

ESSAYS ON U.S. BANKING REGULATORY REFORMS  
AND BANKING OPERATIONS

By  
Pingping Shan

Dissertation

Submitted to the Faculty of the  
Graduate School of Vanderbilt University  
in partial fulfillment of the requirements

for the degree of

DOCTOR OF PHILOSOPHY

In

Economics

May, 2008

Nashville, Tennessee

Approved:

Professor Peter L. Rouseau

Professor Mark Cohen

Professor Ben Eden

Copyright © 2008 by Pingping Shan

All Rights Reserved

To my loving husband Lu Li

and

To my mother Yongli Wang and my father Jinling Shan

## ACKNOWLEDGEMENTS

I would like to sincerely thank my advisor Professor Peter L. Rousseau. This work would never have been possible without the freedom and support he has offered me to pursue my own research interests. I am especially indebted to Professor Rousseau for his detailed guidance, great patience, endless help and tremendous encouragement throughout my graduate study at Vanderbilt University.

Special thanks go to all the distinguished faculty members on my committee: Professor Peter L. Rousseau, Professor Mark Cohen, Professor Ben Eden and Professor Robert Driskill for their continuous support and valuable insights. I'm especially grateful to Professor Mark Cohen for providing me with precious and unique opportunities to gain a wider breadth of experience. I also want to thank Ms. Kathleen Finn for her kindness, warm-hearted nature as well as her professional assistance.

I would like to thank as well the School of Arts and Science and the Department of Economics at Vanderbilt University for their generous financial support of my graduate studies and research.

Finally, I thank my parents, Yongli Wang and Jinling Shan, for their endless and unconditional love, which is the bedrock of my entire life. And most importantly, I would thank my dearest husband Lu Li for his unwavering love, support and encouragement during all the ups and downs of the whole journey.

## TABLE OF CONTENTS

	<b>Page</b>
DEDICATION.....	iii
ACKNOWLEDGEMENT.....	iv
LIST OF TABLES.....	vii
LIST OF FIGURES.....	viii
 <b>Chapter</b>	
I. OVERVIEW.....	1
1. Introduction.....	1
2. FDICIA and Market Discipline.....	2
2.1 How does market discipline work?.....	2
2.2 The federal deposit insurance corporation Improvement act.....	4
2.3 Methodology Overview and Main Result.....	5
3. Interstate Branching Mode Choice and Impact on Branch Performance Outcome.....	6
3.1 A brief history of branching regulations in the U.S. banking industry.....	6
3.2 Debate on de novo interstate branching.....	8
3.3 Methodology overview and main result.....	10
 II. FDICIA AND MARKET DISCIPLINE: AN EMPIRICAL ANALYSIS....	12
1. Introduction.....	12
2. Literature review.....	16
3. Research strategies.....	20
4. Data and estimation.....	25
5. Results and discussion.....	34
6. Concluding remarks.....	44
 III. INTERSTATE BRANCHING MODE CHOICE AND BRANCH PERFORMANCE OUTCOME.....	48

1.	Introduction.....	48
2.	Literature review.....	52
3.	Estimation method.....	58
4.	Variables and hypotheses.....	62
4.1	Dependent variable: Performance outcome.....	62
4.2	Variables measuring factors affecting both choice of branching mode and performance outcome.....	64
4.2.1	Entrant bank's efficiency advantage.....	64
4.2.2	Size.....	64
4.2.3	Market profitability potential.....	65
4.2.4	Instrumental variables.....	65
4.2.5	Market concentration.....	66
4.2.6	Geographical diversity.....	67
4.2.7	Distance to host market.....	68
5.	Data Summary and descriptions.....	69
6.	Results and discussion.....	73
6.1	Interstate branching mode choice.....	73
6.2	Branch performance.....	78
7.	Concluding remarks.....	85
IV. CONCLUSIONS.....		88
REFERENCES.....		91

## LIST OF TABLES

Table	Page
2.1 Descriptive Statistics for Interest Rate Spreads, Risk Measures and Control Variables.....	27
2.2 Results of Unit Root Tests.....	31
2.3 Predictive Power of Risk Measures on Interest Rate Spreads.....	35
2.4 Predictive Power of Interest Rate Spreads on Risk Measures.....	41
3.1 Descriptive Statistics for Variables affecting Entry Mode Choice.....	71
3.2 Descriptive Statistics for Performance Variables.....	72
3.3 Results of First Stage Heckman Estimation: Interstate Branching Mode Choice.....	74
3.4 Results of Second Stage Heckman Estimation: Branch Performance.....	81
3.5 Treatment Effect for the Treated: Performance Difference in Taking the Alternative Interstate Branching Mode.....	84

## LIST OF FIGURES

Figure		Page
1	Deposit Market and Market Discipline.....	22
2	Entry Mode by Year.....	73
3	Entry Mode by Market Concentration.....	75



# CHAPTER I

## OVERVIEW

### 1 Introduction

The banking industry is usually excluded from theoretical and empirical studies on general manufacturing industries due to complications associated with the extensive regulations placed upon this industry and the special characteristics of banks as suppliers of the intermediation services. Nevertheless, regulatory reforms in the U.S. banking industry since the 1990s have not only fundamentally modernized this age-old industry but have also provided us with some natural experiments on its operation and management strategies.

One difficulty in economic studies is that we can not conduct experiments, as scientists do, to directly test economic theories. However, sometimes an isolated change occurs in one aspect of the economic environment and economists can study the effects of that change as if it were an experiment, given that every other exogenous factors was held constant. These types of events and changes are called natural experiments, which are naturally occurring events or situations, and which can be exploited by a researcher to help answer a research question.<sup>1</sup>

The first natural experiment of my analysis has been provided by the enactment of the Federal Deposit Insurance Corporation Improvement Act of 1991. Another natural experiment investigated in my research concerns the passage of the Riegle–

---

<sup>1</sup>Note that these types of experiments are quasi-experiments in that the experimenter has little or no control over the situation that is being observed.

Neal Interstate Banking and Branching Efficiency Act of 1994. Section 2 and section 3 of this chapter respectively introduce the background, purpose, methodology and main results of these two natural experiments.

## **2 FDICIA and Market Discipline**

### **2.1 How does market discipline work?**

In order to maintain the health of the banking industry, banking regulators have been making efforts to promote the safe management of banks. Market discipline, as a supervising device from "the private sector," which supplements the thorough and regularly arranged on-site examinations, has attracted more and more attention of banking regulators and economists. As a matter of fact, market discipline, along with minimum capital requirement and supervisory review processes, is included in the New Basel Accord as one of the three pillars of healthy banking structure. In the banking industry, market discipline is described as a mechanism in which "the financial market provides signals that lead borrowers (i.e., banks) to behave in a manner consistent with their solvency" (Lane, 1993).

It has been noted that the implementation of market discipline, a supervising device from "the private sector," could be highly correlated with the efforts from "the regulatory sector," which also aim to safeguard the health of the banking system (Bruni and Paterno, 1995). Federal Deposit Insurance, which came into effect in 1934, is one of these regulatory solutions, that was designed to protect small depositors, to restore depositors' confidence in banks and thus prevent the systemwide bank runs resulting from the asymmetric information between banks and depositors that had

historically caused several debacles in the U.S. economy. Thanks to Federal Deposit Insurance, small depositors (usually with deposits less than \$100,000) at failed banks have always been fully protected, and nationwide banking panics no longer haunt the U.S. economy. Furthermore, since the enactment of Federal Deposit Insurance, uninsured creditors have naturally been expected to play a critical role in practicing market discipline on banks. Since their loss cannot be recovered in the case of bank failures, they are motivated to monitor banks' default risks. Specifically, uninsured creditors would charge a higher rate to compensate for the higher risk they assume or else withdraw their investment when observing higher default risks.

The balance between " the private sector" supervising device and " the regulatory sector" protection has over time been harmed, however. The incentives of uninsured creditors to monitor banks' default risks have been reduced by a series of forbearance policies announced by the FDIC (Federal Deposit Insurance Corporation), which allows insolvent institutions to remain open in the hope that they would in time recover. Due to protection from these forbearance policies, the expected losses of uninsured creditors were significantly reduced so that while uninsured creditors faced default risk in theory, many of them were shielded from losses in practice. Between 1979 and 1989, 99.7 percent of all deposit liabilities at failed commercial banks were protected. The deteriorating moral hazard problem as a result of reducing the monitoring on banks' default risks was taken as one of the main factors that led to the bank debacles in the 1980s (Osborne and Lee, 2001).

## 2.2 Federal Deposit Insurance Corporation Improvement Act

In response to these failures, the Federal Deposit Insurance Corporation Improvement Act (FDICIA) was passed in 1991 to restore the health of the banking industry. The provisions of the Act forced uninsured creditors to bear much more of the losses associated with bank insolvency. The provisions were expected to increase the incentives of uninsured creditors to monitor banks' risk-taking behavior so as to improve market discipline from uninsured depositors. The enactment of the FDICIA has therefore provided us with a natural experiment in examining how changes in the regulatory design, the banking system safeguarding devices from "the regulatory section," could impact the implementation of banking system safeguarding devices from "the private sector."

Among the various uninsured creditors, the holders of time certificates of \$100,000 or more (Jumbo CDs) are chosen as subjects for this study. On one hand, the balances of Jumbo CDs are beyond the deposit-insurance ceiling of \$100,000 as a counterpart to core deposits, such as checkable deposits, passbook savings, and retail CDs, which are fully protected by Federal Deposit Insurance and respond relatively little to changes in bank conditions and market rates. On the other hand, Jumbo CDs have relatively large uninsured balances and short maturities, which make issuing banks match yields (risk-free interest rates plus default risk premia) asked for by uninsured depositors in the market.<sup>2</sup> The pricing system of Jumbo CDs could therefore be an excellent indicator of the mechanism of market discipline in the banking industry.

---

<sup>2</sup>For example, the average jumbo CD balance in the fourth quarter of 2005 was \$330,886 and the average balance in 95 percent of the U.S. banks exceeded \$152,115. Besides, the average maturity was just over one year (Feldman and Schmidt, 2005).

### 2.3 Methodology Overview and Main Result

This study sets up a theoretical framework of market discipline based on Jordan (2000) in which the market for deposits is described as an interaction between the supply side (both insured and uninsured depositors) and the demand side (bank) wherein market discipline is captured by an upward shifting of the marginal cost curve of uninsured deposits when bank default risk increases. Although previous empirical studies that directly or indirectly look at the FDICIA and its effect on market discipline through the Jumbo CD market did find that interest rates and the quantity of uninsured CDs are sensitive to bank risk, they did not find strong evidence that market discipline from Jumbo CD holders improved after the enactment of the FDICIA. This study proposes a new perspective on the impact of the FDICIA on market discipline. It seeks to explore the dynamic links between interest rate premia and risk measures in a cross-bank framework to take into account the stickiness of interest rates and lags in the effect of changes in bank risk. At the same time, this study also contributes to the literature by examining how bank managers respond to or prevent the excessive funding costs associated with Jumbo CD holders' discipline.

To accomplish this task, I use an adaptation of the generalized method of moments technique developed by Arellano and Bond (1991). My method eliminates bank-specific fixed effects by taking first order differences of all variables in a model originally specified in levels, and then using the predetermined lags of the endogenous system variables as instruments to exploit a large set of over-identifying restrictions so as to attain consistent estimators. Specifically, I collect quarterly data for U.S.

commercial banks for five years prior to the FDICIA (1984-1989) and five years after the FDICIA began to take effect (1992-1996), and then construct the risk measures based on accounting numbers available from Call Reports. Along with controlling for effects from the demand side, I apply two-way Granger-Causality tests for the panel to capture the “timeliness” (predictive power of changes in risk measures on changes in the interest rate spread) and “effectiveness” (predictive power of changes in the interest rate spread on changes in risk measures) of market discipline from uninsured depositors such as Jumbo CD holders.

I find clear-cut evidence that the improved regulatory environment provided by the FDICIA has successfully revived incentives for uninsured depositors to monitor financial institutions’ default risk and has motivated financial institutions to be more responsive to market discipline by engaging in "self-corrective" actions.

### **3 Interstate Branching Mode Choice and Branch Performance Outcome**

#### **3.1 A Brief History of Branching Regulations in U.S. Banking Industry**

The U.S. banking industry has a long and unique history of restrictions on branching. By the early twentieth century, the U.S. had become the only industrialized nation that still retained these restrictions (Giedeman, 2004). In the early stages of American banking system development, banking markets were naturally fragmented by high managing and transportation costs in the absence of an established railroad system and telegraph networks. In the late nineteenth century, state authorities began to set statutory barriers to bank branching in order to preserve the monopolies or oligopolies of local community banks (Golembe, 1994). This situation eventually

led to the federal prohibition of interstate and intrastate banking with the passage of the National Currency Act of 1863 and the National Bank Act of 1864.

The deregulation of branching restrictions began with intrastate branching. The McFadden Act of 1927 allowed national banks to operate under the same branching laws prevailing for state-chartered banks in the states in which they were located. Therefore, national banks were able to realize intrastate branching to some degree since in the early 1900s, states began to permit intrastate branching for state-chartered banks. Further, the Glass-Steagall Act of 1933 set national banks on equal footing with state-chartered banks regarding the right to branch statewide although it gave state regulatory authorities the dominant position in determining the intrastate branching law in each state. Therefore, restrictions on intrastate branching were generally removed while interstate branching was strictly prohibited at that time.

The general prohibition of interstate branching operations spawned multibank holding companies (MBHCs) in the sense that they provided a legal loophole to realize geographic diversification despite branching restrictions. In practice, banks (both national and state banks) that wanted to expand their operations to other markets, especially in states other than where their headquarters were, could set up start-up banks as subsidiaries instead of branches. Although each subsidiary owned by the holding company had to be separately capitalized and to have its own board of directors which was presumed to bring about more operating costs than a network of branch offices, the MBHC structure did open an opportunity for interstate expansion. A holding company's management could still integrate production and a

decision system across its subsidiaries. However, the Douglas Amendment of the 1956 Bank Holding Company Act closed this loophole by allowing states the authority to prohibit out-of-state BHCs from operating banks within their borders.

The past decade has witnessed fundamental deregulations in the American banking industry especially in respect to branching authority. One of the most important acts of deregulation on branching was the passage of the Riegle–Neal Interstate Banking and Branching Efficiency Act of 1994. This act enabled banking organizations to increase the size and reach of their operations through interstate branching. The Riegle-Neal Act allowed bank holding companies to acquire out-of-state banks, allowed foreign banks to interstate branch and enabled banks to operate interstate branches via mergers or the acquisition of incumbent banks. However, the Riegle-Neal Act treats two modes of interstate branching in distinct ways. The Act allows interstate branching through de novo branching (establishing new offices without an acquisition) only if the host state enacts legislation expressly permitting it. By the beginning of 1997 which was the "trigger year" of the Riegle-Neal Act, only nine states in addition to the District of Columbia allowed de novo interstate branching, while eight of them allowed de novo interstate branching on a reciprocal basis.

### **3.2 The Debate on De Novo Interstate Branching**

After the Riegle-Neal Act had been in effect for about 10 years, the issue of de novo interstate branching was again brought forth: For several years, the Financial Services Regulatory Relief Act has been in debate in Congress. It proposes to remove the requirement that states must opt-in to de novo interstate branching, thereby



allowing banks to freely establish de novo branches nationwide. Opponents to free de novo interstate branching are usually concerned that de novo branches of entrant banks might dominate the local market and thus harm the services for the local economies that are usually provided by local banks

However, it has been well-accepted that interstate branching has benefited both the development of the banking industry and the overall economy. In 2004, commercial banks operated more than 65,000 branches in the US, a big increase in number compared with 51,000 branches operated by commercial banks in 1990 (Olson, 2002). The new branches, especially the branches of out-of-state banks, help maintain the competitiveness and dynamism of the American banking industry and raise the accessibility of banking services in previously under-served markets. Both households and small businesses can benefit from the branch entries of out-of-state banks since their entry into the market could decrease the degree of concentration in the local market. They can also stimulate competition, which in turn can bring about better and more available banking services, lower interest rates on loans and higher deposit interest rates. Furthermore, since current customers have become more mobile, working and operating across state borders, they could also benefit from banks operating branches across state lines. At the same time, we also note that restrictions on interstate de novo branching might limit the development of the banking industry as well as the economy. For example, restrictions on interstate de novo branching might set a particularly high barrier against small banks entering a new market since they usually cannot afford the high cost of acquiring another bank.

### 3.3 Methodology Overview and Main Results

This study examines the impact of de novo branching on local economy by investigating the operating strategies and associated performance outcomes of entrant banks regarding their choices of interstate branching modes in the states where both two interstate branching modes (mergers or acquisitions of incumbent banks and de novo branching) are allowed after the Riegle-Neal Act of 1994.

Few studies focus on the impact of choice of interstate branching mode, although some studies do shed some light on the impact of general interstate branching on the market concentration and the general performance of the banking industry. This analysis contributes to the literature in two ways. First, it chooses a fresh angle in looking at this question. Secondly, it proposes examining the impact of interstate branching mode choice on entrant bank performance in host markets rather than the conventional angle taken in the literature that examines the impact of entry events on an entire market or industry. Therefore, the theoretical foundation of our study is based on theories and concepts from both industry organization and management strategy as well as monetary economics. Second, the application of two-stage Heckman estimation corrects for endogeneity problems usually neglected in conventional studies on the impact of management strategy on performance. I also derive entrant bank countereffect performance gains/loss in taking the alternative interstate branching mode in order to test whether bank managements made the right strategic decisions.

I find that, without interstate branching restrictions, small commercial banks

significantly prefer de novo interstate branching to branching via M&A. When the host market is not very competitive ( $HHI < 1000$ ), entrant banks are prone to take the mode of de novo branching rather than M&A. Moreover, the high potential of economic growth seems to tempt entrant banks to enter via M&A more frequently than by de novo branching. Further, the more states into which an entrant bank has already expanded, the more likely it is to enter via de novo branching. After the endogeneity problems associated with selection bias were tackled, the performance estimations and derived treatment effects for three groups of performance measures show that entrant banks choosing interstate branching via M&A have absolute performance advantages over entrant banks setting up de novo branches. However, both groups of banks categorized by their choice of interstate branching mode made the right decision because they would not have been better off had they chosen the alternative strategy. Therefore, free interstate de novo branching would invite more small banks, which could prove beneficial to the development of small business in the host state without posing much threat to incumbent banks.

## CHAPTER II

### FDICIA AND MARKET DISCIPLINE: AN EMPIRICAL ANALYSIS

#### 1. Introduction

The prominent work by Lane (1993) defines market discipline as “financial markets providing signals that lead borrowers (i.e., banks) to behave in a manner consistent with their solvency.” Today, supervisors in the developed world have counted more and more on the market as a means of supervision. In the recently proposed New Basel Capital Accord, market discipline is adopted as one of the three pillars of the structure safeguarding the banking system, along with capital regulation and supervision.

It is widely accepted that market discipline can be executed by three classes of bank creditors: depositors, debt-holders and equity-holders. Since the returns of these stakeholders should be negatively related to default risks of banks and these stakeholders should be able to access banks’ conditions in a nearly efficient market, they should demand higher risk premia from riskier banks or otherwise withdraw their deposits from them. Such a response to banks’ risk-taking behavior might be expected to discourage bank managers from raising the level of risk on the asset sides of their balance sheets too dramatically.

To restore confidence in the financial markets after the severe banking crisis following the Great Depression in the United States, the Federal Deposit Insurance Corporation (FDIC) was created in 1933, and Federal Deposit Insurance became ef-

fective on January 1st, 1934. With the protection of deposit insurance, insured stakeholders had less incentive to monitor banks. This situation occurred because their deposits became safe regardless of the bank's performance. In this setting, uninsured stakeholders were expected to play a critical role in practicing market discipline on banks.

However, the incentives of uninsured creditors to monitor banks' insolvency risk have over time been attenuated by a series of forbearance policies that allowed insolvent institutions to remain open in the hope that they would in time recover, discouraging uninsured stakeholders from playing this role. One manifestation of such a policy is the "too big to fail" doctrine first introduced in May 1984 to prevent the potential systemic consequences associated with the failure of Continental Illinois by covering the losses of all creditors, including the uninsured. Soon after that, eleven of the largest national banks were officially pronounced too big to fail. In 1986, the FDIC announced a Capital Forbearance Program that was designed to help banks that had experienced solvency problems due to economic conditions judged to be beyond their control. Moreover, in 1987, the Competitive Equality Banking Act (CEBA) established the Agricultural Loan Loss Amortization Program (ALLAP). Under this program, banks with less than \$100 million in total assets and with agricultural loans of at least 25 percent of total loans were allowed to defer recognition of losses on such loans and to amortize them over ten years. In fact, the FDIC granted forbearance to 325 banks under these programs between June 1986 and December 1989 (Brinkman and Huang, 1996).

Although forbearance policies were designed to rescue banks suffering losses due to economic shocks rather than from poor management and risk-taking behavior, thereby helping them to raise new capital, the overprotection did lower stakeholders' incentives to monitor banks' behavior so that moral hazard problems increased. The negative impact of the deposit insurance system on financial markets finally led to the bank failures of the 1970s and 1980s. As a matter of fact, at the end of 1990, the U.S. banking system was in its worst condition since 1933. Indeed, during the 1980s more than 2,000 depository institutions went bankrupt, many at a high cost to both shareholders and taxpayers. The ultimate cost of the resolution of insolvent institutions paid by US taxpayers turned out to be almost 3% of GDP (Benston and Kaufman, 1998).

To restore the health of the banking industry, Congress in 1991 enacted the Federal Deposit Insurance Corporation Improvement Act (FDICIA). The Act brought with it fundamental deposit insurance and prudential regulatory reform and was arguably the most important banking legislation since the Banking Act of 1933. Provisions such as prompt corrective action (PAC) and mandatory regular examinations aimed to reduce the cost of providing deposit insurance by lowering the likelihood of bank failures via capital level requirements and increased exam frequencies. Provisions of the FDICIA include abandonment of forbearance, especially the "too big to fail" policy for large banks. On one hand, FDICIA put more restrictions on forbearance policy by requiring the consent of the Secretary of the Treasury, as well as a two-thirds majority of the Board of Governors of the Federal Reserve and the directors

of the FDIC before the approval of forbearance or an announcement of “too big to fail.” On the other hand, instead of the simple purchase of default banks, FDICIA also proposed a less expensive means of failure resolution, which made uninsured creditors share the losses. In fact, in the three years prior to the FDICIA (from 1988 to 1990), Jumbo CD holders suffered losses in only 15 percent of bank failures, while Jumbo-CD holders suffered losses in 82 percent of bank failures in the 3 years following the full implementation of the FDICIA ( from 1993 to 1995) (Benston and Kaufman, 1998). Market discipline was therefore expected to improve after the FDICIA since the provisions of the FDICIA forced uninsured creditors to bear much more of the losses due to bank insolvency so as to increase the incentives of uninsured creditors to monitor banks’ risk-taking behavior.

Since no other banking regulations affecting loss exposure took effect around the year the FDICIA was passed, it provided a natural experiment for examining the effect of the Act on the likelihood that uninsured depositors would discipline risky banks. Among different uninsured creditors, holders of time certificates of \$100,000 or more (Jumbo CDs) are natural subjects for study since the balances of Jumbo CDs are beyond the deposit-insurance ceiling of \$100,000.<sup>3</sup> Further, Jumbo CDs have been an important source of bank funds. For example, by the end of 2002, U.S. commercial banks funded 12.7 percent of assets with Jumbo CDs (Vaughan et al., 2004).

This study applies Arellano’s and Bond’s (1991) GMM technique to quarterly data from 1985 to 1996 for 50 commercial banks with the largest share of Jumbo CDs

---

<sup>3</sup>Equity and subordinated debt holders are also uninsured creditors that are studied in literature and there might be some difference in the effectiveness of these capital instruments (Caldwell 2007).

in their total deposits to examine the two-way Granger causality relation between Jumbo CD risk premia and bank risk. I find strong evidence for the notion that increases in bank risk have predictive power for increases in risk premia banks would have to pay, especially since the enactment of FDICIA. At the same time, the tests for reverse causality between risk measures and risk premia shows that the self-correction behavior of banks improved after the FDICIA when moral hazard problems were attenuated. The rest of the paper is arranged as follows: section 2 summarizes previous studies; section 3 proposes the research strategies and innovations of this study; data and estimation methodology are described in section 4; section 5 presents the results and concluding remarks are stated in section 6.

## **2 Literature Review**

Previous studies on market discipline have employed cross-sectional and/or time-series regressions of Jumbo CD variables on bank risk measures (both publicly available and private measures such as CAMEL ratings and SEER<sup>4</sup>), market risk factors, and seasonal or other bank-specific controls. These empirical studies can be divided into three categories based on the risk premium measures they use: 1) interest rate spreads; 2) quantities 3) both interest rate spreads and quantities.

The first group of studies examines whether the interest rates that Jumbo CD holders require adjust to banks' default risks. Herzig-Marx and Weaver (1979) examine the econometric specification of an OLS regression equation for the impact of bank risks on interest rates and sets the baseline for later studies such as Baer

---

<sup>4</sup>CAMEL is short for Capital, Asset Quality, Management, Earnings and Liquidity. SEER is short for System to Estimate Examination Ratings.



and Brewer (1986), Hannan and Hanweck (1988), James (1988, 1990), Cargill (1989), Keely (1990), Ellis and Flannery (1992), Cook and Spellman (1994), and Brewer and Mondschen (1994). In contrast to most studies that regress Jumbo CD interest rates on bank-specific risk measures, a few studies take into account the effect of market risk introduced through equity volatility or innovation in the stock market (e.g., Baer and Brewer, 1986 and James, 1988, 1990). Many studies find evidence that uninsured depositors respond to bank risks that are observable from balance sheet information. However, there are also some studies that find no significant evidence that uninsured depositors such as Jumbo CD holders impose market discipline on banks. For example, Goldberg and Lloyd-Davies (1985) find no such evidence when analyzing three-month interest rates on large CDs and banks' risk-taking behavior measured by the proportion of Standby Letters of Credit. Gilbert et al. (2001) find that the interest rates of Jumbo CDs have less predictive power than the traditional supervisory ratings.

The second group of studies examine whether the quantities of Jumbo CDs supplied by a bank can reflect bank default risks (e.g., Goldberg and Hudgins, 1996, 2002 and Calomiris and Wilson, 1998). These studies find that uninsured deposit growth falls when a bank's default risk increases. For example, Billet et al. (1998) examine the relationship between changes in bank credit risk and the quantity of insured deposits and observe that risky banks increase their use of insured deposits following a downgrade by Moody's rating agency. Park and Peristiani (1998) find that riskier thrifts attract a smaller amount of uninsured deposits and that the response

of uninsured depositors to risk is more evident than that observed among insured depositors.<sup>5</sup>

The final set of studies combines both price and quantity-based approaches by looking at the effect of banks' institutional risks on both the pricing and quantity of uninsured deposits. Note that previous two approaches assume that change either in the price or quantity of Jumbo CDs results from the change of supply (Jumbo CD holders). What I actually observe, however, are the equilibrium interest rate and the equilibrium quantity resulting from an interaction between the banks' demand for and depositors' supply of Jumbo CDs. In order to deal with this problem, several studies propose considering price and quantity effects at the same time.<sup>6</sup> For example, Park (1995), Park and Peristiani (1998), Martinez-Peria and Schmuckler (2001), Gilbert et al.(2003), and Hall et al.(2002a, 2002b) find evidence that interest rates paid on deposits and the quantity of Jumbo CDs respond to changes in bank risk, although in most cases the evidence is not statistically significant and is economically small.

There is also considerable literature about the effects of deposit insurance reform that came with the FDICIA. Some contributors examine performance improvements in the entire banking system. For example, Benston and Kaufman (1998) find that the banking system became significantly healthier in the early 1990s in the sense that the number of bank failures declined steadily and the industry became better capitalized after the reform. Other studies focus on more specific mechanisms of the

---

<sup>5</sup>However, Jagtiani and Lemieux (2000) argue that risky banks, especially failing ones, tend to replace their uninsured deposits with insured deposits to avoid discipline from markets of uninsured deposits such as Jumbo CDs.

<sup>6</sup>Ideally, we need to specify a simultaneous equation model with demand and supply functions. However, it is difficult to identify those demand and supply functions due to lack of exogenous variables that are significant (Park, 1995).

reform. For instance, Osborne and Lee (2001) study the effects of deposit insurance reform on moral hazard in US banking and find that moral hazard problems were alleviated after the reform.

There are also a few studies that directly or indirectly look at the FDICIA and its effect on market discipline through the Jumbo CD market. Looking at a sample of failing New England banks from 1989 to 1995, Jordan (2000) finds that fully insured deposits increased with the approach of failure more after the FDICIA, and that the interest rate spread the failing banks were paying over the average level in the market also rose. Goldberg and Hudgins (2002) study a sample of failed banks from 1984 to 1994, finding that Jumbo CD holdings fall as banks approach failure and that this sensitivity mildly increased after the FDICIA. Hall et al. (2004) extend the study of Goldberg-Hudgins (2002) by looking at both failing banks and surviving banks and examining Jumbo CD yields as well as run-offs, since the decrease in quantity of the Jumbo CDs of failing banks might have been due to supervisor discipline via enforcement actions rather than market discipline. They also find that interest rates and the quantity of uninsured CDs are sensitive to bank risk, but interestingly find no evidence that the coefficients are statistically or economically different across two very different sample periods( i.e., pre-FDICIA and post-FDICIA). Their study thus implies that the enforcement of FDICIA in 1991 did not affect market discipline in the Jumbo CD market.

### 3 Research Strategies

In addition to following the main logic of previous studies, our study proposes several different research strategies and innovations in methodology. One of the innovations I make is to explore dynamic links between risk premia and risk measures in a cross-bank framework. Although many previous studies have samples of panel data, most of them employ static econometric analysis without taking into account the stickiness of interest rates and the dynamic effects of changes in bank risk. This situation might even explain why many earlier studies did not find the statistically significant relations between risk measures and risk premia that were expected. In this paper, I examine the magnitude and direction of the dynamic relations between Jumbo CD risk premia and bank risks via the concept of Granger causality, and as well as the ability of changes in risk measures to predict changes in risk premia and vice versa. To implement this strategy, I employ the generalized method of moments technique developed by Arellano and Bond (1991) for dynamic panel models. This approach eliminates firm-specific effects by taking the first difference of all variables that are originally specified in levels. Through this action, the biases coming from omitted variables and fixed firm effects are mitigated. In order to tackle the bias coming from the possible correlation between the lags of the endogenous variables and error terms, Arellano and Bond (1991) also propose a linear instrumental variables technique that uses the predetermined lags of the system variables as instruments to obtain consistent estimators. Moreover, since I examine the two-way relation between bank risk and Jumbo CD risk premia, I can further examine banks' self-correcting behavior when facing an increase in risk premium in addition to testing the predicting

power of changes in bank risk on risk premia. In this way, we can obtain some idea of the effectiveness of market discipline as imposed by Jumbo CD holders, a subject that has not been considered in previous studies.<sup>7</sup>

Unlike some recent studies, mine focuses on the price-based approaches when choosing risk premium measures. Some recent studies incorporate the price and quantity of Jumbo CDs to describe the interaction of demand and supply effects. However, a simple set of two OLS regressions is inadequate because endogeneity problems may lead to biased results unless a simultaneous equations model with proper instruments for the interest rate is employed. Even though a simultaneous equation model might be adequate, however, it is very difficult to identify the demand and supply functions due to a lack of exogenous variables that are significant (Park, 1995).<sup>8</sup> I therefore set up a framework of the deposit market (insured deposits and uninsured deposits) based on the one described in Jordan (2000) in which the equilibrium interest rate and quantity of deposits are determined by the interaction of marginal cost (the supply side) and marginal revenue (the demand side) (see figure 1). In figure 1, the horizontal axis measures the quantity of deposits and the vertical axis measures the interest rate spread. The supply of deposits is composed of two parts: insured deposits (denoted as marginal curve  $MC_i$ ) and uninsured deposits (denoted as marginal curve  $MC_{ui}$ ). The demand of deposits is denoted as the downward sloping marginal cost curve  $MR$ .

This framework captures the fact that a bank raises insured deposits (e.g., check-

---

<sup>7</sup>Since risks measures are usually highly correlated with each other and because it is hard to find appropriate instruments for them, we respectively examine the two-way causality relations between interest rate spreads and individual measures of bank risk one at a time.

<sup>8</sup>But this feature could represent possible further exploration on this topic.

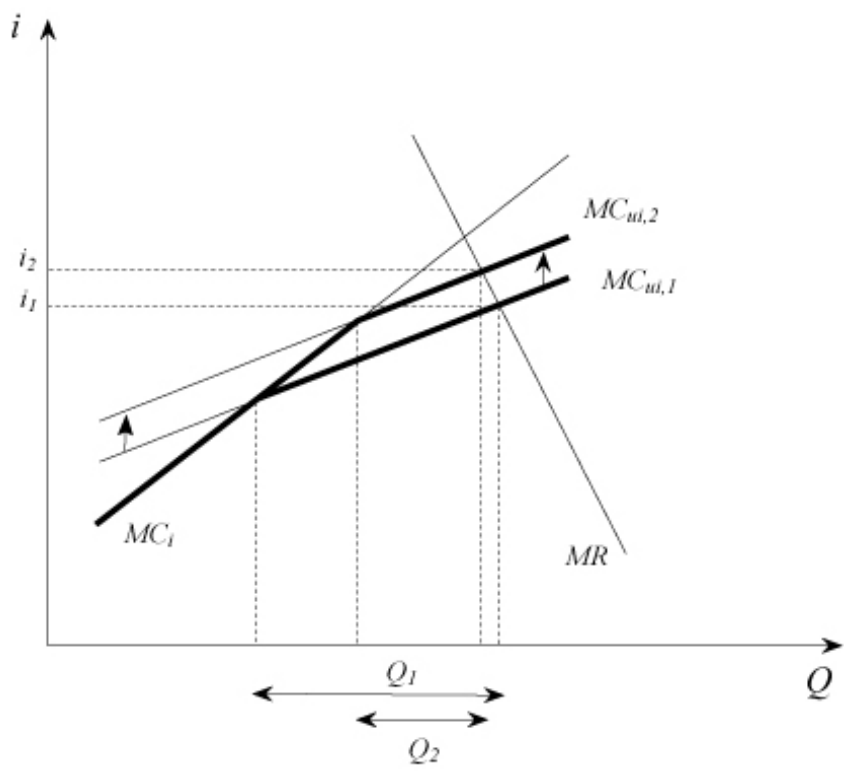


Figure 1: Base on Jordan (2000). This figure presents the impact of the shift-up of the marginal cost curve of uninsured deposits ( $MC_{ui}$ ) when uninsured depositors respond to an increase in banks' default risks.

ing or saving accounts) mostly from branches in local markets and raises uninsured deposits (e.g., Jumbo CDs) from the national market. Since the quantity of “core” deposits is limited by the customer base of local branches, the marginal cost curve for insured deposits is steeper than that of Jumbo CDs. The difference between these two sources of deposits is shown in figure 1 where  $MC_i$  is steeper than  $MC_{ui}$ . Within this framework, market discipline imposed by uninsured depositors is equivalent to an upward shift of the marginal cost curve of uninsured deposits when bank risks rise. As shown in Figure 1, when the marginal cost curve for uninsured deposits ( $MC_{ui,1}$ ) shifts up ( $MC_{ui,2}$ ) due to an increase in bank default risk, the equilibrium interest rate of uninsured deposits rises from  $i_1$  to  $i_2$ , and the quantity of uninsured deposits decreases from  $Q_1$  to  $Q_2$ .

However, shifts of the marginal cost curve for insured deposits and the marginal revenue curve for deposits could also affect the equilibrium interest rate and quantity, and could possibly confound the results. Nevertheless, due to the relative flatness of the marginal cost curve for uninsured deposits, shifts of the marginal cost curve for insured deposits might significantly affect the equilibrium quantity of Jumbo CDs without much impact on the interest rates paid on Jumbo CDs.<sup>9</sup> The shifts of the marginal cost curve for insured deposits could result from economic or demographic changes in the local market.<sup>10</sup> Indeed, the results of previous studies show that the sensitivity of interest rates (or yields) on Jumbo CDs to bank risks are greater than

---

<sup>9</sup>Especially note that shifts of the marginal cost curve for insured deposits do no, in most cases, affect the equilibrium interest rate of uninsured deposits.

<sup>10</sup>In fact, several studies also find some evidence of market discipline from insured depositors (e.g. Billet et al. 1998, Jagtiani and Lemieux 2000 and Martinez-Peria and Schmuckler 2001) which implies that supply curve of insured deposits will also shift up when bank risks increase.

the sensitivity of the quantity of Jumbo CDs (e.g., Park, 1995 and Martinez-Peria and Schmuckler, 2000). Therefore, other than controlling for impacts from the demand side (which will be discussed later), I propose focusing in this study on price-based approaches when examining the market discipline of Jumbo CD holders.

Furthermore, I note that few studies specifically control for possible impacts coming from the demand side. This step is critical because what I want to study is changes in the risk premia that uninsured depositors require rather than changes in the equilibrium risk premia. Therefore, I include several bank-specific variables to control for the demand effect. For example, when banks face a low level of ROA (return on assets), they usually increase leverage to increase returns on shareholders' equity,<sup>11</sup> which means an increase in the demand for debts such as deposits.<sup>12</sup> Another control variable for the demand effect is the ratio of total demand deposit to assets. Although some studies argue that the share of deposits in demand liabilities indicates the local base of customers to whom Jumbo CDs are presumed to be sold (Crane, 1979 and Hannan and Hanweck, 1988), other studies such as Jordan (2000) point out that Jumbo CDs are actually traded nationally. Instead, since demand deposits can be withdrawn at any time, banks tend to collect more deposits such as Jumbo CDs when their assets become increasingly funded with demand deposits. Therefore, I argue that, when the shares of demand deposits increase, banks increase their demand for Jumbo CDs. Another control variable for the demand effect that I

---

<sup>11</sup>Note that  $\frac{ROA}{ROE} = 1 - \frac{liability}{assets}$ .

<sup>12</sup>Although ROA is often referred to as a performance measure, note that high bank risk does not necessarily lead to a low or high return on assets. Therefore, we assume that ROA does not have a major effect on depositors' supply of deposits.



choose is bank size, since growth in assets usually means more lending activity, which requires more deposits.

Another innovation in this study involves the calculation of Jumbo CD risk premia. As discussed above, I select the Jumbo-CD interest rate spreads instead of quantities as the measure of risk premium. I calculate the Jumbo CD interest rate spreads in three steps. First, quarterly Jumbo CD interest expenses are divided by average quarterly Jumbo CD quantity (data are available from the Call Reports) to obtain the average nominal Jumbo CD interest rates. Second, I subtract the risk-free interest rate of the 1-year maturity Treasury bill from the average interest rate to eliminate the market effect. Further, I calculate the forecasted inflation rate at every time point basing on historical inflation rates to capture depositors' subjective depreciation.

#### **4 Data and Estimation**

This study relies on quarterly data for U.S. commercial banks, collected for five years before the FDICIA (1984-1989) and five years after the FDICIA began to take effect (1992-1996). I leave some time gap between the pre- and post- periods to eliminate the chaos right before the Act took effect and the transitional stage right after its enactment. The reason for the cut-off of year 1996 is the passage the following year of the Riegle-Neal Act, which allows interstate merger and acquisition among commercial banks. The potential risk-diversification associated with interstate mergers and acquisitions could, however, cancel out part of Jumbo CD holders' pricing of bank risk (Hall et al., 2004). Specifically, I construct our variables from the income-statement and balance-sheet numbers collected from the Report of Condition and Income (the

Call Report), which are publicly available from the FDIC website. Although some studies such as Hall et al. (2004) use non-public ratings such as SEER or Camel as risk measures, I still select risk measures that are simply constructed, with publicly available data, since that is exactly the information available to those Jumbo CD holders when they execute their disciplining power.

I refine the sample size based on the banks' operating-history and amount of Jumbo CDs. For example, as does Hall et al. (2004), I exclude the banks that keep Jumbo CDs less than 5 million dollars, the banks that did not survive the entire pre- and post- periods and the banks that had been operating less than 5 years as of 1984. Since Jumbo CD holders are only one out of several types of stakeholders who might have incentives to monitor risky banks, and banks vary considerably regarding their asset concentration, I arbitrarily chose 50 commercial banks with the largest shares of Jumbo CDs in their total deposits as the subjects of my study.<sup>13</sup> These banks also have some diversity in size, which can avoid the bias in sample selection.<sup>14</sup> Table 2.1 reports the summary statistics.

I use the interest rate spreads, as introduced in the previous section, as the risk premia of Jumbo CDs. Specifically, I subtract the risk-free interest rate, measured by the interest rate of one-year maturity treasury bonds, from the average interest rate of Jumbo CDs, computed as the total interest expenses on Jumbo CDs divided by the total amount of Jumbo CDs. I then divide the nominal average interest rate spreads by the forecasted inflation rate computed with the historical data.

---

<sup>13</sup>The sample can easily be expanded without greatly affecting the results.

<sup>14</sup>Some of the previous studies chose a very limited number of banks in their samples by focusing on very large banks (e.g., Keely, 1990 and Ellis and Flannery, 1992).

Table 2.1:  
**Descriptive Statistics for Interest Rate Spreads, Risk Measures and Control Variables**

Panel A: Pre-FDICIA (1985:1 to 1989:4)									
	Spread	Overdue	Liquidity	Leverage	Real Estate	Non-interest	ROA	Demand Deposit	Size
Mean	0.080	0.030	0.123	0.914	0.354	0.019	0.009	0.138	11.280
Median	0.075	0.018	0.082	0.920	0.354	0.016	0.008	0.134	11.100
STD	0.044	0.035	0.110	0.036	0.180	0.020	0.019	0.060	1.371
Obs #	1000	1000	1000	1000	1000	1000	1000	1000	1000
Panel B: Post-FDICIA (1992:1 to 1996:4)									
	Spread	Overdue	Liquidity	Leverage	Real Estate	Non-interest	ROA	Demand Deposit	Size
Mean	0.052	0.022	0.058	0.901	0.443	0.022	0.013	0.151	11.760
Median	0.049	0.014	0.046	0.909	0.462	0.018	0.010	0.141	11.508
STD	0.034	0.031	0.048	0.032	0.230	0.019	0.017	0.069	1.548
Obs #	1000	1000	1000	1000	1000	1000	1000	1000	1000

This table presents the descriptive statistics on interest rate spreads, risk measures and control variables. The sample periods for panel A and B are the 1st quarter of 1985 to the 4th quarter of 1989 (1000 quarterly observations) and the 1st quarter of 1992 to the 4th quarter of 1996 (1000 quarterly observations), respectively. "Spread" is the interest rate spread calculated as the gap between the average interest rate of jumbo CDs and the risk-free interest rate of the 1-year bond as a percentage of (1+forecasted inflation rate) where forecasted inflation rates are calculated for each quarter based on the historical inflation rates of 12 months before the first month of each quarter. The risk measures include "overdue," which is defined as non-performing loans as a share of total loans; "liquidity," which is defined as cash as a share of total assets; "leverage," which is defined as debt as a share of total assets; "real estate," which is defined as loans to the real estate industry as a share of total loans; and "non-interest," which is defined as the total non-interest expense as a share of the total assets. The last three variables are control variables: "ROA" is the return on assets; "Demand deposit" is the demand deposit as a share of total deposits, and Size is the natural logarithm of inflation-adjusted total assets (in thousands). 20 observations for each of the 50 commercial banks with the largest number of Jumbo CDs as total assets come up to 1000 observations for each variable.

I choose several risk measures widely cited in literature. The ratio of non-performing (overdue) loans to total loans is the indicator of credit risk. This ratio measures the percentage of a loan a bank might have to write off as losses. I expect the Jumbo CD spread to go up when a bank has a higher ratio of non-performing loans. The liquidity of bank assets is measured as the share of cash in total assets. In a general sense, a bank with a larger amount of liquid assets is thought to be safer, since in the case of a crisis such as a bank run, a bank with more liquid assets has more power to cope with the situation. Therefore, I expect the bank liquidity measure to be negatively related to risk premia on Jumbo CDs. Another risk measure widely cited in literature is the leverage level of a bank, which is calculated as one minus the ratio of capital to total assets. A bank with a higher leverage level is believed to be riskier. Therefore, I expect that Jumbo CD holders would respond to an increase in the leverage of a bank by asking for higher risk premia.

In addition to the three main risk measures mentioned above, I also examine another two risk measures which, according to the literature, might have a prior unclear relation with risk premia under market discipline. The first is the ratio of non-interest expenses to total assets, which is supposed to measure the operating efficiency of banks. Although it is generally believed that a bank with higher non-interest expenses is less efficiently operated, the high expenses may also result from the higher cost of better services for customers. Therefore, the relationship between non-interest expenses and risk premia might be unclear. Many studies also consider the impact of the concentration of bank assets as assessing risk. For example, the

real estate industry is traditionally thought to be unstable and vulnerable, and the ratio of loans to the real estate industry to total loans is expected to be positively related with the risk premium under market discipline. Nevertheless, some studies (e.g., Martinez and Schmuckler, 2004) also mention that most of the real estate loans are actually mortgages that have the assets in questions as collateral. In that sense, loans to the real estate industry could also be considered relatively safe. The results for this risk measure also depend on which impact is dominant.

I also have several variables, as discussed in the previous section, to control the impact from the banks' demand for Jumbo CDs. When the return on assets (ROA) decreases, bank managers tend to increase the return on shareholders' equity by increasing leverage, which means more demand for deposits, especially large uninsured deposits (Jumbo CD). Therefore, the ROA is expected to be negatively related to risk premia since increases in demand for Jumbo CDs would force banks to provide higher risk premia to Jumbo CD holders. Since Jumbo CDs are traded nationally without much restriction from the local customer base, the ratio of demand deposit to total assets, as an indicator of the local customer base, would not have an impact on the supply side of Jumbo CDs. However, when a bank's assets are funded more with demand deposits, which in general can be withdrawn at any time, bank managers would tend to collect more Jumbo CDs to back up a bank's loaning activities. In this sense, an increase in the ratio of demand deposits to total assets might bring forth an increase in Jumbo CD demand, which implies a positive relation between the ratio of demand deposits to total assets and risk premiums of Jumbo CDs. Another variable

to control for Jumbo CD demand is the bank's total assets, since it is traditionally believed that an increase in a bank's assets or size would lead to growth in loaning activity, which requires more deposits, especially deposits in large denominations such as a Jumbo CD. As a result, I expect bank size to be positively related to Jumbo CD premia in the sense of impact from the demand side.

Furthermore, since our estimation involves autoregressive regressions of endogenous variables, I undertook the unit-root tests for all endogenous variables involved in estimations. These tests are necessary because only if variables are stationary can the Granger causality test be directly performed. Specifically, LLC (Levin, Lin and Chu) is a panel data unit-root test with the assumption of a common unit root, while IPS (IM, Pesaran and Shin), Fisher-ADF and Fisher-PP tests take into account the cross-sectional effect by combining individual unit-root tests to derive a panel-specific result. The results show that all endogenous variables are stationary in level except loans to the real estate industry as a share of total loans, and non-interest expense as a share of total assets in panel B (post-FDICIA period). Nevertheless, the first difference of these two non-stationary variables turns out to be stationary in terms of all four types of tests. Therefore, in the dynamic panel data context, our implementation of Granger causality tests with the application of Arellano and Bond GMM estimators that take the first difference of all variables, appropriately suits our purpose.

In order to examine the magnitude and timeliness of market discipline from Jumbo CD holders, I apply the concept of Granger causality (Granger, 1969) to test whether

Table 2.2:  
**Results of Unit Root Tests**  
 (Probability\*\*of Acceptance of the Null Hypothesis of the Unit Root)

Panel A: Pre-FDICIA (1985:1 to 1989:4)						
	Spread	Overdue	Liquidity	Leverage	Real Estate	Non-Interest
LLC	0.000	0.000	0.000	0.000	0.000	0.000
IPS	0.000	0.027	0.000	0.033	0.000	0.000
ADF	0.000	0.003	0.000	0.000	0.003	0.000
PP	0.000	0.001	0.000	0.001	0.013	0.000
Panel B: Post-FDICIA (1992:1 to 1996:4)						
	Spread	Overdue	Liquidity	Leverage	Real Estate	Non-Interest
LLC	0	0.000	0.000	0.000	0.045	1.000
IPS	0.000	0.000	0.000	0.000	0.252	0.567
ADF	0.004	0.000	0.000	0.000	0.325	0.182
PP	0.069	0.000	0.000	0.013	0.005	0.000
	Non-interest_1	Non-Interest	Real Estate_1	Non-Interest	Non-interest_1	Non-interest_1
LLC	0.000	0.000	0.000	0.000	0.000	0.000
IPS	0.000	0.000	0.000	0.000	0.567	0.000
ADF	0.000	0.000	0.000	0.000	0.182	0.000
PP	0.000	0.000	0.000	0.000	0.000	0.000

This table presents the results of panel data unit root tests. The tests are necessary because only if variables are stationary can the Granger Causality test be directly performed. I implemented four types of unit root tests in which LLC (Levin, Lin and Chu) assumes common unit root processes, while IPS (Im, Pesaran and Shin), ADF (ADF - Fisher) and PP (PP - Fisher) assume individual unit root processes. The results show that all endogenous variables are stationary in level except loans to the real estate industry as a share of total loans and non-interest expense as share of total assets in panel B (post-FDICIA period). Nevertheless, the first order difference of Real Estate and Non-Interest turn out to be stationary in terms of all four types of tests. Therefore, in the dynamic panel data context, our implementation of Granger Causality tests with the application of Arellano and Bond GMM estimators, which take first difference of all variables, suits our purpose. \*\*Note: Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality

bank risk measures systematically change before a change of risk premia requested by Jumbo CD holders. At the same time, I also employ the reverse test to examine whether changes in risk premia paid by banks can predict the changes in bank risk measures so that I can capture the effectiveness of Jumbo CD holders' market discipline in the sense of banks' "self-correction" behavior. Specifically, I estimate the following regressions for the pre-FDICIA and the post-FDICIA windows:

$$P_{i,t} = \sum_{j=1}^3 \alpha_{1,j} P_{i,t-j} + \sum_{j=1}^3 \beta_{1,j} S_{i,t-j} + \Gamma_1 X_{i,t} + \eta_{1,i} + \Phi_{1,t} + \epsilon_{1,i,t}, \quad (1)$$

$$S_{i,t} = \sum_{j=1}^3 \alpha_{2,j} P_{i,t-j} + \sum_{j=1}^3 \beta_{2,j} S_{i,t-j} + \Gamma_2 X_{i,t} + \eta_{2,i} + \Phi_{2,t} + \epsilon_{2,i,t}. \quad (2)$$

Where  $P_{i,t}$  is the risk premium of Jumbo-CDs for bank  $i$  at time  $t$ ,  $S_{i,t}$  is the accounting data-based bank risk measure for bank  $i$  at time  $t$ ;  $X_{i,t}$  is bank-specific variables controlling for the demand side effect for bank  $i$  at time  $t$ ;<sup>15</sup>  $\eta_i$  is the omitted bank-specific fixed effect for a bank;  $\Phi_t$  is a time effect to account for trending behavior in the system variables; and  $\epsilon_{i,t}$  is a random disturbance with a distribution approximating the normal. The specification of (1) and (2) assumes that error terms are orthogonal to fixed time effects and controlling variables as well as lagged

---

<sup>15</sup>As previously discussed, we test the causality relation between the bank risk and risk premium for each risk measure, respectively.



values of the endogenous variables. Other standard assumptions include that the errors have positive variance and are uncorrelated across cross-sectional units and time. As pointed out in econometric literature (e.g., Nickell 1981), the least squares dummy variable (LSDV) estimator could produce biased coefficients when applied to equations with lagged values of the dependent variable and fixed effects in a data set with a small time dimension. In order to remove the fixed effect, I can difference all variables in the level. The basic regression equations become:

$$\begin{aligned}
P_{i,t} - P_{i,t-1} &= \sum_{j=1}^3 \alpha_{1,j} (P_{i,t-j} - P_{i,t-j-1}) + \sum_{j=1}^3 \beta_{1,j} (S_{i,t-j} - S_{i,t-j-1}) \\
&\quad + \Gamma_1 (X_{i,t} - X_{i,t-1}) + (\Phi_{1,t} - \Phi_{1,t-1}) + (\epsilon_{1,i,t} - \epsilon_{1,i,t-1}), \quad 3)
\end{aligned}$$

$$\begin{aligned}
S_{i,t} - S_{i,t-1} &= \sum_{j=1}^3 \alpha_{2,j} (P_{i,t-j} - P_{i,t-j-1}) + \sum_{j=1}^3 \beta_{2,j} (S_{i,t-j} - S_{i,t-j-1}) \\
&\quad + \Gamma_2 (X_{i,t} - X_{i,t-1}) + (\Phi_{2,t} - \Phi_{2,t-1}) + (\epsilon_{2,i,t} - \epsilon_{2,i,t-1}). \quad (4)
\end{aligned}$$

Although regressions such as (3) and (4) are free of a cross-sectional fixed effect, there are possible correlation between new error terms and lags of endogenous variables that will lead to bias in least square regressions. Arellano and Bond (1991) tackle this problem by proposing a linear instrumental variables technique that uses the predetermined lags of the endogenous system variables as instruments to exploit a large set of over-identifying restrictions so as to attain consistent coefficient estimates.

If I indicate the first differences of  $P$ ,  $S$ ,  $X$ ,  $\Phi$  and  $\epsilon$  as  $\bar{P}$ ,  $\bar{S}$  and  $\bar{\Phi}$ ,  $\bar{\epsilon}$  the regression specifications with Arellano and Bond's method have the form:

$$\bar{P}_{i,t} = \sum_{j=1}^3 \alpha_{1,j} \bar{P}_{i,t-j} + \sum_{j=1}^3 \beta_{1,j} \bar{S}_{i,t-j} + \Gamma_1 \bar{X}_{i,t} + \bar{\Phi}_{1,t} + \bar{\epsilon}_{1,i,t}, \quad (5)$$

$$\bar{S}_{i,t} = \sum_{j=1}^3 \alpha_{2,j} \bar{P}_{i,t-j} + \sum_{j=1}^3 \beta_{2,j} \bar{S}_{i,t-j} + \Gamma_2 \bar{X}_{i,t} + \bar{\Phi}_{2,t} + \bar{\epsilon}_{2,i,t}. \quad (6)$$

Where the errors of the transformed equations satisfy the orthogonality conditions:

$$E [\bar{P}_{i,s} \bar{\epsilon}_{i,t}] = E [\bar{S}_{i,s} \bar{\epsilon}_{i,t}] = 0 \quad \text{where } s < (t - 1).$$

Since I am particularly interested in Granger causality patterns among those endogenous variables, I also construct an F-test for block exclusion by calculating the difference in criterion functions of restricted and unrestricted models so as to test whether including a number of lags for one variable could significantly improve the predictive power of the regression.

## 5 Results and Discussion

Table 3 summarizes the estimation results for the regressions taking the form of equation 5, which aims to examine whether changes in each risk measure have significant predictive power on changes in risk premia.

The results are reported for each regression regarding the predictive power of

Table 2.3:  
**Predictive Power of Risk Measures on Interest Rate Spreads**

Panel A: Pre-FDICIA (1985:1 to 1989:4)						
	Overdue	Leverage	Liquidity	Real Estate	Non-interest	
Sum of Lags on Risk Measure (F-statistics)	-0.003 (0.305)	0.030*** (0.000)	0.163 (0.141)	-0.020 (0.355)	-0.341*** (0.000)	
Return of Assets	-0.103 (0.119)	0.119 (0.438)	-0.117** (0.020)	-0.215** (0.016)	-0.049 (0.490)	
Demand Deposit	0.218** (0.020)	0.184** (0.019)	0.171** (0.038)	0.162* (0.054)	0.124** (0.025)	
Size	0.006 (0.457)	-0.017 (0.201)	0.004 (0.617)	0.011 (0.306)	-0.021* (0.070)	
Sargan test	29.266 (0.253)	23.964 (0.521)	29.084 (0.260)	28.627 (0.280)	27.751 (0.391)	
Panel B Post-FDICIA (1992:1 to 1996:4)						
	Overdue	Leverage	Liquidity	Real Estate	Non-interest	
Sum of Lags on Risk Measure (F-statistics)	0.059*** (0.000)	0.306* (0.085)	-0.129*** (0.002)	-0.087 (0.56)	-0.109 (0.137)	
Return of Assets	-0.023 (0.525)	-0.014 (0.728)	-0.063* (0.080)	-0.030 (0.521)	-0.094 (0.120)	
Demand Deposit	0.083*** (0.002)	0.096** (0.024)	0.068*** (0.003)	0.077** (0.025)	0.054*** (0.007)	
Size	0.016** (0.034)	0.011* (0.085)	0.010 (0.160)	0.008 (0.370)	0.015** (0.026)	
Sargan Test	31.593 (0.170)	23.080 (0.573)	27.534 (0.331)	29.735 (0.234)	21.011 (0.692)	

This table presents the results of panel GMM regressions of the risk premium on five risk measures respectively to test the predictive power of changes in these risk measures on changes in the risk premium. For each regression, the sum of the coefficients of all lags of risk measure is reported to indicate the aggregate magnitude of predictive power of risk measure. Results of the F-test with the null hypothesis that the coefficients of all lags of risk measures are jointly equal to zero are also reported to indicate the statistical significance of risk measures' predictive power (whether changes in risk measures Granger cause the changes in risk premia). Coefficients of control variables are also reported. Sargan tests aim to test the overidentification problem. P-values are in parentheses. In order to study the impact of the FDICIA on this predictive power, the sample is divided into subsamples: panel A (pre-FIDICA) and panel B (post-FDICIA). \* indicates significance at the 10% level. \*\* indicates significance at the 5% level. \*\*\* indicates significance at the 1% level.

each risk measure. For each regression, the sum of the coefficients of all lags of the risk measure is reported to indicate the aggregate magnitude of the predictive power of each risk measure. The results of an F-test with the null hypothesis that the coefficients of all lags of risk measures are equal to zero are also reported to indicate the statistical significance of the risk measure's predictive power. The coefficients of control variables are also reported. In addition, I run a Sargan test for each regression to examine the validity of the instrumental variables. The null hypothesis of the Sargan test is that instrumental variables are sufficiently uncorrelated with the residuals and are therefore acceptable as instruments. Since the results of the Sargan test for all regressions are insignificant, and thus the null hypothesis cannot be rejected, the instrumental variables applied in our regressions seem valid.

The most important results from these and subsequent tables concern the signs and statistical significance of aggregate coefficients of all lagged risk measure variables, along with the F-statistic, for the hypothesis that the coefficients of all lagged risk measure variables are jointly equal to zero. (I report the associated P-values in parentheses.) These two results show the aggregate predictive power of the specific risk measure. By comparing those results for the same risk measure in two time periods (pre-FDICIA and post-FDICIA), I can capture the effect of the FDICIA on the predictive power of this risk measure, which indicates the existence and timeliness of Jumbo CD holders' market discipline. For the share of overdue loans, it seems that there was no timely reaction from Jumbo CD holders before the FDICIA, since I cannot reject the hypothesis that all the coefficients of the lagged share of overdue

loans are jointly equal to zero. However, after the FDICIA was enacted, the aggregate coefficient turned positive (0.059), which suggests that an increase in the share of overdue loans would lead to an increase in the risk premium Jumbo CD holders demand. The significance of the F-statistic at 1% indicates that their reaction was timely. Therefore, market discipline from Jumbo CD holders was reinforced by the FDICIA in respect to Jumbo-CD holders' reaction to increases in the share of overdue loans.

Another risk measure often referred to in the literature is a bank's leverage level since high leverage is commonly considered an indicator of high default risk. The results indicate that the aggregate coefficients for both periods have positive signs, and the hypothesis that the coefficients for all lagged variables is jointly equal to zero is rejected for both periods as well. This observation shows that Jumbo CD holders react to an increase in banks' leverage levels by requesting a higher risk premia in both periods, which indicates the existence and timeliness of market discipline. Furthermore, the fact that the magnitude of the aggregate coefficient, which increased from the pre-FDICIA period to the post-FDICIA period, also support our hypothesis that market discipline was improved by the enactment of the FDICIA.

A bank with high liquidity is considered to be healthy since it is more able to accommodate unexpected withdrawals. Because I cannot reject the hypothesis that all the coefficients of lagged variables are jointly equal to zero for the pre-FDICIA period, it seems that Jumbo CD holders did not react opportunely to a decrease in bank liquidity by asking for a higher risk premium. Nevertheless, as with the

share of nonperforming loans, the reaction of Jumbo CD holders changed in becoming significant after the FDICIA was enacted. We can see this result in that the aggregate coefficient is negative, which indicates that an increase in banks' liquidity level could predict a decrease in the risk premia Jumbo CD holders demand. The fact that the F-statistic is significant at the 1% level indicates that the prediction is timely as well.

As for the risk measure capturing the default risk coming from asset concentration, the share of loans to the real estate industry and the signs of the aggregate coefficient of the share of loans to the real estate industry are negative in both the pre-FDICIA and post-FDICIA periods. This outcome seems to support the findings of studies such as Martinez and Schmuckler (2004) that consider banks with more loans to real estate as relatively healthier, since almost all loans to the real estate industry are mortgages, which have the real estate itself as collateral. However, the fact that the hypothesis that the coefficients of all lagged variables are jointly equal to zero cannot be rejected in either period suggests that the Jumbo CD holders' reaction was not timely in a statistical sense. One possible explanation for this insignificant result is that Jumbo CD holders do not have a consensus in the risk implied in loans to the real estate industry.

Similarly to the share of loans to real estate industry, the ratio of non-interest expense is also a controversial risk measure. As discussed in the previous section, there are two opinions regarding the implications of this risk measure. The negative signs of the aggregate coefficients for both periods suggest that a large share of non-interest expense is more likely to be a good sign for a bank's operating efficiency,

such as better customer service. Another noteworthy result is that the hypothesis that coefficients for all the lagged ratios of non-interest expense are jointly equal to zero cannot be rejected for the post-FDICIA but was rejected for the pre-FDICIA period. This situation suggests that the Jumbo CD holders' reaction to change in the banks' operating efficiency became less timely after the FDICIA took effect. This observation indicates that uninsured depositors such as Jumbo-CD holders have relied less on operating efficiency to monitor banks' risk-taking behaviors since the FDICIA was enacted.

Finally, note that those variables controlling for the demand side effect perform consistently with my expectation: The return on assets obtains a negative coefficient, which indicates a negative relation between ROA and the demand for deposits, especially Jumbo CDs; the coefficients of the share of demand deposits obtain positive signs, which is consistent with our expectation that banks with a larger share of demand deposits would like to collect more Jumbo CDs; and positive coefficients of total bank assets also show evidence of a positive relation between the growth of bank size and the demand of uninsured deposits such as Jumbo CDs.

The examination of two-way Granger causality between risk premia and risk measures provides us with tools not only to test the existence of market discipline by examining the predictive power of risk measures on changes in risk premia. It also allows us to test the effectiveness of market discipline by examining the predictive power of changes in risk premia on changes in risk measures to see whether the Jumbo-CD holders' monitoring could prevent banks from excessive risk-taking behavior. Table

4 reports the results of regressions taking the form of equation 6 to achieve this goal.

The instrumental variables work well since the null hypothesis of the Sargan test that instrumental variables are uncorrelated with the residuals cannot be rejected for any of the regressions, and thus are acceptable instrumental variables. The negative sign of the aggregate coefficients for nonperforming loans as a share of total loans shows that bank managements do make efforts to mitigate their default risk when Jumbo-CD holders ask for higher risk premia. Moreover, the results of the F-test show that the null hypothesis that coefficients for all lagged risk premia are equal to zero is rejected for both periods although there is a slight decrease in the significance after the FDICIA took effect. Therefore, banks' risk-taking behavior has involved a timely response to changes in risk premia during both the pre-FDICIA period and post-FDICIA period in respect to the ratio of nonperforming loans. In addition, the magnitude of the coefficients and F-statistics barely changed after the FDICIA, which suggests that the sensitivity of banks' risk-taking behavior to changes in risk premia was not much impacted by the enactment of the FDICIA.

The ways in which banks' leverage levels responded to changes in the requested risk premia seems to have significantly changed after the FDICIA was enacted. During the period when the FDICIA was not in force, the aggregate coefficient of lagged risk premia was positive, which suggests that banks tended to raise the leverage level when Jumbo CD holders asked for higher risk premia. This outcome seems contrary to how market discipline is supposed to work. Nevertheless, taking into account the severe moral hazard problems of bank management in the late 80s as



Table 2.4.

**Predictive Power of Interest Rate Spreads on Risk Measures**

Panel A: Pre-FDICIA (1985:1 to 1989:4)						
	Overdue	Leverage	Liquidity	Real Estate	Non-interest	
Sum of Lags on Spread (F-statistics)	-0.150** (0.038)	0.205*** (0.000)	1.281 (0.137)	0.333 (0.111)	0.048*** (0.000)	
Return of Assets	-0.203 (0.529)	0.058*** (0.005)	0.579 (0.531)	0.232 (0.328)	-0.728*** (0.000)	
Demand Deposit	0.218** (0.020)	0.184** (0.019)	0.171** (0.038)	0.162* (0.054)	0.124** (0.025)	
Size	0.013 (0.208)	0.052*** (0.000)	0.078*** (0.009)	0.020 (0.577)	-0.011*** (0.000)	
Sargan test	26.792 (0.366)	25.142 (0.454)	22.410 (0.612)	26.618 (0.375)	33.050 (0.139)	
Panel B Post-FDICIA (1992:1 to 1996:4)						
	Overdue	Leverage	Liquidity	Real Estate	Non-interest	
Sum of Lags on Spread (F-statistics)	-0.188* (0.096)	-0.329** (0.025)	0.261** (0.034)	-0.049 (0.445)	-0.181** (0.018)	
Return of Assets	0.571** (0.044)	0.077 (0.123)	0.230 (0.239)	0.403 (0.284)	0.163*** (0.002)	
Demand Deposit	0.096 (0.144)	-0.005 (0.742)	0.116** (0.046)	0.148 (0.249)	-0.010 (0.725)	
Size	0.013 (0.258)	0.077*** (0.000)	0.001 (0.968)	-0.088 (0.142)	0.042*** (0.009)	
Sargan Test	27.192 (0.346)	27.509 (0.331)	32.223 (0.152)	30.324 (0.212)	20.411 (0.725)	

This table presents the results of panel GMM regressions of risk measures on the risk premium. Five regressions are run for each of the five risk measures in order to test the predictive power of changes in risk premia on changes in risk measures, which examine the bank management's strategic response to changes in risk premia depositors request. For each regression, the sum of coefficients of all lags of interest rate spread is reported to indicate the aggregate magnitude of the predictive power of changes in the risk premium. Results of the F-test with the null hypothesis that coefficients of all lags of interest rate spread are jointly equal to zero are also reported to indicate the statistical significance of the interest rate spreads' predictive power (i.e., whether changes in the interest rate spread Granger cause the changes in risk measures). Coefficients of control variables are also reported. Sargan tests aim to test the overidentification problem. P-values are reported in parentheses. \* indicates significance at the 10% level \*\* indicates significance at the 5% level. \*\*\* indicates significance at the 1% level.

depicted in many studies (e.g., Osborne and Lee, 2001), it is not surprising at all to observe a positive relation between a bank’s risk taking behavior and an increase in risk premia. In contrast, our regression results for the post-FDICIA period show an opposite situation in which banks’ leverage levels respond negatively to an increase in risk premia. Also, the significance of the F-statistic rejects the null hypothesis that all coefficients for lagged risk premia are jointly equal to zero, which suggests that the response is timely as well as negative. The difference in the results of two periods indicates that the “effectiveness” of the Jumbo CD holders’ market discipline was significantly improved by the enactment of the FDICIA.

In the case of liquidity, the results also show a significant improvement (but not as drastic as that involving bank leverage levels) in the “effectiveness” of Jumbo CD holders’ market discipline: The aggregate coefficients are positive for both periods, indicating a positive relation between a change in risk premium and the liquidity of bank assets. Nevertheless, the null hypothesis that all lagged risk premia jointly have zero coefficients is rejected only for the post-FDICIA period, which shows that the change in the risk premia requested by Jumbo CD holders became much more “timely” after the FDICIA took effect.

As discussed in the previous section, the share of loans to the real estate industry and the share of non-interest expenses are two controversial risk measures since there could be two offsetting effects associated with these measures. Regressions regarding the predictive power of these two risk measures show that Jumbo CD holders might not have a consensus on the understanding of these two risk measures, and the mis-

understanding could lead to insignificant predictive power of changes in risk premia on these two risk measures.

Nevertheless, the study of the banks' response to changes in risk premia they must pay by adjusting their risk-taking behavior might help us get a clearer idea of how these two risk measures are related to the banks' risk-taking behavior. As for the share of loans that go to the real estate industry, the results show that, in the pre-FDICIA period, when the risk premia that banks must pay Jumbo CD holders go up, banks tend to increase the concentration of their assets on loans to the real estate industry. In the post-FDICIA period, they tend to decrease the share of loans to the real estate industry in the same situation. Considering the likelihood of moral hazard in the pre-FDICIA period, the change of signs of aggregate coefficients from positive to negative suggests that, from the perspective of bank management, the loans to the real estate industry tend to raise default risk. Bank management would thereby reduce the share of loans to the real estate industry to lower the risk premia Jumbo CD holders ask for if there were a "self-correction" response of banks or else "effectiveness" in the Jumbo CD holders' market discipline. However, the insignificance of F-statistics for both periods cannot reject the null hypothesis that the coefficients of all lagged risk premia are jointly equal to zero. Therefore, there is still mixed behavior from the side of bank management even following the FDICIA enactment, although there seems to be a slight improvement in the banks' "self-correction" response to the signals sent by increases in risk premia.

Another noteworthy result concerns the share of non-interest expense. The exam-

ination of the predictive power of this risk measure on changes in risk premia shows that uninsured depositors such as Jumbo CD holders counted less on non-interest expense as an indicator of banks' risk-taking behavior in the post-FDICIA period, while they did respond negatively to increases in the share of non-interest expense before the FDICIA took effect. The examination of the banks' "self-correction" behavior or the predictive power of changes in risk premia on changes in the share of non-interest expenses shows consistent results for the pre-FDICIA period. The aggregate coefficient turned out to be positive, which means that the banks tended to raise their non-interest expense for purposes such as better customer service when the requested risk premia went up. After the FDICIA was enacted, banks seem to be more inclined to lower their non-interest expense when risk premia increased. This change suggests that, from the perspective of bank management, the share of non-interest expense became more indicative of the inefficiency of operation than it was before the FDICIA's enactment.

## **6 Concluding Remarks**

In this study, I explore from a new perspective the impact of the enactment of the FDICIA on market discipline. I employ the two-sided Granger causality test to examine the dynamic relation between risk measures and risk premia so that I can elucidate the impact of the FDICIA on the "timeliness" and "effectiveness" of market discipline by testing the change in predictive power among accounting risk measures and risk premia.

The first part of our main results concerns the examination of the predictive power

of the change in risk measures on the change in risk premia for each accounting risk ratio in both the pre-FDICIA period and the post-FDICIA period. This segment of results shows that market discipline from Jumbo CD holders was significantly reinforced by the FDICIA with respect to the Jumbo CD holders' reaction to increases in the share of overdue loans, leverage level and liquidity. Nevertheless, I obtained mixed results for controversial risk measures such as the share of loans to the real estate industry and the share of non-interest expense. The results suggest that Jumbo CD holders do not rely on the share of loans to the real estate industry in evaluating banks' risk-taking behavior (the insignificance of F-statistics). A slight majority of Jumbo CD holders seem to believe that loans to real estate, which usually are well-collateralized, might actually benefit the banks' overall soundness. The results also show that, in the period of the pre-FDICIA, most Jumbo CD holders believed that non-interest expense was closely related to improvements in operating efficiency such as better customer service. In depending considerably on this accounting ratio after the FDICIA was enacted, more Jumbo CD holders thought of this ratio as an indicator of operating inefficiency. The misunderstanding among Jumbo CD holders made this accounting ratio lose its predictive power for the change in risk premia after the FDICIA took effect.

The other part of the main results presents the impact of the FDICIA on the predictive power of changes in risk premia on changes in accounting risk measures, which we refer to as the "self-correction" behavior of bank management or the "effectiveness" of market discipline. The results show that bank managements make efforts

to lower the ratio of non-performing loans to all loans when Jumbo CD holders ask for higher risk premia both before and after the FDICIA enactment. Nevertheless, bank managements seemed to take advantage of forbearance policies before the FDICIA was enacted. They even raised their leverage level to take on more risk with the hope of getting a higher return to cover the increased costs when uninsured depositors such as Jumbo CD holders asked for higher risk premia. In contrast, our results suggest a significant improvement after the FDICIA took effect, since in the post-FDICIA period the banks' leverage level started to respond negatively to an increase in risk premia. In addition, this improvement in banks' "self-correction" responses is also found in results regarding the risk measure of liquidity.

In sum, after controlling for impacts from the demand side of the Jumbo CDs on risk premia and employing cross-sectional time-series methodologies, I obtained a clearer picture of the dynamic relation between accounting risk measures and risk premia than did previous studies. I find clear evidence that both the "timeliness" (the predictive power of changes in risk measures on changes in risk premia) and "effectiveness" (the predictive power of changes in risk premia on changes in risk measures) of market discipline from uninsured depositors such as Jumbo CD holders were significantly improved by the enactment of the FDICIA. Therefore, the improved regulatory environment provided by the FDICIA has successfully revived incentives for uninsured depositors to monitor financial institutions' default risk, and has motivated financial institutions to be more responsive to market disciplines through "self-correction."

## CHAPTER III

### INTERSTATE BRANCHING MODE CHOICE AND BRANCH PERFORMANCE OUTCOME

#### 1 Introduction

The past decade has witnessed fundamental deregulation in the American banking industry, especially in respect to branching authority. One of the most important deregulations on branching came with the passage of the Riegle–Neal Interstate Banking and Branching Efficiency Act of 1994. This Act enabled banking organizations to increase the size and reach of their operations by interstate branching. However, the Riegle-Neal Act treats two modes of interstate branching in distinct ways. On one hand, the Act requires state governments to generally allow out-of-state banks to operate within their states through mergers and acquisitions. On the other hand, it still permits each state the right to determine whether to allow an out-of-state bank to branch into the state via de novo branching. That is to say, Riegle-Neal Act permits interstate branching through de novo branching (establishing new offices without an acquisition) only if the host state enacts legislation that expressly permits it. By the beginning of 1997, which was the "trigger year" of the Riegle-Neal Act, nine states in addition to the District of Columbia allowed de novo interstate branching. Only eight, however, allowed de novo interstate branching on a reciprocal basis.<sup>16</sup>

---

<sup>16</sup>These 9 states are Connecticut, Maine, Massachusetts, Maryland, Michigan, North Carolina, Pennsylvania, Rhode Island and Virginia.

After the Riegle-Neal Act had been in effect for about 10 years, the issue of de novo interstate branching was again brought forth: For several years, the Financial Services Regulatory Relief Act has been in debate in Congress. It proposes to remove the requirement that states must opt-in to de novo interstate branching and would thereby allow banks to freely establish de novo branches nationwide.

The natural questions to ask are why has Congress been more cautious about the provision on de novo interstate branching than about interstate branching via M&A? Why have state governments been concerned with the de novo interstate branching entry of out-of-state banks, even when there are no more restrictions on the alternative mode of interstate branching (M&A)? The answers to these questions lie in the difference in impact of these two modes of interstate branching.

The existing literature on interstate branching usually examines the entire impact of banks' branching activities without differentiating between the effects of two different modes of interstate branching (e.g., Hughes et al., 1996 and Berger and De Young, 2000). Some of these studies focus on the impact of interstate branching on the competition or efficiency of local banking markets. DeYoung, et al. (1997) argue that interstate competition in banking markets should result in gains in cost efficiency. Jayaratne and Strahan (1998) find that state branching deregulation improved banking efficiency and led to lower interest rates for borrowers and higher economic growth. Other authors claim that interstate branching activities increase economic stability and improve large-scale financing (Calomiris, 1995). Some other studies examine the aggregate impact of interstate branching on the performance of



an MBHC (multiple bank holding company). For instance, Tirtiroglu and Daniels (2005) find that de novo branching deregulations have a negative long-run effect on banks' productivity growth.

The main purpose of restrictions on market entry is to protect the degree of competition of the local markets and the market share of in-market firms. In the scenario of the banking industry, those regulations aim to keep the local markets from being dominated by large out-of-state banks, and to protect in-state banks from losing significant market shares to branches of out-of-state banks, due to being outperformed by new branches.

Giedeman (2004)'s findings based on data from more than seven hundred cities/local markets indicate that the establishment of de novo interstate branches did not significantly increase local banking market concentration. Although Geideman's results could alleviate some concerns about de novo interstate branching, those results still cannot directly answer the question regarding the different policies on those two interstate branching modes: How do the de novo branches of out-of-state banks and branches acquired by out-of-state banks differ in performance?

Instead of testing whether interstate branching improved/harmed the banking efficiency or competition in the local market as a whole, this study proposes to examine the difference in those two modes of interstate branching (de novo branching v.s. mergers and acquisitions) in the sense of performance outcome of the choice of interstate branching mode by each entrant bank. The interstate branching activities in states which have allowed interstate branching provide a natural experiment for us

to examine how the choice of interstate branching mode could affect the performance of branches. For banking regulators and supervisors, this study could help clarify whether the concerns about free de novo branching are warranted. In addition, our study could also contribute to strategic decisions about the right mode of interstate branching by examining the performance outcome of the choice of interstate branching mode by entrant commercial banks.

The key issue in examining the performance outcome of the interstate branching mode choice in local markets is the problem of endogeneity. The problem lies in the fact that the bank management's choice of branching mode is endogenous to their expected performance outcome. Statistical analysis that does not take into account the decision maker's expectation of performance outcome with respect to the mode choice might suffer from biased coefficient estimates. Note that the fundamental question to ask when assessing whether a bank management made the right decision on the interstate branching mode is: Would branches of a multi-market bank have achieved a higher capacity of acquiring market shares, collecting deposits and setting up branches if the management had chosen the alternative mode of interstate branching? We can't answer this question accurately, however, by simply comparing performance outcomes of branches categorized by the mode of interstate branching, since the observed outcomes may not correspond to the counterfactual performance level of interest. For example, banks choosing to branch via mergers and acquisitions might have some particular production capability that makes this choice highly profitable, while banks choosing de novo branching might not have this production capability in the first

place. As a result, in order to capture the impact of mode choice on performance, we must exclude the impacts from factors endogenous to choice decision, such as the difference in production capability.

Thanks to Nobel Prize Laureate Heckman's contribution, econometric techniques to correct endogeneity lying in discrete strategy choices have been developed and considerably improved. The key point of the estimation approach in allowing for endogeneity is to deal with the unobservable variables that affect both performance outcomes and the strategic choice, since it is generally unrealistic to include all factors affecting performance and strategy choice in control variables in regression. The problem of endogeneity in the scenario of interstate branching and the approach to fixing it will be discussed in detail in the latter part of this paper.

The following sections are arranged as follows. Section 2 summarizes the previous literature. The estimation method is described in section 3. Section 4 discusses the variables and associated hypotheses. Data sources and summary description are presented in section 5. Section 6 reports results and includes discussion. Concluding remarks are stated in section 7.

## **2 Literature Review**

Expansion across state borders is a necessary step for a bank's growth and development. In this sense, a bank's entry into a new market means potential diversity in geography as well as economy of scale. Theories predict that entry is prone to occur when there is strong prospect of future profits. Empirical works find that profitability, concentration and market growth are the primary factors determining entry.

Nevertheless, another critical issue about entering a geographically new market is the choice of the mode of branching. The closest concept to which the interstate branching mode can be related is the “entry mode,” since entrant banks’ interstate branching activities are actually a means of entering new markets. Generally speaking, the modes of entry can be divided into two groups: non-equity entry modes (e.g., licensing) and equity-based entry modes (e.g., joint ventures and wholly owned subsidiaries) (Caves, 1986). However, in the scenario of the U.S. banking industry, all entries into new markets take the form of equity-based entry modes. If an equity-based mode of entry into a new market is then chosen, the issue of whether to acquire an existing local bank (interstate branching via M&A) or to set up completely new branches (interstate branching via de novo branching) must be decided.

In the field of industry organization, Giltert and Newbery (1992) and McCardle and Viswanathan (1994) offer two major theoretical papers on the choice of the equity-based mode of entry: de novo or M&A. Both studies consider strategic factors as well as financial motivations involved in the entrants’ choice of entry mode. Giltert and Newbery (1992) set up a Nash-Cournot oligopoly model to study the build or buy decision of a potential entrant. Although acquiring an existent bank could bring about a high premium cost, this method has advantages in gaining from the more efficient allocation of assets and risk diversification. Giltert and Newbery claim that entry via M&A may be preferred to de novo entry for various other reasons. First, entry via M&A could be chosen over de novo entry to avoid the high entry barrier and the associated fixed cost. Second, as for the aspects of future profitability, when

the number of incumbents in the market is close to the “free-entry” market or the “free-entry” number of the market is low, the profit that an entrant is able to obtain via the de novo entry could be much lower than entry via M&A, since the increase of the number of competitors would significantly raise the degree of competition in the market and drag down the surplus. In addition, Gilbert and Newbery take into account the strategic behavior of entrants and claim that entrants prefer entry via M&A to de novo entry when they have strong bargaining power in bidding for M&A. According to Gilbert and Newbery, the credibility of the entry is one crucial factor in determining of the bargaining power. For example, if the potential entrant has subsidiaries in more markets, the incumbents are more threatened by the possible direct entry and are prone to set a lower reservation price for M&A or a smaller share of post-M&A profits.

McCardle and Viswanathan (1994) extend the Gilbert and Newbery (1992) model from the Nash-Cournot symmetric oligopoly model with complete information to the asymmetric information Cournot oligopoly model. Specifically, there are two types of potential entrants: Entrants with a high entry cost and those with a low entry cost. At the same time, incumbents are uncertain about the true type of a potential entrant. The optimal sequential equilibrium could, for example, consist of pooling equilibrium or separating equilibrium or both. In pooling equilibrium, both types of entrants bid for incumbents and no type information is revealed. In separating equilibrium, the low entry cost entrants choose de novo branching and high entry cost entrants choose interstate branching via M&A, thus revealing their type to incumbents. McCardle and

Viswanathan derive the conditions for which equilibrium would hold and the entrants' preference for targets on condition that they do choose to enter via M&A based on a bargaining game between entrants and incumbents. In separating equilibrium, the model predicts that the choice of targets is a trade-off between the efficiency gains of taking over the inefficient incumbents and the lower profits due to the inferior competitive strength of inefficient incumbents. Particularly, when the entrant is more efficient than at least one of the incumbents, the efficient gains could outweigh the competitive effect so that the inefficient incumbents are more likely to be targeted. In pooling equilibrium, the choice of targets is a trade-off between efficient gains and bargaining power, since more efficient incumbents would be more affected by direct entry so that they have less bargaining power in negotiation with the entrants. Consequently, if the entrant is less efficient than incumbents, bargaining factors would dominate and he would be more likely to target efficient incumbents.

Moreover, in the field of international economics, there are many papers that examine the issue of choosing an equity-based mode of entry into foreign markets: Greenfield investment or M&A. For example, Buckley and Casson (1998) analyze the choice between these two entry modes. One of their important conclusions is that the market structure as well as the degree of competition in the market both have a crucial impact on the entry mode choice. They find that the existence of a high cost of competition associated with high monopoly rents makes acquisition preferred to greenfield investment. At the same time, an entrant's highly specific production technology might result in higher adaptation costs so as to discourage acquisition and

to favor greenfield investment. Gorg (2000) analyzes the impact of market structure on choice between greenfield investment and acquisition in a Cournot-type setting. He shows that, although in general acquisition may be the preferred mode of entry, Greenfield investment may be a preferred choice to avoid high adaptation costs.

Harzing (2002) proposes to examine the determinants of entry mode choice from the aspect of corporate-level strategy rather than the business unit strategy only. Specifically, she argues that a firm's international strategy as a whole would play a critical role in determining the mode of entry into a new market: Firms with global strategies tend to integrate and rationalize their production to produce standardized products in a cost-efficient manner. Therefore, they care less about responsiveness to the local market and would prefer de novo entry over M&A entry. Similarly, firms with multi-market strategies tend to maximize their aggregate performance by maximizing their performance in each market so that they would want their subsidiaries to be responsive to the local market. M&A would therefore be a better choice in entering a new market. In the scenario of the U.S. banking industry, which could be taken as a miniature of the international market, many of the findings about the determinants of entry mode choice could be tested in our study of banks' interstate branching modes. We will elaborate on this projection when we discuss variables and hypotheses.

Although there are quite a few empirical papers on the impact of foreign entry mode decisions on firm performance (e.g., Lu and Beamish, 2001, Harzing 2002 and Brouthers and Nakos, 2004) , there are few empirical works explicitly examining the determinants of commercial banks' choice of interstate branching mode or the impact

of this choice on branch performance. Although some papers did find that M&A was actually a frequently preferable alternative entry mode to direct investment, we note that this outcome might actually stem from the regulation restrictions.

In addition, several papers studying the relation between de novo entry and M&A activities offer the perspective that M&A might be a determinant factor of de novo entry rather than a choice between these two entry modes. Seeling and Critchfield (2003) and Berger, Bonime, Goldberg and White (2004) present two major papers on the impact of M&A activities on de novo entry in the banking industry. In both these two papers, the authors define entry into the banking industry as setting up a new charter. They find that M&A activities, especially in-market M&A, as well as factors such as profitability, concentration and market growth, are positively related to de novo entry. In contrast, my study focuses more on banks' choices of how multi-state commercial banks branch into new markets rather than on their setting up new charters.

From the above literature review, we can see that although interstate banking has become a booming activity, and two modes of interstate branching, de novo branching and M&A, have also caught significant attention from regulators and bank management since the fundamental banking deregulation, little is actually known of how banks make their interstate branching mode choice and how the choices affect branches' performance in new markets they enter. This study could contribute to the literature by applying industrial organization theories and strategic management theories to empirical analysis of the choice of banks' interstate branching mode and



its impact on branch performance in new markets. The banking industry provides an ideal laboratory for examining this issue. The products of banks are relatively homogeneous, and geographically segmented markets vary in demographic and economic characteristics that enable researchers to test predictions of theoretical models under different conditions. In addition, after the Riegle-Neal Act of 1994, banks gained much more freedom in the choice of interstate banking mode, especially for those states with an interstate branching policy, so that their choices of interstate branching mode are primarily based on profit-maximization rather than regulation limits, which matches the assumptions of theoretical models.

Specifically, this study tries to answer several questions regarding potential entrant banks' interstate branching strategies: What are the determinants of banks' interstate branching modes? What is the effect of the choice of interstate branching mode on performance outcomes? Could the banks be better off choosing the alternative mode of interstate branching? Here, *de novo* branching refers to establishing new branches in a target market, while interstate branching via M&A means acquiring or consolidating with any incumbent bank.

### **3 Estimation Method**

In the previous section, we mentioned the problem of endogeneity lying in banks' self-selection in choosing the interstate branching mode, which is also the common caveat in many empirical studies on this subject. In this analysis, a two-step Heckman regression is employed to deal with endogeneity.

First of all, we present a binary strategy set for the scenario of branching mode

$\{S_0, S_1\}$  where  $S_0$  stands for interstate branching via mergers and acquisitions and  $S_1$  stands for de novo branching. We denote the performance of entrants as  $M$ .<sup>17</sup> Accordingly,  $M_0$  stands for the performance outcome when  $S_0$  is chosen and  $M_1$  stands for the performance outcome when  $S_1$  is chosen. As previously discussed, the strategic question concerning us is: How could the entrants' performance have been improved had the commercial bank chosen the alternative mode of interstate branching, which is equivalent to  $M_1 - M_0$ . This difference is called treatment effect or strategy effect according to literature on management strategy (e.g., Rubin 1974 and 1978).

An apparent difficulty in estimating this strategy effect is that we can only observe one of these two performance outcomes for any particular bank. We divide the sample into two subsamples: banks choosing the mode of M&A and banks choosing the mode of de novo branching. Therefore, for each group of banks, we need to find an estimate of what their performance might have been had they chosen the alternative mode of interstate branching. That is to say, we want to estimate the expected counterfactual performance outcomes  $E(M_0|S_1)$  and  $E(M_1|S_0)$  for the two groups of banks respectively. However, the simple univariate regression such as  $M_i = \alpha S_i + \varepsilon_i$ , where  $\varepsilon_i$  is assumed to follow normal distribution, can only provide the estimates of  $E(M_0|S_0)$  and  $E(M_1|S_1)$ . It is easy to see that development when there are factors affecting both the performance and the choice of branching mode,  $E(M_0|S_0) \neq E(M_0|S_1)$  and  $E(M_1|S_1) \neq E(M_1|S_0)$ . For example, if large banks tend to choose to interstate branch via M&A and tend to have a higher capability to enlarge market shares as

---

<sup>17</sup>In this study,  $M$  represents an entrant bank's capabilities of enlarging the market share, increasing the number of branches and collecting deposits.

well, the mean performance of the branches of banks choosing the mode of M&A actually reflects both the direct impact of the branching mode on performance and the fact that branches of large banks tend to have higher capabilities to enlarge the market share compared with branches of smaller banks.

However, if we could observe all factors affecting both performance outcomes and choice of branching modes, including all these factors, denoted as  $X$ , as control variables in the simple regression represented above, we could provide an unbiased estimation of the strategy effect, since in this case,  $E(M_0|S_0, X) = E(M_0|S_1, X)$  and  $E(M_1|S_1, X) = E(M_1|S_0, X)$ . The modified regression can be written as follows:

$$M_i = \alpha S_i + X_i \beta + \varepsilon_i, \quad (1)$$

or we could allow for heterogeneous strategy effects of different groups of banks by writhing the regression as:

$$M_{1i} = X_i \beta_1 + \varepsilon_{1i} \quad (2)$$

$$M_{0i} = X_i \beta_0 + \varepsilon_{0i}. \quad (3)$$

Unfortunately, the problem of endogeneity could still be severe since it is usually impossible to observe all factors conjointly affecting performance outcomes and choice of branching modes, and the omitted variables could lead to biased estimation if OLS regressions are employed.

Following Heckman (1974, 1978), we propose a two-step estimation method to get unbiased estimations of strategy effects of choice of interstate branching. In the first step, we apply a probit estimation by supposing that the mode choice depends

on a continuous latent variable  $S_i^*$ : if  $S_i^*$  passes some threshold (e.g., 0),  $S_1$  (de novo branching) will be chosen while  $S_0$  will be chosen otherwise. At the same time, we introduce an instrumental variable  $Z_i$  which stands for a vector of factors only affecting strategy choice.<sup>18</sup>

The regression can be written as

$$S_i^* = \gamma(M_{1i} - M_{0i}) + Z_i\eta + \tau_i \quad (4)$$

where  $S_i = 1$  (de novo) if  $S_i^* > 0$ ;  $S_i = 0$  (M&A) if  $S_i^* \leq 0$ .

Substitute (2) and (3) for  $M_{1i}$  and  $M_{0i}$ , we obtain

$$S_i^* = X_i\beta + Z_i\eta + \tau_i \quad (5)$$

where  $\tau_i = \gamma(\varepsilon_{1i} - \varepsilon_{0i}) + \tau_i$  and  $\beta = \gamma(\beta_1 - \beta_0)$ . We assume all error terms are joint normal distributions.

From the above probit estimation, we can get an estimation of  $\beta$  and  $\eta$ .

In the second step, we want to obtain an unbiased estimation of  $\beta_1$  and  $\beta_0$  using results from the first step.

From (2) and (5), we have:

$$\begin{aligned} E(\varepsilon_{1i}|S_1) &= E(\varepsilon_{1i}|S_i^* > 0) \\ &= -\sigma_{u1}\phi(X_i\beta + Z_i\eta)/\Phi(X_i\beta + Z_i\eta) = \sigma_{u1}\lambda_{1i}, \end{aligned} \quad (6)$$

and similarly, we have:

$$E(\varepsilon_{0i}|S_0) = E(\varepsilon_{0i}|S_i^* \leq 0)$$

---

<sup>18</sup>In this study, we choose host state concentration, entrant bank bargaining power and distance between the entrant bank headquarters state and host state as instrumental variables.

$$= \sigma_{u0}\phi(X_i\beta + Z_i\eta)/[1 - \Phi(X_i\beta + Z_i\eta)] = \sigma_{u0}\lambda_{0i} \quad (7)$$

where  $\phi$  is normal density,  $\Phi$  is the cumulative normal density.  $\sigma_{u1} = cov(\tau_i, \varepsilon_{1i}); \sigma_{u0} = cov(\tau_i, \varepsilon_{0i})$ .

$\lambda_{1i}$  and  $\lambda_{0i}$  represent the so-called inverse Mills ratio in the literature.

Then, we adjust (2) and (3) with (6) and (7) to get

$$M_{1i} = X_i\beta_1 - \sigma_{u1}\phi(X_i\hat{\beta} + Z_i\hat{\eta})/\Phi(X_i\hat{\beta} + Z_i\hat{\eta}) + e_{1i} \quad (8)$$

and

$$M_{0i} = X_i\beta_0 + \sigma_{u0}\phi(X_i\hat{\beta} + Z_i\hat{\eta})/[1 - \Phi(X_i\hat{\beta} + Z_i\hat{\eta})] + e_{0i} \quad (9)$$

where  $E(e_{0i}|S_0) = E(e_{1i}|S_1) = 0$ .

Note that after correction for self-selection, we can easily obtain unbiased estimators of  $\beta_1$ ,  $\beta_0$ ,  $\sigma_{u1}$  and  $\sigma_{u0}$  through OLS regressions.

We will elaborate on this situation when we discuss the results.

## 4 Variables and Hypotheses

### 4.1 Dependent Variable: Performance Outcome

In an ideal situation, we would capture the performance of a bank's branches by measuring its revenue and operating costs. Unfortunately, the Call Report and other available data sources only provide information of this kind at the institution level so that we cannot isolate branch performance for each market (state). To tackle this problem, we need to find the appropriate proxies of branch performance based on available information.

Firstly, as indicated in Orlow, Radecki and Weminger (1996), the key function of a branch network lies in the collection of deposits so that all else being equal, the more deposits that are held at branches, the greater the profit. Note that for a branch with more deposits, the fixed costs of operating could be spread across a wider deposit base. Furthermore, higher levels of deposits are also associated with a higher premium in branch sales (Edelstein and Morgan, 2004). Besides, the information on the deposits of a bank's branches in every single market is available in the Summary of Deposits at the FDIC (Federal Deposit Insurance Corporation) website. Therefore, we choose total deposits as one of the branch performance proxies. Secondly, since larger market shares in the banking industry are associated with a greater exercise of market power and higher profits (Berger, 1995), we also take the deposit market share of branches in the host state as a measure of the branches' performance outcomes. Similarly, we take the number of branches an entrant bank owns in the market as another measure of its performance since the more branches it has, the more deposits it can collect through them.

Another noteworthy fact is that branches might have different developing curves: De novo branches start with nothing and generally need more time to mature while branches set up via M&A inherit the achievement of the acquired branches. They thus start from a higher point, although they also need some time to adjust to the new management and operating strategies. Considering these factors, we record branch performance measures of entrant banks up to two years after their entries.<sup>19</sup>

---

<sup>19</sup>Due to the limitation of sample size, the current study only focuses on the short-run performance of branches.

## **4.2 Factors Affecting Branching Mode Choice and Performance Outcome**

### **4.2.1 Entrant Bank's Efficiency Advantage**

Some studies (e.g., Jovanovic and Rousseau, 2002, Giltert and Newbery, 1992 and McCardle and Viswanathan, 1994) suggest that the likelihood of entry via M&A could be positively related to the difference between the efficiency of the entrant and the average efficiency of the incumbents. The rationale is that the more efficient the entrant compared with incumbents, the greater the entrant's potential efficiency gain by merging with or acquiring inefficient incumbents. For publicly traded firms, the financial literature authors (e.g., Jovanovic and Rousseau, 2002) usually use Tobin's  $q$  or charter value to measure firms' efficiency. Unfortunately, market-based efficiency measures are not available to our study since only a handful of banks in our sample issue publicly traded stocks. Therefore, we use accounting ratios such as ROA and the liability ratio to measure entrant banks' efficiency. At the same time, since we have access to the average ROA of banks in each state, we can obtain the efficiency advantage by calculating the ROA difference between entrant banks and incumbent banks. Furthermore, a larger efficiency advantage is expected to bring about better performance outcomes.

### **4.2.2 Size**

Many economists who oppose restrictions on de novo interstate branching are most concerned with the barriers caused by those restrictions. These would deter banks of small size from entering the protected market since the high cost of acquiring another bank is usually unaffordable to small banks. This concern also indicates that small

banks tend to interstate branch via de novo branching. Therefore, we expect that the tendency of a bank to interstate branch by setting up do novo branches is negatively related to the entrant bank's size. At the same time, large banks usually have a higher reputation and greater credibility, which are crucial factors when collecting deposits from consumers (Woodward 1988). In this study, an entrant bank's size is defined as the log of its total assets (in thousands).

### **4.2.3 Market Profitability Potential**

Following similar logic as above, when an entrant bank faces a market with high profitability potential, the management might be less concerned with the significant decrease in profit surplus that comes with de novo branching. Also, some studies on the determination of premium payments in M&A show that premium payments are usually positively correlated with market growth (e.g., Hirtle, 2005) so that entrant banks might want to avoid even higher premium payments in markets with a higher market growth rate by choosing the entry mode of de novo branching. As in Hirtle (2005), we take market-level aggregate personal income growth and per capita personal income growth in the year prior to the time the entry occurs as the measure of market profitability potential. Also, other factors being equal, high market profitability potential suggests high performance outcomes.

### **4.2.4 Instrumental Variables**

In order to correct for the endogeneity lying in banks' self-selection in choosing the mode of interstate branching, we need to find some instrumental variables to capture the factors that affect only the choice of branching mode. Based on our previous



discussion, we choose the following three instrumental variables.

#### **4.2.5 Market Concentration**

According to the previous discussion, a high level of concentration ( $HHI > 1800$ ) means a high entry barrier to de novo branches, so that entrant banks would be prone to establish their interstate branches via M&A. Nevertheless, high concentration also means high potential profit surplus for a new competitor in this market, which could make entrant banks more likely to enter via de novo branching. Similarly, when the market concentration is low ( $HHI < 1000$ ), the market is competitive and relatively close to the “free entry” level, which, according to previous discussion, means entrant banks would be more reluctant to enter via de novo branching. This mode would significantly drag down the profit surplus after entrance into the market. The relatively low entry barrier in a more competitive market could also tempt entrant banks to set up de novo branches to avoid paying the high premium associated with acquiring incumbent banks. Considering these two potentially confounding effects, the impact of competition level on entrant banks’ choice of entry mode could be either way, depending on which effect dominates. The statistically insignificant correlation between market concentration level and performance variables confirms the qualification of market concentration as an instrumental variable. Note that the traditional measure of the competition level of one market is HHI, which is defined as the square sum of the market share of participants in the market. The higher the HHI, the more concentrated is the market, which means a lower level of competition.<sup>20</sup>

---

<sup>20</sup>In this estimation, we constructed three dummy variables indicating “low,” “median” and “high” levels of concentration based on actual HHI values.

#### 4.2.6 Geographical Diversity

The previous literature indicates that banks expanding into many states usually have two characteristics: higher bargaining power and lower entry cost. The bargaining power of an entrant comes from his credibility of entry. The theoretical model predicts that when the incumbents believe that if they could not reach an M&A agreement with the potential entrant, the entrant would enter the market via direct investment, which would more severely challenge their future profitability. As a result, the entrants would have more bargaining power to obtain better deals, which would give them more incentive to enter via M&A. In this case, the likelihood of an entrant bank to enter via de novo branching should be negatively related to the number of states into which this entrant bank has expanded thanks to the high credibility of entry. Nevertheless, if a bank has a history of entering many other markets, this bank is much likely to have a low entry cost, which could result from many factors such as high operating efficiency, a good reputation or prompt responsiveness to the new market. If this is the case, the likelihood of an entrant bank to enter via de novo branching should be positively related to the number of states into which it has expanded. Apart from the inconclusive relation between the number of states involved in a bank's expansion and an entrant bank's choice of interstate branching mode, note the fact that branch performance in an individual market mainly depends on the customers' choice of banks in which to deposit their money. Also note that depositors tend to care more about direct health indicators such as size and balance sheet ratios than indecisive factors such as geographical diversity. The significant correlation between the number of states into which an entrant bank has expanded and

the interstate branching mode choice, as well as the insignificant correlation between geographical diversity and branch performance variables, also justifies our choice of instrumental variable.

#### **4.2.7 Distance to Host Market**

This instrumental variable is chosen based on an application of the integration/responsiveness framework in international economics literature (Rosenzweig and JV, 1991). These studies reveal that a corporation focusing more on integration strategy would pay more attention to the scale of economy as a whole and care less about the responsiveness to individual markets, while the reverse is true for a corporation with multi-market strategies. Harzing (2002) applies this theory in analyzing the choice of entry mode into foreign markets and argues that corporations with global strategies would be more likely to enter the new foreign market via greenfield investment (establish a subsidiary from scratch), while corporations with multi-domestic strategies would be more likely to enter via M&A. Because they care more about the responsiveness to the local market, acquiring an existing firm better suits their purpose in this sense. Our study applies this framework in examining entry mode choice in the domestic market, which is considered a miniature of the international market.

A multi-state bank that weighs significantly upon the competition in the whole domestic market will integrate its branches in a geographical sense to achieve highest economy of scale. Nevertheless, a multi-state bank that cares more about performance and competition in individual markets needs to find the most profitable markets

(not necessarily close to each other) and to be more responsive to local markets. In this case, branching via M&A would be superior to de novo branching, since it could significantly alleviate the problem of information asymmetry about local market between entrants and incumbents.

In the present study, we use the distance from the state where an entrant bank's headquarters is located to the host state to indicate an entrant bank's preference in expansion strategy. If an entrant bank targets a distant market, its expansion strategy more resembles that of a multi-market bank and involves more emphasis on responsiveness to the local market, thus preferring de novo branching to M&A. Otherwise, if an entrant bank targets a close market, it tends to benefit from the economy of scale and care less about responsiveness to the new market. It thus prefers M&A to de novo branching. Also, we assume that this kind of intricate factor may not affect customers' choice of banks in which deposit their money, so that it is likely to be independent of the branch performance of entrant banks. The result of the correlation test also supports our choice of this instrumental variable.

## **5 Data Summary and Descriptions**

We chose nine states and the District of Columbia that allow interstate branching to test our hypotheses on the determination of interstate branching mode choice and its impact on branch performance outcomes. From the Summary of Deposits made available at [www.fdic.gov](http://www.fdic.gov), we identify all multi-state commercial banks in these states from 1996 to 2004 which have at least three years of available data on branch performance. By matching the identities of multi-state commercial banks of each

state in adjacent years, we determine the entrant multi-state commercial banks of each market in each year from 1997 to 2004. Next, by checking the activity histories of each multi-state commercial bank among these entrants, we determine their interstate branching mode: If they entered into a new market through M&A, the event will show up in the activity history. If a multi-state commercial bank did enter a market without a specific description in activity history, we took it as entering into a market through de novo branching. In the end, we obtained 145 entry events that occurred among these states through 1997 to 2004. Among these 145 events, 42 were realized through M&A and the rest of 103 were realized through de novo branching.<sup>21</sup> The deposit amount and the market share data of branches of each entrant multi-state commercial bank in a state are available at the FDIC Summary of Deposits. Demographic and state economy data are available at the Bureau of Economic Analysis. Information on bank activity history can be obtained from the institution directory at FDIC website. Balance sheet data were derived from Call Reports of commercial banks, which are available at the website of the federal bank in Chicago.

Table 3.1 shows the summary statistics of primary explanatory variables.

Table 3.2 shows the summary statistics of performance variables categorized by entrant banks' interstate branching modes. The simple description shows that entrant banks choosing interstate branching via M&A generally performed better in the targeted market than entrant banks choosing de novo interstate branching. However,

---

<sup>21</sup>We actually identified 208 interstate branching events during this time period. However, we had to exclude events involving non-commercial bank entrants since FDIC Call Report data are only available for commercial banks. There might be different regulations on entry by these non-commercial banks.

Table 3.1  
**Descriptive Statistics for Variables Affecting Entry Mode Choice**

	Mean	Minimum	Maximum	Std	# of Obs
Median concentration	0.29	0	1	0.46	145
High concentration	0.12	0	1	0.33	145
Low concentration	0.59	0	1	0.49	145
Per capita income growth	1.33	-4.18	3.82	1.63	145
Income growth	2.64	-3.82	6.32	1.75	145
Return on assets difference	0.24	-4.82	19.93	2.53	145
log assets	14.50	10.21	20.06	2.45	145
Liability ratio	11.19	3.58	18.10	2.59	145
Charter type	0.46	0	1	0.50	145
Bargaining power	2.09	0	9.00	1.86	145
Log distance	6.14	0.95	3.33	7.98	145

This table presents the summary statistics of variables with potential impact on banks' choices of interstate branching mode. Median concentration, high concentration and low concentration are dummies variables indicating whether the host markets are fairly, highly (HHI>1800) or lowly concentrated(HHI<1000). Per capita income growth and income growth are inflation-adjusted growth rate percentages at the per capita level and aggregate level. The return on assets difference is the gap between an entrant bank's ROA and the average ROA of incumbent banks in the host market one year before it enters the market. Lnsize is the natural logarithm of inflation-adjusted total assets. Chartertype is a dummy variable that attains 1 when an entrant bank is state-chartered and 0 otherwise. Bargaining power is the number of states to which an entrant bank has expanded before it enters a new market. Log distance is the natural logarithm of the miles between the state in which an entrant bank's headquarter is located and the targeted market. Aggregate income and bank assets are adjusted to 1996 dollars.

we will apply the two-stage Heckman Estimation to correct for the potential sample selection bias to see if one entry mode is actually superior to the other.

Figure 2 shows the distribution of interstate branching events by year. We can see that de novo branching was obviously the dominant entry mode during the time period after the Riegle-Neal Act took effect, which contrasts with what is recorded in studies on entry activities before interstate branching deregulation.

Figure 3 shows the distribution of interstate branching events by the concentration level of host states. From the distribution, we can see that the preference upon de novo interstate branching was most significant in markets with a low level of concentration (67 vs. 18) and was weakest in market with median level of concentration (23 vs. 19). In markets with a high level of concentration, the preference is also evident, according

Table 3.2 :  
**Descriptive Statistics for Performance Variables**

Subsample A: Entrants Choosing De Novo Interstate Branching (103)					
	Mean	Minimum	Maximum	Std	# of Obs
Market share	1.22	0	27.14	4.01	103
Market share_1	1.66	0	23.09	4.67	90
Market share_2	1.87	0	22.01	4.61	73
Branch number	17.27	1	293.00	49.47	103
Branch number_1	23.11	1	392.00	63.37	90
Branch number_2	31.96	1	340.00	69.28	74
Log (total deposit)	9.77	0.60	15.99	2.89	94
Log (total deposit)_1	10.47	5.19	16.43	2.43	86
Log (total deposit)_2	10.91	6.90	16.48	2.47	70
Subsample B: Entrants Choosing Interstate Branching via M&A (42)					
	Mean	Minimum	Maximum	Std	# of Obs
Market share	3.35	0	32.17	6.76	42
Market share_1	3.40	0	28.70	6.57	39
Market share_2	3.38	0	26.63	6.28	36
Branch number	47.93	1.00	270.00	79.89	42
Branch number_1	50.33	1.00	259.00	80.62	39
Branch number_2	46.25	1.00	240.00	73.32	36
Ln(total deposit)	12.55	6.64	16.17	2.19	41
Ln(total deposit)_1	12.46	7.87	16.17	2.19	39
Ln(total deposit)_2	12.73	9.15	16.14	1.88	35

This table presents the summary statistics of variables measuring entrant banks' performance up to two years after the entry. The calculation of market shares is based on deposits. The simple description shows that entrant banks choosing interstate branching via mergers and acquisitions generally performed better in the targeted market than entrant banks choosing de novo interstate branching. Total deposits are adjusted to 1996 dollars.

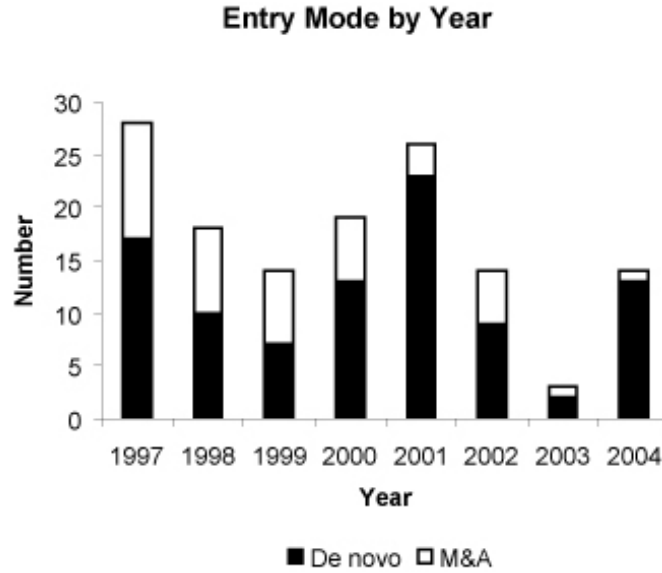


Figure 2: This figure shows the frequencies of two interstate branching modes in each year from 1997 to 2004.

to the figure.

## 6 Results and Discussion

### 6.1 Interstate Branching Mode Choice

The results of first stage Heckman estimation, which examines the determinants of interstate branching mode choice, are presented in Table 3.3.

The first noteworthy fact is that the entry mode choice has no relation to the entrant banks' charter type, which justifies our assumption that all entrant multi-state commercial banks could freely choose an interstate branching mode whether they are national or state-chartered banks.

Across all regression specifications, the coefficients of bank size are always negative and significant at the 1% percent level. Our previous discussion shows that banks of small size usually cannot afford high premium costs associated with M&A and thus

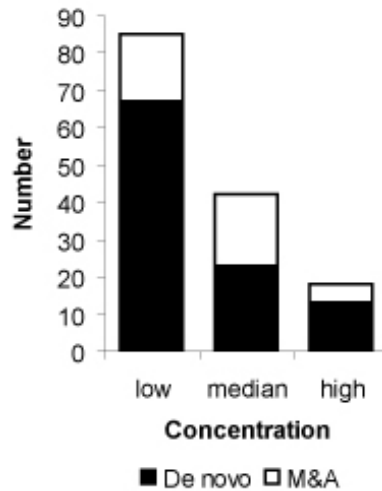


Table 3.3:  
**Results of First Stage Heckman Estimation: Interstate Branching Mode Choice**

	1	2	3	4
Intercept	4.9153*** ( $<.0001$ )	4.1185*** (0.0008)	3.7929*** (0.0016)	4.7117*** ( $<.0001$ )
Median concentration	-0.7595*** (0.0052)	0.7024* (0.0780)		-0.8244*** (0.0027)
High concentration		0.7793*** (0.0069)	0.6382 (0.1063)	
Low concentration			0.8968*** (0.0025)	
Per capita Income growth			-0.1871** (0.0253)	-0.1783** (0.0296)
Income growth	-0.1696** (0.0220)	-0.1690** (0.0034)		
ROA difference	0.00784 (0.8744)	0.00803 (0.8713)	0.00841 (0.8657)	0.00967 (0.8459)
Log assets	-0.2024*** (0.0033)	-0.2037*** (0.0034)	-0.2009*** (0.0038)	-0.1968*** (0.0041)
Liability ratio	0.0161 (0.7658)	0.0156 (0.7724)	0.0112 (0.8353)	0.0133 (0.8048)
Charter type	-0.3547 (0.1739)	-0.3576 (0.1708)	-0.3554 (0.1737)	-0.3457 (0.1839)
Bargaining power	0.1712** (0.0425)	0.1711** (0.0426)	0.1667** (0.0476)	0.1680** (0.0462)
Log distance	-0.1681 (0.2615)	-0.1587 (0.3103)	-0.1447 (0.3524)	-0.1743 (0.2434)

The dependent variable is the dummy variable that attained 1 when the entrant bank chose de novo interstate branch and attained 0 otherwise. The reported results concern four primary regression specifications and other specifications of similar kinds (e.g. ROA instead of ROA difference, per capita income growth rate instead of aggregate income growth rate, distance quintile instead of the log value of distance etc.) produce similar results. Moreover, all regression specifications satisfy convergence criteria and have a high level of ordinal variable association. P-values are reported in parentheses. \* indicates significance at the 10 percent level. \*\* indicates significance at the 5 percent level. \*\*\* indicates significance at the 1 percent level.

**Entry Mode by Market Concentration**



**Figure 3:** This figure shows the frequencies of two interstate branching modes regarding different competition levels of target markets.

prefer de novo interstate branching. Since we use a natural logarithmic transform of bank size, the significant coefficient also indicates the decreasing marginal effect of bank size on entrant banks' interstate branching mode choice.

As for the impact of entrant banks' efficiency on their choice of interstate branching mode, our hypothesis seems not to be supported by the regression results. Coefficients of the ROA difference between entrant banks and the host state average level as well as entrant banks' liability ratios are both insignificant. According to the results, it seems that the potential efficiency gains from acquiring incumbent banks are not an influential factor in choosing an interstate branching mode, although previous empirical studies have found that the likelihood of M&A events are positively related with an efficiency gap between acquirers and targets. The possible reason is that accounting variables such as ROA and liability ratio are not adjusted for company size and only take into account the past performance, unlike Tobin's q which is based

on discounted present value. Therefore, accounting ratios may not be good measures of entrant banks' efficiency so that we cannot observe the expected relation between efficiency gains and the choice of interstate branching mode.<sup>22</sup>

As for the impact of the number of states to which an entrant bank had expanded on the choice of interstate branching mode, we obtained positive coefficients at the 5% significance level in all model specifications. When we restricted Probit regressions to the sub-sample of entry events that occurred in markets of low concentration, the coefficient of the number of states to which an entrant bank had expanded was significant at the 1% level with larger magnitude (0.6997 v.s. 0.1712 in the full sample). These results indicate that entrant banks that have expanded to more states are more likely to expand to a new market via de novo branching to take advantage of their low entry cost rather than to threaten incumbent banks with their entry credibility to obtain better deals in M&A negotiation. Especially when the target markets are lowly concentrated but not nearly competitive, where the impact of one extra bank on incumbents' profit surplus is low, the bargaining power lying in the entry credibility would not be very influential.

We've already seen from Figure 2 that in markets with low or high concentration, de novo interstate branching dominates the alternative mode. Our results confirmed this finding. Specifically, the coefficient of the dummy variable, which indicates whether the target market is lowly concentrated ( $HHI < 1000$ ), are positive and significant at the 1% level. The coefficient of the high concentration ( $HHI > 1800$ ) dummy

---

<sup>22</sup>This topic could be dealt with in future research by expanding the data source and employing more precise efficiency measures such as Tobin's Q.

variable is also positive although barely significant in statistic sense. Similarly, in regression models incorporating only a median concentration dummy instead of low and high concentration, the coefficient of the median concentration dummy is negative and significant at the 1% level, which is consistent with results from alternative regression specifications. These results imply that when the entry barrier is low, entrant banks prefer de novo branching to branching via M&A without much concern with the possible shrinking of profit surplus following their entry. Nevertheless, when facing a highly concentrated market, entrant banks' preference regarding the interstate branching mode could be ambiguous: Some of them might be more concerned with the entry barrier and thus prefer to enter via M&A, while others might still prefer de novo branching since the premium cost could be high in highly concentrated markets.<sup>23</sup> Moreover, when facing a market of a normal level of concentration, entrant banks seem to care more about the potential deduction of profit surplus and prefer entrance via M&A.

Also note that the coefficients of distance between states entrant banks' headquarters and target markets are all positive across all regression specifications, which is consistent with our hypothesis. An entrant bank targeting a distant market is more likely to take a "multi-market" strategy, which requires prompt responsiveness to the local market. Thus, acquiring an established organization from a target market is superior in this sense. Similarly, an entrant bank that aims at expanding to mar-

---

<sup>23</sup>Studies on the determination of merger premium show mixed results on the relation of merger premium and market concentration. For example, Beatty, Santomero and Smirlock (1987) found a positive and significant relationship while other authors found no significant relationship (Hakes et al., 1997; Brewer et al., 2000b).

kets close to where its headquarters takes a “unite-market” strategy, which requires economy of scale so that it would be likely to set up its own de novo branches to conveniently align the operations of all subsidiaries in order to realize the economy of scale. However, the lack of the statistical significance of coefficients implies that this factor is not the crucial one in determining the entry mode decision, although this framework from international trade works to some extent.

Another noteworthy finding is the consistently significant negative relation between the likelihood of de novo branching and economic prospects of target markets, which is contrary to our hypothesis. However, this result makes much more sense when we take into account the transitional stage of a new competing bank in a market. A de novo branch would need up to five years to fight the entry barrier and to mature, while acquiring an established incumbent bank means prompt acceptance in the market. At the same time, we need to note that the economic potential cannot last long either. Therefore, when entering a market that has particular economic potential,<sup>24</sup> entrant banks would be more likely to take advantage of the prompt responsiveness and acceptance of acquired banks so as to benefit from the temporary economic thriving of the host markets.

## **6.2 Branch Performance**

To correct for the possible endogeneity, we apply a two-stage Heckman estimation. After obtaining the inverse Mills ratios from the first-stage Probit regression, we can get unbiased estimated coefficients on the determinants of branch performance with

---

<sup>24</sup>Many studies on entry decision have found a positive relation between markets’ economic potential and the likelihood of their being targeted.

OLS regression in the second stage. Note that the main goal of this study is to see how entrant banks' choices of interstate branching mode impact their performance in the host market and whether entrant banks would have performed better if they had chosen the alternative branching mode. Nevertheless, the information on whether an entrant bank could have been better off by switching to the alternative interstate branching mode cannot simply be derived from coefficients of determinants. The solution to this difficulty is to calculate the treatment effect on the treated (Heckman and Robin 1985, Hamilton and Nickerson 2003). In our study, the treatment effect on the treated is the expected performance gain of firms choosing strategy by  $S_i$  switching to  $S_{-i}$  strategy.

Specifically,

$$\begin{aligned}
& E(M_1 - M_0 | S_1, X_i) \\
&= X_i(\beta_1 - \beta_0) + (\sigma_{u0} - \sigma_{u1})\phi(X_i\hat{\beta} + Z_i\hat{\eta})/\Phi(X_i\hat{\beta} + Z_i\hat{\eta}) \quad (10)
\end{aligned}$$

for banks choosing de novo interstate branching;

$$\begin{aligned}
& E(M_1 - M_0 | S_0, X_i) \\
&= X_i(\beta_1 - \beta_0) + (\sigma_{u1} - \sigma_{u0})\phi(X_i\hat{\beta} + Z_i\hat{\eta})/[1 - \Phi(X_i\hat{\beta} + Z_i\hat{\eta})] \quad (11)
\end{aligned}$$

for banks choosing interstate branching via M&A.

Before we present the estimated treatment effect on the treated, let us take a closer look at the coefficients on Mills ratios,  $\sigma_{u0}$  and  $\sigma_{u1}$ , which can provide us with valuable insights into the comparative advantage of two types of entry strategies.

Recall that the expected performance of banks observed entering via de novo branching is  $E(M_{1i} | S_1) = X_i\beta_1 - \sigma_{u1}\phi(X_i\hat{\beta} + Z_i\hat{\eta})/\Phi(X_i\hat{\beta} + Z_i\hat{\eta})$  and the Mill ra-

tios are always positive. Therefore, a negative  $\sigma_{u1}$  means the expected performance  $E(M_{1i}|S_1) > X_i\beta_1$  and also note that  $X_i\beta_1$  is the expected performance with strategy  $S_1$  for all banks. This situation implies that if entrant banks choosing M&A had chosen de novo interstate branching, their expected performance would be lower than that of banks actually choosing de novo interstate branching. In the literature, this case is called “positive selection into strategy  $S_1$ ”. Conversely, a positive  $\sigma_{u1}$  implies that banks choosing strategy  $S_1$  have the below average performance which means that if banks that actually chose the M&A interstate branching mode had taken the alternative strategy, they would have had better performance than that of banks that actually chose de novo branching. In the literature, this case is called “negative selection into strategy  $S_1$ ”. Also, recall that the expected performance of banks choosing interstate branching via M&A is  $E(M_{0i}|S_0) = X_i\beta_0 + \sigma_{u0}\phi(X_i\hat{\beta} + Z_i\hat{\eta})/[1 - \Phi(X_i\hat{\beta} + Z_i\hat{\eta})]$ . Following the same logic, we can see that a negative  $\sigma_{u0}$  means that  $E(M_{0i}|S_0) < X_i\beta_0$ , which implies a “negative selection into strategy  $S_0$ ,” while a positive  $\sigma_{u0}$  implies a “positive selection into strategy  $S_0$ .”

When we take both the signs of  $\sigma_{u1}$  and  $\sigma_{u0}$  into account, if  $\sigma_{u1} < 0$  and  $\sigma_{u0} > 0$ , we see that both categories of banks chose strategies in which they have comparative advantages since they all had above average performance. In the case that  $\sigma_{u1} > 0$  and  $\sigma_{u0} > 0$ , banks choosing the interstate branching mode of M&A have the absolute advantage over banks choosing de novo interstate branching since no matter what strategy they took, they could perform better than their counterpart. Similarly, in the case where  $\sigma_{u1} < 0$  and  $\sigma_{u0} < 0$ , banks choosing de novo interstate branching

Table 3.4:  
**Results of the Second Stage Heckman Estimation: Branch Performance**

Performance Measures	$\sigma_{u1}$	$\sigma_{u0}$
Log (Total deposits)	-0.117 (0.922)	2.078* (0.082)
Log (Total deposits)_1	1.525* (0.075)	2.981* (0.055)
Log (Total deposits)_2	1.312** (0.013)	1.985 (0.131)
Branch number	51.200** (0.018)	120.483*** (0.008)
Branch number_1	74.376*** (0.007)	127.392** (0.017)
Branch number_2	91.740*** (0.001)	130.476** (0.016)
Market share	1.015 (0.579)	6.422 (0.119)
Market share_1	3.879** (0.048)	7.992* (0.090)
Market share_2	3.028** (0.027)	8.914* (0.059)

This table presents the results of the second stage Heckman estimations. Dependent variables are performance variables. Estimation of covariances between the interstate branching mode and error terms are reported with P-values in parentheses. \* indicates significance at the 10 percent level. \*\* indicates significance at the 5 percent level. \*\*\* indicates significance at the 1 percent level.

have the absolute advantage over banks choosing the alternative strategy. The latter case, where  $\sigma_{u1} > 0$  and  $\sigma_{u0} < 0$ , means all banks chose the strategy with which they would have a relative disadvantage, a situation that would rarely happen in real life.

Table 3.4 shows the results of second-stage Heckman Estimation.<sup>25</sup>

The results regarding the estimations of  $\sigma_{u1}$  (the coefficient of the inverse Mills ratio for banks entering via de novo branching) show that for all three types of

---

<sup>25</sup>The results of second-stage Heckman estimation for all six performance measures are based on the first model specification in the first-stage Heckman estimation.



performance measures (total deposits, total number of branches and the market share) up to two years after entering the market,  $\hat{\sigma}_{u1}$  is significantly positive, especially for the performance measure of branch numbers. This fact implies, that banks choosing de novo interstate branching actually do not have a performance advantage over their counterparts regarding this specific entry mode. Keep in mind that it does not mean that banks choosing de novo branching should, however, have chosen the alternative interstate branching mode. Nevertheless,  $\hat{\sigma}_{u0}$  (the coefficient of the inverse Mills ratio for banks interstate branching via M&A) are positive across all performance measures, while only significant at a high level (1% or 5%) for performance measures of branch numbers. This result implies that unlike banks choosing de novo interstate branching, banks choosing the M&A mode actually have performance advantage over their counterparts, especially when the performance is measured by total branch numbers. Therefore, the performance outcome of our sample regarding the entry mode choice seems to fall into the case of  $\sigma_{u1} > 0$  and  $\sigma_{u0} > 0$  which, according to our previous discussion, means that banks that actually chose interstate branching via M&A have the absolute performance advantage compared with those banks that chose the de novo mode of interstate branching.

In order to have a better understanding of this situation, we compare the results from the first-stage estimation regarding interstate branching mode choice and the results from the second-stage estimation regarding performance outcome. Recall that the likelihood of an entrant choosing de novo interstate branching is significantly negatively related to bank size and market profitability potential such as income growth

rate. Furthermore, for both subsamples, the performance outcomes are significantly positively related to bank size and market potential, which implies that banks choosing the M&A interstate branching mode “by nature” have the capability of achieving better performance than do their counterparts.

However, the fact that banks choosing the M&A interstate branching mode “congenitally” have the performance advantage does not necessarily mean that de novo branching is inferior to M&A as an interstate branching mode in general, since the current results have not fully answered the question of “did the banks make the right decision?” To put it more precisely, the question of “would an entrant bank have achieved better performance had the management chosen the alternative interstate branching mode?” And that is the rationale behind the concept of “treatment effect on the treated” which has been previously discussed in detail.

Table 3.5 shows the treatment effects on two subsamples of commercial banks categorized by their interstate branching mode choice regarding three performance measures up to two years after their entry.

Table 3.5 shows that the average treatment effects on banks choosing de novo interstate branching,  $E(M_1 - M_0 | S_1, X_i)$ , are significantly positive across all performance measures up to two years after the entry, except the performance measure of branch numbers for which the treatment effects are significantly negative.<sup>26</sup> Therefore, banks choosing the interstate branching mode of de novo branching generally did choose the mode to their own advantage since they might have achieved significantly less if they

---

<sup>26</sup>It seems that banks choosing de novo interstate branching could have set up more branches in the transitional stage if they had entered markets via M&A.

Table 3.5:  
**Treatment Effect for the Treated**  
Performance Difference if Taking the Alternative Entry Mode

Performance Measures	Panel A (De novo)	Panel B (M&A)
Log (Total deposits)	4.23*** (0.000)	1.10*** (0.000)
Log (Total deposits)_1	3.08*** (0.000)	0.74*** (0.006)
Log (Total deposits)_2	3.96*** (0.000)	3.23*** (0.000)
Branch number	-85.96*** (0.000)	-207.74*** (0.000)
Branch number_1	-47.92*** (0.000)	-144.66*** (0.000)
Branch number_2	11.2*** (0.008)	-55.05*** (0.000)
Market share	0.09 (0.763)	-8.43*** (0.000)
Market share_1	4.49*** (0.000)	-1.91*** (0.001)
Market share_2	2.48*** (0.000)	-6.37*** (0.000)

This table reports the possible performance change if entrant banks had chosen the alternative interstate branching mode. The mean of the treatment effects on the treated are reported for two groups of banks categorized by their choice of interstate branching mode. The associated P-values are also reported in the parentheses. In most cases, entrant banks could not have improved their branch performance if they had chosen the alternative interstate branching mode since average treatment effects for the treated of the banks choosing de novo interstate branching are significantly positive across almost all performance measures. However, the performance measure of branch number and average treatment effects for the treated of the banks choosing interstate branching via mergers and acquisitions are significantly negative across almost all performance measures except total deposits. \* indicates significance at the 10 percent level. \*\* indicates significance at the 5 percent level. \*\*\* indicates significance at the 1 percent level.

had taken the alternative strategy. As for the other group of banks that chose to enter via M&A, the average treatment effects on the treated are significantly negative for performance measures of branch numbers and market share ( $E(M_1 - M_0|S_0, X_i) < 0$ ), which means that banks that did choose to enter via M&A would have built up fewer branches and gained less of the market share if they had taken the alternative strategy. Thus, banks choosing the interstate branching mode of M&A also made the right decision in this sense. However, the treatment effect regarding the capacity to collect deposits shows the opposite results ( $E(M_1 - M_0|S_0, X_i) > 0$ ). This outcome implies that banks that entered the market via M&A might have collected more deposits if they had chosen de novo interstate branching instead. Therefore, in most cases, entrant banks could not have improved their branch performance if they had chosen the alternative interstate branching mode, which also means that bank managements did make the right decision on the choice of interstate state branching mode.

## 7. Concluding Remarks

The banking industry is usually excluded from theoretical and empirical studies on general manufacturing industries due to the complication of extensive regulations upon this industry and the special characteristics of banks as intermediation service suppliers. That is why there many questions on banking management strategies are left unanswered. This study aims to empirically answer one of these questions which has brought forth much debate among industry regulators, government lawmakers and economists: whether it is warranted to allow banks to freely establish de novo branches nationwide. To answer this question, we make it clear that the opponents

of deregulation on de novo branching are mainly concerned that multi-state banks branching into local markets would dominate incumbent banks in performance and radically take away market shares and profits. Although to my knowledge, there are few studies dwelling on the impact of this specific interstate branching mode, some studies do shed some light on the impact of general interstate branching on market concentration and general performance of the banking industry (e.g., Hughes et al., 1996, Berger and De Young, 2000). Our study contributes to the literature in two ways. Firstly, we choose a fresh angle from which to consider this question: We propose to examine the impact of interstate branching mode choice on entrant banks' performance in host markets rather than the conventional angle taken in the literature that examines the impact of the occurrence of entry events on the entire market (e.g., a change of market concentration) or industry (general efficiency improvement). Therefore, the theoretical foundation of our study borrows theories and concepts from fields such as industrial organization and management strategy as well as money and finance since we are more interested in individual entrant banks' performance in host markets. Secondly, the application of a two-stage Heckman estimation corrects for the endogeneity problem, which is usually neglected in conventional studies on the impact of management strategy on performance.

Basically, we find that without interstate branching restriction, small commercial banks significantly prefer de novo interstate branching to branching via M&A. When the host market is lowly competitive ( $HHI < 1000$ ), entrant banks would be more likely to take the mode of de novo branching than to take the mode of M&A. Moreover,

the high potential of economic growth seems to tempt entrant banks to enter via M&A more than via de novo branching. In addition, the more states to which an entrant bank has expanded its service, the more likely is this entrant bank to enter via de novo branching. After tackling the endogeneity lying in the selection bias, the performance estimations and derived treatment effects regarding the three groups of performance measures up to two years after entry, we show that entrant banks choosing interstate branching via M&A have absolute performance advantages over entrant banks setting up de novo branches in achieving market shares, building up more branches and collecting deposits. However, both groups of banks categorized by their choice of interstate branching mode made the right decision because they would not have been better off had they chosen the alternative strategy. Therefore, free interstate de novo branching would invite more small banks, which can greatly benefit the development of small business of the host state without significantly threatening incumbent banks.

## CHAPTER IV

### CONCLUSION

My dissertation empirically addresses some unanswered questions that have motivated much debate among banking practitioners, government lawmakers and economists by investigating two natural experiments provided by regulatory reform.

Chapter II examines the impact of the Federal Deposit Insurance Corporation Improvement Act of 1991 (FDICIA) on the "timeliness" and "effectiveness" of market discipline imposed by uninsured depositors. I set up a theoretical framework of market discipline based on Jordan (2000) in which the market for deposits is described as an interaction between the supply side (both insured and uninsured depositors) and the demand side (banks) wherein market discipline is captured by an upward shifting marginal cost curve for uninsured deposits as bank default risk increases. I collect quarterly data for U.S. commercial banks for five years prior to the FDICIA (1984-1989) and five years after the FDICIA began to take effect (1992-1996), and construct the risk measures based on accounting data available from Call Reports. Along with controlling for effects from the demand side, I employ two-way Granger causality tests with the application of the generalized method of moments technique developed by Arellano and Bond (1991) for panel data to capture the "timeliness" (predictive power of changes in risk measures on changes in the interest rate spread) and "effectiveness" (predictive power of changes in the interest rate spread on changes in risk measures) of market discipline imposed by uninsured depositors such as Jumbo CD

holders. I find clear-cut evidence that the improved regulatory environment provided by the FDICIA successfully revived incentives for uninsured depositors to monitor financial institutions' default risks, and has motivated financial institutions to be more responsive to market discipline by engaging in "self-corrective" actions. The results imply that policy or regulatory choices, such as deposit insurance, could bring cost to the economy by interfering with the implementation of the market's self-regulation, such as market discipline. Therefore, the optimization of regulatory devices should take into account the real costs from various aspects.

Chapter III investigates the impact of the choice of interstate branching mode on entrant banks' branch performance in host markets based on interstate commercial banks' operating strategies in the states that permit both interstate branching via acquisitions and setting up de novo branches after the Riegle-Neal Act of 1994. The theoretical foundation is based on theories and concepts from industrial organization and management strategy as well as monetary economics. The application of two-stage Heckman estimation corrects for endogeneity problems that are usually neglected in conventional studies measuring the impact of management strategy on performance. I also derive the entrant banks' counterfactual performance gains/losses associated with taking the alternative interstate branching mode to test whether bank managements made the right strategic decisions. The results indicate that under several well-defined circumstances, the de novo interstate branching mode is preferred to M&A, and entrant banks choosing interstate branching via M&A have absolute performance advantages over entrant banks setting up de novo branches. At the same



time, both groups of banks categorized by their choice of interstate branching mode seem to have made the right decision. Therefore, free interstate de novo branching might encourage more small banks to enter the industry, which could prove beneficial to the development of small business within the host state without posing much threat to incumbent banks.

## REFERENCES

- Arellano, M and S Bond (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Fluctuations. *Review of Economic Studies* 58.
- Ayaratne, Jith and Philip E. Strahan (1998). Entry Restrictions, Industry Evolution and Dynamic Efficiency: Evidence from Commercial Banking. *Journal of Law and Economics*, vol. 41.
- Baer, H and E. Brewer (1986). Uninsured Deposit as a Source of Market Discipline. Economic Perspectives: Federal Reserve Bank of Chicago.
- Bensten, George J., George G. Kaufman (1998). Deposit Insurance Reform in the FDIC Improvement Act: the Experience to Date. *Economic Perspective*. March.
- Berger, Allen N., Seth D. Bonime, Lawrence G. Goldberg and Lawrence J. White (2004). The Dynamics of Market Entry: The Effects of Mergers and Acquisitions on Entry in the Banking Industry. *Journal of Business*. 2004, Vol.77, No.4.
- Berger, Allen and Astrid A. Dick (2006). Entry into Banking Markets and the Early-Mover Advantages. working paper.
- Berger, Allen N. and Robert De Young (2000). The Effects of Geographic Expansion on Bank Efficiency. Working Paper Series WP-00-14, Federal Reserve Bank of Chicago.
- Billet, M., J. Garfinkel, and E. O'Neal (1998). The Cost of Market Versus Regulatory Discipline in Banking. *Journal of Financial Economics*. 48.
- Birchler, U.W and A.M.Maechler (2001). Do Depositors' Discipline Swiss Banks? Discussion Paper No.6, Swiss National Bank.
- Brinkmann, Emile J., Horvitz, Paul M., Huang Ying-lin (1996). Forbearance: An Empirical Analysis. *Journal of Financial Services Research* 10 (1996).
- Brouthers, Keith D. and George Nakos (2004). SME Entry Mode Choice and Performance: A Transaction Cost Perspective. *Entrepreneurship Theory and Practice*.
- Bruni, Franco and Francesco Paterno (1995). Market Discipline of Banks' Riskiness: A Study of Selected Issues. *Journal of Financial Services Research*. 9 (3).
- Buckley, P.J. & Casson, M.C. (1998). Analyzing Foreign Market Entry Strategies: Extending the Internalization Approach. *Journal of International Business Studies*. Vol.29 (3).

- Calomiris, Charles W. (1995). The Costs of Rejecting Universal Banking: American Finance in the German Mirror, 1870-1914. *Coordination and Information: Historical Perspectives on the Organization of Enterprise*. University of Chicago Press.
- Caves, R.E. and Mehra, S.K. (1986). Entry of Foreign Multinationals into the US Manufacturing Industries. *Competition in Global Industries*. Harvard Business School Press.
- Calomiris, C and A.Powell (2001). Can Emerging Market Bank Regulators Establish Credible Discipline? The Case of Argentina, 1992-99'. Prudential Supervision: What Works and What Doesn't?. University of Chicago Press: USA.
- Cargill, T. (1989). CAMEL Ratings and the CD Market. *Journal of Financial Services Research*. 3(4).
- Cook, D., and L. Spellman (1994). Repudiation Risk and Restitution Costs: Toward Understanding Premia on Insured Deposits. *Journal of Money, Credit, and Banking*. 26(3).
- Covitz, D.M., D. Hancock and M. Kwast (2000). Mandatory Subordinated Debt: Would Banks Face More Market Discipline? Finance and Economic Discussion Series. Federal Reserve Board.
- Demirguc-Kunt, Asli and Harry Huizinga (2004). Market Discipline and Deposit Insurance. *Journal of Monetary Economics*. 51.
- Ellis, D and M.Flannery (1992). Does the Debt Market Assess Large Banks' Risk? Time Series Evidence from Money Center CDS'. *Journal of Monetary Economics*. 30.
- Espahbodi, Hassan and Poursan Espahbodi (2003). Binary Choice Models and Corporate Takeover. *Journal of Banking and Finance* Vol.27.
- Feldman, Ron and Jason Schmidt (2001). Increased Use of Uninsured Deposits: Implications for Market Discipline. *Regional Business and Economics Newspaper*, March.
- Flannery, M (1998). Using Market Information in Prudential Bank Supervision: A Review of U.S. Empirical Evidence. *Journal of Money, Credit and Banking*. 3.
- Flannery, M and S.M. Sorescu (1996). Evidence of Bank Market Discipline in Subordinated Debt Yields. *Journal of Finance*. 4.
- Giedeman, Daniel C (2004). The Riegle-Neal Act and Local Banking Market Concentration. *International Advances in Economic Research*. November.

- Gilbert, A. R., A. P. Meyer, and M. D. Vaughan (2001). The Use of Market Information Bank Supervision: Interest Rates on Large Time Deposits. Working Paper, Federal Reserve Bank of St. Louis.
- Gilbert, Gary G. (1974). Predicting De Novo Expansion in Bank Merger Cases. *Journal of Finance*, 29.
- Gilbert, Richard J. and David M. Newbery (1992). Alternative Entry Paths: The Build or Buy Decision. *Journal of Economics and Management Strategy*, Vol. 1, No.1.
- Goldberg, L and S. Hudgins (2002). Depositor Discipline and Changing Strategies for Regulating Thrift Institute. *Journal of Financial Economics*, 63.
- Gorg, H. (2000). Analyzing Foreign Market Entry: The Choice between Greenfield Investment and Acquisitions. *Journal of Economic Studies*, Vol.27 (3).
- Grzelonska, Patrycja (2005). Benefit from Branch Networks: Theory and Evidence from the Summary of Deposit Data. working paper.
- Hamilton, Barton H and Jackson A. Nickerson (2003). Correcting for Endogeneity in Strategic Management Research. *Strategic Organization* Vol. 1(1).
- Hall, J., T. King, A. Meyer, and M. Vaughan (2002a). Did FDICIA Enhance Market Discipline on Community Banks? A Look at Evidence from the Jumbo-CD Market. Working Paper, Federal Reserve Bank of St. Louis Supervisory Policy Analysis, No.2002-04 (June).
- Hall, J. R., T. B. King, A. P. Meyer, and M. D. Vaughan (2002b). Do Jumbo-CD Holders Care about Anything? Working Paper, Federal Reserve Bank of St. Louis Supervisory Policy Analysis, No. 2002-05.
- Hall, John R, Thomas B. King, Andrew P. Meyer and Mark D. Vaughan (2004). Did FDICIA Enhance Market Discipline? A Look at Evidence from the Jumbo-CD Market. Working paper.
- Hannan, T. H. and G. A. Hanweck (1988). Bank Insolvency Risk and Market for Large Certificates of Deposit. *Journal of Money, Credit and Banking*, 20(2).
- Harzing, Anne-Wil (2002). Acquisitions versus Greenfield Investments: International Strategy and Management of Entry Modes. *Strategic Management Journal* Vol.23.
- Herzig-Marx, C and A.S.Weaver (1979). Bank Soundness and the Market for Large Negotiable Certificates of Deposit, Federal Reserve Bank of Chicago Research Paper, No. 79-1.
- Hirtle, Beverly (2005). The Impact of Network Size on Bank Branch Performance. Federal Reserve Bank of New York Staff Reports, 2005, Vol. 211.

- Hughes, Joseph P. and William Lang, Loretta J. Mester and Choon-Geol Moon (1996). "Efficient Banking under Interstate Branching. *Journal of Money, Credit and Banking*, Vol. 28, No. 4.
- Jagtiani, J., and C. Lemieux (2000). Stumbling Blocks to Increasing Market Discipline in the Banking Sector: A Note on Bond Pricing and Funding Strategy Prior to Failure, Federal Reserve Bank of Chicago Emerging Issues Series S&R-99-8R.
- James, C. (1988). The Use of Loan Sales and Standby Letters of Credit by Commercial Banks. *Journal of Monetary Economics*, 22.
- James, C (1990). Heterogeneous Creditors and the Market Value of Bank LDC Loan Portfolios, *Journal of Monetary Economics*, 25.
- Jayarathne, Jith, and Philip E. Strahan (1998). Entry Restrictions, Industry Evolution and Dynamic Efficiency: Evidence from Commercial Banking." *Journal of Law and Economics*, vol. 41.
- Jordan, J.S. (2000). Depositor Discipline at Failing Banks, *New England Economic Review*, March/April.
- Jovanovic, Boyan and Peter L. Rousseau (2002). The Q-Theory of Mergers. *American Economic Review*, Vol.92.
- Kaufman George G. (2003). Market Discipline in Banking: Theory and Evidence. Elsevier JAI.
- Keely, M. C. (1990). Deposit Insurance, Risk, and Market Power in Banking. *The American Economic Review*, 80.
- Lane, T.D. (1993). Market Discipline. IMF Staff Papers, 4(March).
- Lu, Jane W. and Paul W. Beamish (2001). The Internationalization and Performance of SMEs. *Strategic Management Journal*, Vol. 22.
- McCardle, Kevin F and S. Viswanathan (1994). The Direct Entry versus Takeover Decision and Stock Price Performance around Takeovers. *The Journal of Business*, Vol.67, No.1.
- Nickell, S (1981). Biases in Dynamic Models with Fixed Effects. *Econometrica* 49.
- Osborne, Dale K. and Seokwon Lee (2001). Effects of Deposit Insurance Reform on Moral Hazard in US Banking. *Journal of Business Finance and Accounting*. 28 (7).
- Olson, Mark W. (2002). Testimony of the Financial Service Regulatory Relief Act of 2002. The Federal Reserve Board.

- Orlow, Daniel K, Lawrence J. Radecki, and John Wenninger (1996). Ongoing Restructuring of Retail Banking. Research Paper #9634, Federal Reserve Bank of New York.
- Park, S (1995). Market Discipline by Depositors: Evidence from Reduced Form Equations. *Quarterly Review of Economics and Business*. 35.
- Park, S., and S. Peristiani (1998). Market Discipline by Thrift Depositors. *Journal of Money, Credit, and Banking*, 30(3).
- Peria, M.S.Martines and Sergio L. Schmukler (2001). Do Depositors Punish Banks for Bad Behavior? Market Discipline, Deposit Insurance, and Banking Crises. *The Journal of Finance*. 3.
- Rosenzweig, PM and Singh JV (1991). Organizational Environments and the Multinational Enterprise. *Academy of Management Review* Vol.16. No.2.
- Sarkar, J and S. Bhaumik (1998). Deregulation and the Limits to Banking Sector Competition: Some Insights from India. *International Journal of Development Banking*. 16.
- Seelig, Steven A. and Tim Critchfield (2003). Merger Activity as a Determinant of De Novo Entry into Urban Banking Markets. FDIC working paper 2003-01
- Shleif, A and W. Vishny (1997). A Survey of Corporate Governance. *Journal of Finance*, 52, 737.
- Tirtiroglu, Dogan; Daniels, Kenneth N; Tirtiroglu, Ercan (2005). Deregulation, Intensity of Competition, Industry Evolution, and the Productivity Growth of U.S. Commercial Banks. *Journal of Money, Credit and Banking* Volume: 37, Issue: 2.
- Woodward, Susan (1988). A Transaction, Cost Analysis of Banking Activity and Deposit Insurance. *The Cato Journal* Vol.7 No.3 1988.