	**(3.232)**	(0.560)
Efficiency$_{t-2}$*Crises				0.999	0.999	1.003
				(-0.468)	(-0.488)	(1.005)
ROA $_{t-2}$	0.256***	0.254***	0.256***	0.256***	0.254***	0.256***
	(-33.852)	(-34.041)	(-33.517)	(-33.846)	(-34.037)	(-33.530)
Size $_{t-2}$	1.086***	1.093***	1.097***	1.085***	1.093***	1.097***
	(3.432)	(3.739)	(3.904)	(3.426)	(3.726)	(3.906)
Capital $_{t-2}$	1.083***	1.082***	1.085***	1.083***	1.082***	1.085***
	(9.663)	(9.557)	(9.867)	(9.659)	(9.554)	(9.869)
NPL $_{t-2}$	1.206***	1.205***	1.208***	1.206***	1.205***	1.208***
	(13.396)	(13.308)	(13.602)	(13.373)	(13.284)	(13.626)
M_share $_{t-2}$	0.968*	0.969*	0.967*	0.967*	0.969*	0.968*
	(-1.744)	(-1.687)	(-1.781)	(-1.750)	(-1.692)	(-1.763)
TMTF $_{t-2}$	0.689***	0.686***	0.686***	0.688***	0.686***	0.688***
	(-7.164)	(-7.221)	(-7.169)	(-7.166)	(-7.222)	(-7.111)
Growth $_{t-2}$	0.900***	0.902***	0.901***	0.900***	0.902***	0.900***
	(-4.097)	(-4.018)	(-4.021)	(-4.080)	(-4.016)	(-4.065)
Young	1.334***	1.349***	1.341***	1.335***	1.351***	1.342***
	(5.879)	(6.161)	(6.026)	(5.906)	(6.189)	(6.035)
Constant	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(-17.863)	(-18.161)	(-16.491)	(-17.794)	(-18.061)	(-15.727)
Observations	1,158,653	1,158,653	1,158,653	1,158,653	1,158,653	1,158,653

Panel B. Marginal efficiency effects on banks probability of failure at normal and crisis periods			
	CE	TE	AE
Normal times	**-0.0075***	**-0.0064****	**-0.0068****
	(-2.04)	**(-2.00)**	**(-2.22)**
Crises	**-0.0113***	**-0.0098***	**-0.0061***
	(-2.01)	**(-1.94)**	**(-1.81)**

Panel C. Marginal crises effects on bank probability of failure given different levels of efficiency			
	CE	TE	AE
p25	**0.4512***	**0.4555***	**0.3006***
	(1.88)	**(1.86)**	**(1.81)**
p50	**0.3764***	**0.3864***	**0.2999***
	(1.87)	**(1.87)**	**(1.85)**
p75	**0.3172***	**0.3348***	**0.2983***
	(1.78)	**(1.79)**	**(1.85)**

NOTES: This table shows the results of how bank cost efficiency (**CE**), technical efficiency (**TE**) and allocative efficiency (**AE**) affect banks' probability of failure, after excluding the 19 largest banks per quarter. The method employed is a parametric survival (PS) model, with a Gompertz proportional hazard function. The dependent variable, **Fail**, is a dummy that equals one if a bank failed or received government assistance in a given quarter, and zero otherwise. **Crises** is a dummy that equals one for periods of financial distress and the following four quarters. Crisis periods are two banking crises (the 1990s credit crunch between 1990:Q1 and 1992:Q4; and the global financial crisis that took place between 2007:Q3 and 2009:Q4) and three market crises (the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3). **ROA** is the ratio between bank net income and bank total assets, **Size** is the log of bank total assets measured in thousands of US dollars and in real terms, **Leverage** is the ratio between bank total assets and bank book value of equity, **NPL** is the ratio between non-performing loans and total loans, **M_Share** is the ratio between bank total assets and the volume of bank total assets in the State where the bank is chartered, **TMTF** is the average capital ratio of the other banks in the same State, **Growth** is the quarterly change of personal income growth in the State where the bank is chartered, and **Young** is a dummy variable that equals one if a bank is young, and zero otherwise. Young is defined as a bank, which is younger that the first quartile of the banks' age in the sample. All independent variables apart from Crises and Young are lagged by two quarters to avoid possible endogeneity. The coefficients presented are hazard rates, which show how much a one unit change in the independent variable increases (decreases) the probability of a bank's failure. z values are provided in parentheses; values below one indicate a decline in bank probability of failure, and values above one indicate an increase in the dependent variable. All models are estimated with robust standard errors clustered by bank. Panel B presents marginal efficiency effects on banks probability of failure during normal and crisis periods, and Panel C presents Marginal crises effects on bank probability of failure given the first (p25), second (p50) and third (p75) quartile of the sample efficiencies. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

TABLE A 3-8
EXPONENTIAL DISTRIBUTION

Panel A. PS model results						
	(1) CE	(2) TE	(3) AE	(1) CE	(2) TE	(3) AE
Efficiency$_{t-2}$	**0.991*** **	**0.993*** **	**0.991*** **	**0.990*** **	**0.993*** **	**0.987*** **
	(-5.701)	**(-4.975)**	**(-5.767)**	**(-3.941)**	**(-3.224)**	**(-5.633)**
Crises	**1.540*** **	**1.523*** **	**1.555*** **	**1.447*** **	**1.499*** **	0.920
	(9.098)	**(8.855)**	**(9.309)**	**(3.241)**	**(3.194)**	(-0.357)
Efficiency$_{t-2}$*Crises				1.002	1.000	1.007**
				(0.599)	(0.139)	(2.283)
ROA $_{t-2}$	0.245***	0.242***	0.246***	0.245***	0.242***	0.246***
	(-34.870)	(-35.073)	(-34.287)	(-34.875)	(-35.067)	(-34.362)
Size $_{t-2}$	1.101***	1.111***	1.110***	1.102***	1.112***	1.108***
	(3.997)	(4.383)	(4.304)	(4.011)	(4.388)	(4.281)
Capital $_{t-2}$	1.087***	1.087***	1.090***	1.087***	1.087***	1.089***
	(9.965)	(9.858)	(10.225)	(9.964)	(9.858)	(10.211)
NPL $_{t-2}$	1.194***	1.192***	1.196***	1.194***	1.192***	1.197***
	(12.575)	(12.456)	(12.842)	(12.574)	(12.441)	(12.916)
M_share $_{t-2}$	0.996	0.997	0.995	0.997	0.997	0.996
	(-0.182)	(-0.168)	(-0.237)	(-0.173)	(-0.166)	(-0.189)
TMTF $_{t-2}$	0.925***	0.928***	0.917***	0.924***	0.928***	0.915***
	(-5.342)	(-5.139)	(-5.857)	(-5.375)	(-5.145)	(-5.995)
Growth $_{t-2}$	0.901***	0.903***	0.903***	0.901***	0.903***	0.900***
	(-4.166)	(-4.073)	(-4.107)	(-4.178)	(-4.073)	(-4.214)
Young	1.345***	1.363***	1.353***	1.343***	1.363***	1.353***
	(6.119)	(6.450)	(6.296)	(6.089)	(6.448)	(6.304)
Constant	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(-29.113)	(-29.895)	(-25.261)	(-28.119)	(-29.160)	(-22.327)
Observations	1,160,804	1,160,804	1,160,804	1,160,804	1,160,804	1,160,804

Panel B. Marginal efficiency effects on banks probability of failure at normal and crisis periods			
	CE	TE	AE
Normal times	**-0.0685*** **	**-0.0575*** **	**-0.0475*** **
	(-3.40)	**(-3.07)**	**(-3.65)**
Crises	**-0.0874*** **	**-0.0850** **	**-0.0362** **
	(-2.90)	**(-2.79)**	**(-2.26)**

Panel C. Marginal crises effects on bank probability of failure given different levels of efficiency			
	CE	TE	AE
p25	**3.8646*** **	**4.5192*** **	**1.9848*** **
	(2.88)	**(2.92)**	**(2.60)**
p50	**3.6001*** **	**4.1157*** **	**2.1040*** **
	(3.03)	**(3.02)**	**(2.74)**
p75	**3.3604*** **	**3.8000*** **	**2.1519*** **
	(2.93)	**(2.91)**	**(2.76)**

NOTES: This table shows the results of how bank cost efficiency (**CE**), technical efficiency (**TE**) and allocative efficiency (**AE**) affect banks' probability of failure. The method employed is a parametric survival (PS) model, with an **Exponential** proportional hazard function.. The dependent variable, **Fail**, is a dummy that equals one if a bank failed or received government assistance in a given quarter, and zero otherwise. **Crises** is a dummy that equals one for periods of financial distress and the following four quarters. Crisis periods are two banking crises (the 1990s credit crunch between 1990:Q1 and 1992:Q4; and the global financial crisis that took place between 2007:Q3 and 2009:Q4) and three market crises (the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3). **ROA** is the ratio between bank net income and bank total assets, **Size** is the log of bank total assets measured in thousands of US dollars and in real terms, **Leverage** is the ratio between bank total assets and bank book value of equity, **NPL** is the ratio between non-performing loans and total loans, **M_Share** is the ratio between bank total assets and the volume of bank total assets in the State where the bank is chartered, **TMTF** is the average capital ratio of the other banks in the same State, **Growth** is the quarterly change of personal income growth in the State where the bank is chartered, and **Young** is a dummy variable that equals one if a bank is young, and zero otherwise. Young is defined as a bank, which is younger that the first quartile of the banks' age in the sample. All independent variables apart from Crises and Young are lagged by two quarters to avoid possible endogeneity. The coefficients presented are hazard rates, which show how much a one unit change in the independent variable increases (decreases) the probability of a bank's failure. z values are provided in parentheses; values below one indicate a decline in bank probability of failure, and values above one indicate an increase in the dependent variable. All models are estimated with robust standard errors clustered by bank. Panel B presents marginal efficiency effects on banks probability of failure during normal and crisis periods, and Panel C presents Marginal crises effects on bank probability of failure given the first (p25), second (p50) and third (p75) quartile of the sample efficiencies. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

TABLE A 3-9
ACQUISITION AS EXIT

Panel A. PS model results

	(1) CE	(2) TE	(3) AE	(1) CE	(2) TE	(3) AE
Efficiency$_{t-2}$	**0.996*** **	**0.996*** **	**0.995*** **	**0.995*** **	**0.996*** **	**0.996*** **
	(-7.491)	**(-7.530)**	**(-7.525)**	**(-6.091)**	**(-6.160)**	**(-5.878)**
Crises	**0.941*** **	**0.933*** **	**0.949*** **	**0.923***	**0.914***	0.987
	(-3.101)	**(-3.591)**	**(-2.672)**	**(-1.843)**	**(-1.858)**	(-0.132)
Efficiency$_{t-2}$*Crises				1.001	1.000	1.000
				(0.512)	(0.458)	(-0.418)
ROA $_{t-2}$	0.801***	0.798***	0.804***	0.801***	0.798***	0.804***
	(-11.783)	(-11.966)	(-11.597)	(-11.784)	(-11.965)	(-11.582)
Size $_{t-2}$	1.155***	1.158***	1.169***	1.155***	1.158***	1.169***
	(15.308)	(15.795)	(17.337)	(15.312)	(15.796)	(17.309)
Capital $_{t-2}$	1.045***	1.045***	1.048***	1.045***	1.045***	1.048***
	(13.878)	(13.712)	(14.674)	(13.882)	(13.717)	(14.675)
NPL $_{t-2}$	0.912***	0.912***	0.911***	0.912***	0.912***	0.911***
	(-10.334)	(-10.239)	(-10.502)	(-10.318)	(-10.222)	(-10.504)
M_share $_{t-2}$	1.003	1.003	1.002	1.003	1.003	1.002
	(0.988)	(0.960)	(0.435)	(0.992)	(0.963)	(0.433)
TMTF $_{t-2}$	0.946***	0.944***	0.946***	0.946***	0.944***	0.946***
	(-4.278)	(-4.418)	(-4.326)	(-4.253)	(-4.408)	(-4.341)
Growth $_{t-2}$	1.045***	1.045***	1.047***	1.045***	1.045***	1.047***
	(5.587)	(5.551)	(5.777)	(5.581)	(5.552)	(5.781)
Young	1.408***	1.414***	1.412***	1.408***	1.414***	1.412***
	(16.570)	(16.802)	(16.798)	(16.566)	(16.793)	(16.784)
Constant	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***
	(-49.073)	(-49.531)	(-46.890)	(-48.798)	(-49.275)	(-46.004)
Observations	1,171,659	1,171,659	1,171,659	1,171,659	1,171,659	1,171,659

Panel B. Marginal efficiency effects on banks probability of being acquired at normal and crisis periods

	CE	TE	AE
Normal times	**-0.0221*** **	**-0.0197*** **	**-0.0215*** **
	(-5.46)	**(-5.52)**	**(-5.75)**
Crises	**-0.0183*** **	**-0.0165*** **	**-0.0225*** **
	(-4.41)	**(-4.25)**	**(-4.30)**

Panel C. Marginal crises effects on bank probability of being acquired given different levels of efficiency

	CE	TE	AE
p25	**-0.3311*** **	**-0.3668*** **	**-0.2379** **
	(-2.78)	**(-3.17)**	**(-2.33)**
p50	**-0.2742*** **	**-0.3131*** **	**-0.2509** **
	(-2.74)	**(-3.10)**	**(-2.43)**
p75	**-0.2266***	**-0.2713** **	**-0.2575** **
	(-1.85)	**(-2.22)**	**(-2.18)**

NOTES: This table shows the results of how bank cost efficiency (**CE**), technical efficiency (**TE**) and allocative efficiency (**AE**) affect banks' probability of being acquired. The method employed is a parametric survival (PS) model, with a Gompertz proportional hazard function.. The dependent variable, **Acq**, is a dummy that equals one if a bank was acquired in a given quarter, and zero otherwise. **Crises** is a dummy that equals one for periods of financial distress and the following four quarters. Crisis periods are two banking crises (the 1990s credit crunch between 1990:Q1 and 1992:Q4; and the global financial crisis that took place between 2007:Q3 and 2009:Q4) and three market crises (the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3). **ROA** is the ratio between bank net income and bank total assets, **Size** is the log of bank total assets measured in thousands of US dollars and in real terms, **Leverage** is the ratio between bank total assets and bank book value of equity, **NPL** is the ratio between non-performing loans and total loans, **M_Share** is the ratio between bank total assets and the volume of bank total assets in the State where the bank is chartered, **TMTF** is the average capital ratio of the other banks in the same State, **Growth** is the quarterly change of personal income growth in the State where the bank is chartered, and **Young** is a dummy variable that equals one if a bank is young, and zero otherwise. Young is defined as a bank, which is younger that the first quartile of the banks' age in the sample. All independent variables apart from Crises and Young are lagged by two quarters to avoid possible endogeneity. The coefficients presented are hazard rates, which show how much a one unit change in the independent variable increases (decreases) the probability of a bank being acquired. z values are provided in parentheses; values below one indicate a decline in bank probability of being acquired, and values above one indicate an increase in the dependent variable. All models are estimated with robust standard errors clustered by bank. Panel B presents marginal efficiency effects on banks probability of being acquired during normal and crisis periods, and Panel C presents Marginal crises effects on bank probability of being acquired given the first (p25), second (p50) and third (p75) quartile of the sample efficiencies. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

Chapter 4. Long-Term Effects of Failed Bank Acquisitions on Acquiring Banks

4.1. Introduction

Since 1985 the US banking industry has suffered from a large number of bank failures. The 1990s credit crunch together with the Recent Global Financial Crisis have obliterated as many as 1,365 Commercial banks and Savings institutions. This number of failures accounts for almost 40% of the total insured institution failures since the establishment of the Federal Deposit Insurance Corporation (FDIC) in 1933.

To deal with the numerous bank failures the FDIC has predominantly opted for passing the assets of failed banks to the private sector. In this respect, to date the most widely employed resolution method is the Purchase and Assumption (P&A) transaction, where some or all of the failed bank assets and liabilities are auctioned off to the private sector. For instance, during the recent financial crisis approximately 95% of the total bank receivership cases have been resolved using P&A transactions (Granja et al., 2014).

This chapter extends the limited number of studies on the resolution of failed banks via P&As by examining the long-term effects of these transactions for the acquiring institutions.

The analysis is based on a sample of 486 failed bank acquisitions selected for the period between 1985 and 2010.

It is widely believed that P&As lower costs to the insurance funds and ensure continuity of smooth operations and services to the customers (FDIC, 2014b), as well as the preservation of the failed banks' charter values (James, 1991; Bennett and Unal, 2014). However, surprisingly little is known about the long-term impact these transactions have on the acquiring institutions.

This appears to be an important omission for several reasons. First, in the case of evidence on performance gains for the acquirers, the FDIC could benefit from promoting the healthy institutions' participation in failed bank auctions, thus, reducing the costs stemming from these resolutions (for evidence on the increased competition gains to the FDIC, see, for example, Bennett and Unal, 2014). Second, improved performance of the acquiring banks would suggest better use of the failed banks' assets in the hands of the successors' management team, which would boost confidence of the failed bank depositors, and diminish the likelihood of a run on a failing bank prior to closing. If, by contrast, acquiring banks would not achieve significant performance gains, alternative resolution design methods could be considered. In essence, if the passing of failed bank assets to the private sector harms the existing healthy banks, further support to the acquirers and additional post-merger incentives may need to be implemented.

Despite their relevance, the long-term effects produced by failed bank acquisitions on the acquiring institutions are only marginally examined in Peristiani (1997). Specifically, Peristiani (1997) analyses X-efficiency gains following three types of consolidation categories: intrastate mergers, BHC consolidations and FDIC-assisted mergers. He finds that FDIC-assisted mergers resulted in increased scale efficiencies for both, single- and multiple-time acquirers. This chapter adds to the study of Peristiani (1997) in several ways.

First, the analysis presented here focuses on the impact of failed bank acquisitions on a wider range of bank characteristics that previous studies have related to non-failed bank acquisitions and that are generally linked with stability conditions at the bank level. In particular, the impact of these acquisitions on profitability, efficiency, capital adequacy and asset quality is examined. The findings show that, on average, failed bank acquirers deteriorate significantly in the three years following an acquisition, however, remained more profitable and with better quality of assets than the average industry bank.

Second, by constructing the analysis over a 26-year period, the impact the P&A transactions have on acquiring banks in crisis and normal times can be distinguished. In this regard Bertin et al. (1989) and Wan and Yiu (2009) argue that firms may benefit from acquisitions in times when the economy is in distress, because overpayment of assets is less likely as firms may be more prudent in terms of acquisition strategies and managers must avoid costly mistakes. In addition, an increase of potential targets due to crises "should allow banks to be more selective in their bidding process" (Bertin et al., 1989). Furthermore, Cowan and Salotti (2015) suggest that the gains to the acquirers during crises include wealth transfers from the FDIC, which subsidize these sales, and accepts bids below their fair values due to the high numbers of bank failures and the other banks reduced ability to bid high.

The findings in this chapter do not show evidence to support the view that failed bank acquisitions in crisis periods resulted in higher gains/losses than acquisitions in normal times. In fact, the results show that failed bank acquirers' performance deteriorates after the acquisition regardless of the period of the acquisition. A notable exception is, however, the group of acquisitions that took place during the financial crisis that erupted in the second half of 2007. Apart from reduced profitability indicators, other performance measures did not change significantly following an acquisition. The potential explanation for this is that nearly 60% of the

P&A transactions during the recent financial crisis in the sample included a loss-sharing agreement, which increased the amount of vulnerable assets acquired. However, at the same time, it increased the incentives for the assuming institutions to be more prudent in credit management (FDIC, 1998).

This chapter further adds to the existing literature by studying the potential factors that help explain the changes in the long-run performance of the acquiring firms following an acquisition. Stemming from existing evidence on factors that help explain long-term performance changes after acquisitions (see, for instance, Kim and Finkelstein, 2009), it might be the case that the change in the difference between the pre and post- acquisition performance of the acquirer improves with better pre-acquisition characteristics of the acquirer. The findings, however, do not present a clear pattern that allows to identify a type of acquirer that enhances the performance of the acquirer.

Finally, this chapter examines whether, in spite of not leading to benefits that materialize in accounting ratios, failed bank acquisitions help the acquirers survive in the market because of an increased size. This is done by evaluating the probability of a failed bank's acquirer to disappear in the market through failure or acquisition. The results show that banks that acquired failed institutions in the preceding 4 and 8 quarters had a significantly lower likelihood to fail and be acquired. These findings are in line with the general consensus that larger banks are more likely to survive/and or be bailed out (Berger et al., 1999; Mishkin et al., 2006; Liu and Ngo, 2014), and with the study by Gorton et al. (2009), who suggest that consolidation in the banking industry is often driven by defensive strategies, i.e. banks engage in acquisitions in order to reduce the risk of becoming acquisition targets themselves.

The analysis presented here complements a number of studies that have focused on the immediate market reaction on the acquisition announcement. The general consensus stemming from these studies is that failed bank acquisitions generate excessive returns to the acquiring institutions (see, for example, James and Wier, 1987a; Cochran et al., 1995; Cowan and Salotti, 2015). Nevertheless, long-term gains/losses accrued for the acquirers following mergers might be very different from the short-term market reactions around merger announcements due to several reasons. For instance, as suggested by DeLong & DeYoung (2007), there may be long-run changes in the set of determinants that are used for the short-run market evaluation of the merger, as well as poor-understanding of the event by market participants. The latter may result in an inefficient evaluation of a merger, which, therefore, will not be a reliable long-run predictor of the firm's value. Furthermore, looking into the accounting-based performance measures rather than the stock price shift (associated with market participants' expectations toward the effects of the merger) has several benefits. First, the actual rather than the expected performance can be measured, as suggested by DeLong & DeYoung (2007). Second, using various accounting measures allows to identify the sources of gains to the acquireers (DeLong and DeYoung, 2007) and to avoid restricting the analysis to a smaller sample of publicly listed companies.

The analysis presented in this chapter is also related to the number of studies on the long-run acquirers' performance gains of ordinary deals (see, for instance, Cornett and Tehranian, 1992; Amel et al., 2004). How much the findings on the long term effects for non-failed bank acquisitions might be valid for failed acquisition is unclear for several reasons. First, failed bank acquisitions mainly occur in times of crisis, when liquidity is scarce and overall bank performance has deteriorated. Healthy institutions have several motivations to acquire during such disturbed economic conditions, including sending a signal of financial strength to the market (Beltratti and Paladino, 2013), acquiring assets at fire sales (Acharya and Yorulmazer,

2008), and the increased numbers of potential acquisition targets as well as reduced number of potential bidders (James and Wier, 1987b) is also likely to have a bearing.

Second, the FDIC offers loss-share agreement (LSA) – introduced under the FDICIA Act of 1991 - replacing the put guarantees, which allowed the acquiring institutions to return substandard assets to the FDIC. With the loss-sharing agreement, the FDIC is required to reimburse 80% of the losses of the covered assets up to a certain threshold, and 95% for the losses above the threshold[20]; and the remaining losses are covered by the acquiring institution (Cowan and Salotti, 2015). Following this LSA was the impact of regulatory capital ratios: under the general risk-based capital rules, an asset can be assigned a risk weight that of the eligible guarantor (in this case the FDIC) rather the obligor[21]. As a result of the loss-share agreement, it is therefore an opportunity for healthy banks to acquire assets of mitigated risks.

Third, the whole acquisition process is much quicker than in traditional mergers and acquisitions, i.e. the time between the bidding opportunity announcement and the closing of the deal is typically two weeks. Furthermore, the process of due diligence is limited to 2 to 3 days (and only if granted by the board of the failing bank) rather than the average of 115 days in traditional mergers and acquisitions (Granja, 2013). Such a quick process is thus unlikely to help mitigate information asymmetries between the target and the bidder (Granja, 2013), and can, therefore, hinder the managers of the potential acquirers from taking the correct actions.

The remaining part of the chapter is structured as follows. The next section discusses the related literature. Section 4.3 introduces the data sample and methodology employed in this

[20] "Sharing losses on a 95/5 basis was eliminated for all LSAs executed after March 26, 2010". (for full details, see https://www.fdic.gov/bank/individual/failed/lossshare/index.html)

[21] Specifically, the acquiring institutions are allowed to assign a risk weight of 20 % to the guaranteed assets under the LSA.

chapter. Sections 4.4 and 4.5 introduce the results and robustness checks. Finally, the last section concludes.

4.2. Related Literature

The long-term effects of failed bank acquisition on the acquirers have been largely overlooked in the literature. A partial exception is Peristiani (1997), where FDIC-assisted acquisitions are examined in the context of a broader investigation of bank consolidation. Specifically, the analysis examines the efficiency gains associated with three categories of banks' consolidation (intrastate mergers, BHC consolidations and FDIC-assisted mergers) and finds that acquirers do not improve, in general, their X-efficiencies and rank X-efficiencies following a merger. In fact, from the overall sample BHC consolidations result in significantly reduced industry-adjusted (rank) X-efficiencies. However, all types of mergers, including the FDIC-assisted mergers between 1980 and 1990 resulted in increased scale efficiencies for both, single- and multiple-time acquirers.

A much larger number of studies has focused on the short-term wealth effects for the shareholders of the acquiring bank generated by the acquisition of a failed institution. This literature dates back to the 1980s and is normally based on relatively small samples given the need to focus on publicly listed institutions. The general consensus emerging from these studies is that the auctions used by the Federal Deposit Insurance Corporation to resolve failing banks result in significantly positive excess returns that accrue to the acquiring institutions.

For example, James and Wier (1987a) find positive abnormal returns for the acquirer when auction results are announced over the period 1973-1983 and show that these returns are significantly higher than for the acquirers participating in unassisted acquisitions over a 2-day-period. However, Zhang (1997), by comparing 128 FDIC assisted acquisitions and 387 non-assisted acquisitions in the 1980-1990 period, find that the positive abnormal returns for the

FDIC-assisted acquirers are driven by repeated acquirers. They argue that one of the reasons for the statistically positive cumulative abnormal returns for the repeated acquirers is the information advantage they have in terms of the acquisition process. As a result other potential acquirers might refrain from bidding altogether, or offer lower bids. This in turn reduces the winning bid and the acquirer benefits at the expense of the FDIC.

While Cochran et al. (1995) confirm significant abnormal returns for the acquiring banks for different typologies of acquisition targets, Bertin et al. (1989) find evidence of significant abnormal returns prior and at the date of the announcement. Furthermore, Pettway and Trifts (1985) document positive average abnormal stock returns 10 days prior to the merger, which are followed by negative abnormal returns in the 50-day period after the merger.

Evidence of gains by shareholders from the announcement of a failed bank acquisition is also reported by a recent study by Cowan and Salotti (2015) focusing on the period 2008-2013. Their findings show a 3.23 % average two-day announcement-period cumulative abnormal return[22].

The analysis in this chapter is also related to the strand of the literature that examines long-term effects stemming from the acquisitions on non-failed banks (see, for instance, Rhoades, 1998; Amel et al., 2004; Cornett et al., 2006). This literature shows mixed results in terms of effects on the acquiring bank. For instance, in their review of studies on financial sector consolidation and efficiency Amel et al. (2004) conclude that in the commercial bank industry,

[22] The evidence on positive abnormal returns following a P&A transactions indicate either a synergy effect or a well documented wealth transfer from the seller (the FDIC) to the acquirer (Gupta and Misra, 1999). In line with the wealth transfer hypothesis are the studies by James and Wier (1987a) and Cowan and Salotti (2015). Specifically, James and Wier (1987a) show that due to restrictions on bidder participation the returns for the winning bidders increase, whereas the revenue for the seller (the FDIC) reduces. In support of this finding, Cowan and Salotti (2015) show that "acceptance of bids below fair value" by the FDIC is one of the factors contributing to the CARs of the acquiring banks.

there is a lack of evidence to support that there are any cost or profit efficiency gains related to the M&As. They explain the lack of evidence due to regulation. The Glass-Steagall Act (of 1933 up until 1999) could have "impeded realization of gains from cross-selling", and the restrictions on branching and geographic expansion (up until the Riegle-Neal Act of 1994) could have restricted the use of scale economies. They also suggest that there is not enough evidence of the long-term effects, and suggest that the efficiency gains might emerge in a long-run. Finally, they suggest that "non-value maximising[23]" motives might be the reason for the lack of evidence in efficiency gains.

On the contrary to the conclusions drawn by Amel et al. (2004), DeLong (2003) finds that efficiency of combined banks improves in the three-years following an acquisition. However, apart from improved efficiency, DeLong (2003) uses improved ROA and long-term stock returns as addiditonal measures of improvement in long-term performance from mergers. He finds that while long-term stock returns increase significantly, ROA does not. He also shows that the improvement in long-term performance manifests when the merger involves an inefficient acquirer, also when the partners have similar earning streams, and when the debt rating of the combined entity improves, i.e. the costs of bankruptcy reduce.

Additional evidence of performance gains for merged banks relative to the whole banking industry is also presented by Cornett and Tehranian (1992), who study pre- and post-merger operating cash flows surrounding mergers that occurred in the period between 1982 and 1987. Specifically, they show that merged banks underperformed the industry by 0.2 % before

[23] In the absence of conclusive evidence on M&A gains in the banking industry, the existing literature has proposed that other than "value-maximising" motives foster bank concentration. Managers, who make decisions for corporate takeovers, might either make irrational decisions or seek personal benefit. In the case of the former, a manager can be convinced that his/her valuation of the target is correct, and it is the market which does not recognize the true value of the consolidation (Roll, 1986). In the latter case, the objective of managers might be "empire building", which is driven by expectations for higher compensation (Berger et al., 1999).

the merger, however outperformed the industry by 1.0% after the merger, and the 1.2% increase was significantly different from zero. They also demonstrate that the improvement in performance was the result of greater ability to attract more loans and deposits per dollar of equity, as well as greater employee productivity and asset growth.

Finally, Cornett et al. (2006) study US commercial bank mergers in the period between 1990 and 2000. They, like Cornett and Tehranian (1992), use the changes in operating pre-tax cash flows as an indicator for performance. They find that the industry-adjusted performance significantly improves after a merger, and show that the effect is especially evident in large, activity and geographically focusing bank mergers. They also show that the performance gains were larger after the implementation of the Riegle-Neal Act in 1997.

Overall, there is a lack of evidence in the existing literature on the long-term impact failed bank acquisitions have on the acquiring banks. With a partial exception of the study by Peristiani (1997), who bases his analysis solely on efficiency gains from mergers, the benefits stemming from failed bank acquisitions have been mainly analysed through the perspective of the immediate market reaction on the acquisition announcement. Although the long-term impact of acquisitions has been studied for ordinary deals, the latter findings cannot be undoubtedly applied on P&A transactions due to their unique features.

4.3. Data Sample and Performance Measures

The analysis in this chapter is based on 486 acquisitions of U.S. FDIC-insured commercial and savings banks that were completed between 1985 and 2010. The sample is constructed using the acquisition data reported by the FDIC[24]. Although in the observed period more than 2500

[24] The full information on all FDIC-insured banks is obtained from www.data.gov, and includes demographic information, operating status, and other key statistics related to the institution. Specifically, the structural event changes are used to identify all acquired-with-government-assistance institutions and their successors. Information on all non-assisted mergers were also selected from this dataset.

commercial and savings banks have been auctioned off to the private sector, only the deals for which all of the following conditions hold are selected: 1) an active institution took over the failing bank; 2) data are available for the acquiring bank for at least 4 quarters (1 year) prior to the acquisition and for at least 12 quarters (3 years) following the acquisition; 3) the acquiring institution did not participate in any other government-assisted merger, or in any other non-government assisted merger, 4 quarters prior to and 12 quarters following the acquisition. In contrast, deals, where a single institution acquires more than one failing bank in the same or two consecutive quarters, are not excluded. Instead, the information of the failed banks are aggregated and considered as one deal.[25]

For the characteristics of the acquiring and target banks as well as all other banks in the market the Consolidated Reports of Condition and Income provided by the FDIC (for data after the first quarter of 1993) as well as the Federal Reserve Bank of Chicago (for data before the first quarter of 1993) are used.

Table 4-1 displays descriptive statistics of the merger deals in the dataset for the full sample and for the sample by year in Panel A and Panel B, respectively. The number of deals in the sample as well as the total number of bank failures is provided for comparison. The average and median assets of the acquirer and the average and median assets of the target are shown in Columns 3 to 6. For the assets of both, the target and the acquirer, the last entry in the Call Reports prior to the merger is used. The dollar value of assets is adjusted using implicit price deflator, provided by the Federal Reserve Bank of St. Louis, indexed to the price level of the year 2009.

[25] From the 486 deals observed in this chapter, 13 are multiple acquisitions.

The number of failures and the number of failed bank acquisitions included in the dataset, not surprisingly, cluster in two distinct periods: 1986-1992, as well as 2007-2010. These periods belong mainly to the two banking crises - the 1990s credit crunch and the recent global financial crisis (for crisis dating, see chapter 3.3.2). Both the size of the acquirer as well as the size of the target seem to have increased throughout the observed time period. Apart from the acquisition in 1999, where the target was on average five times larger than the acquirer, most of the target to acquirer size ratios cluster around the 39.54% full sample median[26].

[Table 4-1 here]

To test the long-term effects of the deal for the acquiring bank, the study by Fraser and Zhang (2009) is followed and profitability, efficiency, capital adequacy and asset quality indicators are used. For profitability return on assets (ROA), return on equity (ROE), and net interest margin (measured as the difference between interest income and interest expense and expressed as a ratio of the book value of total assets) are used. For efficiency indicators cost efficiency and its two components: technical and allocative efficiencies, are used. The efficiency measures are computed using Data Envelopment Analysis (DEA), which is detailed in chapter 3.3.3.

As for the capital adequacy indicators loans to total equity, deposits to total equity and the capitalization ratio expressed as a ratio of equity to total assets are used. Allowance for loan losses as a ratio of total loans and leases and non-performing loans expressed as a ratio to total loans and leases are employed to measure the acquiring banks' asset quality.

[26] The data for the actual amount of assets acquired is available only from 1989, and represents approximately 72% of the total sample starting in 1989. For the regression analyses, where the relative size ratio is used, this issue is addressed by performing various robustness checks. The extreme value is for the First National Bank of Keystone, which was acquired by Ameribanc, Inc.; however, from the over $1 billion of assets that the target bank had at the time of failure, only $74 million were acquired.

All the acquired banks' performance measures are adjusted by industry performance to avoid the possibility that the performance measures are influenced by external factors, such as economic conditions, rather than the effects of the merger itself. The industry benchmark is based on banks that are located in the same state as the acquiring bank in the specific quarter of the acquisition. All banks that were involved in a government-assisted merger in the same state and quarter as the event in the sample are not classified as not part of the industry benchmark. The study by DeLong and DeYoung (2007) is followed to identify the pre-merger window as a 1-year period, therefore, the performance measures are averaged over the 4 quarters prior to the merger. The post-merger window, which reflects the long-term effects of an acquisition, is considered as a three year (12-quarter) period following an acquisition. The definitions and summary statistics for all performance measures employed in this chapter are provided in Table 4-2.

[Table 4-2 here]

4.4. The Long-Term Effects of Failed Bank Acquisitions on Acquirer Performance

4.4.1. Failed Bank Acquisitions and Acquirer Long-Term Performance

For the full sample of 468 acquisitions, Table 4-3 reports the pre- and post-acquisition measures for industry-adjusted acquiring banks' performance. The results show that the acquiring banks were significantly more profitable than the average industry bank in the four quarters prior an acquisition. Specifically, the acquiring banks were more profitable than the industry banks by 0.19 percentage points (pp)[27], 3.61pp and 0.04pp as indicated by ROA, ROE and Net interest margin, respectively. Following an acquisition the profitability of the acquiring banks dropped

[27] The difference between the performance of acquiring institution and the average industry bank is expressed as the actual change in percentage points rather than the relative change in percent. For the interpretation of percentage points, see section 3.4.1.

significantly, i.e. ROA dropped by 0.13pp, ROE reduced by 1.93pp and net interest margin dropped by 0.04pp. However, apart from net interest margin, which shows no significant difference from zero in the post-merger period, both ROA and ROE remained significantly higher for the acquiring banks as opposed to the industry average.

Acquiring banks were not different from the rest of the industry in terms of the overall cost efficiency. The insignificant medians of industry-adjusted technical and allocative efficiencies suggest that most of the acquiring banks used similar quantities of inputs for the given level of outputs as an average industry bank, and were not superior to other banks in selecting the input mix. However, the significantly lower average of allocative efficiency suggests, that amongst acquiring banks there were some that exhibited extremely lower efficiencies in allocating resources. Following an acquisition cost efficiency reduced significantly, and this drop was mainly a result of a significant decrease in technical efficiency, as indicated by the greater magnitudes of the changes in industry-adjusted technical efficiency coefficients. As a result, in the three years following an acquisition the acquiring banks underperformed the average industry bank by 5.36 pp, 5.72 pp and 1.58 pp in terms of overall cost, technical and allocative efficiencies, respectively.

Moving on to analyse the capital adequacy indicators, the results suggest that acquiring banks were better capitalized prior an acquisition, as indicated by the negative and significantly different from zero industry-adjusted loans to capital and deposits to capital ratios, as well as the significantly higher than zero industry adjusted equity to assets ratio. After the acquisition, however, the capitalization of acquiring banks deteriorated significantly. As a result, loans to capital and deposits to capital increased from significantly lower than other banks to not significantly different from the industry average. Furthermore, the equity to asset ratio dropped from being 0.76pp higher to 0.74pp lower than the industry benchmark. Finally, allowance for

loan losses to loans did not change significantly after an acquisition and remained lower than other banks, whereas the median of non-performing loans to assets increased significantly by 0.24pp.

[Table 4-3 here]

Overall, the results suggest that winning bidders of failed bank auctions did not benefit from acquiring failing banks in the long run. On the contrary, all performance measures deteriorated significantly following an acquisition.

4.4.2. Failed Bank Acquisitions and Acquirer Long-Term Performance Across Time Periods

To test whether the results discussed above are consistent throughout the observed timeframe, the pre-and post-acquirers' performance in alternative periods is investigated next.

First, tests are conducted to check whether acquirers' performance differs if the acquisition occurred in crisis or normal times. The crisis periods are then split into banking and market crises and, finally, analysis is conducted with the focus on acquisitions that occurred in the recent financial crisis only. The results for crisis periods, normal times, banking crises, market crises and the recent financial crisis are reported in Panels A, B, C, D and E of Table 4-4, respectively.

The results in Panel A are not different from those of the full sample. Overall, all performance indicators deteriorated following an acquisition during crisis periods. A similar conclusion can be drawn for the acquirers' performance after taking over a failing bank in normal times. The only exception from the full sample is that acquiring banks were significantly more efficient before an acquisition, however, apart from allocative efficiency, became significantly less efficient after an acquisition. Splitting the crisis periods into market and banking crisis, again

do not change the general finding that failed bank acquirers perform significantly worse following an acquisition, as evident from Panels C and D.

Failed bank acquisitions during the recent financial crisis, however, had a different impact on the acquirers' performance. Interestingly, apart from reduced profitability, failed bank acquirers did not perform differently in the three year after the acquisition took place. One of the possible explanations for this result is that from the sample of 58 P&A transactions in the period of the recent financial crisis, almost 60% included a loss-sharing agreement. According to the full sample of P&A transactions, these loss-sharing agreements on average covered 72% of failing banks' total assets at the time of failure (Granja, 2013). The loss-sharing agreement increased the level of acquired commercial and real estate loans, however, at the same time, due to the portion of losses left for the acquirer to absorb, it provided the incentives for prudent credit management (FDIC, 1998)[28].

[Table 4-4 here]

4.4.3. Additional Tests

Although to check for consistency in the findings more than one measure for each of the performance indicators is included, the results are still potentially sensitive to several key issues. First, as the choice of 1 year pre- and 3 years post-acquisition window is to a degree arbitrary, the analysis is repeated for -1 years/+5 years windows. In addition, rather than taking the average performance of the 12 quarters post and 4 quarters prior the acquisition, the analysis is repeated by comparing the actual performance measures at the twelfth quarter post and the fourth quarter prior the P&A. The results are reported in Table 4-5. In line with the previous findings, the

[28] The acquirers' pre- and post-performance measures for those deals that included loss-sharing agreement are presented in the following section (section 4.4.3). The results are qualitatively similar to those reported for the recent financial crisis.

results show that industry adjusted performance indicators of the acquiring institutions deteriorated significantly following an acquisition and this result was not driven by a specific pre- and post-event window used.

[Table 4-5 here]

Second, while the full sample analysis includes resolutions that occurred between 1985 and 2010, the enactment of the FDICIA in 1991 fundamentally changed the failed bank resolution process. In this regard, the sample is split into pre- and post-FDICIA period for further tests and the results are reported in Table 4-6. The results are consistent with the initial tests for the both periods, suggesting that the benefits of acquiring a relatively healthier institution in the post-FDICIA period were offset by higher bids offered by the bidding institutions.

[Table 4-6 here]

Third, one of the potential gains associated with acquisitions include the increase in market share. If this is so, potentially greater gains from relatively larger acquisitions should be observed. Therefore, further analysis is conducted to test the acquirers' performance changes following large acquisitions, i.e. acquisitions, where the relative size of the target to that of the acquiring bank is greater than the median (39.54%). The results are reported in Table 4-7 and show no differences from the initial analysis, suggesting the performance gains from failed bank acquisitions were not dependent on the size of the acquisition.

[Table 4-7 here]

Furthermore, it is likely that the differing results for the sample of the recent financial crisis is due to the loss-share agreement that was included in the majority of the P&A transactions. To test the validity of this inference the analysis is replicated for merely the deals

that included the loss-sharing agreement. The results are reported in Table 4-8 and are in line with the results for the sample of acquisitions that occurred in the recent financial crisis. Specifically, apart from ROA, no significant acquirers' performance changes are evident from those P&As that included a loss-sharing agreement. An exception here is, however, the improved loans to capital and deposits to capital measures, however, only significant for the mean test, not for the median test of equality, suggesting that the improvement in these measures were only a result of extreme values.

[Table 4-8 here]

4.4.4. Regression Analysis

This section investigates the determinants of the change in performance produced by the acquisition of a failed bank. The changes in the industry-adjusted performance measures after the merger are used as the dependent variables in a set of cross-sectional regressions estimated via OLS and with standard errors clustered by quarter to control for any potential time dependence across observations. More formally, the regression model is expressed as follows:

$$\Delta Performance_i = a_0 + Size_{i,t-n} + Rel\_size_{i,j,t-1} + Capital_{i,t-1} + NPL_{i,t-1} + LLA_{i,t-1} + Same\_state_{i,j} + A\_age_{i,t-1} + T\_age_{j,t-1} + LSA_{i,t} + FDICIA_t + Banking\ Crisis_t + Market\ Crisis_t + \varepsilon_{i,t} \quad (4.1)$$

where $\boldsymbol{\Delta Performance_i}$ is the change in the pre- and the post-acquisition performance measures of the acquirer *i*. $\boldsymbol{Size_{i,t-1}}$ is the size of the acquirer, expressed as the natural log of the total assets in real terms in thousands. Similarly to DeLong and DeYoung (2007) it is expected that the effects of acquisitions are smaller for large institutions, which have already reached their diversification and scale efficiencies. $\boldsymbol{Rel\_size_{i,j,t-1}}$ is the relative size factor, measured as the total assets of the target divided by the total assets of the acquirer. There are no a priori expectations

for its effect on performance. On the one hand, larger institutions might be more difficult to assimilate under the existing operations of the acquiring ones, as suggested by Ramaswamy and Waegelein (2003). On the other hand, if the size increase after an acquisition is trivial, the acquisition might have no bearing on the acquirer's performance at all.

$\boldsymbol{Capital_{i,t-1}}$ is measured as total equity to total assets; $\boldsymbol{NPL_{i,t-1}}$ is the non-performing loans ratio, measured as non-performing loans to total loans and leases; $\boldsymbol{LLA_{i,t-1}}$ is the acquirer's loan loss allowance, adjusted by total loans and leases. Higher capitalization, lower levels of non-performing loans and lower loan loss allowance are expected to have a positive effect on the performance change.

$\boldsymbol{Same\_state_{i,j}}$ is a dummy variable that acquires a value of one if the headquarters of the target bank are in the same state as the headquarters of the acquiring bank, and 0 otherwise. There are no a priori expectations for this variable. On the one hand, acquirers might benefit expanding their market share from same state acquisitions. On the other hand, it might reduce their geographic diversification.

The age of the acquirer and the age of the target - $\boldsymbol{A\_age_{i,t-1}}$ and $\boldsymbol{T\_age_{j,t-1}}$, respectively, are measured as the natural logarithm of the years since the establishment of the bank. As for the age of the acquirer, as in Kim and Finkelstein (2009), it is expected that older age of the acquirer improves performance changes, as older age indicates "more resources, management skills, and legitimacy", as well as successful past operations. As for the age of the target, there are no a priori expectations on the effect it might have on the acquirers' performance changes. On one hand, if a young firm that fails has not yet reached their full potential (Ouyang, 2009), acquirers may benefit from exploiting these lost opportunities and performance gains. On the other hand, Povel and Sertsios (2014) suggest that young targets are more opaque, and it is more difficult for the acquirer to gather information about it. In fact, Granja (2013) shows higher

levels of information asymmetries increases the costs to the FDIC, and reduces the portion of assets the acquiring institution takes over, suggesting that bidders are prepared to pay less for a target they do not have enough information on. This information disadvantage might thus lead to an ambiguous outcome for the acquiring bank.

$\boldsymbol{LSA_{i,t}}$ is a dummy variable, which acquires a value of 1 if the P&A transaction included a loss-share agreement, and 0 otherwise. It is expected that P&A transactions including a loss-sharing agreement should have a positive effect on the post-merger acquirers' performance, because the losses of troubled assets are mainly covered by the FDIC, therefore the risk of the assets acquired reduces.

$\boldsymbol{FDICIA_t}$ is a dummy variable that acquires a value of 1 if the deal was after the enactment of the FDICIA in 1991, and 0 otherwise. One of the main provisions of the FDICIA is the 'prompt corrective action", which requires the federal banking agencies to assign banks under one of the capital groups: well capitalized, adequately capitalized, undercapitalized, significantly undercapitalized, and critically undercapitalized. In the case a bank falls into any of the last three categories, the regulatory agencies must take on mandatory supervisory and in some cases discretionary actions. Critically undercapitalized banks must be placed under conservatorship or receivership in a period of 90 days if the bank fails to restore its capital. In general, this 'prompt corrective action' allowed a quicker and more vigorous intervention, which in turn allowed closing banks "before their accounting net worth is exhausted" (Kane et al., 2008), and selling them off to the private sector before the condition has further deteriorated (Cowan and Salotti, 2015). It is therefore, expected that the dummy FDICIA has a positive effect on the post-merger acquirers' performance.

Finally, ***Banking Crisis***$_t$ and ***Market Crisis***$_t$ – dummy variables that acquire a value of one if the transaction occurred during banking or market crises, respectively, and 0 otherwise, are included in the regression. It is expected that acquisitions during crisis periods improve post-acquisition performance due to assets acquired at fire-sale prices, i.e. far below their true value (Acharya and Yorulmazer, 2008; Bennett and Unal; 2014). It is also believed that this effect is especially strong during banking crises, when the number of failing banks increases, and the amount if liquid assets in the market diminishes.

Acquirer- and target-specific variables are observed at the last available quarter prior an acquisition, and the remaining variables are included as of the time of the acquisition.

Table 4-9 reports the regression results of the potential factors that might have an impact on the acquirers' performance changes following a failed bank acquisition. Acquisitions during market crises resulted in deteriorated overall cost and allocative efficiencies, whereas acquisitions during banking crises had no effect on post-acquisition acquirers' performance. As expected, after the enactment of the FDICIA acquirers' performance change improved following an acquisition. Older acquiring banks and younger targets increased the change in the equity levels. Same state acquisitions reduced the post-acquisition cost, and technical efficiencies, and reduced the equity to asset ratio. Interestingly, higher levels of loan loss allowance improved the return on equity, and recued the loans to equity and deposits to equity ratios. P&As, in which the acquirer was larger, resulted in post-acquisition improvements in terms of profitability indicators (not significant for the change in ROE). However, the size of the acquirer also increased the level of non-performing loans. The smaller the size of the target, relative to the acquiring bank, the greater the improvement in net interest margin and the better the capitalization level (significant only for the deposit-to-capital change). Interestingly, though, relatively smaller

acquisitions increased the levels of loan loss allowance. Finally, higher equity levels reduced the change in net interest margin.

Overall, the results mainly support the a priori expectations on the effects the explanatory variables have on the acquirers' performance changes. However, given the lack of consistency of the explanatory variable effects across various performance indicators, a particular type of acquirer or acquisition target that enhances/diminishes the performance changes of the acquirers cannot be specified. It is likely that other factors influence the change in performance after an acquisition, and these factors are not captured by the measures included in the analysis. For instance, the change in performance may be dependent on the acquiring institution's managerial ability to assimilate the failed bank into its own operations. In addition, it is likely that the risk of failed bank assets and its negative effects materialize with a lag after its failure, and therefore, cannot be captured using the pre-acquisition measures.

[Table 4-9 here]

4.4.4.1. ADDITIONAL TESTS

One possible concern related to the specification of the relative size measure in the regression analysis is that the last observed total assets of the target rather than the actual amount of assets that were assumed by the buyer is used. Further analysis is, therefore, conducted for the 220 P&A transactions, for which data on the actual total assets sold exists, and the relative size measure re-estimated. The results are reported in Table 4-10, and are qualitatively similar to the initial analysis with a minor exception of the replaced relative size variable. Specifically, the variable lost its significance in explaining deposit to capital ratio and loan-loss allowance, however, became significant in the ROA and the non-performing loans regressions.

[Table 4-10 here]

4.5. Do Failed Bank Acquisitions Generate Non-Performance Benefits?

The previous section suggests that there are no significant performance benefits produced by failed bank acquisitions for the acquirer. However, this does not exclude the possibility that this type of acquisitions might generate other types of gains for the acquiring institutions. This section focuses on two possible benefits that might arise from the deal: 1) an increase in the possibility to maintain a preferable relationship with regulators; 2) a decrease in the possibility to be subject to a takeover.

4.5.1. Do Failed Bank Acquisitions Protect the Acquiring Banks from Failing?

The lack of evidence on the long-term gains to the acquirers' performance implies that other factors might motivate healthy banks to take over failing ones.

One of such factors could be the possibility to gain a preferable treatment by regulators when there is a risk to lose a bank's charter. In essence acquiring banks might seek to realize the deal, simply to maintain a preferable relationship with regulators. In fact, as most P&As happen during times of distress, realizing the deal might be an effective strategy for the acquiring banks to ensure cheaper access to financial safety net subsidies provided by the government, as well as increasing the possibility of being bailed out if their condition deteriorates (Berger et al., 1999; Mishkin et al., 2006).

To test whether failed bank acquirers are less likely to lose their charter after they complete the deal, this section employs the data and the Parametric Survival model as described in chapter 3.3.4. To capture the failed bank acquisition effect a dummy variable FBA_4_j, which acquires a value of 1 if the bank acquired a failing bank in the preceding four-quarter period, and zero otherwise, is included to the baseline model. The analysis is repeated including alternative timeframes of an acquisition. Specifically, the analysis is run using FBA_8_j and FBA_12_j, which

are dummy variables that equal 1 if a bank acquired a failing bank in the preceding 8 and 12 quarters, respectively.

Table 4-11 reports the PS model that tests the likelihood of a bank failing if it had acquired a failing bank in the past. Specifically, Columns I, II and III show respectively, how a failed bank acquisition in the preceding 4, 8 and 12 quarters affected the likelihood of the acquiring bank to fail. The results show that the probability to fail reduces significantly for banks that acquire a failing bank in the preceding 4 and 8 quarters. In particular, having acquired a failed bank reduced the probability of failure by 89.4 pp and 52 pp if the acquisition happened in the last 4 and 8 quarters, respectively. The effect, however, is not significant for the acquisitions that occurred in the preceding 12 quarters. It, therefore, seems that the benefit of acquiring a failing bank in terms of reduced likelihood of failure evaporates with time.

[Table 4-11 here]

Taken together the result reported in this section with the fact that the acquisition does lead to a deterioration of the majority of the industry adjusted performance indicators that have been analysed, it appears that a major gain from acquiring failed bank is an increase in the possibility that the acquirer maintain its charter in time of distress.

4.5.2. Do Failed Bank Acquisitions Protect the Acquirers From Becoming Takeover Targets?

This section investigates how failed bank acquisitions affect the acquirers' probability of becoming takeover targets themselves. Gorton et al. (2009) propose two alternative theories how consolidation may impact banks' – that are involved in acquisitions – likelihood of being acquired. First, by acquiring other firms, managers may use a defensive strategy, which suggests they wish to acquire other firms to increase in size, and thus lessen the probability of being

acquired themselves. On the other hand, managers might involve themselves in "positioning" acquisitions, which would allow them to become more attractive targets themselves.

To test the theories of managerial motives, proposed by Gorton et al. (2009), this section analyses whether failed bank acquirers were more or less likely to become acquisition targets. By employing in the baseline PS model (described in 3.3.4) as a dependent variable Acq_j [29] - a dummy variable that acquires a value of 1 if a bank has been acquired at a specific quarter, and 0 otherwise – the results, provided in Table 4-12, show that the probability to be acquired reduced by 63.4 pp, 59.1 pp and 49 pp for banks that acquired a failed bank in the preceding 4, 8, and 12 quarter, respectively.

[Table 4-12 here]

4.6. Conclusions

It is shown in this chapter that on average the acquirers of failed banks over the period ranging from 1985 to 2010 did not achieve any long-term performance benefit by realizing the deal. In fact, the performance measures deteriorated significantly after the acquisition took place, however, remained more profitable and with better asset quality than the average industry bank.

However, the result observed for the full sample period is not confirmed when the analysis is repeated by focusing merely on the acquisitions realized during the recent financial crisis. Apart from deteriorated ROA, all acquirers' performance measures remained unchanged from the pre-acquisition period. This result is not striking: during the recent financial crisis nearly 60% of the sample P&A transactions included a loss-sharing agreement, which protected the acquirers from the potential losses of the assets acquired. In addition, as suggested by the FDIC

[29] The dependent variable Acq_j is the same as in explained in section 3.4.2.

(1998), the included loss-share agreement increased the amount of vulnerable assets acquired, which at the same time increased the buyer's incentives for more prudent credit management.

Evidence on the factors that help explain the acquirers' performance changes are ambiguous. Although the results do not contradict the general notion that increase (decrease) in performance is associated with better (worse) economic conditions as well as better (worse) pre-acquisition performance of the acquiring institution, the effects of these factors differ across the measures of performance used in this study. Therefore, a factor (or a group of factors) that consistently improve/worsen the change in acquirers performance after a failed bank's acquisition cannot be depicted.

However, further analysis suggests that failed bank acquirers, in spite of the lack of any significant improvement in performance and asset quality produced by the acquisition, show a reduced likelihood to disappear from the market after the completion of the deal. Specifically, the results show that banks that participated in failed bank acquisitions had lower likelihood of failing in the following 4 and 8 quarters. In addition, further analysis provides evidence that the likelihood of becoming an acquisition target reduced significantly for banks that acquired a failing bank in the preceding 4, 8 and 12 quarters. In general, these results seem to suggest that acquirers of failed institutions enhance their possibilities to maintain their charter within the industry.

Overall, this chapter shows critically that although P&A transactions have become the most widely used resolution methods due to reduced costs to the FDIC, there is no evidence that these transactions improve the long-term performance of the acquirers. This finding casts doubts on the potential systemic benefits arising from the completion of such deals.

4.7. Tables

TABLE 4-1
DESCRIPTIVE STATISTICS FOR U.S. GOVERNMENT ASSISTED FAILED BANK ACQUISITIONS, 1985-2010

	(1)	(2)	(3)		(4)		(5)	
Year	Number of Acquisitions in the Dataset	Total number of bank failures	Size of the Acquirer ($ millions)		Size of the Target ($ millions)		Relative size of the Target to the Acquirer (%)	
			Mean	Median	Mean	Median	Mean	Median
Panel A: All Acquisitions								
1985-2010	486	2541	549.3866	103.7191	115.9619	39.8076	62.94%	39.54%
Panel B: By Year of Acquisition								
1985	23	139	127.4281	79.0910	39.8196	21.3564	48.06%	37.20%
1986	42	159	256.1192	85.1078	55.2403	39.8736	67.13%	36.17%
1987	72	217	114.4493	74.8969	36.7813	20.8719	53.45%	35.39%
1988	40	231	110.4683	66.4611	32.1313	24.9805	61.15%	42.44%
1989	51	527	120.8365	76.4921	39.3607	27.9576	54.88%	50.27%
1990	79	380	320.6294	110.4697	133.5345	51.0598	79.72%	45.23%
1991	42	268	713.6012	144.2765	156.8134	54.8070	61.60%	37.77%
1992	35	178	528.5602	178.7828	326.5623	54.7351	64.47%	56.22%
1993	15	50	317.9637	284.8986	125.7152	74.3856	57.19%	27.35%
1994	8	15	544.6661	258.0184	55.1140	58.0286	28.64%	23.01%
1995	3	8	1229.162	391.9115	173.6320	85.6195	39.23%	13.26%
1996	2	6	79.7399	79.7399	51.9542	51.9542	65.78%	65.78%
1997	0	1	-	-			-	-
1998	1	3	393.1828	392.1828	294.9688	294.9688	75.30%	75.30%
1999	2	8	623.8726	623.8726	709.0796	709.0796	1075.46%	1075.46%
2000	2	7	449.5594	449.5594	90.7004	90.7004	20.74%	20.74%
2001	3	4	119.9943	113.6570	22.4303	20.9765	20.52%	19.08%
2002	4	11	1415.7600	363.1720	50.7875	52.4466	15.34%	15.26%
2003	3	3	2281.4230	320.3826	366.2364	39.9436	12.19%	12.51%
2004	1	4	3320.5340	3320.5340	32.4940	32.4940	0.99%	0.99%
2005	0	0	-	-	-	-	-	-
2006	0	0	-	-	-	-	-	-
2007	1	3	7043.0984	7043.0984	2536.5610	2536.5610	3.34%	3.34%
2008	5	25	596.1977	210.0533	206.2156	104.3207	56.82%	32.94%
2009	20	140	1377.8380	394.9959	184.2657	73.7850	31.91%	34.24%
2010	32	154	726.9550	240.2688	159.8437	68.6513	54.34%	30.13%

NOTES: This table reports summary statistics for 486 government assisted failed bank acquisitions of US commercial and savings banks between 1985 and 2010. Panel A shows the summary statistics for all acquisitions employed in the chapter, and Panel B reports the statistics for acquisitions by year. Column 1 shows the number of deals included in the sample, and Column 2 shows the total number of bank failures for comparison. Column 3 (Column 4) reports the mean and median size of the acquirer (target), measured as total assets prior to an acquisition in real terms and expressed in millions of US dollars. Column 5 reports the mean and median relative size of the target to the acquirer, measured as a ratio of total assets of the target to the total assets of the acquirer, and expressed as percentages.

TABLE 4-2
SUMMARY OF ACQUIRING BANKS' INDUSTRY-ADJUSTED PERFORMANCE INDICATORS

Variable	Definition	N	Mean	p50	S. Dev.	p1	p99
Profitability indicators							
ROA	Net income divided bank total assets.	8,082	0.0010	0.0009	0.0039	-0.0102	0.0101
ROE	Net income divided bank total equity capital.	8,082	0.0253	0.0142	0.4409	-0.2470	0.4216
NIM	Difference between net income and net expense divided bank total assets.	8,082	0.0000	-0.0001	0.0025	-0.0051	0.0064
Efficiency Indicators							
CE	Cost efficiency measured by using DEA.	8,125	-0.0416	-0.0537	0.1722	-0.3804	0.4467
TE	Technical efficiency measured by using DEA.	8,125	-0.0436	-0.0501	0.1838	-0.4030	0.4412
AE	Allocative efficiency measured by using DEA.	8,125	-0.0149	0.0160	0.1396	-0.4782	0.2335
Capital adequacy indicators							
Loans_cap	Total loans and leases divided bank total equity capital.	8,182	-0.4894	-0.5219	12.9389	-12.1639	12.8455
Dep_cap	Total deposits divided bank total equity capital.	8,182	-0.3778	-0.1851	18.5696	-18.2905	18.7443
Capital	Total book equity divided total assets.	8182	-0.0042	-0.0087	0.0263	-0.0510	0.0863
Asset Quality Indicators							
LLA	Allowance for loans and leases over total loans and leases.	8,182	-0.0032	-0.0046	0.0104	-0.0196	0.0357
NPL	Non-performing loans over total loans and leases.	8,182	-0.0048	-0.0045	0.1442	-0.0324	0.0690

NOTES: This table presents descriptions and summary statistics of the key performance variables of failed bank acquirers. Summary is provided for the -4/+12 quarter acquisition window. The performance variables include Profitability indicators – **ROA** (return on assets), **ROE** (return on equity), and **NIM** (net interest margin); Efficiency indicators – **CE** (cost efficiency), **TE** (technical efficiency), and **AE** (allocative efficiency); Capital adequacy indicators – **Loans_cap** (loans to capital), **Dep_cap** (Deposits to capital), and **Capital**; and Asset quality indicators - **LLA** (loan loss allowance), and **NPL** (non-performing loans). All variables are adjusted by industry bank average. An industry bank is considered a bank in the same state and quarter as the acquiring bank, and which did not participate in failed bank acquisitions that quarter.

TABLE 4-3
PRE- AND POST-ACQUISITION CHANGES IN ACQUIRERS' ACCOUNTING-BASED PERFORMANCE INDICATORS

Variable	Pre-Acquisition			Post-Acquisition				
	N	Mean	p50	N	Mean	p50	MEAN TEST of equality	MEDIAN TEST of equality
Profitability Indicators								
ROA	486	**0.0019*** **	**0.0018*** **	486	**0.0006*** **	**0.0005*** **	**-0.0013*** **	**-0.0013*** **
		(17.06)	**(15.00)**		**(6.70)**	**(8.17)**	**(-8.53)**	**(-9.79)**
ROE	486	**0.0361*** **	**0.0304*** **	486	**0.0169** **	**0.0139*** **	**-0.0193** **	**-0.0165*** **
		(10.67)	**(15.00)**		**(2.38)**	**(12.12)**	**(-2.45)**	**(-6.86)**
NIM	486	**0.0004*** **	**0.0003*** **	486	0.0000	-0.0001	**-0.0004*** **	**-0.0004*** **
		(4.40)	**(4.15)**		(0.44)	(-0.74)	**(-2.85)**	**(-3.52)**
Efficiency Indicators								
CE	486	-0.0035	0.0017	486	**-0.0536*** **	**-0.0640*** **	**-0.0501*** **	**-0.0657*** **
		(-0.50)	(-0.83)		**(-8.80)**	**(-9.26)**	**(-5.39)**	**(-5.53)**
TE	486	0.0007	0.0128	486	**-0.0572*** **	**-0.0591*** **	**-0.0579*** **	**-0.0718*** **
		(0.09)	(-0.07)		**(-8.59)**	**(-8.38)**	**(-5.93)**	**(-5.92)**
AE	486	**-0.0118** **	0.0132	486	**-0.0158*** **	-0.0016	-0.004	**-0.0148* **
		(-2.41)	(0.87)		**(-3.35)**	(-0.98)	(-0.59)	**(-1.70)**
Capital Adequacy Indicators								
Loans_cap	486	**-1.3455*** **	**-1.1600*** **	486	-0.149	**-0.3134*** **	**1.1965*** **	**0.8465*** **
		(-6.89)	**(-8.64)**		(-0.52)	**(-3.54)**	**(3.47)**	**(4.57)**
Dep_cap	486	**-2.2283*** **	**-1.7114*** **	486	0.234	0.1088	**2.4623*** **	**1.8201*** **
		(-9.10)	**(-10.35)**		(0.57)	(-0.91)	**(5.17)**	**(7.65)**
Capital	486	**0.0076*** **	**0.0024*** **	486	**-0.0074*** **	**-0.0111*** **	**-0.015*** **	**-0.0135*** **
		(5.47)	**(3.79)**		**(-7.45)**	**(-9.31)**	**(8.79)**	**(-8.96)**
Asset Quality Indicators								
LLA	486	**-0.0033*** **	**-0.0042*** **	486	**-0.0031*** **	**-0.0046*** **	0.0002	-0.0003
		(-8.33)	**(-10.63)**		**(-7.21)**	**(-9.56)**	(0.41)	(-0.12)
NPL	486	-0.0143	**-0.006*** **	486	**-0.0018** **	**-0.0036*** **	0.0125	**0.0024*** **
		(-1.52)	**(-11.04)**		**(-2.50)**	**(-8.37)**	(1.32)	**(5.04)**

NOTES: This table reports pre- and post-merger industry-adjusted accounting-based performance measures for the acquiring banks. The cells contain the number of observations (N), the mean (mean) and the median (p50) for the averaged industry-adjusted performance measures for the 4 quarters before the acquisition (Pre-Acquisition) and 12 quarters after the acquisition (Post-Acquisition). The t-statistics and z-statistics presented below the mean and median respectively show the significant differences from zero, which represent the significant difference from an average industry bank. The last two columns present the mean and median changes between the post-acquisition and pre-acquisition performance measures. Equality tests with the t-statistics and z-statistics are provided in the brackets below. The Performance indicators include Profitability Indicators: return on assets (**ROA**), measured as net income to total assets, return on equity (**ROE**), measured as net income to equity, net interest margin (**NIM**), measured as the difference between net income and net expense to total assets; Efficiency Indicators: Cost efficiency (**CE**), measured using DEA, and its two components: Technical Efficiency (**TE**) and Allocative efficiency (**AE**); Capital Adequacy Indicators: Loans to capital (**Loans_cap**), measured as total loans and leases to total book equity capital, Deposits to capital (**Dep_cap**), measured as total deposits to total book equity capital, **Capital**, measured as total book equity capital to total assets; Asset Quality Indicators: loan loss allowance (**LLA**), measured as allowance for loans and leases to total loans and leases, non-performing loans (**NPL**), measured as non-performing loans to total loans and leases. All performance measures are adjusted by industry bank average. Industry banks are the banks that operated in the same state and the same quarter as the acquiring bank, and exclude the banks that acquired failed bank institutions in the given quarter.
* Significant at 10%. ** Significant at 5%. *** Significant at 1%.

TABLE 4-4
PRE- AND POST-ACQUISITION CHANGES IN ACQUIRERS' ACCOUNTING-BASED PERFORMANCE INDICATORS DURING DIFFERENT TIME PERIODS

Panel A: Crisis periods

	Pre-Acquisition			Post-Acquisition				
Variable	N	mean	p50	N	mean	p50	MEAN TEST of equality	MEDIAN TEST of equality
Profitability Indicators								
ROA	302	**0.0018*** **	**0.0017*** **	302	**0.0007*** **	**0.0004*** **	**-0.0012*** **	**-0.0013*** **
		(12.01)	**(11.19)**		**(5.57)**	**(6.02)**	**(-5.91)**	**(-7.02)**
ROE	302	**0.0273*** **	**0.0242*** **	302	**0.0163*** **	**0.0125*** **	**-0.0110** **	**-0.0117*** **
		(5.64)	**(10.43)**		**(9.08)**	**(9.69)**	**(-2.13)**	**(-4.56)**
NIM	302	**0.0006*** **	**0.0004*** **	302	**0.0002***	**0.0001** **	**-0.0003***	**-0.0004*** **
		(4.41)	**(4.40)**		**(1.76)**	**(0.82)**	**(-1.85)**	**(-2.62)**
Efficiency Indicators								
CE	302	**-0.0221** **	**-0.0286*** **	302	**-0.0781*** **	**-0.0870*** **	**-0.0560*** **	**-0.0584*** **
		(-2.40)	**(-2.72)**		**(-10.67)**	**(-9.84)**	**(-4.77)**	**(-4.57)**
TE	302	**-0.0174***	**-0.0186** **	302	**-0.0806*** **	**-0.0866*** **	**-0.0632*** **	**-0.0680*** **
		(-1.87)	**(-2.03)**		**(-9.61)**	**(-8.62)**	**(-5.05)**	**(-4.95)**
AE	302	**-0.0207*** **	0.0092	302	**-0.0285*** **	**-0.0109*** **	-0.0077	-0.0201
		(-3.20)	(-0.66)		**(-4.18)**	**(-2.71)**	(-0.82)	(-1.45)
Capital Adequacy Indicators								
Loans_cap	302	**-1.4040*** **	**-1.2638*** **	302	-0.1796	-0.1109	**1.2244*** **	**1.1528*** **
		(-4.89)	**(-6.35)**		(-1.01)	(-0.93)	**(3.63)**	**(4.74)**
Dep_cap	302	**-2.4812*** **	**-1.8838*** **	302	-0.0890	0.3059	**2.3922*** **	**2.1897*** **
		(-7.01)	**(-8.29)**		(-0.42)	(0.48)	**(5.81)**	**(7.03)**
Capital	302	**0.0056*** **	**0.0010***	302	**-0.0074*** **	**-0.0116*** **	**-0.0130*** **	**-0.0127*** **
		(3.16)	**(1.75)**		**(-5.44)**	**(-7.35)**	**(-5.81)**	**(-6.08)**
Asset Quality Indicators								
LLA	302	**-0.0030*** **	**-0.0038*** **	302	**-0.0025*** **	**-0.0036*** **	0.0005	0.0002
		(-5.85)	**(-7.90)**		**(-4.66)**	**(-6.82)**	(0.72)	(0.62)
NPL	302	-0.018	**-0.0045*** **	302	-0.0005	**-0.0029*** **	0.0175	**0.0016*** **
		(-1.19)	**(-7.62)**		(-0.47)	**(-5.25)**	(1.15)	**(3.86)**

Table 4-4 *continued*
PRE- AND POST-ACQUISITION CHANGES IN ACQUIRERS' ACCOUNTING-BASED PERFORMANCE INDICATORS DURING DIFFERENT TIME PERIODS

Panel B: Normal times

	Pre-Merger			Post-Merger				
Variable	N	mean	p50	N	mean	p50	MEAN TEST of equality	MEDIAN TEST of equality
Profitability Indicators								
ROA	184	**0.0020*** (13.03)**	**0.0020*** (9.91)**	184	**0.0006*** (3.76)**	**0.0008*** (5.47)**	**-0.0014*** (-6.46)**	**-0.0012*** (-6.90)**
ROE	184	**0.0506*** (13.01)**	**0.0372*** (10.93)**	184	0.0178 (0.96)	**0.0165*** (7.29)**	**-0.0329* (-1.74)**	**-0.0207*** (-5.18)**
NIM	184	0.0002 (1.27)	0.0001 (1.05)	184	**-0.0003** (-2.40)**	**-0.0002** (-2.30)**	**-0.0004** (-2.52)**	**-0.0003** (-2.31)**
Efficiency Indicators								
CE	184	**0.0270** (2.60)**	**0.0281** (2.36)**	184	-0.0134 (-1.33)	**-0.0250** (-2.15)**	**-0.0404*** (-2.80)**	**-0.0531*** (-3.04)**
TE	184	**0.0303*** (2.82)**	**0.0271*** (2.73)**	184	**-0.0188* (-1.82)**	**-0.0237** (-2.25)**	**-0.0491*** (-3.29)**	**-0.0508*** (-3.43)**
AE	184	0.0029 (0.41)	**0.0277** (2.28)**	184	0.0051 (1.01)	**0.0095** (2.32)**	0.0022 (0.25)	-0.0182 (-1.12)
Capital Adequacy Indicators								
Loans_cap	184	**-1.2494*** (-5.90)**	**-1.0809*** (-6.01)**	184	-0.0987 (-0.14)	**-1.1358*** (-4.34)**	1.1507 (1.59)	-0.0550 (1.05)
Dep_cap	184	**-1.8133*** (-6.44)**	**-1.4706*** (-6.31)**	184	0.7640 (0.75)	**-0.2353** (-1.97)**	**2.5773** (2.43)**	**1.2352*** (3.13)**
Capital	184	**0.0108*** (4.89)**	**0.0064*** (4.02)**	184	**-0.0076*** (-5.28)**	**-0.0100*** (-5.70)**	**-0.0184*** (-6.98)**	**-0.0163*** (-6.78)**
Asset Quality Indicators								
LLA	184	**-0.0038*** (-6.11)**	**-0.0047*** (-7.16)**	184	**-0.0040*** (-5.74)**	**-0.0053*** (-6.75)**	-0.0003 (-0.27)	-0.0006 (-1.18)
NPL	184	**-0.0083*** (-8.00)**	**-0.0105*** (-8.19)**	184	**-0.0040*** (-4.78)**	**-0.0058*** (-6.50)**	**0.0043*** (3.23)**	**0.0047*** (4.02)**

Table 4-4 *continued*
PRE- AND POST-ACQUISITION CHANGES IN ACQUIRERS' ACCOUNTING-BASED PERFORMANCE INDICATORS DURING DIFFERENT TIME PERIODS

Panel C: Banking Crises								
	Pre-Acquisition			Post-Acquisition				
Variable	N	mean	p50	N	mean	p50	MEAN TEST of equality	MEDIAN TEST of equality
Profitability Indicators								
ROA	229	**0.0018*** **	**0.0016*** **	229	**0.0006*** **	**0.0004*** **	**-0.0012*** **	**-0.0011*** **
		(10.94)	**(10.43)**		**(5.58)**	**(5.94)**	**(-5.80)**	**(-6.35)**
ROE	229	**0.0219*** **	**0.0213*** **	229	**0.0142*** **	**0.0126*** **	-0.0077	**-0.0087*** **
		(3.64)	**(8.87)**		**(8.62)**	**(8.97)**	(-1.23)	**(-3.71)**
NIM	229	**0.0005*** **	**0.0004*** **	229	0.0002	-0.0000	-0.0003	**-0.0004** **
		(3.07)	**(3.04)**		(1.00)	(0.06)	(-1.42)	**(-2.09)**
Efficiency Indicators								
CE	229	**-0.0404*** **	**-0.0453*** **	229	**-0.0895*** **	**-0.1009*** **	**-0.0491*** **	**-0.0556*** **
		(-3.95)	**(-4.18)**		**(-10.35)**	**(-9.16)**	**(-3.66)**	**(-3.75)**
TE	229	**-0.0330*** **	**-0.0363*** **	229	**-0.0932*** **	**-0.1216*** **	**-0.0602*** **	**-0.0853*** **
		(-3.12)	**(-3.29)**		**(-9.22)**	**(-8.10)**	**(-4.11)**	**(-4.25)**
AE	229	**-0.0317*** **	**-0.0064** **	229	**-0.0338*** **	**-0.0107** **	-0.0021	-0.0044
		(-4.24)	**(-2.49)**		**(-3.86)**	**(-2.32)**	(-0.18)	(0.19)
Capital Adequacy Indicators								
Loans_cap	229	**-1.1774*** **	**-1.0270*** **	229	-0.2773	-0.0941	**0.9002** **	**0.9329*** **
		(-3.31)	**(-4.75)**		(-1.45)	(-0.90)	**(2.23)**	**(3.48)**
Dep_cap	229	**-2.1627*** **	**-1.6468*** **	229	-0.2004	0.2366	**1.9624*** **	**1.8834*** **
		(-4.98)	**(-6.56)**		(-0.88)	(-0.13)	**(4.00)**	**(5.33)**
Capital	229	**0.0045** **	-0.0004	229	**-0.0067*** **	**-0.0116*** **	**-0.0112*** **	**-0.0112*** **
		(2.20)	(0.85)		**(-4.37)**	**(-5.86)**	**(-4.36)**	**(-4.33)**
Asset Quality Indicators								
LLA	229	**-0.0029*** **	**-0.0034*** **	229	**-0.0024*** **	**-0.0036*** **	0.0005	-0.0001
		(-5.51)	**(-6.75)**		**(-4.13)**	**(-6.26)**	(0.61)	(0.01)
NPL	229	-0.0219	-0.0039***	229	-0.0006	**-0.0032*** **	0.0213	**0.0007** **
		(-1.10)	(-6.34)		(-0.47)	**(-5.49)**	(1.07)	**(2.40)**

Table 4-4 *continued*
PRE- AND POST-ACQUISITION CHANGES IN ACQUIRERS' ACCOUNTING-BASED PERFORMANCE INDICATORS DURING DIFFERENT TIME PERIODS

Panel D: Market Crises								
		Pre-Acquisition			Post-Acquisition			
Variable	N	mean	p50	N	mean	p50	MEAN TEST of equality	MEDIAN TEST of equality
Profitability Indicators								
ROA	73	**0.0019*** **	**0.0023*** **	73	**0.0008** **	**0.0002** **	**-0.0011** **	**-0.0021*** **
		(5.29)	**(4.71)**		**(2.26)**	**(2.00)**	**(-2.20)**	**(-3.00)**
ROE	73	**0.0442*** **	**0.0367*** **	73	**0.0228*** **	**0.0089*** **	**-0.0214** **	**-0.0278*** **
		(6.93)	**(5.68)**		**(4.32)**	**(4.04)**	**(-2.58)**	**(-2.58)**
NIM	73	**0.0009*** **	**0.0006*** **	73	**0.0005***	**0.0002**	-0.0004	-0.0004
		(3.70)	**(3.53)**		**(1.97)**	**(1.56)**	(-1.29)	(-1.60)
Efficiency Indicators								
CE	73	**0.0356***	**0.0381***	73	**-0.0423*** **	**-0.0463*** **	**-0.0778*** **	**-0.0844*** **
		(1.88)	**(1.75)**		**(-3.35)**	**(-3.75)**	**(-3.42)**	**(-2.96)**
TE	73	**0.0316***	0.0476	73	**-0.0411*** **	**-0.0360*** **	**-0.0728*** **	**-0.0836*** **
		(1.73)	(1.63)		**(-3.11)**	**(-3.51)**	**(-3.23)**	**(-2.97)**
AE	73	0.0137	**0.0339*** **	73	**-0.0117** **	**-0.0111***	**-0.0254***	**-0.0451*** **
		(1.12)	**(3.08)**		**(-2.01)**	**(-1.92)**	**(-1.88)**	**(-4.09)**
Capital Adequacy Indicators								
Loans_cap	73	**-2.1145*** **	**-2.3774*** **	73	0.1269	-0.1473	**2.2414*** **	**2.2301*** **
		(-5.40)	**(-4.51)**		(0.30)	(-0.19)	**(3.86)**	**(3.43)**
Dep_cap	73	**-3.4802*** **	**-3.0796*** **	73	0.2603	0.3917	**3.7406*** **	**3.4713*** **
		(-6.62)	**(-5.25)**		(0.53)	(1.03)	**(5.19)**	**(4.79)**
Capital	73	**0.0090** **	**0.0048** **	73	**-0.0095*** **	**-0.0139*** **	**-0.0185*** **	**-0.0186*** **
		(2.62)	**(2.09)**		**(-3.29)**	**(-4.63)**	**(-4.12)**	**(-4.56)**
Asset Quality Indicators								
LLA	73	**-0.0033** **	**-0.0054*** **	73	**-0.0026** **	**-0.0040*** **	0.0007	0.0014
		(-2.47)	**(-4.09)**		**(-2.18)**	**(-2.86)**	(0.38)	(0.93)
NPL	73	**-0.0055*** **	**-0.0072*** **	73	-0.0001	-0.0011	**0.0054** **	**0.0061*** **
		(-3.03)	**(-4.22)**		(-0.08)	(-1.17)	**(2.41)**	**(3.43)**

Table 4-4 *continued*
PRE- AND POST-ACQUISITION CHANGES IN ACQUIRERS' ACCOUNTING-BASED PERFORMANCE INDICATORS DURING DIFFERENT TIME PERIODS

Panel E: Recent Financial Crisis

	Pre-Acquisition			Post-Acquisition				
Variable	N	mean	p50	N	mean	p50	MEAN TEST of equality	MEDIAN TEST of equality
Profitability indicators								
ROA	58	**0.0028*** **	**0.0026*** **	58	**0.0012*** **	**0.0011*** **	**-0.0016*** **	**-0.0015*** **
		(6.60)	**(5.73)**		**(4.20)**	**(4.08)**	**(-3.08)**	**(-3.13)**
ROE	58	0.0153	**0.0358*** **	58	**0.0179*** **	**0.0187*** **	0.0025	**-0.0171** **
		(0.86)	**(3.71)**		**(4.86)**	**(4.63)**	(0.14)	**(-2.04)**
NIM	58	**0.0009** **	**0.0009*** **	58	**0.0007*** **	**0.0005*** **	-0.0002	-0.0004
		(2.57)	**(3.20)**		**(3.05)**	**(3.40)**	(-0.39)	(-0.18)
Efficiency Indicators								
CE	58	**-0.0637*** **	**-0.0938*** **	58	**-0.0774*** **	**-0.0990*** **	-0.0137	-0.0051
		(-2.97)	**(-3.45)**		**(-4.39)**	**(-4.86)**	(-0.49)	(-0.61)
TE	58	**-0.0584*** **	**-0.0754*** **	58	**-0.0642*** **	**-0.0887*** **	-0.0058	-0.0133
		(-2.71)	**(-3.16)**		**(-2.73)**	**(-2.81)**	(-0.18)	(-0.45)
AE	58	**-0.0398***	0.0039	58	**-0.0475***	0.0181	-0.0077	0.0141
		(-1.98)	(-0.96)		(-1.82)	(-1.48)	(-0.23)	(0.53)
Capital Adequacy Indicators								
Loans_cap	58	1.3655	-0.1568	58	0.0690	-0.0523	-1.2965	0.1045
		(1.56)	(0.32)		(0.29)	(0.02)	(-1.43)	(-0.03)
Dep_cap	58	1.3178	-0.3454	58	-0.2746	-0.4067	-1.5924	-0.0613
		(1.27)	(-0.66)		(-0.87)	(-1.38)	(-1.47)	(-0.21)
Capital	58	-0.0054	**-0.0122** **	58	-0.0053	**-0.0105** **	0.0001	0.0017
		(-1.36)	**(-2.05)**		(-1.41)	**(-2.44)**	(0.02)	(0.39)
Asset Quality Indicators								
LLA	58	**-0.0029*** **	**-0.0032*** **	58	**-0.0022** **	**-0.0021*** **	0.0007	0.0010
		(-3.58)	**(-3.67)**		**(-2.31)**	**(-2.64)**	(0.54)	(0.35)
NPL	58	-0.0763	**-0.0032** **	58	0.0041	-0.0012	0.0803	0.0020
		(-0.97)	**(-2.12)**		(0.82)	(-0.65)	(1.02)	(0.89)

NOTES: This table reports pre- and post-merger industry-adjusted accounting-based performance measures for the acquiring banks. The cells contain the number of observations (N), the mean (mean) and the median (p50) for the averaged industry-adjusted performance measures for the 4 quarters before the acquisition (Pre-Acquisition) and 12 quarters after the acquisition (Post-Acquisition). The t-statistics and z-statistics presented below the mean and median respectively show the significant differences from zero, which represent the significant difference from an average industry bank. The last two columns present the mean and median changes between the post-acquisition and pre-acquisition performance measures. Equality tests with the t-statistics and z-statistics are provided in the brackets below. The Performance indicators include Profitability Indicators: return on assets (ROA), measured as net income to total assets, return on equity (ROE), measured as net income to equity, net interest margin (NIM), measured as the difference between net income and net expense to total assets; Efficiency Indicators: Cost efficiency (CE), measured using DEA, and its two components: Technical Efficiency (TE) and Allocative efficiency (AE); Capital Adequacy Indicators: Loans to capital (Loans_cap), measured as total loans and leases to total book equity capital, Deposits to capital (Dep_cap), measured as total deposits to total book equity capital, Capital, measured as total book equity capital to total assets; Asset Quality Indicators: loan loss allowance (LLA), measured as allowance for loans and leases to total loans and leases, non-performing loans (NPL), measured as non-performing loans to total loans and leases. All performance measures are adjusted by industry bank average. Industry banks are the banks that operated in the same state and the same quarter as the acquiring bank, and exclude the banks that acquired failed bank institutions in the given quarter.
Panel A and Panel B report the results for crisis periods and normal times, respectively. Crisis periods are two banking crises (the 1990s credit crunch between 1990:Q1 and 1992:Q4; and the global financial crisis that took place between 2007:Q3 and 2009:Q4) and three market crises (the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3) full sample statistics, Panels C, D and E report separately statistics for the banking crises, market crises and the Global Financial Crisis, respectively.
* Significant at 10%. ** Significant at 5%. *** Significant at 1%.

TABLE 4-5
DIFFERENT PRE- AND POST-ACQUISITION WINDOW ESTIMATION

Variable	-1/+5 year window		-4/+12 quarter window	
	MEAN TEST of equality	MEDIAN TEST of equality	MEAN TEST of equality	MEDIAN TEST of equality
Profitability Indicators				
ROA	**-0.0013*** **	**-0.0014*** **	**-0.0018*** **	**-0.0014*** **
	(-8.23)	**(-9.99)**	**(-7.91)**	**(-10.25)**
ROE	**-0.0242*** **	**-0.0188*** **	0.0332	**-0.0196*** **
	(-6.58)	**(-7.36)**	(0.60)	**(-7.67)**
NIM	**-0.0003***	**-0.0002** **	-0.0002	**-0.0002***
	(-1.66)	**(-2.26)**	(-1.50)	**(-1.76)**
Efficiency Indicators				
CE	**-0.0650*** **	**-0.0808*** **	**-0.0642*** **	**-0.0767*** **
	(-5.96)	**(-5.91)**	**(-5.98)**	**(-6.08)**
TE	**-0.0753*** **	**-0.0891*** **	**-0.0704*** **	**-0.0812*** **
	(-6.68)	**(-6.54)**	**(-6.17)**	**(-6.10)**
AE	-0.0068	**-0.0305*** **	-0.0116	**-0.015***
	(-1.04)	**(-3.60)**	(-1.34)	**(-1.73)**
Capital Adequacy Indicators				
Loans_cap	**1.5426*** **	**1.2930*** **	0.2376	**1.1521*** **
	(5.62)	**(5.49)**	(0.20)	**(5.93)**
Dep_cap	**2.7718*** **	**2.1495*** **	0.8333	**1.7582*** **
	(7.95)	**(7.72)**	(0.47)	**(7.60)**
Capital	**-0.0157*** **	**-0.0161*** **	**-0.0143*** **	**-0.0125*** **
	(-8.08)	**(-8.23)**	**(-7.53)**	**(-8.02)**
Asset Quality Indicators				
LLA	0.0009	0.0004	**0.0015** **	0.0005
	(1.35)	(1.51)	**(2.25)**	(1.19)
NPL	0.0173	**0.0034*** **	0.0231	**0.0035*** **
	(1.29)	**(6.17)**	(1.25)	**(7.14)**

NOTES: This table reports pre- and post-merger industry-adjusted accounting-based performance measures for the acquiring banks. The cells contain the mean (median) tests for the changes in failed bank acquirers' performance indicators. The first two columns present the results for the -1/+5 year window, and the last two columns present the results for the -4/+12 quarter window. The variable changes for the -1/+5 window are computed as the change between the average value in the 5 years (20 quarters) post-acquisition and the average value of the 1 year (4 quarters) pre-acquisition. The variables changes for the -4/+12 quarter window is the change of the value between the 12th quarter post-acquisition and the 4th quarter pre-acquisition. Equality tests with the t-statistics and z-statistics are provided in the brackets below. The Performance indicators include Profitability Indicators: return on assets (**ROA**), measured as net income to total assets, return on equity (**ROE**), measured as net income to equity, net interest margin (**NIM**), measured as the difference between net income and net expense to total assets; Efficiency Indicators: Cost efficiency (**CE**), measured using DEA, and its two components: Technical Efficiency (**TE**) and Allocative efficiency (**AE**); Capital Adequacy Indicators: Loans to capital (**Loans_cap**), measured as total loans and leases to total book equity capital, Deposits to capital (**Dep_cap**), measured as total deposits to total book equity capital, **Capital**, measured as total book equity capital to total assets; Asset Quality Indicators: loan loss allowance (**LLA**), measured as allowance for loans and leases to total loans and leases, non-performing loans (**NPL**), measured as non-performing loans to total loans and leases. All performance measures are adjusted by industry bank average. Industry banks are the banks that operated in the same state and the same quarter as the acquiring bank, and exclude the banks that acquired failed bank institutions in the given quarter.
* Significant at 10%. ** Significant at 5%. *** Significant at 1%.

TABLE 4-6
BEFORE AND AFTER THE ENACTMENT OF THE FDICIA

Variable	Before FDICIA		After FDICIA	
	MEAN TEST of equality	MEDIAN TEST of equality	MEAN TEST of equality	MEDIAN TEST of equality
Profitability Indicators				
ROA	**-0.0014*** **	**-0.0014*** **	**-0.0011*** **	**-0.0010*** **
	(-7.99)	**(-8.81)**	**(-3.94)**	**(-4.63)**
ROE	**-0.0268** **	**-0.0188*** **	-0.0063	**-0.0080*** **
	(-2.31)	**(-6.38)**	(-0.83)	**(-2.77)**
NIM	**-0.0005*** **	**-0.0003*** **	-0.0001	-0.0003
	(-3.83)	**(-3.45)**	(-0.54)	(-1.21)
Efficiency Indicators				
CE	**-0.0477*** **	**-0.0593*** **	**-0.0542*** **	**-0.0605*** **
	(-4.09)	**(-4.34)**	**(-3.70)**	**(-3.83)**
TE	**-0.0530*** **	**-0.0616*** **	**-0.0664*** **	-0.0877***
	(-4.44)	**(-4.61)**	**(-4.08)**	(-4.21)
AE	-0.0051	**-0.0200*** **	-0.0021	-0.0083
	(-0.75)	**(-2.75)**	(-0.15)	(-0.23)
Capital Adequacy Indicators				
Loans_cap	**1.6059*** **	**1.2369*** **	0.4943	**0.5765** **
	(3.39)	**(4.16)**	(1.06)	**(1.99)**
Dep_cap	**3.1987*** **	**2.1124*** **	**1.1993** **	**1.4129*** **
	(4.72)	**(6.91)**	**(2.13)**	**(3.47)**
Capital	**-0.0191*** **	**-0.0172*** **	**-0.008*** **	**-0.0079*** **
	(-9.12)	**(-9.10)**	**(-2.79)**	**(-3.05)**
Asset Quality Indicators				
LLA	0.0001	-0.0006	0.0005	0.0008
	(0.09)	(-0.79)	(0.60)	(0.78)
NPL	**0.0043*** **	**0.0037*** **	0.0266	0.0009
	(4.10)	**(5.52)**	(1.04)	(1.57)

NOTES: This table reports pre- and post-merger industry-adjusted accounting-based performance measures for the acquiring banks. The first two columns present the results for the P&A transactions that happened before the enactment of the FDICIA in 1991, and the last two columns present the results for the P&A transactions that happened after the enactment of the FDICIA in 1991. The cells contain mean and median and median tests of the changes in the averaged industry-adjusted performance measures for the 12 quarters after the merger and 4 quarters before the merger. The t-statistics and z-statistics are provided in the brackets below. The Performance indicators include Profitability Indicators: return on assets (**ROA**), measured as net income to total assets, return on equity (**ROE**), measured as net income to equity, net interest margin (**NIM**), measured as the difference between net income and net expense to total assets; Efficiency Indicators: Cost efficiency (**CE**), measured using DEA, and its two components: Technical Efficiency (**TE**) and Allocative efficiency (**AE**); Capital Adequacy Indicators: Loans to capital (**Loans_cap**), measured as total loans and leases to total book equity capital, Deposits to capital (**Dep_cap**), measured as total deposits to total book equity capital, **Capital**, measured as total book equity capital to total assets; Asset Quality Indicators: loan loss allowance (**LLA**), measured as allowance for loans and leases to total loans and leases, non-performing loans (**NPL**), measured as non-performing loans to total loans and leases. All performance measures are adjusted by industry bank average. Industry banks are the banks that operated in the same state and the same quarter as the acquiring bank, and exclude the banks that acquired failed bank institutions in the given quarter.
* Significant at 10%. ** Significant at 5%. *** Significant at 1%.

TABLE 4-7
ONLY LARGE ACQUISITIONS

Variable	MEAN TEST of equality	MEDIAN TEST of equality
Profitability Indicators		
ROA	**-0.0013*** **	**-0.0014*** **
	(-6.21)	**(-7.04)**
ROE	-0.0181	**-0.0154*** **
	(-1.24)	**(-4.67)**
NIM	**-0.0006*** **	**-0.0006*** **
	(-4.07)	**(-4.03)**
Efficiency Indicators		
CE	**-0.0569*** **	**-0.0714*** **
	(-4.55)	**(-4.51)**
TE	**-0.0660*** **	**-0.0762*** **
	(-4.99)	**(-4.80)**
AE	-0.0085	-0.0138
	(-0.63)	(-1.22)
Capital Adequacy Indicators		
Loans_cap	**1.5915*** **	**1.2284*** **
	(2.90)	**(4.20)**
Dep_cap	**3.4753*** **	**2.4426*** **
	(4.39)	**(7.42)**
Capital	**-0.0235*** **	**-0.0196*** **
	(-9.03)	**(-9.22)**
Asset Quality Indicators		
LLA	-0.0008	-0.0011
	(-1.01)	(-1.33)
NPL	**0.0030*** **	**0.0030*** **
	(2.67)	**(3.76)**

NOTES: This table reports pre- and post-merger industry-adjusted accounting-based performance measures for the acquiring banks for the largest deals in the sample. The largest deals are the ones, where the relative size of the target to the acquirer is larger than the median relative size in the sample (0.3954). The cells contain mean and median and median tests of the changes in the averaged industry-adjusted performance measures for the 12 quarters after the merger and 4 quarters before the merger. The t-statistics and z-statistics are provided in the brackets below. The Performance indicators include Profitability Indicators: return on assets (**ROA**), measured as net income to total assets, return on equity (**ROE**), measured as net income to equity, net interest margin (**NIM**), measured as the difference between net income and net expense to total assets; Efficiency Indicators: Cost efficiency (**CE**), measured using DEA, and its two components: Technical Efficiency (**TE**) and Allocative efficiency (**AE**); Capital Adequacy Indicators: Loans to capital (**Loans_cap**), measured as total loans and leases to total book equity capital, Deposits to capital (**Dep_cap**), measured as total deposits to total book equity capital, **Capital**, measured as total book equity capital to total assets; Asset Quality Indicators: loan loss allowance (**LLA**), measured as allowance for loans and leases to total loans and leases, non-performing loans (**NPL**), measured as non-performing loans to total loans and leases. All performance measures are adjusted by industry bank average. Industry banks are the banks that operated in the same state and the same quarter as the acquiring bank, and exclude the banks that acquired failed bank institutions in the given quarter.
* Significant at 10%. ** Significant at 5%. *** Significant at 1%.

TABLE 4-8
ONLY DEALS INCLUDING LOSS-SHARING AGREEMENT

Variable	MEAN TEST of equality	MEDIAN TEST of equality
Profitability Indicators		
ROA	**-0.0022*** **	**-0.0018*** **
	(-3.07)	**(-2.96)**
ROE	0.0171	-0.0237
	(0.57)	(-1.40)
NIM	-0.0005	-0.0003
	(-0.86)	(-0.47)
Efficiency Indicators		
CE	-0.0236	-0.0201
	(-0.90)	(-1.14)
TE	-0.0128	-0.0725
	(-0.39)	(-0.64)
AE	-0.0194	-0.0304
	(-0.44)	(0.27)
Capital Adequacy Indicators		
Loans_cap	**-2.5796***	-0.0012
	(-1.74)	(-0.66)
Dep_cap	**-3.0669***	-0.3817
	(-1.75)	(-0.47)
Capital	-0.0010	0.0006
	(-0.13)	(0.04)
Asset Quality Indicators		
LLA	0.0009	0.0011
	(0.46)	(0.41)
NPL	0.0031	0.0013
	(0.31)	(0.04)

NOTES: This table reports pre- and post-merger industry-adjusted accounting-based performance measures for the acquiring banks for the largest deals in the sample. The largest deals are the ones, where the relative size of the target to the acquirer is larger than the median relative size in the sample (0.3954). The cells contain mean and median and median tests of the changes in the averaged industry-adjusted performance measures for the 12 quarters after the merger and 4 quarters before the merger. The t-statistics and z-statistics are provided in the brackets below. The Performance indicators include Profitability Indicators: return on assets (**ROA**), measured as net income to total assets, return on equity (**ROE**), measured as net income to equity, net interest margin (**NIM**), measured as the difference between net income and net expense to total assets; Efficiency Indicators: Cost efficiency (**CE**), measured using DEA, and its two components: Technical Efficiency (**TE**) and Allocative efficiency (**AE**); Capital Adequacy Indicators: Loans to capital (**Loans_cap**), measured as total loans and leases to total book equity capital, Deposits to capital (**Dep_cap**), measured as total deposits to total book equity capital, **Capital**, measured as total book equity capital to total assets; Asset Quality Indicators: loan loss allowance (**LLA**), measured as allowance for loans and leases to total loans and leases, non-performing loans (**NPL**), measured as non-performing loans to total loans and leases. All performance measures are adjusted by industry bank average. Industry banks are the banks that operated in the same state and the same quarter as the acquiring bank, and exclude the banks that acquired failed bank institutions in the given quarter.
* Significant at 10%. ** Significant at 5%. *** Significant at 1%.

TABLE 4-9
REGRESSION ANALYSIS OF CHANGES IN INDUSTRY-ADJUSTED PERFORMANCE INDICATORS

	Profitability Indicators			Efficiency Indicators			Capital Adequacy Indicators			Asset Quality Indicators	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
VARIABLES	ΔROA	ΔROE	ΔNIM	ΔCE	ΔTE	ΔAE	ΔLoans_cap	ΔDep_cap	ΔCapital	ΔLLA	ΔNPL
$Size_{t-1}$	**0.000*** **	-0.000	**0.000*** **	0.000	0.000	0.000	0.000	-0.000	0.000	-0.000	**0.000*** **
	(6.032)	(-0.289)	**(2.983)**	(0.156)	(0.167)	(1.476)	(0.092)	(-0.848)	(1.340)	(-0.628)	**(2.310)**
Rel_size	0.000	0.000	**-0.000****	-0.003	-0.004	-0.001	0.064	**0.375****	-0.003	**-0.002*** **	-0.000
	(0.718)	(0.124)	**(-2.204)**	(-0.647)	(-0.739)	(-0.401)	(0.473)	**(2.044)**	(-1.573)	**(-5.529)**	(-0.084)
$Capital_{t-1}$	-0.002	-0.094	**-0.009*** **	-0.169	-0.156	-0.110	12.850	20.183		-0.006	-0.001
	(-0.457)	(-0.420)	**(-3.047)**	(-0.740)	(-0.572)	(-0.589)	(1.385)	(1.607)		(-0.532)	(-0.053)
NPL_{t-1}	0.009	0.738	-0.010	0.133	0.303	-0.202	18.973	27.628	0.020	-0.047	
	(0.939)	(1.400)	(-1.659)	(0.407)	(0.774)	(-0.673)	(1.143)	(1.021)	(0.310)	(-1.238)	
LLA_{t-1}	0.023	**1.136***	-0.006	-0.005	0.175	-0.039	**-86.432****	**-126.103*** **	0.167		**-0.317*** **
	(1.269)	**(1.866)**	(-0.585)	(-0.007)	(0.237)	(-0.085)	**(-2.543)**	**(-2.738)**	(1.562)		**(-3.309)**
Same_state	-0.000	0.011	0.001	**-0.070****	**-0.093****	0.013	0.320	-0.186	**-0.016****	0.001	-0.005
	(-0.577)	(0.402)	(1.441)	**(-2.573)**	**(-2.154)**	(0.478)	(0.272)	(-0.115)	**(-2.375)**	(0.476)	(-0.963)
A_age	-0.000	-0.002	0.000	-0.002	-0.002	-0.004	-0.722	-1.156	**0.007*** **	-0.000	-0.001
	(-0.563)	(-0.134)	(0.366)	(-0.309)	(-0.306)	(-0.811)	(-1.487)	(-1.583)	**(4.659)**	(-0.574)	(-1.303)
T_age	0.000	0.005	-0.000	0.006	0.007	-0.003	-0.119	-0.023	**-0.002***	-0.000	-0.000
	(0.716)	(1.651)	(-0.402)	(1.127)	(1.227)	(-0.961)	(-0.716)	(-0.101)	**(-1.915)**	(-0.360)	(-0.197)
LSA	**-0.002*** **	0.021	-0.000	0.018	0.035	-0.013	**-4.061***	**-5.878****	0.006	0.001	-0.001
	(-5.366)	(0.514)	(-0.598)	(0.873)	(1.267)	(-0.711)	**(-1.883)**	**(-2.374)**	(1.308)	(0.683)	(-0.106)
FDICIA	**0.000****	0.013	**0.000****	-0.018	-0.028	0.005	-0.558	**-1.276****	**0.007****	-0.000	**-0.004*** **
	(2.235)	(1.279)	**(2.457)**	(-1.069)	(-1.468)	(0.433)	(-1.089)	**(-2.004)**	**(2.219)**	(-0.106)	**(-3.183)**
Banking Crisis	0.000	0.025	-0.000	0.003	0.005	-0.008	0.846	1.366	-0.002	0.001	0.001
	(1.102)	(1.387)	(-0.753)	(0.213)	(0.293)	(-0.715)	(1.058)	(1.185)	(-0.441)	(0.691)	(0.088)
Market Crisis	0.000	0.008	0.000	**-0.039***	-0.025	**-0.027****	1.264	1.341	-0.001	0.002	0.002
	(0.448)	(0.362)	(0.252)	**(-1.964)**	(-1.309)	**(-2.186)**	(1.433)	(1.050)	(-0.306)	(1.391)	(0.398)
Constant	-0.001	-0.077	0.000	0.033	0.039	0.028	3.648	6.527	-0.024***	0.002	-0.062
	(-1.165)	(-0.902)	(0.055)	(0.726)	(0.682)	(0.681)	(1.027)	(1.275)	(-2.654)	(0.800)	(-1.440)
Observations	486	486	486	486	486	486	486	486	486	486	486
R-squared	0.05	0.02	0.08	0.03	0.03	0.02	0.06	0.06	0.20	0.08	0.10

NOTES: This table presents OLS regression results for the changes in industry-adjusted performance measures of failed bank acquirers. The dependent variables include **ΔROA** (the change in return on assets), **ΔROE** (the change in return in equity), **ΔNIM** (the change in net interest margin), **ΔCE** (the change in cost efficiency), **ΔTE** (the change in technical efficiency), ΔAE (the change in allocative efficiency), **ΔLoans_cap** (the change in the loans to equity ratio), **ΔDep_cap** (the change in the deposits to equity ratio), **ΔCapital** (the change in equity to assets ratio), **ΔLLA** (the change in loan loss allowance to total loans and leases ratio), **ΔNPL** (the change in non-performing loans to total loans and leases ratio). All the dependent variables are calculated as the difference between the average industry-adjusted value of 12 quarters post- and the average industry-adjusted value of 4 quarters pre-acquisition. The explanatory variables include **Size** (the log of acquiring banks' total assets measured in thousands of US dollars and in real terms), **Rel_size** (the ratio of the total assets of the target to total assets of the acquirer), **Capital (**the ratio between the acquirers' bank book value of equity and bank total assets), **NPL** (the ratio between acquirers' non-performing loans and total loans and leases), **LLA** (the ratio between the acquirers' loan loss allowance and total loans and leases), Same_state (a dummy variable that equals one if both, the target and the acquirer, are headquartered in the same state, and zero otherwise), **A_age** (the log of the age of the acquirer), **T_age** (the log of the age of the target), **LSA** (a dummy that equals one if the P&A transaction included a loss sharing agreement, and zero otherwise), **FDICIA** (a dummy that equals one if the P&A transaction happened after the enactment of the FDICIA in 1991, and zero otherwise), **Banking Crisis** (a dummy variable that equals one if the P&A transaction happened during a banking crisis period, and zero otherwise), **Market Crisis** (a dummy variable that equals one if the P&A transaction happened during a market crisis period, and zero otherwise). Banking crises are the 1990s credit crunch between 1990:Q1 and 1992:Q4, and the global financial crisis that took place between 2007:Q3 and 2009:Q4; and the market crises are the stock market crash in 1987:Q4, the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4, and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3. Size, Rel_size, Capital, NPL and LLA are measured with a one quarter lag. The coefficients presented show how much a one unit change in the independent variable increases (decreases) the dependent variables. All models are estimated with robust standard errors clustered by quarter. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

TABLE 4-10
ACTUAL RELATIVE SIZE (USING THE TOTAL ASSETS ACQUIRED TO TOTAL ASSETS OF THE ACQUIRING BANK)

	Profitability Indicators			Efficiency Indicators			Capital Adequacy Indicators			Asset Quality Indicators	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
VARIABLES	ΔROA	ΔROE	ΔNIM	ΔCE	ΔTE	ΔAE	ΔLoans_cap	ΔDep_cap	ΔCapital	ΔLLA	ΔNPL
$Size_{t-1}$	**0.000*** **	-0.000	**0.000** **	-0.000	-0.000	0.000	-0.000	-0.000	0.000	-0.000	**0.000*** **
	(7.350)	(-0.410)	**(2.650)**	(-0.615)	(-0.365)	(0.888)	(-0.078)	(-0.551)	(0.991)	(-0.872)	**(3.431)**
Rel_size*	**0.001***	-0.042	**0.000***	-0.015	-0.012	0.001	1.307	1.085	0.000	-0.002	**0.006** **
	(1.848)	(-0.840)	**(1.720)**	(-0.715)	(-0.501)	(0.030)	(1.041)	(0.675)	(0.064)	(-1.253)	**(2.686)**
$Capital_{t-1}$	-0.005	-0.052	**-0.010*** **	-0.389	-0.578	-0.072	6.972	13.417		0.014	0.006
	(-0.810)	(-0.141)	**(-3.143)**	(-1.075)	(-1.265)	(-0.231)	(0.342)	(0.511)		(0.680)	(0.177)
NPL_{t-1}	-0.003	1.588	**-0.027*** **	0.751	0.757	0.072	18.995	19.614	**0.141** **	-0.059	
	(-0.169)	(1.024)	**(-3.412)**	(1.230)	(1.220)	(0.104)	(0.524)	(0.385)	**(2.592)**	(-1.465)	
LLA_{t-1}	0.020	0.966	-0.018	-0.417	0.110	-0.834	-73.704	-64.892	-0.137		-0.102
	(0.973)	(1.324)	(-1.246)	(-0.439)	(0.106)	(-1.115)	(-1.672)	(-1.227)	(-0.826)		(-1.198)
Same_state	-0.000	0.015	0.001	**-0.057***	**-0.081***	0.013	0.464	-0.052	**-0.015** **	-0.001	-0.004
	(-0.310)	(0.492)	(1.563)	**(-1.994)**	**(-1.927)**	(0.449)	(0.420)	(-0.036)	**(-2.439)**	(-0.228)	(-1.207)
A_age	-0.000	-0.015	0.000	0.009	0.006	0.001	-0.856	-1.101	**0.006*** **	0.001	-0.000
	(-0.070)	(-0.741)	(0.762)	(1.055)	(0.576)	(0.131)	(-1.480)	(-1.390)	**(3.866)**	(0.714)	(-0.068)
T_age	**0.000** **	**0.017***	-0.000	-0.005	-0.005	-0.004	-0.401	-0.443	-0.002	**-0.001*** **	**-0.002** **
	(2.318)	**(1.769)**	(-0.728)	(-0.755)	(-0.560)	(-0.597)	(-0.999)	(-0.878)	(-1.353)	**(-2.746)**	**(-2.265)**
LSA	**-0.001*** **	0.050	-0.000	0.008	0.023	-0.018	**-5.194** **	**-6.886** **	0.003	-0.000	-0.005
	(-4.283)	(0.993)	(-1.030)	(0.389)	(0.763)	(-0.917)	**(-2.194)**	**(-2.441)**	(0.606)	(-0.056)	(-0.880)
FDICIA	**0.001***	0.004	**0.001*** **	-0.037	**-0.048***	0.012	-0.322	-1.241	**0.010** **	-0.000	**-0.002***
	(1.996)	(0.204)	**(2.795)**	(-1.588)	**(-1.689)**	(0.764)	(-0.376)	(-1.181)	**(2.525)**	(-0.332)	**(-1.824)**
Banking Crisis	0.000	0.044	-0.000	0.037	0.043	-0.009	**1.998***	**3.205** **	-0.001	0.000	-0.001
	(0.892)	(1.582)	(-1.501)	(1.525)	(1.569)	(-0.637)	**(1.931)**	**(2.371)**	(-0.231)	(0.283)	(-0.681)
Market Crisis	**0.002*** **	**0.058** **	-0.000	0.017	0.020	-0.020	**1.847***	1.647	0.006	-0.005	-0.002
	(2.743)	**(2.081)**	(-0.159)	(0.355)	(0.370)	(-0.464)	**(1.724)**	(1.154)	(0.641)	(-1.323)	(-0.696)
Constant	-0.003***	-0.072	0.000	0.041	0.076	0.013	3.795	5.612	-0.019**	0.004	0.016**
	(-2.740)	(-0.490)	(0.454)	(0.746)	(1.158)	(0.242)	(0.731)	(0.817)	(-2.117)	(0.864)	(2.273)
Observations	220	220	220	220	220	220	220	220	220	220	220
R-squared	0.15	0.04	0.13	0.07	0.07	0.01	0.09	0.09	0.20	0.05	0.17

NOTES: This table presents OLS regression results for the changes in industry-adjusted performance measures of failed bank acquirers. The dependent variables include **ΔROA** (the change in return on assets), **ΔROE** (the change in return in equity), **ΔNIM** (the change in net interest margin), **ΔCE** (the change in cost efficiency), **ΔTE** (the change in technical efficiency), ΔAE (the change in allocative efficiency), **ΔLoans_cap** (the change in the loans to equity ratio), **ΔDep_cap** (the change in the deposits to equity ratio), **ΔCapital** (the change in equity to assets ratio), **ΔLLA** (the change in loan loss allowance to total loans and leases ratio), **ΔNPL** (the change in non-performing loans to total loans and leases ratio). All the dependent variables are calculated as the difference between the average industry-adjusted value of 12 quarters post- and the average industry-adjusted value of 4 quarters pre-acquisition. The explanatory variables include **Size** (the log of acquiring banks' total assets measured in thousands of US dollars and in real terms), **Rel_size*** (the ratio of the total assets of the target sold to total assets of the acquirer), **Capital (**the ratio between the acquirers' bank book value of equity and bank total assets), **NPL** (the ratio between acquirers' non-performing loans and total loans and leases), **LLA** (the ratio between the acquirers' loan loss allowance and total loans and leases), Same_state (a dummy variable that equals one if both, the target and the acquirer, are headquartered in the same state, and zero otherwise), **A_age** (the log of the age of the acquirer), **T_age** (the log of the age of the target), **LSA** (a dummy that equals one if the P&A transaction included a loss sharing agreement, and zero otherwise), **FDICIA** (a dummy that equals one if the P&A transaction happened after the enactment of the FDICIA in 1991, and zero otherwise), **Banking Crisis** (a dummy variable that equals one if the P&A transaction happened during a banking crisis period, and zero otherwise), **Market Crisis** (a dummy variable that equals one if the P&A transaction happened during a market crisis period, and zero otherwise). Banking crises are the 1990s credit crunch between 1990:Q1 and 1992:Q4, and the global financial crisis that took place between 2007:Q3 and 2009:Q4; and the market crises are the stock market crash in 1987:Q4, the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4, and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3. Size, Rel_size, Eq, NPL and LLA are measured with a one quarter lag. The coefficients presented show how much a one unit change in the independent variable increases (decreases) the dependent variables. All models are estimated with robust standard errors clustered by quarter. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

TABLE 4-11
FAILED BANK ACQUISITIONS AND PROBABILITY OF FAILING

VARIABLES	(1) FBA4	(2) FBA8	(3) FBA12
FBA4	**0.106****		
	(-2.256)		
FBA8		**0.480*****	
		(-2.628)	
FBA12			0.745
			(-1.618)
ROA $_{t-2}$	0.451***	0.450***	0.450***
	(-17.690)	(-17.702)	(-17.707)
Size $_{t-2}$	0.944**	0.945**	0.944**
	(-2.475)	(-2.429)	(-2.482)
Capital $_{t-2}$	0.338***	0.338***	0.338***
	(-22.903)	(-22.901)	(-22.895)
NPL $_{t-2}$	1.126***	1.126***	1.126***
	(9.083)	(9.096)	(9.111)
M_share $_{t-2}$	1.026	1.026	1.024
	(1.299)	(1.254)	(1.165)
TMTF $_{t-2}$	0.915**	0.914**	0.915**
	(-2.242)	(-2.257)	(-2.218)
Growth $_{t-2}$	0.876***	0.877***	0.877***
	(-5.297)	(-5.267)	(-5.260)
Young $_{t-2}$	1.121**	1.122**	1.121**
	(2.396)	(2.417)	(2.396)
Crisis $_{t-2}$	1.575***	1.574***	1.574***
	(10.004)	(9.986)	(9.978)
CE $_{t-2}$	0.994***	0.994***	0.994***
	(-4.037)	(-4.068)	(-4.062)
Constant	0.286***	0.284***	0.285***
	(-2.854)	(-2.868)	(-2.863)
Observations	1,160,810	1,160,810	1,160,810

NOTES: This table shows the results of how having acquired a failing bank in the preceding 4 (**FBA4**), 8 (**FBA8**), and 12 (**FBA12**) quarters affect banks' probability of failing. The method employed is a parametric survival (PS) model, with a Gompertz proportional hazard function. The dependent variable, **Fail**, is a dummy that equals one if a bank failed in a given quarter, and zero otherwise. **ROA** is the ratio between bank net income and bank total assets, **Size** is the log of bank total assets measured in thousands of US dollars and in real terms, **CE** is the cost efficiency, measured using DEA, **Capital** is the ratio between bank book value of equity and bank total assets, **NPL** is the ratio between non-performing loans and total loans and leases, **M_Share** is the ratio between bank total assets and the volume of bank total assets in the State where the bank is chartered, **TMTF** is the average capital ratio of the other banks in the same State, **Growth** is the quarterly change of personal income growth in the State where the bank is chartered, and **Young** is a dummy variable that equals one if a bank is young, and zero otherwise. Young is defined as a bank, which is younger that the first quartile of the banks' age in the sample. **Crises** is a dummy that equals one for periods of financial distress and the following four quarters. Crisis periods are two banking crises (the 1990s credit crunch between 1990:Q1 and 1992:Q4; and the global financial crisis that took place between 2007:Q3 and 2009:Q4) and three market crises (the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3). All independent variables apart from Crises and Young are lagged by two quarters to avoid possible endogeneity. The coefficients presented are hazard rates, which show how much a one unit change in the independent variable increases (decreases) the probability of a bank's failure. z values are provided in parentheses; values below one indicate a decline in bank probability of failure, and values above one indicate an increase in the independent variable. All models are estimated with robust standard errors clustered by bank.
* Significant at 10%. ** Significant at 5%. *** Significant at 1%.

TABLE 4-12
FAILED BANK ACQUISITIONS AND THE PROBABILITY OF BEING ACQUIRED

VARIABLES	(1) FBA4	(2) FBA8	(3) FBA12
FBA4	**0.366*** **		
	(-5.427)		
FBA8		**0.409*** **	
		(-6.649)	
FBA12			**0.510*** **
			(-6.557)
ROA $_{t-2}$	0.766***	0.766***	0.766***
	(-14.475)	(-14.482)	(-14.476)
Size $_{t-2}$	1.169***	1.172***	1.172***
	(16.891)	(17.085)	(17.130)
CE $_{t-2}$	0.995***	0.995***	0.995***
	(-8.495)	(-8.511)	(-8.526)
Capital $_{t-2}$	0.967***	0.967***	0.967***
	(-7.244)	(-7.226)	(-7.233)
NPL $_{t-2}$	0.919***	0.920***	0.920***
	(-9.516)	(-9.455)	(-9.462)
M_share $_{t-2}$	0.998	0.998	0.999
	(-0.430)	(-0.403)	(-0.388)
TMTF $_{t-2}$	0.933***	0.931***	0.930***
	(-5.229)	(-5.375)	(-5.399)
Growth $_{t-2}$	1.046***	1.047***	1.047***
	(5.700)	(5.707)	(5.734)
Young $_{t-2}$	1.437***	1.438***	1.438***
	(17.555)	(17.566)	(17.559)
Crisis $_{t-2}$	0.957**	0.958**	0.957**
	(-2.223)	(-2.189)	(-2.222)
Constant	0.003***	0.003***	0.003***
	(-43.777)	(-43.817)	(-43.826)
Observations	1,171,602	1,171,602	1,171,602

NOTES: This table shows the results of how having acquired a failing bank in the preceding 4 (**FBA4**), 8 (**FBA8**), and 12 (**FBA12**) quarters affect banks' probability of being acquired. The method employed is a parametric survival (PS) model, with a Gompertz proportional hazard function. The dependent variable, **Acq**, is a dummy that equals one if a bank was acquired in a given quarter, and zero otherwise. **ROA** is the ratio between bank net income and bank total assets, **Size** is the log of bank total assets measured in thousands of US dollars and in real terms, **CE** is the cost efficiency, measured using DEA, **Capital** is the ratio between bank book value of equity and bank total assets, **NPL** is the ratio between non-performing loans and total loans, **M_Share** is the ratio between bank total assets and the volume of bank total assets in the State where the bank is chartered, **TMTF** is the average capital ratio of the other banks in the same State, **Growth** is the quarterly change of personal income growth in the State where the bank is chartered, and **Young** is a dummy variable that equals one if a bank is young, and zero otherwise. Young is defined as a bank, which is younger that the first quartile of the banks' age in the sample. **Crises** is a dummy that equals one for periods of financial distress and the following four quarters. Crisis periods are two banking crises (the 1990s credit crunch between 1990:Q1 and 1992:Q4; and the global financial crisis that took place between 2007:Q3 and 2009:Q4) and three market crises (the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3). All independent variables apart from Crises and Young are lagged by two quarters to avoid possible endogeneity. The coefficients presented are hazard rates, which show how much a one unit change in the independent variable increases (decreases) the probability of a bank's failure. z values are provided in parentheses; values below one indicate a decline in bank probability of failure, and values above one indicate an increase in the independent variable. All models are estimated with robust standard errors clustered by bank.
* Significant at 10%. ** Significant at 5%. *** Significant at 1%.

Chapter 5. The Effects of Competitive Pressures on Failed Bank Resolution Costs

5.1. Introduction

This chapter employs a sample of 1,040 failed bank P&A transactions, selected for the period between 1986 and 2013, to explore how competitive pressures in the banking markets affect failed bank resolution costs. Since the establishment in 1933, the FDIC acted as a receiver for over 2,500 failed banks and thrifts, which cost the Deposit Insurance Fund (DIF) a total of 118.5 billion US dollars to resolve these failures. While the FDIC has been appointed as the most efficient receiver of failed banks, the recent wave of bank failures has depleted the insurance funds to a record high negative balance of -$20.9 billion (Davison and Carreon, 2010). As a result, the FDIC has once again become under the scrutiny of regulators and practitioners, bringing back the debate amongst academics as to what drives the resolution costs stemming from bank failures.

In this respect, the point of departure of the analysis presented in this chapter is the set of studies that have shown that a higher charter value of a failed bank, which has been by and large associated with limited market competition (Buser et al., 1981; Keeley, 1990; Repullo, 2004), reduces resolution costs (Giliberto and Varaiya, 1989; James, 1991). Accordingly, the

chapter postulates that resolution costs are not independent from competitive pressures in the banking market.

Although largely omitted from the existing research, understanding the impact of competitive pressures on failed bank resolution costs is important for several reasons. First, if increased competitive pressures erode the values of banks' charters, as suggested by Keeley (1990), and, in turn, increases the costs to the FDIC (Giliberto and Varaiya, 1989; and James, 1991), perhaps a wider use of alternative resolution methods, such as deposit payoffs, should be considered in markets that have higher competitive pressures[30]. Second, the characteristics that make a failed bank more (less) desirable may be different across markets with different levels of competition (Gorton et al., 2009). Understanding these factors would, therefore, help the FDIC to design and market failed bank auctions in a way to attract more and higher bids to the advantage of the FDIC.

To understand how market competitive pressures influence resolution costs, the analysis employs the adoption of intrastate branching deregulation in the US as an exogenous shock to the degree of market competitive pressures[31]. Since the 1970s, the US banking industry changed significantly following the relaxation of intrastate branching and interstate banking laws (see, for instance, Jayaratne and Strahan, 1996; Demyanyk et al, 2007; and Gorton et al., 2009). The rapid consolidation process that followed considerably changed the competitive dynamics in the markets: the average size of a bank increased (Demyanyk et al., 2007), and small banks lost their market share (Calem, 1994).

[30] It is argued that the value of a franchise is lost, when deposit payoff is used (see, for instance, James, 1991; and Bennett and Unal, 2014). However, if the franchise value diminishes in highly competitive markets, perhaps the use of deposit payoffs may be a preferable choice for the FDIC for banks that fail in those markets.

[31] The focus is on intrastate rather than interstate deregulation, because due to the S&L crisis in the 1980s, federal legislators allowed interstate acquisitions of failed banks and thrifts regardless of the individual state laws (Kerr and Nanda, 2009).

Despite the important implications that the deregulation process has in terms of competitive dynamics, to the best of my knowledge, only one early study has attempted to examine the relation between such event and failed bank resolution costs. Specifically, James (1991) has employed branching deregulation as a determinant of change in the value of the charter to explain the losses realized in bank failures without offering conclusive evidence.

This chapter differs from the study of James (1991) in several ways. First, the analysis presented here includes larger pre- and post-deregulation periods for numerous US states. In contrast, the analysis of James (1991) includes failed bank resolutions that occurred from 1985 to the mid-year of 1988, a period where only 7 states experienced the adoption of branching deregulation. However, as well as James (1991), the results presented in this chapter do not show any direct effect of branching deregulation on failed bank resolution costs.

Second, the analysis continues by evaluating whether the effect of the shift in competitive pressures on resolution costs was dependent on the relative size of the survived banks and the size of the failing bank. The relative size factor employed in this study reflects several important elements. First, it shows the ability of the survived banks in the local market to acquire the failing firms. It is likely that in markets, where the failing bank is relatively large compared to the potential acquirers, survived banks in the local market will be less able to offer high bids in failed bank auctions, thus, increasing the costs to the FDIC. Second, in markets where branching through M&As is allowed, the relative size variable shows the average size of other potential acquisitions compared to that of the failing bank. Although a number of studies use the size of the failing firm as a factor to explain failed bank resolutions costs (see, for instance, Schaeck, 2008; Bennett and Unal, 2014; and Kang et al., 2015), the results are highly mixed[32]. If, in fact,

[32] On the one hand, Schaeck (2008) shows that the size of the failing bank is positively related to resolution costs. On the other hand, Bennett and Unal (2014) find that lower losses were incurred when resolving larger banks.

size is an important determinant for potential acquirers, in a market, where alternative targets exist, the relative size is a more appropriate measure of size.

This chapter shows that the effect of intrastate deregulation was dependent on the relative size variable. In fact, it is shown that deregulation reduced failed bank resolution costs for those failing banks that were closest by size to an average survived bank, whereas the costs increased for the relatively smallest failed banks. These findings have a sensible economic interpretation. When the restrictions to merge are relaxed, survived banks race to expand their market shares by acquiring relatively large institutions. In this case, the relative size factor seems to reflect the size of the target relative to other potential acquisition targets rather than the ability for the survived banks to acquire.

Finally, this chapter contributes to the existing literature by analyzing whether branching deregulation effect, and by implication the effect of competitive pressures, was different in crisis periods and normal times. Stemming from existing evidence that costs to resolve failed banks increase during times of economic distress (see, for instance, Bennett and Unal, 2014), the initial conjecture is that the effects of branching deregulation materialize merely in normal times. For competitive pressures in the market to have an effect on failed bank resolution costs, the increased (reduced) incentives to participate in a failed bank auction should be evident in terms of increased (reduced) number of bidders and the value of bids offered. However, as argued Bennett and Unal (2014), when the industry is in distress, there is a lack of viable bidders in the market, and the knowledge of this motivates the existing potential buyers to offer lower bids.

Finally, Kang et al. (2015) shows a positive relation between the size of the failing bank and resolution costs for the 1986 to 1992 period, however, no significant effect of size was found for the resolutions in the 2008-2012 period.

Essentially, the findings confirm the expectations and show that the effect of deregulation was significant only during normal times.

The analysis in this chapter further extends the debate on factors that influence failed bank resolution costs. The consensus stemming from existing studies is that better quality of failed banks' assets and better macroeconomic conditions reduce the resolution costs incurred by the FDIC (see, for instance, Barth et al., 1990; Schaeck, 2008; Bennett and Unal, 2014; and Kang et al., 2015). Other factors found to reduce failed bank resolution costs include a greater level of the target's information transparency (Granja, 2013; Granja et al., 2014), lower levels of insider loans- a proxy for fraud (Bennett and Unal, 2014), acquirer's geographic proximity (Granja et al., 2014; and Cowan and Salotti, 2015). Finally, bids, which are inversely related to resolution costs (Bennett and Unal, 2014), have been found to increase with the number of bidders participating in the auction (James and Wier, 1987; Bennett and Unal, 2014).

The remaining part of this chapter is structured as follows. The next section introduces the related literature and presents the development of the hypotheses. The third section describes the sample and methodology employed in this chapter. Section 5.4 and section 5.5 present the results of the analysis and robustness checks, respectively. Finally, conclusions are drawn in section 5.6.

5.2. Related Research and the Development of Hypotheses

5.2.1. The Effects of Intrastate Deregulation on Failed Bank Resolution Costs

The existing literature suggests that restrictions on competition should reduce failed bank resolution costs (James, 1991). In this regard, studies have identified two main reasons that motivate the relationship between restrictions on competition and failed bank resolution costs (or the value of the bids offered).

First, limitations on entry and/or expansion increase the local banks' franchise values (see, for instance, Giliberto and Varaiya, 1989; James, 1991) and, consequently, the potential value of the bids in the resolution process. More specifically, the value of a bank's franchise is determined by "the capitalized value of expected future profits" (Hellmann et al., 2000), and this is by and large associated with limited competition due to tough entry requirements in local banking markets (see, for example, Buser et al., 1981; Keeley, 1990; Repullo, 2004).

Second, in regulated markets, where alternative takeover targets are limited, branching through failed bank acquisitions may be a more attractive expansionary strategy, prompting overbidding in failed bank auctions (Bertin et al., 1989). In more detail, branching deregulation in the US changed the competitive dynamics in the market, which in turn had a great influence on the consolidation process (see, for instance, Palia, 1993; Demyanyk et al., 2007). The lifting of restrictions to participate in M&As increased the numbers of potential acquisition targets, thus, likely reducing the incentives to bid in failed bank auctions. In this regard, Bertin et al. (1989) show that cumulative abnormal returns were higher for those failed bank acquirers, which were located in the states that allowed branch banking, and offer the following explanation. "The ability to branch statewide promotes an active takeover market that provides management with value-maximizing incentives and also reduces the attraction to branching through failed bank acquisitions. Thus, the existence of unrestricted statewide branching reinforces the underbidding behaviour".

The above arguments imply that lifting branching restrictions in the US eroded bank charter values, as suggested by Keeley (1990), with the consequence of increased resolution costs of failed banks.

Empirical support for this prediction is, however, scarce. The direct relationship between branching restrictions and failed bank resolution costs has been studied only by a very limited number of early studies and under an empirical setting that makes it problematic to infer the competitive effects of the deregulation process.

Specifically, James (1991) studies 412 bank failures in the period between 1985 and 1988 and he fails to find any significant relation between the losses realized in failed bank resolutions and state branching laws. The lack of evidence to support the relation between branching deregulation and resolution costs in his study, however, may be a result of the limited deregulation events in the sample period analysed. Specifically, only seven states experienced the adoption of branching deregulation in the years between 1985 and 1988. He further employs core deposits as a proxy for the value of the charter of the failed bank to analyse its effects on resolution costs and the level of bids offered in the auction process and shows that the higher the level of core deposits (charter value) the lower are the resolution costs incurred by the FDIC, which suggests that "at least a portion of the bank's charter value accrues to the FDIC". In addition, he finds a positive and significant effect of core deposits on the premiums paid in failed bank auctions, which is consistent with the notion that core deposits contribute to the value of the charter.

In a similar manner, Giliberto and Varaiya (1989) test state branching restrictions as a control variable to test for the effects the value of the charter has on the value of the bids offered in 219 failed bank auctions over the 1975-1985 period. Again, they do not find any statistically significant relation between the branching restrictions and the value of the bids offered, and explain this as follows. Because the states with restrictions on branching are neighbouring states, the Federal District control that they include in their analysis might already reflect the restrictions

on branching. However, similarly to James (1991) they show that the value of bids increases with the level of core deposits acquired.

The empirical evidence contradicts, therefore, the theory of aforementioned studies, which suggests that branching deregulation should have increased the failed bank resolution costs incurred by the FDIC. The lack of evidence on the relationship between state branching restrictions and resolution costs and/or the premiums paid in failed bank auctions suggests other factors may affect these relations. In particular, none of the existing studies differentiate how the impact of the deregulation process might depend on the characteristics of the failed institution.

In this respect, it is likely that in an environment with higher competitive pressures, gaining an additional share in the market drives the acquisition process. Gorton et al. (2009) suggest that regime shifts (in technology or regulation such as the intrastate deregulation) makes larger firms more attractive acquisition targets due to economies of scale. Accordingly, if the competitive pressure is higher, due to the anticipation of other banks expansion, healthy banks may bid high to take over a large failing institution. It is, therefore, plausible that the size of the failing bank should have an impact on failed bank resolution costs when the competitive dynamic changes.

The more general nexus between the size of the failing bank and the losses incurred by the FDIC in the existing literature is mixed. On the one hand, Schaeck (2008) shows that in the period between 1984 and 2003 the losses to FDIC were positively related to the size of the failing target. On the other hand, Bennett and Unal (2014) find that larger banks were less costly to resolve in the period between 1986 and 2007. Finally, Kang et al. (2015) find that smaller banks

were more costly to resolve in the period between 1986 and 1992. The effect of size was, however, not significant for the resolution costs that occurred in the 2008-2012 period.

The contradictory results regarding the relation between the size of the failing bank and the resolution costs are not entirely surprising. First, the observed time frames in these studies differ. Based on the theory proposed by Gorton et al. (2009), the race to expand the market share may be induced by a regime shift. Therefore, large institutions may be preferable targets in more competitive markets or in markets where there is high anticipation of increased merger activities amongst rivals. It follows that the relation between the size of the failing institution and the costs to the FDIC may be dependent on individual states' restrictions on competition.

Furthermore, the size variable employed in these studies does not reflect how large (or small) a failing bank is in the given local market. As a result, the relative size of other banks in the market to that of the failing bank (hereinafter relative size) may be a more appropriate measure of size in the context of a regulatory shift that modifies competitive conditions. More precisely, a relative size measure provides indications not only for the size of the failing bank in the market, but also for the average size of alternative takeover targets and/or the average size of potential acquirers.

Given the arguments discussed above, it is argued in this chapter that failed bank resolution costs depend on the interplay between the shift in competition induced by the removal of branching restrictions imposed by individual state laws and the size distribution of the surviving banks and the failed bank.

In this respect, the following two hypotheses are formulated:

Hypothesis 1: An increase in competitive pressures increased failed bank resolution costs for those banks that were relatively smaller to other banks in the market.

Hypothesis 2: An increase in competitive preesures reduced failed bank resolution costs for those banks that were relatively larger to other banks in the market.

5.2.2. Crises Effects

Additional studies have also drawn attention to the effect of crises on failed bank resolution costs. The general view is that crisis periods increase failed banks' resolution costs substantially. This is because during periods of severe economic distress more failed banks are auctioned off, less and lower bids are received, and liquidity constraints in the banking industry result in failed banks being bought at fire-sale prices, thus increasing the costs to the insurance fund (see, Acharya and Yorulmazer, 2007; Acharya and Yorulmazer, 2008; Schaeck, 2008). Bennet and Unal (2014) show that once the industry escaped the 1986-1991 crisis period, the FDIC received higher bids for failed banks, which in turn led to lower costs. In this regard, Schaeck (2008) suggests that during episodes of economic distress, it is more cost-effective for the FDIC to liquidate the failed banks' assets, even after controlling for the premiums paid for the franchise value in private-sector reorganizations. Acharya and Yorulmazer (2007) argue that it becomes optimal for the regulators to bail out banks, which in turn, increases the incentives for banks to herd ex-ante, thus increasing the risk of them failing together. Acharya and Yorulmazer (2008) show that in order to avoid the ex-ante herding, liquidity provisions should be provided for the surviving banks to purchase the failed banks.

From the studies above, it follows that deregulation might have the anticipated reducing effect on failed bank resolution costs only during normal times, whereas this effect may fail to materialise during periods of economic distress. In this regard, the following hypothesis is constructed:

Hypothesis 3: Deregulation reduced failed bank resolution costs only in normal times.

Validation of Hypothesis 3 would verify the findings of Acharya and Yorulmazer (2008) and Bennet and Unal (2014) that during crises potential acquirers have limited liquidity to assume failing banks, thus, reducing the bids offered. It would further imply that, as in Bertin et al. (1989), with an increase of potential targets, banks would be more selective in their bidding process, and that during crises managers are less likely to overbid in order to reduce the risk of costly mistakes. If Hypothesis 3 is, however, rejected it would imply crises do not reduce the incentives for other banks to bid and the effects of deregulation are strong regardless of the time period of failure.

5.3. Sample and Methodology

5.3.1. Sample

Data on failed bank resolution costs are obtained from the Federal Deposit Insurance Corporation (FDIC) from 1986 to 2013. Consolidated Reports of Condition and Income are used for failed and acquiring bank specific variables as well as for aggregated local banking market controls. Most of the acquirers' certificate IDs were obtained from the SNL Financial with the missing ones collected manually from the FDIC website[33]. The years of intrastate deregulation were used as in Demyanyk et al. (2007) and the missing date for Iowa was collected from the Iowa Legislature (for the full list of deregulation years by state, see Table A 5-1 in section 5.7.1).

The initial data set consisted of 2,929 banks that were included in the FDIC's failed bank list during the sample period between 1986 and 2013. After excluding 347 resolutions, in which the bank's charter survived (assistance transactions), and observations with missing data on resolution costs, a sample of 2,489 failed banks was left. The acquisitions for which there was

[33] https://research.fdic.gov/bankfind/ offers history of all FDIC-insured banking institutions.

no financial data on either the failing or the acquiring institutions were further removed. Specifically, deals, where the last observed Call Report entry for the failing bank was more than two years (eight quarters) prior the failure, were excluded. Finally, deals, where the financial data on the acquiring institution were absent, were also excluded. These rearrangements led to a total sample of 1,040 unique failed bank resolutions, including P&As, P&As of insured deposits only and insured deposit transfers.

The computation of the main dependent variable (**Loss_ass**) is based on previous studies (see, for instance, Granja et al., 2014; Kang et al., 2015). It is, therefore, equal to the total value of resolution costs incurred by the FDIC, adjusted by the failed bank's total assets. Summary statistics of the main dependent variable ***Loss_ass***, as well as its constituents, total losses (***Tot_losses***) and total assets (***Asset***), are provided in Panel A of Table 5-1.

[Table 5-1 here]

In the empirical setting a dummy variable that takes a value of one to identify years following the permission by states for banks to branch statewide through M&As, and 0 otherwise, is used. The summary statistics of the deregulation dummy variable is provided in Panel B of Table 5-1. The mean of 0.821 shows that from the full sample of 1,040 failed bank resolutions, 81.7 % occurred in deregulated states, and 18.3 % occurred in states that restricted branching through M&As.

The relative size variables **SASS_FASS** is computed as the ratio between the average size of a survived bank in the market and the size of the failing bank. The survived banks in the market are the ones that did not fail in a given quarter and are headquartered in the same state as the failing bank. Size is measured as banks' total assets at the time of the P&A transaction for survived banks and at the last available entry for the failed banks. The variable SASS_FASS is

summarized in Panel C of Table 5-1. The mean of 11.57 shows that an average survived bank in the market was 11.57 times larger than the failing bank.

For crisis dating, as in the previous empirical chapters, the study by Berger and Bouwman (2013) is followed. Accordingly, crises include the two banking crises - the 1990s credit crunch between 1990:Q1 and 1992:Q4 and the global financial crisis that took place between 2007:Q3 and 2009:Q4, as well as the three market crises - the stock market crash in 1987:Q4, the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4 and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3.

To identify crisis periods in the empirical analysis a dummy variable that takes a value of 1 for all crisis periods together with a four-quarter post-crisis period, and 0 otherwise, is included. The four-quarter post-crisis period is included to capture the effect of crises that materialize from the initial shock with a lag.

5.3.2. Regression Analysis for Resolution Costs

To evaluate the impact of intrastate deregulation on failed banks' resolution costs, the following linear regression is estimated:

$$Loss\_ass_{i,t,s} = \alpha + \beta_1 Deregulation_{t,s} + \beta_2 SASS\_FASS_{t-n} + \beta_3 Crises_t + \Gamma_{i,t-n}\mathbf{K}_{i,t-n} + \Theta_{i,t-n,s}\mathbf{L}_{i,t-n,s} + \Phi_t \boldsymbol{time}_t + \varepsilon_{i,t,s} \quad (5.1)$$

where *i* indexes a failed bank at time *t* in state *s*. $\boldsymbol{Loss\_ass_{i,t,s}}$ is the dependent variable that measures the losses incurred by the FDIC from failed banks' resolutions, scaled by the last reported failed bank's assets. The main independent variables include $\boldsymbol{Deregulation_{t,s}}$, which is a dummy variable that represents deregulation at time *t* for state *s*, $\boldsymbol{SASS\_FASS_{i,t-n,s}}$, which is a ratio between the average size of the survived bank in the state to the size of the failing bank;

and $\boldsymbol{Crises_t}$ - a dummy variable that equals one if time *t* is in a crisis period, and 0 otherwise. $\boldsymbol{K_{i,t-n}}$ is the vector of target specific controls, $\boldsymbol{L_{i,t-n,s}}$ is the vector for other controls, and $\boldsymbol{time_t}$ controls for the specific quarter of the resolution.

The hypotheses are tested by including interaction terms in the baseline model between deregulation and relative size, as well as deregulation and crises and the following regressions are estimated, accordingly:

$$Loss\_ass_{i,t,s} = \alpha + \beta_1 Deregulation_{t,s} + \beta_2 SASS\_FASS_{i,t-n} + \beta_3 Deregulation_{t,s} * SASS_{FASS}{}_{i,t-n} + \beta_4 Crises_t + \Gamma_{i,t-n}\mathbf{K}_{i,t-n} + \Theta_{i,t-n,s}\mathbf{L}_{i,t-n,s} + \Phi_t \boldsymbol{time}_t + \varepsilon_{i,t,s} \quad (5.2)$$

$$Loss\_ass_{i,t,s} = \alpha + \beta_1 Deregulation_{t,s} + \beta_2 Crises_t + \beta_3 Deregulation_{t,s} * Crises_t + \beta_4 SASS\_FASS_{i,t-n} + \Gamma_{i,t-n}\mathbf{K}_{i,t-n} + \Theta_{i,t-n,s}\mathbf{L}_{i,t-n,s} + \Phi_t \boldsymbol{time}_t + \varepsilon_{i,t,s} \quad (5.3)$$

where the interaction term $Deregulation_{t,s}*SASS\_FASS_{i,t,s}$ measures the effects of deregulation given different levels of the relative size of the average survived banks' size to the size of the failing bank in a state; and where the interaction term $Deregulation_{t,s}*Crises_t$ measures the effect of deregulation given normal and crisis periods.

The set of target-specific controls employed in the econometric analysis are as in Schaeck (2008) and Bennett and Unal (2014) and are presented in Panel E of Table 5-1. Target bank **Size** is measured as the natural logarithm of assets in thousands and in real terms. There are no a priori expectations for the target size and resolution costs relation, as the existing literature provides mixed results. On the one hand, Schaeck (2008) finds that larger banks are more costly to resolve; on the other hand, Bennett and Unal (2014) find an opposite relation and argue that

larger banks have different asset characteristics, and the higher amount of assets allows the receivership to form, service and market asset pools more efficiently. Finally, Kang et al., 2015 show that asset size reduced resolution costs in the 1986-1992 period, however played no effect in the 2008-2012 period. **Capital** is measured as total equity to total assets, and is expected to reduce resolution costs because, as in Schaeck (2008), it is expected that equity serves as a cushion between the asset value and the payments to debtholders. Non-performing loans (**NPL**), measured as the ratio of non-performing loans to total loans, other real estate owned (**ORE**), measured as other real estate owned to total assets, reflect asset quality, are expected to be inversely related to resolution costs (see, James, 1991; Schaeck, 2008; Bennett and Unal, 2014). The ratio of real estate loans to total assets (**REL**) is further included in the econometric model because it is expected that high reliance on real estate lending had a negative effect on banks' performance during crises, thus, deteriorating asset quality and in turn increasing costs incurred by the FDIC. Finally, the ratio of brokered deposits to total deposits (**Bro**) is included, which is inversely related to the charter value (James, 1991), and is expected to have a positive effect on resolution costs (see James, 1991; Bennett and Unal, 2014; Kang et al., 2015).

Other controls employed in the econometric analysis are described in Panel F of Table 5-1. **TSAS** measures the relative size of the target to that of the acquirer and is calculated as the ratio between total assets of the target and total assets of the acquirer. There are no a priori expectations for the relation between the acquirer size and resolutions costs. On the one hand, larger banks may be financially capable to offer higher bids, thus, reducing the costs to the FDIC. On the other hand, if a large bank exhibits market power in a local market, it may reduce other banks' incentives to participate in an auction, thus, allowing the large bank to offer a lower bid. Similarly, the size of the target (**Size_target**), measured as the natural logarithm of assets in thousands and in real terms, can have either a positive, or a negative effect on resolution costs.

A further variable included in the empirical analysis is a dummy that represents deals that occurred after the enactment of the FDICIA (**FDICIA**), and as in Schaeck (2008), is expected to have a negative relation with resolution costs, as the purpose of this act was to reduce the costs for deposit insurers that result from bank failures.

Two dummy variables are included to control for the type of the resolution: insured deposit transfer (**IDT**), and P&A transaction of insured deposits only (**PI**). The benchmark is the most widely used P&A transaction, where both, insured and uninsured deposits are transferred (as well as some other liabilities), and a portion of the assets are sold to the acquirer (**P&A**). IDTs and PIs are expected to be a more costly resolution method than other P&A transactions, because less assets and/or liabilities are transferred to the private sector, leaving more for the FDIC to liquidate.

Other banks' capitalization (**OBC**), measured as the average survived banks' total equity to total assets in the state, is expected to have a negative relation with resolution costs (Granja et al., 2014; and Kang et al., 2015). Finally, better local economic conditions, measured by **Unemployment** (the ratio of unemployment in the state), and **Growth** (quarterly income growth rate in the local state of the failing bank), are expected to reduce failed banks' resolution costs (Schaeck, 1991; Bennett and Unal, 2014; Kang et al., 2015).

5.4. Results

5.4.1. Intrastate Deregulation and Relative Size Effects on Failed Bank Resolution Costs

Panel A of Table 5-2 reports the results of the baseline model in column (1), which tests the general effect of intrastate deregulation on failed bank resolution costs. As in previous studies, the results suggest that intrastate deregulation had no significant effect on failed bank resolution costs. While this result does not contradict the notion that intrastate branching restrictions

elevate the value of a bank's charter, neither does it support the idea that more bids and higher premiums were offered merely due to higher restrictions on competition.

As for the control variable, as expected, better failed banks' characteristics and strong macroeconomic conditions reduce failed bank resolution costs. Specifically, better capitalization, lower levels of non-performing loans, less other real estate owned, lower levels of real estate loans, and lower levels of brokered deposits reduce resolution costs. Failed banks that operate in states where other banks are better capitalized, and income growth is higher, as well as banks that fail during normal times are less costly to resolve. From the three types of resolutions, banks resolved using P&A transactions result in lower losses to the FDIC than those resolved using insured deposit transfer or P&A transaction of insured deposits only. As expected, failing banks were less costly to resolve after the enactment of FDICIA.

As for the size effect, the results are contradictory. While larger banks seem to be less costly to resolve, the relative size of other banks to the failing bank seems to have a positive effect on the costs incurred by the FDIC. However, the coefficient of the relative size effect is not economically meaningful, hence, needs further evaluation. The relative size of the target to the acquirer has a positive and significant coefficient, suggesting that the bigger the failing bank compared to the acquiring bank, the higher the resolution costs. State unemployment and the size of the acquirer has no significant effect on resolution costs. Finally, the greater the concentration in the market, the higher the costs, suggesting some large institutions exhibit market power, thus, eliminating the smaller banks from the competition.

[Table 5-2 here]

To test the validity of the first and second hypotheses an interaction term between intrastate deregulation and the relative size variable is included. The results are reported in

column (2) of Table 5-2. The significant coefficients of the interaction term and of its components indicate that the effect of intrastate deregulation on failed bank resolution costs was dependent on the relative size of the failed bank.

More importantly, for the direct test of Hypothesis 1 and Hypothesis 2, Figure 5-1 shows the marginal effects of deregulation for each decile of the sample distribution of the variable SASS_FASS. The graph shows that intrastate deregulation had a significant impact on resolution costs at the 10^{th}, 20^{th} and the 90^{th} percentile of the SASS_FASS distribution. Specifically, when the average survived bank was similar by size to the failing bank (merely 1.08 times larger), intrastate deregulation reduced the costs to the insurance fund by 4.5 pp[34]. However, when the average survived bank was nearly 20 times (19.20 times) larger than the failing bank, intrastate deregulation, in fact, increased failed bank resolution costs by 5.2 pp. These effects also seem to be economically relevant. Considering that the average failed bank's loss to assets ratio is 23.7%, a 4.5 pp reduction means that on average the total costs of a failed bank reduced by almost 19 % (4.5÷23.7*100), whereas a 5.2 pp increase is equivalent to almost a 22 % (5.2/23.7*100) increase in costs.

This finding is in support of the first and second hypotheses and shows that when the restrictions to merge freely were lifted, failed bank resolution costs were lower for those failed banks that were of a similar size to the survived banks; and larger for the failed banks that were relatively small compared to the average survived bank in the market.

It, therefore, seems that a sudden shift in competition not only increased the consolidation process amongst healthy banks, as suggested by Palia (1993) and Demyanyk et al. (2007), but also prompted failed bank acquisitions of relatively large insolvent banks, as indicated

[34] For the interpretation of percentage points, see section 3.4.1.

by the negative effect on failed bank resolution costs. The relatively small failing banks, however, seem to be more costly to resolve in market with higher competitive pressures, which is not surprising. As argued by Gorton et al. (2009), a regime shift makes larger acquisition targets more preferable due to economics of scales. In addition, in anticipation of other firms' concentration, acquisition of smaller targets may become a less attractive strategy, as they add smaller market share. Finally, branching deregulation may reduce large banks' franchise values less, as they hold higher market shares. Therefore, small failing banks become even less attractive, whereas large failing banks may attract higher premiums for the value of the charter.

[Figure 5-1 here]

The findings are further supported by the effect of SASS_FASS in regulated and deregulated states. To ease the interpretation, and to evaluate the significance of the combined SASS_FASS and the interaction term effect, marginal effects are reported in Panel B of Table 5-2. The results show that, on the one hand, in regulated markets the relative size of survived banks to that of the failing bank reduces resolution costs by 0.5 pp. On the other hand, the opposite is true for deregulated markets: there the relative size factor increases failed bank resolution costs by 0.04 pp. This finding has a sensible economic interpretation. In regulated markets, where acquiring a failing institution can be seen as the only means for expansion, and the value of the charter is high, the competition amongst bidders may be particularly strong especially for small banks, as more survived firms can participate in the auction and offer higher bids. In deregulated markets, however, the incentives to acquire a failing bank is reduced due to existence of other potential acquisition targets in the market, and larger targets become more desirable, as suggested by the existing literature and confirmed by the negative coefficient of the size variable in this

study. Therefore, smaller failing banks most likely attract fewer bidders and smaller premiums in states, where expansion through M&As is free, hence increasing the costs to the DIFs.

5.4.2. Intrastate Deregulation and Crises Effect on Failed Bank Resolution Costs

To test the validity of the third hypothesis, which states that the effects of deregulation materializes during normal times, an interaction term between deregulation and crisis is included in the baseline model specification. The results of the regression analysis are provided in Table 5-3 Panel A. However, more importantly, Panel B shows the marginal effects of deregulation separately for normal times and crisis periods. The results provide support for the third hypothesis. Specifically, they show that intrastate deregulation reduced failed bank resolution costs in normal times while it had no effect in crisis periods. This suggests that the benefits stemming from deregulation in terms of resolution costs do not materialise during times of economic distress.

The reason why a shift in competition has an effect on failed bank resolution costs merely in normal times can be explained as follows. Failed bank resolution costs are by and large dependent on other banks' willingness and financial ability to bid (Cowan and Salotti, 2015), i.e. the more bidders in the auction and the better their financial ability to offer higher bids, the lower are the resolution costs. Both of these determinants are, however, distorted in times of crisis. First, willingness to acquire during crises may be reduced due to uncertainty, which urges managers to act conservatively (Wan and Yiu, 2009) and avoid costly mistakes (Bertin et al., 1989). Second, in times of crisis, lack of liquidity in the banking system reduces the number of buyers, who wish to buy illiquid assets (Cowan and Salotti, 2015) and can afford to offer high bids (Acharya and Yorulmazer, 2008; Bennett and Unal, 2014). Finally, as argued Bennett and Unal (2014), the knowledge of the lack of viable bidders in periods of industry distress motivates the existing auction participants to offer lower bids.

Overall, the effects of the reduced number of potential buyers and the increased number of targets in crisis periods seems to eliminate the effects of the competitive pressures in the market on failed bank resolution costs.

[Table 5-3 here]

5.5. Robustness Checks

In this section the results of a series of robustness checks are summarized. The results are provided in the *Additional Tables* section (section 5.7.1).

First, one of the potential drawbacks of the relative size measure included in the analysis is the use of the average size of survived banks, which may be sensitive to extreme values. Therefore, the initial analysis is replicated by replacing in the current measure of relative size the average of survived banks' assets to the median of their assets. The results are reported in Table A 5-2, and are consistent with the initial findings.

Second, the arguments in this chapter are based on the behaviour of local market participants, as well as their reaction to the change in the competitive environment. However, some states allowed interstate acquisitions before they permitted intrastate branching through M&As. As a result, additional analysis is provided after excluding all interstate acquisitions. Once again, the results, which are reported in Table A 5-3, are fundamentally similar to those reported in the initial analysis.

Finally, it can be argued that the results, and the conclusions drawn, are driven by very large failed bank acquisitions. To check whether the findings are robust to extreme sizes of failed banks, the analysis is repeated after excluding the largest 1% and 5% failed banks according to their assets (in real terms). The results are reported in Table A 5-4, and are qualitatively similar to the initial findings.

5.6. Conclusions

Based on 1,040 failed bank P&A transactions that were completed in the period between 1986 and 2013, this chapter shows that the relation between failed bank resolution costs and competitive pressures in the failed bank's market depends on the relative size of the failed bank to the size of other banks in the market. For the purpose of evaluating the shift in competition, individual state branching deregulation through M&As is employed as an instrument in the empirical setting.

Essentially, the results show that branching deregulation reduced the costs to resolve those failed banks that were of a similar size to an average bank in the market; however, increased the costs for the relatively smallest failed banks. This finding is in support of the notion that a shift in competition induces acquisitions of bigger targets, which offer a larger gain in terms of market share. Further analysis, however, shows that this effect was evident merely in normal times and eliminated in times of crisis.

Overall, the results in this chapter suggest that competitive pressures in the market should be considered when dealing with a failed bank. Specifically, in order to reduce the costs incurred from resolving failed banks, alternative resolution strategies and/or additional incentives for potential buyers should be introduced, when dealing with small failed banks in markets with higher competitive pressures.

5.7. Figures and Tables

TABLE 5-1
SUMMARY STATISTICS

Variable	Symbol	Description	N	mean	p50	St. dev.	p1	p99
Panel A. Dependent variable and its constituents								
Loss on assets ratio	Loss_ass	Ratio of resolution losses incurred by the FDIC to total failing bank's asset last observed	1040	0.237	0.222	0.135	0.004	0.632
Loss	Loss	Failed bank's resolution loss incurred by the FDIC (000s)	1040	46868.630	9686.500	163931.700	127.000	651308.000
Total assets	Asset	Failed bank's assets before failure (000s)	1040	554391.500	43118.500	9580282.000	4555.000	3715433.000
Panel B. Deregulation variable								
Intrastate deregulation	Deregulation	A dummy that equals one following intrastate deregulation in a state, and 0 otherwise	1040	0.817	1.000	0.387	0.000	1.000
Panel C. Relative Size variable								
Relative size	SASS_FASS	Average survived banks' assets in a state to the failing bank's assets	1040	11.572	4.817	36.073	0.186	138.766
Panel D. Crisis dummy								
Crisis period dummy	Crises	Crises is a dummy variable equal 1 if a quarter is in a crisis or post-crisis period, and 0 otherwise.	1040	0.606	1.000	0.489	0.000	1.000
Panel E. Target-specific control variables								
Size	Size	Log(assets) (000s)[a]	1040	11.315	11.056	1.453	8.924	15.445
Equity capital	Capital	Ratio of total equity to total assets[a]	1040	-0.003	0.006	0.052	-0.209	0.086
Non-performing Loans	NPL	Non-performing loans to total loans[a]	1040	0.070	0.051	0.068	0.000	0.326
Other real estate owned	OREO	Ratio of other real estate owned to total assets	1040	0.050	0.038	0.049	0.000	0.203
Real estate loans	REL	Ratio of real estate loans to total assets	1040	0.400	0.380	0.214	0.036	0.833
Brokered deposits	Bro	Ratio of brokered deposits to total deposits	1040	0.046	0.000	0.109	0.000	0.507

TABLE 5-1 *continued*
SUMMARY STATISTICS

Panel F. Other control variables								
Target to acquirer size	TSAS	A ratio between the total assets of the target and the total assets of the acquirer.	1040	0.438	0.241	1.254	0.002	2.856
Size of the acquirer	Size_acquirer	Log(assets) (000s)[a]	1040	12.825	12.431	1.899	9.790	18.763
Enactment of the FDICIA	FDICIA	A dummy variable that equals one if the quarter is after the enactment of FDICIA, and 0 otherwise.	1040	0.538	1.000	0.499	0.000	1.000
P&A transactions	PA	Purchase and Assumption, where the insured and uninsured deposits, certain other liabilities and a portion of the assets were sold to an acquirer.*	1040	0.818	1.000	0.386	0.000	1.000
Insured Deposit Transfer	IDT	Insured Deposit Transfer, where the acquiring institution served as a paying agent for the insurer, established accounts on their books for depositors, and often acquired some assets as well. Includes ABT.*	1040	0.095	0.000	0.294	0.000	1.000
P&A transactions of insured deposits only	PI	Purchase and Assumption of the insured deposits only, where the traditional P&A was modified so that only the insured deposits were assumed by the acquiring institution.*	1040	0.087	0.000	0.281	0.000	1.000
Other Banks' Capitalization	OBC	The average capital ratio of the survived banks in the state, where the failed bank is headquartered.	1040	0.095	0.090	0.020	0.070	0.157
Unemployment	Unemployment	The unemployment rate in the state, where the failed bank is headquartered.	1040	7.720	7.300	1.998	4.200	12.800
Income Growth	Growth	Personal income growth rate in the state of the failed bank's headquarters.	1040	3.275	3.900	3.288	-5.900	8.600
Asset concentration index	HHI	Concentration index of the banks' assets in the same state as the failed bank's headquarters, estimated using the Herfindahl-Hirschman Index.	1040	0.075	0.025	0.124	0.002	0.541

NOTES: This table presents descriptions and summary statistics of the key variables used in this chapter. Panel A presents definition and summary statistics of the dependent variable **Loss_ass**, used in the regression analyses, as well as definitions and summary statistics of its constituents: **Loss** and **Total assets**. Panel B presents the description and summary statistics of the intrastate deregulation variable **Deregulation**, and Panel C presents the relative size measure (**SASS_FASS**) employed in the empirical analyses. Crisis dummy **Crises** is presented in Panel D. Crisis periods are two banking crises (the 1990s credit crunch between 1990:Q1 and 1992:Q4; and the global financial crisis that took place between 2007:Q3 and 2009:Q4) and three market crises (the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3), and include four quarters of post-crisis periods. Panel E and Panel F present respectively target-specific controls, and other controls. Target-specific controls include **Size**, **Capital**, non-performing loans (**NPL**), other real estate owned (**OREO**), real estate loans (**REL**) and brokered deposits (**Bro**). Other controls are the relative size of the target to the acquirer (**TSAS**), the size of the acquirer (**Size_target**), dummy for the enactment of the Federal Deposit Insurance Corporation Improvement Act (**FDICIA**), the type of transaction, including the dummy for P&A transaction (**P&A**), insured deposit transfer (**IDT**), and P&A transaction of insured deposits only (**PI**), as well as state-specific controls, including other banks average equity capital (**OBC**), state unemployment rate (**Unemployment**), and state income growth (**Growth**).

*Definitions are taken from the FDIC help website https://www5.fdic.gov/hsob/help.asp#BF1TT

TABLE 5-2
THE EFFECTS OF INTRASTATE DEREGULATION AND RELATIVE SIZE ON FAILED BANKS' RESOLUTION COSTS

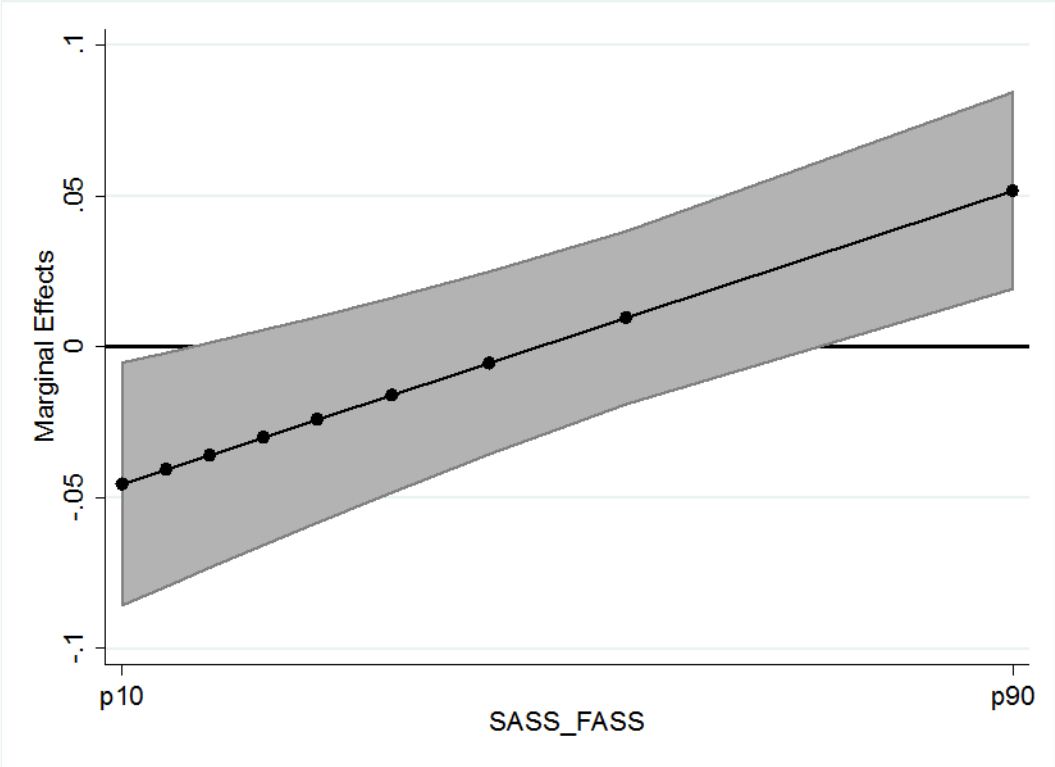
Panel A. OLS regression analysis results		
	(1)	(2)
Deregulation	-0.017	**-0.052****
	(-0.884)	**(-2.048)**
$SASS\_FASS_{t-n}$	**0.000****	**-0.005*****
	(2.428)	**(-3.447)**
Deregulation*.SASS_FASS		0.006***
		(3.674)
Crises	0.079***	-0.041
	(4.060)	(-0.646)
$Size_{t-n}$	-0.027***	-0.030***
	(-3.746)	(-4.338)
$Capital_{t-n}$	-0.565***	-0.563***
	(-10.119)	(-10.449)
NPL_{t-n}	0.169***	0.161***
	(2.830)	(2.767)
$OREO_{t-n}$	0.625***	0.639***
	(10.274)	(10.393)
REL_{t-n}	0.091***	0.094***
	(2.909)	(2.994)
Bro_{t-n}	0.209***	0.211***
	(4.928)	(5.036)
$TSAS_{t-n}$	0.009***	0.009***
	(2.927)	(3.015)
$Size\_acquirer_{t-n}$	0.003	0.003
	(0.692)	(0.837)
FDICIA	-0.161***	0.123*
	(-3.046)	(1.680)
IDT	0.061***	0.061***
	(3.566)	(3.631)
PI	0.052***	0.054***
	(2.718)	(2.779)
OBC	-1.850***	-1.825***
	(-3.931)	(-3.973)
Unemployment	0.004	0.005
	(1.367)	(1.465)
Growth	-0.012***	-0.011***
	(-4.195)	(-4.038)
HHI	0.041*	0.044*
	(1.789)	(1.993)
Constant	0.538***	0.582***
	(6.959)	(7.332)
Time fixed effects	+	+
Observations	1,040	1,040
R-squared	0.44	0.45

Table 5-2 *continued*
THE EFFECTS OF INTRASTATE DEREGULATION AND RELATIVE SIZE ON FAILED BANKS' RESOLUTION COSTS

Panel B: Marginal SASS_FASS effects in regulated and deregulated states	
Regulated states	-0.0053***
	(-3.45)
Deregulated states	0.0004**
	(2.38)

NOTES: This table shows the results of how intrastate deregulation (Deregulation) and the relative size (SASS_FASS) affect failed bank resolution costs (Loss_ass). The method employed is an ordinary least squares (OLS) regression. The dependent variable Loss_ass is the loss incurred by the FDIC from resolving a failed bank, adjusted by the failed bank's total assets. Deregulation is a dummy that equals one if the failed bank's acquisition occurred in a state after intrastate branching was permitted, and zero otherwise. SASS_FASS is the ratio between the average survived banks' total assets in a state at a specific quarter and the total assets of the failed bank. Crises is a dummy that equals one for periods of crises and the following four quarters. Crisis periods are two banking crises (the 1990s credit crunch between 1990:Q1 and 1992:Q4; and the global financial crisis that took place between 2007:Q3 and 2009:Q4) and three market crises (the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3). The target-specific variables include the following: Size - the log of the bank total assets measured in thousands of US dollars and in real terms, Capital, which is the ratio between bank book value of equity and bank total assets, NPL - the ratio between non-performing loans and total loans, OREO – the ratio between other real estate loans to total assets, REL – the ratio between real estate loans and total assets, and Bro - ratio of brokered deposits to total deposits. TSAS is the ratio between the total assets of the target and the total assets of the acquirer. Size_acquirer is the log of the acquiring bank total assets measured in thousands of US dollars and in real terms. FDICIA is a dummy that equals one if the transaction occurred after the enactment of the FDICIA in 1991, and zero otherwise. IDT is a dummy that equals one if the method of the resolution was deposit insurance transfer, and zero otherwise PI is a dummy that equals one if the method of the resolution was Purchase and Assumption of the insured deposits only, and zero otherwise. OBC represents the average survived banks' capitalization level, and is measured as the average capital ratio of the survived banks in the same State, Unemployment is the level of unemployment in the state, where the failed bank is chartered, Growth is the quarterly change of personal income growth in the State where the bank is chartered, and HHI is the concentration index of the total assets of the banks in a state, where the failed bank is chartered, and measured using the Herfindahl-Hirschman Index. Quarter fixed effects are also included. All target- (acquirer-) specific independent variables are observed at the last available quarter before failure (acquisition). Other independent variables are observed at the time of the acquisition. The coefficients presented show how much a one unit change in the independent variable increases (decreases) the dependent variable Loss_ass. z values are provided in parentheses. For the ease of interpretation of the interaction term and its components, Panel B presents marginal SASS_FASS effects for regulated and deregulated states separately. All models are estimated with robust standard errors clustered by bank. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

FIGURE 5-1
MARGINAL DEREGULATION EFFECTS ON FAILED BANK RESOLUTION COSTS



NOTES: This graph shows the results of **Deregulation** marginal effects on failed banks' resolution costs. The dependent variables, **Loss_ass**, is the loss incurred by the FDIC from resolving a failed bank, adjusted by bank total assets. The independent variable, Deregulation, is a dummy that equals one for all the years following deregulation of state branching restrictions by M&As. The marginal effects of Deregulation, shown by the progressive line, are presented for each 10th percentile of the sample distribution of the variable SASS_FASS, which is the ratio between the average survived banks' total assets in a state at a specific quarter and the total assets of the failed bank. The shaded grey area presents the 90th percent confidence interval for the marginal Deregulation effect. The reference line at 0 shows at which points of the SASS_FASS distribution are the marginal Deregulation effects are significantly greater than zero at the 90 percent confidence level. Specifically, the crossing (not crossing) of the shaded area suggests an insignificant (significant) marginal Deregulation effect at that point of SASS_FASS.

TABLE 5-3
THE EFFECTS OF INTRASTATE DEREGULATION AND CRISES ON FAILED BANKS' RESOLUTION COSTS

Panel A. OLS regression analysis results	
Deregulation	**-0.058****
	(-2.212)
SASS_FASS$_{t-n}$	**0.000****
	(2.417)
Crises	-0.101
	(-1.536)
Deregulation*Crises	0.060**
	(2.622)
Size$_{t-n}$	-0.027***
	(-3.725)
Capital$_{t-n}$	-0.574***
	(-9.851)
NPL$_{t-n}$	0.171***
	(2.990)
OREO$_{t-n}$	0.629***
	(10.262)
REL$_{t-n}$	0.091***
	(2.929)
Bro$_{t-n}$	0.206***
	(4.862)
TSAS$_{t-n}$	0.009***
	(2.909)
Size_acquirer$_{t-n}$	0.003
	(0.652)
FDICIA	0.141*
	(1.900)
IDT	0.062***
	(3.588)
PI	0.052***
	(2.708)
OBC	-1.851***
	(-3.956)
Unemployment	0.004
	(1.381)
Growth	-0.012***
	(-4.240)
HHI	0.040*
Constant	(1.769)
Time fixed effects	+
Observations	1,040
R-squared	0.44

TABLE 5-3 *continued*
THE EFFECTS OF INTRASTATE DEREGULATION AND CRISES ON FAILED BANKS' RESOLUTION COSTS

Panel B. Marginal deregulation effects during normal times and crisis periods	
Normal times	-0.0578**
	(-2.21)
Crises	0.0020
	(0.10)

NOTES: This table shows the results of how intrastate deregulation (Deregulation) and Crises affect failed bank resolution costs (Loss_ass). The method employed is an ordinary least squares (OLS) regression. The dependent variable Loss_ass is the loss incurred by the FDIC from resolving a failed bank, adjusted by the failed bank's total assets. Deregulation is a dummy that equals one if the failed bank's acquisition occurred in a state after intrastate branching was permitted, and zero otherwise. SASS_FASS is the ratio between the average survived banks' total assets in a state at a specific quarter and the total assets of the failed bank. Crises is a dummy that equals one for periods of crises and the following four quarters. Crisis periods are two banking crises (the 1990s credit crunch between 1990:Q1 and 1992:Q4; and the global financial crisis that took place between 2007:Q3 and 2009:Q4) and three market crises (the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3). The target-specific variables include the following: Size - the log of the bank total assets measured in thousands of US dollars and in real terms, Capital, which is the ratio between bank book value of equity and bank total assets, NPL - the ratio between non-performing loans and total loans, OREO – the ratio between other real estate loans to total assets, REL – the ratio between real estate loans and total assets, and Bro - ratio of brokered deposits to total deposits. TSAS is the ratio between the total assets of the target and the total assets of the acquirer. Size_acquirer is the log of the acquiring bank total assets measured in thousands of US dollars and in real terms. FDICIA is a dummy that equals one if the transaction occurred after the enactment of the FDICIA in 1991, and zero otherwise. IDT is a dummy that equals one if the method of the resolution was deposit insurance transfer, and zero otherwise PI is a dummy that equals one if the method of the resolution was Purchase and Assumption of the insured deposits only, and zero otherwise. OBC represents the average survived banks' capitalization level, and is measured as the average capital ratio of the survived banks in the same State, Unemployment is the level of unemployment in the state, where the failed bank is chartered, Growth is the quarterly change of personal income growth in the State where the bank is chartered, and HHI is the concentration index of the total assets of the banks in a state, where the failed bank is chartered, and measured using the Herfindahl-Hirschman Index. Quarter fixed effects are also included. All target- (acquirer-) specific independent variables are observed at the last available quarter before failure (acquisition). Other independent variables are observed at the time of the acquisition. The coefficients presented show how much a one unit change in the independent variable increases (decreases) the dependent variable Loss_ass. z values are provided in parentheses. For the ease of interpretation of the interaction term and its components, Panel B presents marginal SASS_FASS effects during normal times and crisis periods separately. All models are estimated with robust standard errors clustered by bank. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

5.7.1. Additional Tables

TABLE A 5-1
YEARS OF INTRASTATE DEREGULATION

State	The year of intrastate branching deregulation
Alabama	**1981**
Alaska	**1960**
Arizona	**1960**
Arkansas	**1994**
California	**1960**
Colorado	**1991**
Connecticut	**1980**
Delaware	**1960**
District of Columbia	**1960**
Florida	**1988**
Georgia	**1983**
Hawaii	**1986**
Idaho	**1960**
Illinois	**1988**
Indiana	**1989**
Iowa	**1997**
Kansas	**1987**
Kentucky	**1990**
Louisiana	**1988**
Maine	**1975**
Maryland	**1960**
Massachusetts	**1984**
Michigan	**1987**
Minnesota	**1993**
Mississippi	**1986**
Missouri	**1990**
Montana	**1990**
Nebraska	**1985**
Nevada	**1960**
New Hampshire	**1987**
New Jersey	**1977**
New Mexico	**1991**
New York	**1976**
North Carolina	**1960**
North Dakota	**1987**
Ohio	**1979**
Oklahoma	**1988**
Oregon	**1985**
Pennsylvania	**1982**
Rhode Island	**1960**
South Carolina	**1960**
South Dakota	**1960**
Tennessee	**1985**
Texas	**1988**

Table A 5-1 *continued*
YEARS OF INTASTATE DEREGULATION

Utah	**1981**
Vermont	**1970**
Virginia	**1978**
Washington	**1985**
West Virginia	**1987**
Wisconsin	**1990**
Wyoming	**1988**

This table presents the years, when the states removed restrictions on intrastate geographic expansion. The data is based on Demyanyk et al. (2007) and the missing date for Iowa deregulation has been obtained from Iowa Legislature.

TABLE A 5-2
ALTERNATIVE RELATIVE SIZE VARIABLE

Deregulation	**-0.062*** **
	(-2.692)
$SMASS\_FASS_{t-1}$	**-0.014*** **
	(-3.898)
Deregulation* $SMASS\_FASS_{t-1}$	0.019***
	(5.624)
Crises	-0.039
	(-0.632)
$Size_{t-1}$	-0.026***
	(-3.529)
$Capital_{t-1}$	-0.567***
	(-10.408)
NPL_{t-1}	0.150**
	(2.602)
$OREO_{t-1}$	0.661***
	(10.157)
REL_{t-1}	0.099***
	(3.110)
Bro_{t-1}	0.215***
	(5.271)
$TSAS_{t-1}$	0.008***
	(2.878)
$Size(target)_{t-1}$	0.002
	(0.534)
FDICIA	0.102
	(1.404)
IDT	0.062***
	(3.797)
PI	0.049**
	(2.614)
OBC	-1.454***
	(-3.059)
Unemployment	0.005
	(1.641)
Growth	-0.012***
	(-4.250)
HHI	0.054**
	(2.325)

Table A 5-1 *continued*
ALTERNATIVE RELATIVE SIZE VARIABLE

Constant	0.523***
	(5.680)
Time fixed effects	+
Observations	1,040
R-squared	0.45

NOTES: This table shows the results of how intrastate deregulation (Deregulation) and the relative size (SMASS_FASS) affect failed bank resolution costs (Loss_ass). The method employed is an ordinary least squares (OLS) regression. The dependent variable Loss_ass is the loss incurred by the FDIC from resolving a failed bank, adjusted by the failed bank's total assets. Deregulation is a dummy that equals one if the failed bank's acquisition occurred in a state after intrastate branching was permitted, and zero otherwise. SMASS_FASS is the ratio between the average survived banks' total assets in a state at a specific quarter and the total assets of the failed bank. Crises is a dummy that equals one for periods of crises and the following four quarters. Crisis periods are two banking crises (the 1990s credit crunch between 1990:Q1 and 1992:Q4; and the global financial crisis that took place between 2007:Q3 and 2009:Q4) and three market crises (the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3). The target-specific variables include the following: Size - the log of the bank total assets measured in thousands of US dollars and in real terms, Capital, which is the ratio between bank book value of equity and bank total assets, NPL - the ratio between non-performing loans and total loans, OREO – the ratio between other real estate loans to total assets, REL – the ratio between real estate loans and total assets, and Bro - ratio of brokered deposits to total deposits. TSAS is the ratio between the total assets of the target and the total assets of the acquirer. Size_acquirer is the log of the acquiring bank total assets measured in thousands of US dollars and in real terms. FDICIA is a dummy that equals one if the transaction occurred after the enactment of the FDICIA in 1991, and zero otherwise. IDT is a dummy that equals one if the method of the resolution was deposit insurance transfer, and zero otherwise PI is a dummy that equals one if the method of the resolution was Purchase and Assumption of the insured deposits only, and zero otherwise. OBC represents the average survived banks' capitalization level, and is measured as the average capital ratio of the survived banks in the same State, Unemployment is the level of unemployment in the state, where the failed bank is chartered, Growth is the quarterly change of personal income growth in the State where the bank is chartered, and HHI is the concentration index of the total assets of the banks in a state, where the failed bank is chartered, and measured using the Herfindahl-Hirschman Index. Quarter fixed effects are also included. All target- (acquirer-) specific independent variables are observed at the last available quarter before failure (acquisition). Other independent variables are observed at the time of the acquisition. The coefficients presented show how much a one unit change in the independent variable increases (decreases) the dependent variable Loss_ass. z values are provided in parentheses. All models are estimated with robust standard errors clustered by bank. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

TABLE A 5-3
EXCLUDING INTERSTATE ACQUISITIONS

Deregulation	**-0.047***
	(-1.849)
$SASS\_FASS_{t-1}$	**-0.004*** **
	(-2.734)
$Deregulation*SASS\_FASS_{t-1}$	0.005***
	(2.957)
Crises	0.012
	(0.151)
$Size_{t-1}$	-0.022**
	(-2.535)
$Capital_{t-1}$	-0.592***
	(-11.253)
NPL_{t-1}	0.164**
	(2.631)
$OREO_{t-1}$	0.556***
	(10.361)
REL_{t-1}	0.080**
	(2.511)
Bro_{t-1}	0.180***
	(3.049)
$TSAS_{t-1}$	0.008***
	(3.377)
$Size(target)_{t-1}$	0.001
	(0.238)
FDICIA	0.107
	(1.307)
IDT	0.060***
	(3.518)
PI	0.044*
	(1.960)
OBC	-2.368***
	(-6.181)
Unemployment	-0.001
	(-0.161)
Growth	-0.014***
	(-4.760)
HHI	0.119***
	(4.485)

Table A 5-2 *continued*
EXCLUDING INTERSTATE ACQUISITIONS

Constant	0.617***
	(7.579)
Time fixed effects	+
Observations	898
R-squared	0.45

NOTES: This table shows the results of how intrastate deregulation (Deregulation) and the relative size (SASS_FASS) affect failed bank resolution costs (Loss_ass) of intrastate acquisitions only. The method employed is an ordinary least squares (OLS) regression. The dependent variable Loss_ass is the loss incurred by the FDIC from resolving a failed bank, adjusted by the failed bank's total assets. Deregulation is a dummy that equals one if the failed bank's acquisition occurred in a state after intrastate branching was permitted, and zero otherwise. SASS_FASS is the ratio between the average survived banks' total assets in a state at a specific quarter and the total assets of the failed bank. Crises is a dummy that equals one for periods of crises and the following four quarters. Crisis periods are two banking crises (the 1990s credit crunch between 1990:Q1 and 1992:Q4; and the global financial crisis that took place between 2007:Q3 and 2009:Q4) and three market crises (the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3). The target-specific variables include the following: Size - the log of the bank total assets measured in thousands of US dollars and in real terms, Capital, which is the ratio between bank book value of equity and bank total assets, NPL - the ratio between non-performing loans and total loans, OREO – the ratio between other real estate loans to total assets, REL – the ratio between real estate loans and total assets, and Bro - ratio of brokered deposits to total deposits. TSAS is the ratio between the total assets of the target and the total assets of the acquirer. Size_acquirer is the log of the acquiring bank total assets measured in thousands of US dollars and in real terms. FDICIA is a dummy that equals one if the transaction occurred after the enactment of the FDICIA in 1991, and zero otherwise. IDT is a dummy that equals one if the method of the resolution was deposit insurance transfer, and zero otherwise PI is a dummy that equals one if the method of the resolution was Purchase and Assumption of the insured deposits only, and zero otherwise. OBC represents the average survived banks' capitalization level, and is measured as the average capital ratio of the survived banks in the same State, Unemployment is the level of unemployment in the state, where the failed bank is chartered, Growth is the quarterly change of personal income growth in the State where the bank is chartered, and HHI is the concentration index of the total assets of the banks in a state, where the failed bank is chartered, and measured using the Herfindahl-Hirschman Index. Quarter fixed effects are also included. All target- (acquirer-) specific independent variables are observed at the last available quarter before failure (acquisition). Other independent variables are observed at the time of the acquisition. The coefficients presented show how much a one unit change in the independent variable increases (decreases) the dependent variable Loss_ass. z values are provided in parentheses. All models are estimated with robust standard errors clustered by bank. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

TABLE A 5-4
EXCLUDING LARGEST BANK FAILURES

	(1) Without 1% largest failed banks	(2) Without 5% largest failed banks
Deregulation	**-0.049***	**-0.049***
	(-1.950)	**(-1.923)**
SASS_FASS$_{t-1}$	**-0.005*****	**-0.004*****
	(-3.024)	**(-2.767)**
Deregulation*SASS_FASS$_{t-1}$	0.005***	0.005***
	(3.251)	(2.987)
Crises	-0.040	0.014
	(-0.656)	(0.196)
Size$_{t-1}$	-0.026***	-0.021***
	(-3.446)	(-2.703)
Capital$_{t-1}$	-0.571***	-0.612***
	(-10.884)	(-12.224)
NPL$_{t-1}$	0.164***	0.156**
	(2.711)	(2.555)
OREO$_{t-1}$	0.627***	0.612***
	(10.127)	(9.651)
REL$_{t-1}$	0.087***	0.066**
	(2.751)	(2.387)
Bro$_{t-1}$	0.203***	0.181***
	(4.699)	(3.349)
TSAS$_{t-1}$	0.008***	0.006**
	(2.738)	(2.277)
Size(target)$_{t-1}$	0.003	0.003
	(0.775)	(0.625)
FDICIA	0.115	0.089
	(1.638)	(1.152)
IDT	0.061***	0.062***
	(3.700)	(3.818)
PI	0.049**	0.037*
	(2.549)	(1.885)
OBC	-1.709***	-1.633***
	(-3.745)	(-3.890)
Unemployment	0.004	0.003
	(1.391)	(1.010)
Growth	-0.012***	-0.011***
	(-3.972)	(-3.906)
HHI	0.043*	0.086***
	(1.871)	(3.213)

Table A 5-3 *continued*
EXCLUDING LARGEST BANK FAILURES

Constant	0.530***	0.494***
	(6.553)	(6.228)
Time fixed effects	+	+
Observations	1,029	988
R-squared	0.45	0.45

NOTES: This table shows the results of how intrastate deregulation (Deregulation) and the relative size (SASS_FASS) affect failed bank resolution costs (Loss_ass), excluding the 1% and 5 % largest failures, according to the failing bank total assets. The method employed is an ordinary least squares (OLS) regression. The dependent variable Loss_ass is the loss incurred by the FDIC from resolving a failed bank, adjusted by the failed bank's total assets. Deregulation is a dummy that equals one if the failed bank's acquisition occurred in a state after intrastate branching was permitted, and zero otherwise. SASS_FASS is the ratio between the average survived banks' total assets in a state at a specific quarter and the total assets of the failed bank. Crises is a dummy that equals one for periods of crises and the following four quarters. Crisis periods are two banking crises (the 1990s credit crunch between 1990:Q1 and 1992:Q4; and the global financial crisis that took place between 2007:Q3 and 2009:Q4) and three market crises (the stock market crash in 1987:Q4; the Russian debt crisis together with the Long-Term Capital Management (LTCM) bailout during 1998:Q3 and 1998:Q4; and the dot.com bubble burst coinciding with the September 11 terrorist attacks between 2000:Q2 and 2002:Q3). The target-specific variables include the following: Size - the log of the bank total assets measured in thousands of US dollars and in real terms, Capital, which is the ratio between bank book value of equity and bank total assets, NPL - the ratio between non-performing loans and total loans, OREO – the ratio between other real estate loans to total assets, REL – the ratio between real estate loans and total assets, and Bro - ratio of brokered deposits to total deposits. TSAS is the ratio between the total assets of the target and the total assets of the acquirer. Size_acquirer is the log of the acquiring bank total assets measured in thousands of US dollars and in real terms. FDICIA is a dummy that equals one if the transaction occurred after the enactment of the FDICIA in 1991, and zero otherwise. IDT is a dummy that equals one if the method of the resolution was deposit insurance transfer, and zero otherwise PI is a dummy that equals one if the method of the resolution was Purchase and Assumption of the insured deposits only, and zero otherwise. OBC represents the average survived banks' capitalization level, and is measured as the average capital ratio of the survived banks in the same State, Unemployment is the level of unemployment in the state, where the failed bank is chartered, Growth is the quarterly change of personal income growth in the State where the bank is chartered, and HHI is the concentration index of the total assets of the banks in a state, where the failed bank is chartered, and measured using the Herfindahl-Hirschman Index. Quarter fixed effects are also included. All target- (acquirer-) specific independent variables are observed at the last available quarter before failure (acquisition). Other independent variables are observed at the time of the acquisition. The coefficients presented show how much a one unit change in the independent variable increases (decreases) the dependent variable Loss_ass. z values are provided in parentheses. All models are estimated with robust standard errors clustered by bank. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

Chapter 6. Conclusions

6.1. Background to the Thesis

Throughout its history, the US banking industry has faced numerous bank failures that have mainly clustered in waives caused by economic downturns. These failure waives have caused severe damages to the economy and, as a result, attracted great attention from academics, regulators and practitioners, who have sought to identify the causes and offer solutions to minimise the negative consequences associated with these failures. This thesis contributes to the general debate on bank failures and is aimed to provide further insight into the management of insolvent banks in the US. Specifically, based on commercial and savings bank failures in the period between 1984 and 2013 and structured around three empirical investigations, this thesis has covered several questions regarding the determinants of bank failures in normal and crisis times, the performance of failed bank acquirers and the determinants of failed bank resolution costs.

The first question raised in this thesis concerns how the interplay between crises and bank efficiency affects the likelihood of a bank failing. The point of departure for this investigation is the notion, first offered by Schumpeter (1939), that crises may have a "cleansing" effect on the markets, by removing the most inefficient market participants and replacing them with the ones that can take over the released resources and employ them more effectively. An

alternative view of crises, known as the "scarring" view, however, suggests that crises destroy firms regardless their productivity. Although there is lack of empirical evidence on which view prevails in the banking industry, understanding it is of a great importance for crises management. On the one hand, evidence on the "cleansing" effect would motivate more limited government interventions to minimise the short-term impact of crises on bank failures. On the other hand, evidence on the "scarring" effect would justify a wider use of bailout policies to reduce the short-term effects of crises on bank failures.

The second question raised in this thesis concerns the impact of failed bank acquisitions on the acquiring banks' long-term performance and is of a great importance for failed bank management. Specifically, prevalence of performance gains for the acquirers would motivate the FDIC to promote healthy institutions' participation in failed bank auctions, thus, reducing the costs stemming from these resolutions. In addition, it would suggest that the successors of the failed banks' assets are more successful in managing these assets, which, in turn, would boost confidence of the failed bank depositors, and reduce the likelihood of a run on a failing bank prior to its closing. If, however, no performance gains to the acquiring banks are evident, alternative resolution design methods could be considered. In other words, if these acquisitions harm the existing healthy banks, further support to the acquirers and additional post-merger incentives may need to be implemented.

The final question raised in this thesis is how competitive pressures affect failed bank resolution costs, incurred by the FDIC. Understanding the impact that competitive pressures may have on failed bank resolution costs is important for two main reasons. First, if increased competitive pressures increase the costs to the FDIC, perhaps a wider use of alternative resolution methods should be used in markets that have higher pressures for competition. Second, if the characteristics that make failed banks more or less desirable are different across

markets with different levels of competitive pressures, as suggested by Gorton et al. (2009), the FDIC could design and market failed bank auctions in a way to reduce the costs stemming from these failures.

The remaining part of this chapter summarises the main findings in the three empirical chapters and depicts policy implications. Further, it indicates the limitations of the empirical analyses conducted and offers directions for future research.

6.2. Summary of Findings

6.2.1. The First Empirical Chapter

Based on quarterly US commercial and savings bank data between 1984 and 2013, the first empirical chapter of this thesis shows that the nature of bank failures during financial crises cannot be fully explained by either the cleansing or the scarring view. In line with the scarring view, it is shown that especially in severe crises, as was the recent global financial crisis that started in the second half of 2007, efficiency does not help banks survive, and the magnitude of the effect of crises does not differ according to the efficiency levels of banks. In other words, crises that are extremely detrimental to the banking industry do not tend to accelerate the removal of inefficient banks compared to normal times. However, while the scarring view is evident when analysing the global financial crisis, the analysis of other crises effects on bank survival provides ambiguous results. Although it is shown that efficiency reduces the likelihood of a bank failing in other crisis periods, the effects of these crises are no different than normal times and are not dependent on the levels of bank efficiency.

Additional support for the scarring view is provided in further analysis, which extends the initial empirical models by incorporating the impact of bank age. While the results partly support the cleansing effect of crises for older banks, they also show that crises have a scarring effect on young banks, which have not reached their full potential. Specifically, the least efficient

older banks are more likely to be removed from the market, however, efficiency does not help young banks survive in times of crises.

Finally, although the results regarding which effect of crises, the cleansing or the scarring, prevails in the US banking industry are controversial, the final step of the analysis conducted in this chapter shows that some benefits arise from crises via an entry effect. In essence, the results show that banks that enter the market during crisis periods achieve higher levels of efficiency than incumbent banks and the banks that enter in normal times. It, therefore, seems that although sometimes scarring to the existing banks, crises liberate the resources for new banks to take over and use more efficiently.

6.2.2. The Second Empirical Chapter

The analysis presented in the second empirical chapter shows that in the period between 1985 and 2010 failed bank acquirers did not gain in terms of long-term performance after realizing the deal. In fact, the results show that the performance measures deteriorated significantly after the acquisition took place.

However, the result observed for the sample of acquisitions realized during the recent financial crisis does not confirm the results of the full sample period analysis. Specifically, with an exception being the declining ROA, all other acquirers' performance measures after the deal remained unchanged as compared to the pre-acquisition period. This result has a sensible economic interpretation: nearly 60% of the sample P&A transactions that occurred during the recent financial crisis included a loss-sharing agreement, which largely eliminated the costs of potential losses of the assets acquired for the acquirer. Furthermore, as a result of the loss-share agreement, the amount of vulnerable assets acquired by a healthy firm increased, which in turn increased the buyer's incentives for more prudent credit management (FDIC, 1998).

The results from the OLS regression analysis on the determinants of acquirers' performance changes do not present a clear pattern. While the explanatory variables employed confirm the view that better (worse) pre-acquisition characteristics of the acquirer and better (worse) economic conditions improve (worsen) the performance measures of the acquirer, the effects differ across the performance measures used in the analysis. Specifically, the effects of the variables employed differ across the measures of performance used in this analysis. Therefore, from the results presented it is not clear which factor (or a group of factors) helps improve the change in failed bank acquirers' performance.

Despite the lack of evidence to support any performance gains that materialize to the acquirer after an acquisition of a failed bank, further analysis shows that having acquired a failed bank reduces the likelihood to disappear from the market. Specifically, banks are less likely to fail if they had participated in failed bank acquisitions in the preceding 4 and 8 quarters. In addition, banks that acquired a failed bank were significantly less likely to become acquisition targets themselves for the following 4, 8 and 12 quarters. Overall, the results suggest that failed bank acquirers increase their possibilities to maintain their charter within the industry.

Overall, the analysis conducted in the second empirical chapter shows critically that despite the fact that P&A transactions have become the most widely used method to resolve failed banks, these transactions are not beneficial for the acquirers in terms of their long-term post-acquisition performance. It, therefore, seems that although the least costly to the insurance funds, such deals may be systemically harmful to the banking sector.

6.2.3. The Third Empirical Chapter

Based on a sample of 1,040 failed bank P&A transactions, selected for the period between 1986 and 2013, the third empirical chapter shows that the relation between competitive pressures in

the market of a failed bank and the costs associated with resolving it depends on the size of the failed bank relative to the size of other banks in the market. Specifically, the results show that relaxed competitive pressures to merge lower the costs for those failed banks that are of a similar size to an average bank in the market. However, deregulation increased resolution costs for the failed banks that were relatively small compared to other banks in the market. These findings support the notion that relaxed restrictions on competitive pressures induce acquisitions of bigger targets, which become more desirable due to their larger market share. Further analyses, however, show that the abovementioned findings hold for normal times, whereas, do not emerge during crisis periods.

6.3. Policy Implications

Failures in the US banking industry, especially when they appear in waves, have been associated with tremendous consequences on the financial system and the economy in general. Not surprisingly, policymakers have sought to identify the causes and evaluate the consequences of bank failures and design the regulatory framework in a way to reduce the number and the extent of bank failure episodes, as well as resolve the troubled and failed banks in the least disruptive to the economy and most cost efficient to the federal system way.

The empirical findings in this thesis have highlighted the need for modifications in both, ex-ante and ex-post, mechanisms for the management of troubled and failed banks in the US. Specifically, the lack of evidence to support the cleansing view of financial crises, which suggests that the least efficient institutions are removed from the market in times of economic distress, indicates a need of ex-ante mechanisms for crisis management (such as the establishment of resolution funds) to reduce the required costly bailout policies.

Furthermore, the lack of gains evident from the analysis on the long-term performance of failed bank acquirers, with an exception being the deals that occurred during the recent global

financial crisis, demonstrates the need for modifications in the process of P&A transactions. Essentially, although the most beneficial to the insurance funds in terms of costs, policymakers should avoid transferring failed banks' assets to healthy firms, if these transactions harm the healthy firms in the system. Instead, additional support for the acquirers, such as the loss-share agreements used during the recent global financial crisis, should be offered.

Finally, the results presented in the last empirical chapter of this thesis shows that the FDIC should consider the competitive pressures in the market when designing the resolution strategy and marketing the auction of a failed bank. Specifically, it seems that gaining market share in markets reduces the incentives for healthy institutions to acquire small targets, which consequently increases the costs to the insurance funds. Therefore, an alternative resolution strategy or additional incentives for the acquirers could be introduced when dealing with small failed banks.

6.4. Limitations and Directions for Future Research

The empirical investigation presented in the first empirical chapter is subject to two main limitations. First, other than outright failure exit mechanism could be considered in the empirical analysis. While robustness tests, where bank acquisitions are modelled as a separate exit event, are provided in the first empirical chapter and show that the two exit mechanisms should not be investigated jointly, an alternative empirical model could be employed. Specifically, a classification method, which allows investigating more than two discrete outcomes in the empirical model, such as multinomial logistic regression, could be employed in future analysis.

Second, an alternative entry mechanism could be further employed in the empirical models. To this end, the investigation has been carried out using the date of the institution's establishment for the definition of entry, however, further analysis could be conducted using entry via branching in new locations.

The main constraint regarding the econometric analysis presented in the second empirical chapter concerns the regression analysis, which is aimed to identify potential determinants of the change in the performance measures of failed bank acquirers. The lack of a clear pattern of the exogenous variable effects employed in the analysis suggests other factors influence the change in the post-acquisition performance of failed bank acquirers. Specifically, factors representing geographic proximity and the business model similarity could be further employed in the model to help explain the change in the acquirers' pre- and post-performance measures.

Finally, the analysis presented in the third empirical chapter could be extended by analysing a longer time frame. As most of the states allowed branching through M&As before the sample period employed, older resolutions could be included in the analysis. The main issue here is, however, the lack of available data on resolution losses incurred by the FDIC prior 1986, which could be potentially overcome by employing an alternative measure for resolution costs.

References

Acharya, V. V. and Yorulmazer, T., 2007. Too Many to Fail - An Analysis of Time-Inconsistency in Bank Closure Policies. *Journal of Financial Intermediation*. **16**(1), pp. 1-31.

Acharya, V. V. and Yorulmazer, T., 2008. Cash-in-the-Market Pricing and Optimal Resolution of Bank Failures. *The Review of Financial Studies*. **21**(6), pp. 2705-2742.

Adrian, T. and Shin, H. S., 2010. Liquidity and Leverage. *Journal of Financial Intermediation*. **19**(3), pp. 418-437.

Allen, F. and Carletti, E., 2010. An Overview of the Crisis: Causes, Consequences, and Solutions. *International Review of Finance*. **10**(1), pp. 1-26.

Aly, H.Y., Grabowski, R., Pasurka, C. and Rangan, N., 1990. Technical, Scale, and Allocative Efficiencies in U.S. Banking: An Empirical Investigation. *The Review of Economics and Statistics*. **72**(2), pp. 211-218.

Amel, D., Barnes, C., Panetta, F. and Salleo, C., 2004. Consolidation and Efficiency in the Financial Sector: A review of the international evidence. *Journal of Banking and Finance*. **28**(10), pp. 2493-2519.

Banker, R., Charnes, A. and Cooper, W. W., 1984. Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis. *Management Science*. **30**(9), pp. 1078-1092.

Barlevy, G., 2002. The Sullying Effect of Recessions. *The Review of Economic Studies*. **69**(1), pp. 65-96.

Barlevy, G., 2003. Credit Market Frictions and the Allocation of Resources over the Business Cycle. *Journal of Monetary Economics*. **50**(8), pp. 1795-1818.

Barth, J. R., Bartholomew, P. F. and Bradley, M. G., 1990. Determinants of Thrift Institution Resolution Costs. *The Journal of Finance*. **45**(3), pp. 731-754.

Beltratti, A. and Paladino, G., 2013. Is M&A Different during a Crisis? Evidence from the European Banking Sector. *Journal of Banking and Finance*. **37**(12), pp. 5394-5405.

Bennett, R. L. and Unal, H., 2014. The Effects of Resolution Methods and Industry Stress on the Loss on Assets from Bank Failures. *Journal of Financial Stability*. **15**, pp. 18-31.

Bennett, R. L., 2001. Failure Resolution and Asset Liquidation: Results of an International Survey of Deposit Insurers. *FDIC Banking Review*. **14**(1), pp. 1-28.

Berg, S. A., Forsund, F. R. and Jansen, E. S., 1992. Malmquist Indices of Productivity Growth during the Deregulation of Norwegian Banking, 1980-89. *Scandinavian Journal of Economics*. **94**(Supplement), pp. S211-S228.

Berger, A. N. and Bouwman, C. H., 2013. How does Capital Affect Bank Performance during Financial Crises? *Journal of Financial Economics*. **109**(1), pp. 146-176.

Berger, A. N. and DeYoung, R., 1997. Problem Loans and Cost Efficiency in Commercial Banks. *Journal of Banking and Finance*. **21**(6), pp. 849-870.

Berger, A. N. and Humphrey, D. B., 1991. The Dominance of Inefficiencies over Scale and Product Mix Economies in Banking. *Journal of Monetary Economics*. **28**(1), pp. 117-148.

Berger, A. N. and Humphrey, D. B., 1997. Efficiency of Financial Institutions: International Survey and Directions for Future Research. *European Journal of Operational Research*. **98**(2), pp. 175-212.

Berger, A. N., Demsetz, R. S. and Strahan, P. E., 1999. The Consolidation of the Financial Services Industry: Causes, Consequences, and Implications for the Future. *Journal of Banking and Finance*. **23**(2-4), pp. 135-194.

Berger, A. N., Imbierowicz, B. and Rauch, C., 2012. The Roles of Corporate Governance in Bank Failures during the Recent Financial Crisis. European Banking Center Discussion Paper, No. 2012-023.

Bernanke, B. S., 1983. Non-Monetary Effects of the Financial Crisis in the Propagation of the Great Depression. NBER Working Paper No. 1054. [Accessed 14 May 2016]. Available from: http://www.nber.org/papers/w1054.

Bertin, W. J., Ghazanfari, F. and Torabzadeh, K. M., 1989. Failed Bank Acquisitions and Successful Bidders' Returns. *Financial Management*. **18**(2), pp. 93-100.

Blalock, G., Gertler, P. J., and Levine, D. I., 2008. Financial Constraints on Investment in an Emerging Market Crisis. *Journal of Monetary Economics*. **55**(3), pp. 568-591.

Bordo, M. D. and Haubrich, J. G., 2010. Credit Crises, Money and Contractions: An Historical View. *Journal of Monetary Economics*. **57**(1), pp. 1-18.

Bordo, M. D. and Wheelock, D. C., 2004. Monetary Policy and Asset Prices: A Look Back at Past U.S. Stock Market Booms. *Federal Reserve Bank of St. Louis Review*. **86**(6), pp. 19-44.

Bovenzi, J. F., 2015. Inside the FDIC. Thirty Years of Bank Failures, Bailouts and Regulatory Battles. Hoboken, New Jersey: John Wiley & Sons, Inc.

Bradbury, M., 1972. Legal Privilege and the Bank of North America. *The Pennsylvania Magazine of History and Biography*. **96**(2), pp. 139-166.

Bresnahan, T. F. and Raff, D. M., 1991. Intra-Industry Heterogeneity and the Great Depression: The American Motor Vehicles. *The Journal of Economic History*. **51**(2), pp. 317-331.

Brown, C. O., and Dinç, I. S., 2011. Too Many to Fail? Evidence of Regulatory Forbearance when the Banking Sector is Weak. *The Review of Financial Studies*. **24**(4), pp. 1378-1405.

Brunnermeier, M. K., 2009. Deciphering the Liquidity and Credit Crunch 2007-2008. *Journal of Economic Perspectives*. **23**(1), pp. 77-100.

Buser, S. A., Chen, A. H. and Kane, E. J., 1981. Federal Deposit Insurance, Regulatory Policy, and Optimal Bank Capital. *The Journal of Finance*. **36**(1), pp. 51-60.

Caballero, R. J. and Hammour, M. L., 1994. The Cleansing Effect of Recessions. *The American Economic Review*. **84**(5), pp. 1350-1368.

Calem, P. S., 1994. The Impact of Geographic Deregulation on Small Banks. Federal Reserve Bank of Philadelphia, Business Review. Philadelphia, PA

Calomiris, C.W. and Mason, J.R., 1997. Contagion and Bank Failures during the Great Depression: The June 1932 Chicago Banking Panic, *American Economic Review*. **87**(5), pp. 863-83.

Calomiris, C. W. and Schweikart, L., 1991. The Panic of 1857: Origins, Transmission, and Containment. *The Journal of Economic History*. **51**(4), pp. 807-834.

Canhoto, A. and Dermine, J., 2003. A Note on Banking Efficiency in Portugal, New vs. Old Banks. *Journal of Banking and Finance*. **27**(11), pp. 2087-2098.

Carpenter, D. H. and Murphy, M. M., 2008. Financial Institution Insolvency: Federal Authority over Fannie Mae, Freddie Mac, and Depository Institutions. CRS Report.

Casacuberta, C. and Gandelman, N., 2012. Protection, Openness, and Factor Adjustment: Evidence from the Manufacturing Sector in Uruguay. *Economic Development and Cultural Change*. **60**(3), pp. 597-629.

Cebenoyan, A. S., Cooperman, E. S. and Register, C. A., 1993. Firm Efficiency and the Regulatory Closure of S&Ls: An Empirical Investigation. *The Review of Economics and Statistics*. **75**(3), pp. 540-545.

Chari, V.V. and Jagannathan, R., 1988. Banking Panics, Information, and Rational Expectations Equilibrium. *Journal of Finance*. **43**(3), pp. 749-761.

Chen, Y., 1999. Banking Panics: The Role of First-Come, First-Served Rule and Information Externalities, *Journal of Political Economy*. **107**(5), pp. 946-968.

Cochran, B., Rose, L. C. and Fraser, D. R., 1995. A Market Evaluation of FDIC Assisted Transactions. *Journal of Banking and Finance*. **19**(2), pp. 261-279.

Coelli, T. J., Rao, D. S. P., O'Donnell, C. J. and Battese, G. E., 2005. An Introduction to Efficiency and Productivity Analysis. 2 ed. New York: Springer Science & Business Media.

Cole, R. A. and White, L. J., 2012. Déjà Vu All Over Again: The Causes of U.S. Commercial Bank Failures This Time Around. *Journal of Financial Services Research*. **42**(1-2), pp. 5-29.

Cornett, M. M. and Tehranian, H., 1992. Changes in Corporate Performance Associated with Bank Acquisitions. *Journal of Financial Economics*. **31**(2), pp. 211-234.

Cornett, M. M., McNutt, J. J. and Tehranian, H., 2006. Performance Changes around Bank Mergers: Revenue Enhancements versus Cost Reductions. *Journal of Money, Credit and Banking*. **38**(4), pp. 1013-1050.

Cowan, A. R. and Salotti, V., 2015. The Resolution of Failed Banks during the Crisis: Acquirer Performance and FDIC Guarantees, 2008 - 2013. *Journal of Banking and Finance*. **54**, pp. 222-238.

Dasgupta, A., 2004. Financial Contagion through Capital Connections: A Model of the Origin and Spread of Bank Panics. *Journal of the European Economic Association*. 2(6), pp. 1049-1084.

Davison, L. K. and Carreon, A. M., 2010. Toward a Long-Term Strategy for Deposit Insurance Fund Management. *FDIC Quarterly*. **4**(4), pp. 29-37.

Dell'Ariccia, G., Detragiache, E., and Rajan, R., 2008. The Real Effect of Banking Crises. *Journal of Financial Intermediation*. **17**(1), pp. 89-112.

DeLong, G. and DeYoung, R., 2007. Learning by Observing: Information Spillovers in the Execution and Valuation of Commercial Bank M&As. *The Journal of Finance*. **62**(1), pp. 181-216.

DeLong, G., 2003. Does Long-Term Performance of Mergers Match Market Expectations? Evidence from the US Banking Industry. *Financial Management*. **32**(2), pp. 5-25.

Demyanyk, Y., Ostergaard, C. and Sørensen, B. E., 2007. U.S. Banking Deregulation, Small Businesses, and Interstate Insurance of Personal Income. *The Journal of Finance*. **62**(6), pp. 2763-2801.

Den Haan, W. J., Sumner, S. W. and Yamashiro, G., 2002. Construction of Aggregate and Regional Bank Data Using the Call Reports, Mimeo.

DeYoung, R. and Hasan, I., 1998. The Performance of De Novo Commercial Banks: A profit Efficiency Approach. *Journal of Banking and Finance*. **22**(5), pp. 565-587.

DeYoung, R. and Torna, G., 2013. Nontraditional Banking Activities and Bank Failures during the Financial Crisis. *Journal of Financial Intermediation*. **22**(3), pp. 397-421.

DeYoung, R., 2003. De Novo Bank Exit. *Journal of Money, Credit, and Banking*. **35**(5), pp. 711-728.

FDIC, 1998. Managing the Crisis: The FDIC and RTC Experience 1980-1994. Washington DC: Federal Deposit Insurance Corporation.

FDIC, 2014a. Historical Timeline. [Accessed 13 May 2016]. Available from: https://www.fdic.gov/about/history/timeline/

FDIC, 2014b. Resolutions Handbook. [Accessed 3 March 2016]. Available from: https://www.fdic.gov/about/freedom/drr_handbook.pdf#nameddest=Ch1

Fethi, M. D. and Pasiouras, F., 2010. Assessing Bank Efficiency and Performance with Operational Research and Artificial Intelligence Techniques: A Survey. *European Journal of Operational Research*. **204**(2), pp. 189-198.

Fiol, C. M. and Lyles, M. A., 1985. Organizational Learning. *The Academy of Management Review*. **10**(4), pp. 803-813.

Fiordelisi, F., Marques-Ibanez, D. and Molyneux, P., 2011. Efficiency and Risk in European Banking. *Journal of Banking and Finance*. **35**(5), pp. 1315-1326.

Fraser, D. R. and Zhang, H., 2009. Mergers and Long-Term Corporate Performance: Evidence from Cross-Border Bank Acquisitions. *Journal of Money, Credit and Banking*. **41**(7), pp. 1503-1513.

Geroski, P., 1995. What do We Know about Entry? *International Journal of Industrial Organization*. **13**(4), pp. 421-440.

Giliberto, S. M. and Varaiya, N. P., 1989. The Winner's Curse and Bidder Competition in Acquisitions: Evidence from Failed Bank Auctions. *The Journal of Finance*. **44**(1), pp. 59-75.

Gomes, J., Greenwood, J., and Rebelo, S., 2001. Equilibrium Unemployment. *Journal of Monetary Economics*. **48**(1), pp. 109-152.

Gorton, G., Kahl, M. and Rosen, R. J., 2009. Eat or Be Eaten: A Theory of Mergers and Firm Size. *The Journal of Finance*. **64**(3), pp. 1291-1344.

Granja, J., 2013. The Relation between Bank Resolutions and Information Environment: Evidence from the Auctions of Failed Banks. *Journal of Accounting Research*. **51**(5), pp. 1031-1070.

Granja, J., Matvos, G. and Seru, A., 2014. Selling Failed Banks. NBER Working Paper No. 20410. [Accessed 3 June 2015]. Available from: http://www.nber.org/papers/w20410.

Greenspan, A., 2004. Risk and Uncertainty in Monetary Policy. *The American Economic Review*. **94**(2), pp. 33-40.

Grossman, R. S., 2008. US Banking History, Civil War to World War II. [Accessed 16 May 2016]. Available from: http://eh.net/encyclopedia/us-banking-history-civil-war-to-world-war-ii/.

Gupta, A. and Misra, L., 1999. Failure and Failure Resolution in the US Thrift and Banking Industries. *Financial Management*. **28**(4), pp. 87-105.

Hallward-Driemeier, M. and Rijkers, B., 2013. Do Crises catalyze Creative Destruction? Firm-level Evidence from Indonesia. *The Review of Economics and Statistics*. **95**(5), pp. 1788-1810.

Havrylchyk, O., 2006. Efficiency of the Polish Banking Industry: Foreign Versus Domestic Banks. *Journal of Banking and Finance*. **30**(7), pp. 1975-1996.

Hellmann, T. F., Murdock, K. C. and Stiglitz, J. E., 2000. Liberalization, Moral Hazard in Banking, and Prudential Regulation: Are Capital Requirements Enough?. *The American Economic Review*. **90**(1), pp. 147-165.

Hermalin, B. E. and Wallace, N. E., 1994. The Determinants of Efficiency and Solvency in Savings and Loans. *RAND Journal of Economics*. **25**(3), pp. 361-381.

Holod, D. and Lewis, H. F., 2011. Resolving the Deposit Dilemma: A new DEA Bank Efficiency Model. *Journal of Banking and Finance*. **35**(11), pp. 2801-2810.

Isik, I. and Hasan, M., 2002. Technical, Scale and Allocative Efficiencies of Turkish Banking Industry. *Journal of Banking and Finance*. **26**(4), pp. 719-766.

Iyer, R. and Puri, M., 2012. Understanding Bank Runs. *American Economic Review*. **102**(4), pp. 1414-1445.

James, C., 1991. The Losses Realized in Bank Failures. *The Journal of Finance*. **46**(4), pp. 1223-1242.

James, C. M. and Wier, P., 1987a. An Analysis of FDIC Failed Bank Auctions. *Journal of Monetary Economics*. **20**(1), pp. 141-153.

James, C. M. and Wier, P., 1987b. Returns to Acquirers and Competition in the Acquisition Market: The Case of Banking. *Journal of Political Economy*. **95**(2), pp. 355-370.

Jayaratne, J. and Strahan, P. E., 1996. The Finance-Growth Nexus: Evidence from Bank Branch Deregulation. *The Quarterly Journal of Economics*. **111**(3), pp. 639-670.

Jin, J. Y., Kanagaretnam, K. and Lobo, G. J., 2011. Ability of Accounting and Audit Quality Variables to Predict Bank Failure during the Financial Crisis. *Journal of Banking and Finance*. **35**(11), pp. 2811-2819.

Kane, E. J., Bennett, R. and Oshinsky, R., 2008. Evidence of Improved Monitoring and Insolvency Resolution after FDICIA. NBER Working Paper No. 14576. [Accessed 18 May 2016]. Available from: http://www.nber.org/papers/w14576.

Kang, A., Lowery, R. and Wardlaw, M., 2015. The Costs of Closing Failed Banks: A Structural Estimation of Regulatory Incentives. *The Review of Financial Studies*. **28**(4), pp. 1060-1102.

Keeley, M. C., 1990. Deposit Insurance, Risk, and Market Power in Banking. *American Economic Review*. **80**(5), pp. 1183-1200.

Kerr, W. R. and Nanda, R., 2009. Democratizing Entry: Banking Deregulations, Financing Constraints, and Entrepreneurship. *Journal of Financial Economics*. **94**(1), pp. 124-149.

Kim, J.Y. and Finkelstein, S., 2009. The Effects of Strategic and Market Complementarity on Acquisition Performance: Evidence from the U.S. Commercial Banking Industry, 1989-2001. *Strategic Management Journal*. **30**(6), pp. 617-646.

Kindleberger, C. P. and Aliber, R. Z., 2005. Manias, Panics, and Crashes: A History of Financial Crises. 5th ed. New Jersey: John Wiley & Sons, Inc.

Knott, A. M. and Posen, H. E., 2005. Is Failure Good? *Strategic Management Journal* **26**(7), pp. 617-641.

Koetter, M. and Poghosyan, T., 2010. Real Estate Prices and Bank Stability. *Journal of Banking and Finance*. **34**(6), pp. 1129-1138.

Komai, A. and Richardson, G., 2011. A Brief History of Regulations Regarding Financial Markets in the United States: 1789 to 2009. NBER Working Paper No. 17443. [Accessed 15 May 2016]. Available from: http://www.nber.org/papers/w17443.

Laeven, L. and Valencia, F. 2013. Systemic Banking Crises Database. *IMF Economic Review*. **61**, pp. 225-270.

Liu, W. M. and Ngo, P. T., 2014. Elections, Political Competition and Bank Failure. *Journal of Financial Economics*. **112**(2), pp. 251-268.

Luo, X., 2003. Evaluating the Profitability and Marketability Efficiency of Large Banks: An Application of Data Envelopment Analysis. *Journal of Business Research*. **56**(8), pp. 627-635.

Mishkin, F. S., Stern, G. and Feldman, R., 2006. How Big a Problem Is Too Big to Fail? A Review of Gary Stern and Ron Feldman's "Too Big to Fail: The Hazards of Bank Bailouts". *Journal of Economic Literature*. **44**(4), pp. 988-1004.

Moen, J. and Tallman, E. W., 1992. The Bank Panic of 1907: The Role of Trust Companies. *The Journal of Economic History*. **52**(3), pp. 611-630.

Mukherjee, K., Ray, S. C. and Miller, S. M., 2001. Productivity Growth in Large US Commercial Banks: The Initial Post-Deregulation Experience. *Journal of Banking and Finance*. **25**(5), pp. 913-939.

Nishimura, K. G., Nakajima, T., and Kiyota, K., 2005. Does the Natural Selection Mechanism Still Work in Severe Recessions? Examination of the Japanese economy in the 1990s. *Journal of Economic Behavior and Organization*. **58**(1), pp. 53-78.

Odell, K. A. and Weidenmier, M. D., 2004. Real Shock, Monetary Aftershock: The 1906 San Francisco Earthquake and the Panic of 1907. *The Journal of Economic History*. **64**(4), pp. 1002-1027.

Ouyang, M., 2009. The Scarring Effect of Recessions. *Journal of Monetary Economics*. **56**(2), pp. 184-199.

Palia, D., 1993. The Managerial, Regulatory, and Financial Determinants of Bank Merger Premiums. *The Journal of Industrial Economics*. **41**(1), pp. 91-102.

Pe'er, A. and Vertinsky, I., 2008. Firm Exits as a Determinant of New Entry: Is there Evidence of Local Creative Destruction? *Journal of Business Venturing*. **23**(3), pp. 280-306.

Peek, J. and Rosengren, E., 1995. The Capital Crunch: Neither a Borrower nor a Lender Be. *Journal of Money, Credit and Banking*. **27**(3), pp. 625-638.

Peristiani, S., 1997. Do Mergers Improve the X-Efficiency and Scale Efficiency of U.S. Banks? Evidence from the 1980s. *Journal of Money, Credit and Banking*. **29**(3), pp. 326-337.

Pettway, R. H. and Trifts, J. W., 1985. Do Banks Overbid When Acquiring Failed Banks?. *Financial Management*. **14**(2), pp. 5-15.

Povel, P. and Sertsios, G., 2014. Getting to Know Each Other: The Role of Toeholds in Acquisitions. *Journal of Corporate Finance*. **26**, pp. 201-224.

Ramaswamy, K. P. and Waegelein, J. F., 2003. Firm Financial Performance Following Mergers. *Review of Quantitative Finance and Accounting*. **20**(2), pp. 115-126.

Reinhart, C. M. and Rogoff, K. S., 2014. Recovery from Financial Crises: Evidence from 100 Episodes. *American Economic Review*. **104**(5), pp. 50-55.

Repullo, R., 2004. Capital Requirements, Market Power, and Risk-Taking in Banking. *Journal of Financial Intermediation*. **13**(2), pp. 156-182.

Rhoades, S. A., 1998. The Efficiency Effects of Bank Mergers: An Overview of Case Studies of Nine Mergers. *Journal of Banking and Finance*. **22**(3), pp. 273-291.

Roll, R., 1986. The Hubris Hypothesis of Corporate Takeovers. *The Journal of Business*. **59**(2), pp. 197-216.

Rothbard, M. N., 1962. The Panic of 1819: Reactions and Policies. New York and London: Columbia University Press.

Rousseau, P. L., 2002. Jacksonian Monetary Policy, Specie Flows, and the Panic of 1837. *The Journal of Economic History*. **62**(2), pp. 457-488.

Ruggiero, J., 2007. A Comparison of DEA and the Stochastic Frontier Model Using Panel Data. *International Transactions in Operational Research*. **14**(3), pp. 259-266.

Saunders, A. and B. Wilson, 1996. Contagious Bank Runs: Evidence from the 1929–1933 Period, *Journal of Financial Intermediation*. **5**(4), pp. 409-423.

Shachmurove, Y., 2011. A Historical Overview of Financial Crises in the United States. *Global Finance Journal*. **22**(3), pp. 217-231.

Schaeck, K., 2008. Bank Liability Structure, FDIC Loss, and Time to Failure: A Quantile Regression Approach. *Journal of Financial Services Research*. **33**(3), pp. 163-179.

Schaeck, K., Cihak, M. and Wolfe, S., 2009. Are Competitive Banking Systems More Stable? *Journal of Money, Credit and Banking*. **41**(4), pp. 711-734.

Schumpeter, J., 1939. Business Cycles. New York: McGraw-Hill.

Sprague, O. M. W., 1910. History of Crises under the National Banking System. Washington: U.S. Government Printing Office, 1910.

Sun, L. and Chang, T. P., 2011. A Comprehensive Analysis of the Effects of Risk Measures on Bank Efficiency: Evidence from Emerging Asian Countries. *Journal of Banking and Finance*. **35**(7), pp. 1727-1735.

Tallman, E. W. and Moen, J. R., 1990. Lessons from the Panic of 1907. *Federal Reserve Bank of Atlanta Economic Review*. **12**, pp. 2-13.

Wan, W. P. and Yiu, D. W., 2009. From Crisis to Opportunity: Environmental Jolt, Corporate Acquisitions, and Firm Performance. *Strategic Management Journal*. **30**(7), pp. 791-801.

Warburton, C., 1958. Variations in Economic Growth and Banking Developments in the United States from 1835 to 1885. *The Journal of Economic History*. **18**(3), pp. 283-297.

Wheelock, D. C. and Wilson, P. W., 2000. Why Do Banks Disappear? The Determinants of U.S. Bank Failures and Acquisitions. *The Review of Economics and Statistics*. **82**(1), pp. 127-138.

Wilson, J., 1942. The Bank of North America and Pennsylvania Politics: 1781-1787. *The Pennsylvania Magazine of History and Biography*. **66**(1), pp. 3-28.

Zhang, H., 1997. Repeated Acquirers in FDIC Assisted Acquisitions. *Journal of Banking and Finance*. **21**(10), pp. 1419-1430.

Zhang, Q., Vallascas, F., Keasey, K. and Cai, C., 2015. Are Market Measures of Global Systemic Importance of Financial Institutions Useful for Regulators and Supervisors? *Journal of Money Credit, and Banking*. 47(7), pp. 1403-1442.