Bank Organization, Market Structure and Risk

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Abstract

One reason for regulation of the banking sector is to avoid bank failure; one regulatory policy is the restriction of banks to certain geographic areas. But are banks that are only active in a single banking markets more stable? What happens to bank's bankruptcy risk if we allow banks to branch freely as they wish?

I approach these questions by providing a theory and accompanying empirical results. The theoretical model argues that bankruptcy risk does not need to decrease as banks branch into other markets: As banks open more branches, loan officers change their lending behavior and adjust their loan monitoring effort. This then translates into changes of bank's bankruptcy risk. Competing banks, that do not expand geographically (= single-market banks) are also affected: As banks branch out, single-market banks shift lending towards borrowers with soft information. This shift might increase or decrease their monitoring effort which then translates into lower or higher risk.

I test this theoretical implications using data from the US banking sector. States in the US liberalized their intrastate branching restrictions at different points in time. I am able to identify the effect of changes in the organizational structure of banks on risk. The results suggest that risk decreases only for single-market banks following intrastate branching deregulation. Further, this effect is stronger in markets that are characterized by a larger share of soft information borrowers.

1 Introduction

"Forget 'too big to fail.' These [community] banks consider themselves too small to risk embarrassment.
They are run by people who grew up in the towns where they work, [...] steep profits earned by national banks didn't turn their heads in the last decade because they were inherently skeptical of double-digit growth rates."[1]

Banks - around the world and especially - in the United States comprise an interesting microcosm. If you were to classify banks in the U.S., you would probably - apart from other things - come up with the following characteristics: Some members of the species 'bank' focus on investment activities, others focus on commercial banking (activity); some are very large, others are fairly small (size); some banks are spread out across several states, others stick to their local market (geography). Categorizing banks by these characteristics is fairly easy. Looking closer at a bank's business to assess their profitability or risk is harder. Morgan (2002) shows that compared to other industries, the financial sector is more opaque: Bond rating agencies disagree more often about their assessment of bank's bond issues than about their assessment of other industry's issues. This lack of transparency is also one of the main reasons why banks are heavily regulated by a country's government. Furthermore, one might argue that especially the effects of heavy regulation of banks lead to the rather interesting microcosm. One aspect of regulation is to make the financial system safer. This is especially important since banks play a vital role for the functioning of the real economy.[2] Among the many restrictions banks face is the regulation of their geographical activity: A bank's business is often confined to a certain region and banks are not allowed to branch freely into other areas. But does this regulation make the banking system more stable? Or should we regulate a bank's geographical scope at all?

My paper aims at providing some answers to these questions. In order to do this, I proceed in two steps: First I analyze the relationship between the organization of banks, market structure and risk. By doing this, I can focus on the impact of certain channels on risk as banks expand. Following on this, I turn to data to evaluate my theory empirically. Specifically, I focus on the liberalization of intrastate branching

[1] "We're Dull, Small Banks Say, but Have Profits", New York Times, May 11, 2009 (http://www.nytimes.com/2009/05/12/business/12small.html)

[2] Dell'Ariccia et al. (2008) and Kroszner et al. (2007) for instance find that banking crises have negative effects for the real economy. However, over-regulation on the other hand obstructs the functioning of banks which also leads to unfavorable economic outcomes (Levine et al. (2006)).

restrictions in the United States.

That banks behave differently if they are active in more markets (= multi-market banks) is explored in earlier research. Thereby, empirical evidence suggests that multi-market banks charge different loan rates than local, single-market banks and also focus on different borrowers (Barros (1999), Berger et al. (2005)). However, little is known about the relationship between geographical scope and risk. This paper therefore tries to fill that gap and provide some evidence based on theoretical and empirical arguments.

I answer this question by developing a theoretical framework following earlier work by Stein (2002). I extend Stein's model by allowing loan officers to choose two different, yet complementary parameters: Monitoring effort and borrower type. Thereby, I assume that borrowers are either characterized as being "soft" information borrowers or "hard" information borrowers. "Soft" information borrowers provide a higher expected loan return, but are also more risky with respect to their repayment probability. Higher monitoring effort by loan officers however can limit the risk of default on these loans.

The model argues that geographically expanding banks tend to increase lending based on "hard" information. A bank's overall monitoring effort however does not need to increase as it expands geographically. Hence, risk does not need to decrease as banks expand. The second novelty compared to Stein's model is my consideration of the market structure: Specifically, I analyze what happens to a single-market bank as one of its competitor branches out into other markets: There, the model shows that single-market banks focus on "soft" information borrowers as competitors expand. This implies a higher risk since "soft" borrowers are more likely to default for single-market banks. However a single-market bank's monitoring effort might increase which then lowers total bank risk. Overall the theoretical framework allows for both possibilities.

In the second part of the paper, I turn towards data from the United States to test the empirical hypotheses. States in the U.S. liberalized their restrictions on intrastate branching at different points in time. Using a difference-in-differences approach, I show that commercial bank's risk declines following intrastate branching deregulation. Investigating this more closely, If find this decline in risk only for banks that are not expanding geographically after deregulation. Following this finding, I analyze what happens to the risk of banks, as competing banks increase their number of markets. Using intrastate branching deregulation as an instrument, I am able to show that bank risk declines significantly as competing banks expand geographically. Furthermore, I find that this effect is stronger in counties that hold more "soft" information borrowers. This seems to suggest that a consideration of the underlying market structure is

important for bank's risk.

Overall my research complements other theories investigating the relationship between market structure and financial stability (Boyd and de Nicolo (2005), Keeley (1990), Allen and Gale (2000)). Further, it extends this literature by introducing the organizational structure of banks into this question. In my paper I use the tools of institutional economics to provide some insights on the relationship between geographical restrictions and bank risk.

2 Related Literature

2.1 (Geographic) Diversification of Banks

My research is related to theoretical and empirical work that studies the effect of (geographic) diversification of banks.

Earlier research focuses for instance on the impact of diversification across markets on deposit rates (Barros (1999)) or value (Deng and Elyasiani (2008)). Deng and Elyasiani (2008) find that geographic diversification is associated with value enhancement for bank holding companies in the United States. Further they provide evidence that geographically diversified bank holding companies experience a smaller standard deviation of stock returns than undiversified banks. Hence, they conclude that diversification is risk reducing. In contrast to that, Demsetz and Strahan (1997) find that geographically diversified bank holding companies in the US are not necessarily less risky. They find that - even though banks are better diversified across regions - banks increase their leverage following mergers or acquisition. Therefore diversification is not necessarily associated with a decrease in risk as banks finance themselves with less equity and hold riskier portfolios.

Muñoz et al. (2008) focus on the expansion pattern and risk taking of Spanish Savings Banks. Their results suggest that corporate governance plays an important role in the expansion of banks: Banks in which the regional government has a stake tend to expand more into areas that are politically "close". Further they find that banks tend to take more risk as they expand geographically. Again, banks in which the regional government has a stake take on more risk than banks that are not politically connected. Wheelock and Wilson (2000) analyzes determinants of bank failures. Apart from bank specific variables, they find that the deregulation of branching restrictions in the US is associated with lower bank risk. However, they only provide reduced form regression results.

2.2 Bank Market Structure and Risk

Another strand of literature focuses on the relationship between market structure and financial fragility in the banking sector.

2.2.1 Concentration - Stability

Keeley (1990) was the first to show that a monopolistic banking sector is more stable than a competitive one. Similarly, Allen and Gale (2000) provide a framework that argues that banks will not gamble away their monopolistic position by taking on too much risk. Competition erodes monopolistic profit which induces banks to take on more risk. Keeley (1990) was the first to also find empirical support from the US banking sector for this hypothesis. More recently, Jimenez et al. (2007) present evidence for the Spanish banking market which supports this view: Higher market power in the loan market is associated with lower bank risk. Similarly, Berger et al. (2009) find evidence that is consistent with this theory. However, Berger et al. (2009) also present evidence that is consistent with the following theory.

2.2.2 Competition - Stability

That a competitive banking system is associated with lower bank risk taking is the main finding of Boyd and de Nicolo (2005): A monopolistic banking system implies high loan interest rates for borrowers. Borrowers therefore increase their risk in order to fulfill their repayment obligations. This increases then the probability of loan defaults. Competition among banks on the other hand lowers loan interest rates which then lowers the probability of loan defaults. Evidence for this support was found in cross-country studies by Boyd et al. (2007) and de Nicolo (2000).

2.2.3 Nonlinear relationship between competition and stability

Martinez-Miera and Repullo (2008) argue that the truth lies somewhere in between these two theories. They show that the effect of bank competition on bank risk is ambiguous if loan defaults are imperfectly correlated. Further, they show that in general there is a U-shaped relationship between competition and bank risk.

2.3 Historical Evidence: Geographic (Branching) Restrictions and Bank Risk

Studies of the Great Depression investigate the role of (intrastate) branching restriction on bank risk. Thereby, researchers investigate whether states that had less restrictions on intrastate branching experience less banking failures during this period and are therefore more stable. Calomiris and Mason (2000) find that banks with larger branching networks are more likely to fail than other banks. Similarly, Carlson (2004) analyzes whether unit or branch banks are more likely to fail during the Great Depression. He finds that banks with branches are more likely to fail since they are holding a riskier portfolio than other banks. Specifically, branch banks hold fewer reserves and more loans than other banks. This makes them more susceptible to bank runs as they occurred during the Great Depression. In contrast to that finding, Carlson and Mitchener (2005) show that states without restrictions on intrastate branching experience lower failure rates during the Great Depression. They attribute their finding to selection: Weak banks are not able to survive in a deregulated state which leads to a more stable banking system. During the Great Depression, this more stable banking system exhibits less failures. Support for this view is also found by Carlson and Mitchener (2009). They show that incumbent banks responded to increased competition from branch banks by changing their operations to become more efficient and profitable. Similarly, Ramirez (2003) investigates differences of bank failures in Virginia and West Virginia for the years 1925 to 1929. Virginia allowed banks to branch freely within a state whereas West Virginia did not. Using this, he finds that branching restrictions are associated with a higher incidence of bank failures. Further, he presents evidence that banks with branches in Virginia are bigger and enjoy a greater depository base. Combining this with his earlier findings he suggests that branching restrictions limit the size and depository base of banks and therefore decreases stability. Also, Wheelock (1995) finds that failure rates during the Great Depression are lower in states where banks have on average a larger branching network. He argues that a larger branching network is associated with larger bank size. Similar to Ramirez (2003) he supposes that this is the cause for lower failure rates in these states.

2.4 Bank Branching Deregulation

2.4.1 History of Deregulation

Across the United States, banks were restricted with respect to their choice of location of branch offices for many decades. Limits on the location of branch offices were im-

posed in the 19th century. These regulatory measures were supported by the argument that allowing banks to expand their operations freely could lead to a monopolistic banking system. Furthermore, the granting of bank charters was a profitable income source for states which increased the incentives for states to enact regulatory policies.

Kroszner and Strahan (1999) provide evidence that supports a private-interest theory of deregulation: "Beneficiaries of branching regulation had supported a coalition in favoring geographical restrictions."[3] With the emergence of new technologies like Automated Teller Machines and more advanced credit scoring techniques these benefits from regulation declined. Because of this, intrastate branching restrictions were lifted in states.

The passage of the Riegle-Neal Act in 1994 by U.S. Congress finally removed all remaining barriers by the middle of the 1990s. An overview of the timing of deregulation is given in table A.I in the appendix.

2.4.2 Effect of Deregulation

The study of intrastate branching deregulation in previous research has shown that it has significant effects on the real economy. Deregulation is associated with an increase in the number of new incorporations (Jayaratne and Strahan (1996)), a decrease in income inequality (Beck et al. (2009)) and personal income insurance (Demyanyk et al. (2006)). Jayaratne and Strahan (1997) provide evidence that lifting intrastate branching restrictions is associated with a decline in borrowing rates of banks. Additionally they argue that deregulation is followed by an increase in bank efficiency (Jayaratne and Strahan (1998)). Underlying market forces are studied by Stiroh and Strahan (2003). They show that following intrastate branching deregulation the market mechanism rewards profitable banks as banks with profits above average gain market share.

3 Organizational Form and Risk: Theoretical framework

3.1 Preliminaries

Stein (2002) shows that the ability to produce information within firms depends upon the organizational form. His work is motivated by the banking sector and he argues that

[3] Kroszner and Strahan (1999), p.1463

single-managed banks are better able to produce and process "soft" information. Large, hierarchical banks on the other hand have a comparative advantage when producing "hard" information. He relates his theory to the ongoing consolidation in the US banking sector and argues that consolidation is associated with a decline in lending to small-businesses since small businesses is based on "soft" information.

I extend his model by relating differences in organizational structure to bank risk. Apart from a bank's choice of lending to certain borrowers, my framework incorporates a bank's choice of monitoring effort.[4]

3.2 Borrowers and Lenders

A banking market consists of borrowers and lenders. Borrowers differ with respect to the information ("soft" versus "hard" information) they can provide to bank branches. Each borrower seeks financing from a bank branch. Ex ante he will repay an uncertain amount $\tilde{y}$ to lenders. This loan return $\tilde{y}$ is assumed to be normally distributed with expected value y and standard deviation σ. There are no other investors apart from loan officers in the market. Loan returns across borrowers are assumed to be identically and independently distributed.

3.2.1 Borrowers

Information and expected loan return Borrowers differ in their level of information. Some borrowers can provide "soft" information whereas other borrowers are able to present "hard" information to lenders. "Hard" information is quantitative, communicated easily to other parties; "soft" information on the other hand is difficult to code and catalog (Petersen (2004)). An example of "hard" information borrowers are businesses: They usually can provide balance sheet information which is easy to assess and store. Loans to "soft" information borrowers are also called "character loans": lending to these borrowers depends upon the character of the borrower as well as the judgment of the lender. The parameter z ($z > 0$) captures a borrower's degree of information: Larger values of z thereby characterize "harder" information.

I assume that expected loan returns to "soft" information borrowers are higher than loan returns to "hard" information borrowers, ie. $y(z_1) > y(z_2) \Leftrightarrow z_1 < z_2$. Because "hard" information is easier to communicate and verify, borrowers with a higher z are able to obtain funding more easily. Hence, their cost of borrower is lower - lending is

[4]Related to this model are also theories that relate bank competition on lending relationships (Petersen and Rajan (1995), Dell'Ariccia and Marquez (2004)) and theories regarding the relaxation of entry barriers in banking (Besanko and Thakor (1992)).

less profitable for banks. Furthermore, I assume that there are decreasing marginal returns to lending: Doubling the amount of borrowing does not double the expected profit for a given borrower.

Standard Deviation of Lending Depending upon the informational level of each borrower, the standard deviation of loan returns for each borrower type is given as $\sigma(z)$. I assume that the standard deviation of loan returns increase as information becomes "softer", ie. $\sigma(z_1) > \sigma(z_2) \Leftrightarrow z_1 < z_2$. Further, I assume that the expected risk adjusted return is independent of the level of information, ie. $\frac{y(z)}{\sigma(z)} = const.$ for all values of z.

3.2.2 Lenders: Bank branches

Loans are provided by bank branches. Bank branches are operated by loan officers which are similar to investors in standard corporate finance models. In my model I do not investigate the depository base of bank branches. I simply assume that each loan officer has one unit of funding available that he will lend to one specific borrower. Furthermore, loan officers decide on how much monitoring effort to exert when they lend to a specific borrower. Suppose there are two different loan officers labeled i and j in this market. Each loan officer lends all of his available funds to one borrower with a specific level of z. He maximizes expected profits by picking a borrower with a specific level of information and choosing a certain level of effort. However, banks differ with respect to their organizational structure:

1. Single-Market Banks
   In the benchmark case, every bank operates simply one branch in one market. These single-market banks (or unitbanks) compete for borrowers in the market. Each loan officer has one unit available to lend.

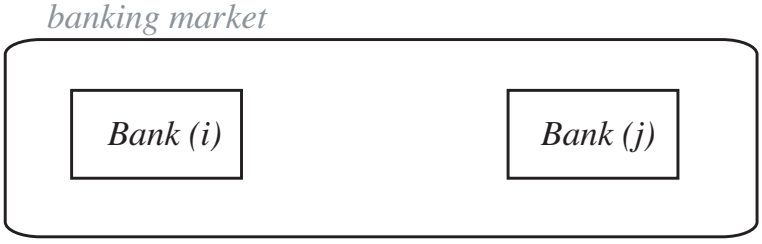


Figure 1: Two single-market banks

2. Multi-Market Banks

Multi-market banks operate branches in N several, distinct banking markets. For simplicity, assume that a multi-market bank only operates one branch in each market. Now, loan officers of multi-market banks are part of a bigger branch network. This multi-market bank is run by a CEO who has the power to allocate funds across branches. Since each branch has one unit of funding, the CEO decides how to allocate N units of funding. Depending upon the CEO's allocation, a loan officer within a multi-market bank can lend more than one unit to a borrower.

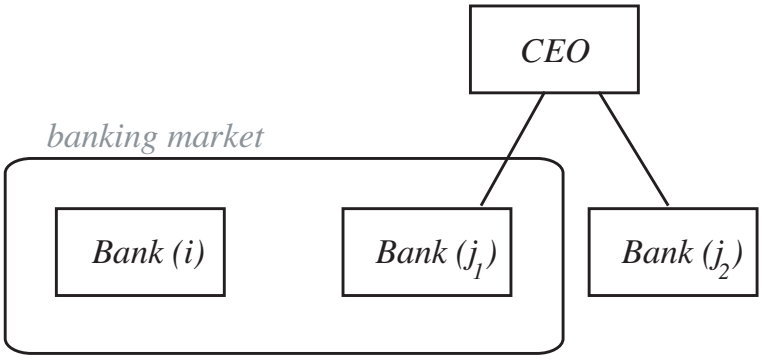


Figure 2: One single-market and one multi-market bank with two branches

Loan officers of competing branch within the market and within the mulit-market bank choose their level of z and e simultaneously.

Single-market bank branches Each loan officer of a single-market bank has one unit to lend. He chooses effort e and information z to maximize expected utility:

$$E(U_i) = p(e_i)y_i(z_i, z_j, 1) - (\gamma e_i - \delta z_i) \tag{1}$$

where $p(e_i)$ is the probability of obtaining expected loan return y. p is supposed to be concave and twice differentiable. Expected loan return for loan officer i of borrowing one unit to type z_i-borrower is given as $y_i(z_i, z_j, 1)$. e_i is loan officer i's level of monitoring effort. Since expected ex post profits from lending to type z_i increase in e, effort can also be seen as monitoring effort.

By construction, i's expected loan return also depends upon loan officer $j's$ chosen borrower type (z_j). I assume that bank i's expected loan return increases as bank j chooses a loan portfolio with larger z, ie. "harder" information. One interpretation of

this assumption is that there are benefits as bank branches differentiate themselves in their lending activity. However, this differentiation is only beneficial for a loan officer if his competitor moves into lending to "hard" information borrowers. One could also argue that lending to "soft" information borrowers requires more skills and encompasses lending to "hard" information borrowers: As a loan officers 'specializes' in lending to "hard" information borrowers he will loose his ability for "soft" information borrowers.

Multi-market bank branches Banks can also operate a branch network across N several markets. Each branch of this multi-market bank shares similar features to single-market bank branches: Each branch has one unit of funding available and is run by a loan officer that maximizes expected profits by choosing parameters z and e. However, a multi-market bank has an additional level of hierarchy: the bank's CEO.

CEO A bank's CEO distributes the banks total funds across branches. Because each of the N branches has one unit of funds available, the CEO will decide on how to distribute these N units across the N branches. She thereby decides for each branch upon a share of total funds that she will allocate to that branch for lending. Let the share of total funds awarded to branch b be denoted as q_b, then the CEO will allocate $q_b \times N$ units to lend to branch b. A CEO decides q_b by observing the chosen level of z by the loan officer in each branch.

I assume that a CEO picks - ceteris paribus - a larger share q_b if the loan officer chooses borrowers that are characterized by "harder" information. This assumption can be rationalized by the idea that "soft" information is harder to communicate and verify. Similarly, one could argue that the CEO would like to evaluate borrowers: This evaluation will be easier as information is "harder" which then leads to the fact that she will allocate more funds to the loan officer with the relatively "harder" information borrower.

Loan officers in multi-market bank Suppose loan officer j is part of a multi-market bank. Similar to before, he will choose e and information z to maximize:

$$E(U_j) = p(e_j)y_j(z_j, z_i, q \times N) - (\gamma e_j - \delta z_j) \tag{2}$$

Note that the total amounts of funding available to j are given by $q \times N$. In comparison to the single-market bank case (equation 1), the amount of funds can be larger or less than 1. This is the only change compared to loan officers in single-market banks.

3.2.3 Lending Risk

As noted earlier, loan returns are described by their expected return y and standard deviation σ. By assumption, the standard deviation of loan returns decreases as information becomes "harder". An increase in monitoring effort affects expected loan returns as the probability of obtaining expected loan return (y) increases with effort. In addition to this, I assume that monitoring effort also decreases the standard deviation of loan returns. However, this effect only occurs when borrowers are of sufficiently "soft" information, ie. if $z < \hat{z}$.

$$\frac{\partial \sigma}{\partial e} < 0 \quad \text{if} \quad z < \hat{z}$$

Note that this assumption does not affect expected loan returns but only the spread of loan returns: As effort increases, the spread of loan returns decreases if borrowers are of "soft" information.

The reason for the threshold level $\hat{z}$ is that monitoring effort is not supposed to always lower the spread of loan returns. If borrowers are of "hard" information, increasing monitoring does not yield a lower loan return spread. "Hard" information borrowers already provide information that can be easily processes. Loan returns for these borrowers are mainly determined by their level of information and not by the loan officer's choice of monitoring effort.

3.3 Optimal Choices of e and z

For the equilibrium to exist, I assume that the second derivatives of expected loan returns y and probability $p(e)$ exist.

3.3.1 Single-Market bank

Choice of e and z The choice of δ and γ ensures that there is an interior solution, ie. the equilibrium values of e ad z are not zero. Maximizing (1) yields the symmetric equilibrium:

Lemma 1 *Given δ and γ, there exists a symmetric equilibrium characterized by e_S^*, z_S^*.*

Relationship between e and z Information z and monitoring effort e can be substitutes or complements.

Proposition 1

1. *If the optimal level of loan portfolio information is larger than a specific level $\bar{z}$, then monitoring effort and information are substitutes, ie.* $\dfrac{\partial e^*}{\partial z^*} < 0$.

2. *If the optimal level of loan portfolio information is lower than $\bar{z}$, then effort and information are complements, ie.* $\dfrac{\partial e^*}{\partial z^*} > 0$.

This finding follows from the shape of the expected loan return function: Note that, lower levels of z are associated with higher expected loan returns and hence profits. Part one of proposition 1 says that effort might decrease as information becomes "harder": "Harder" information crowds out monitoring effort. Why? Because an increase in z leads to a decrease in profitability, lower profitability simply diminishes the incentive for monitoring. But this only occurs if the borrower is of sufficient "hard" information, ie. $z > \bar{z}$. If the borrower is of very "soft" information ($z < \bar{z}$) and expected loan returns therefore high, then increasing effort can compensate the drop in profitability. Hence, information cannot crowd out effort if profits are high enough (because $z < \bar{z}$).

Relationship between z_i and z_j I assume that expected loan returns for loan officer i are increasing as (competing) loan officer j decides to lend to "harder" borrowers. This assumption leads to the following lemma:

Lemma 2 *A loan officer's choice of z is negatively related to his competitor's choice of z, ie.* $\dfrac{\partial z_i^*}{\partial z_j^*} < 0$.

3.3.2 Multi-Market Bank

Choice of e and z The organization of branches under the roof of a multi-market bank leads to changes in the optimal choice of e and z. In comparison to single-market bank branches, the following can be shown:

Lemma 3 *Let the optimal choices of loan officers in a multi-market bank be given as e_M^*, z_M^*:*

1. *A loan officer in a multi-market bank chooses borrowers with "harder" information than a loan officer in a single-market bank, ie. $z_M^* > z_S^*$.*

2. *The optimal level of effort of multi-market loan officers is lower than the optimal monitoring effort of single-market loan officers, ie. $e_H^* < e_U^*$.*

Loan officers in a multi-market bank need to convince their CEO when they are applying for funds: A loan portfolio with relatively "harder" borrowers (= higher z) increases - ceteris paribus - their share of total funds. This induces loan officers in multi-market banks to select borrowers with "harder" information. The second finding of lemma 3 is similar to Stein (2002).

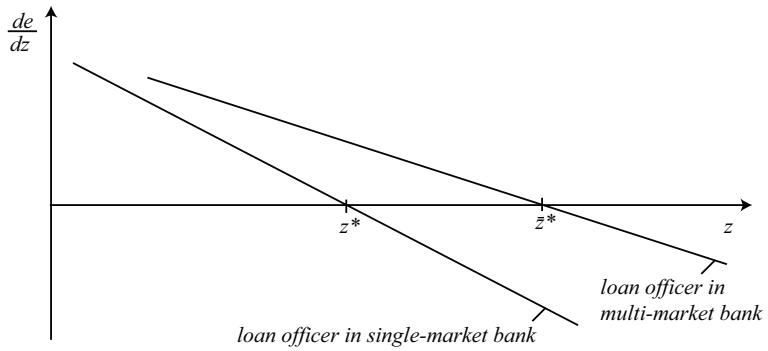


Figure 3: Relationship between $\frac{\partial e}{\partial z}$ and z

The previous result already shows that loan officers in a multi-market bank choose a higher level of z and a lower level of e than his counterpart in a single-market bank. Let the number of branches for a multi-market bank be given as N, then the following lemma can be shown:

Lemma 4 *Loan officers in multi-market banks choose relatively "harder" information borrowers as the multi-market bank expands, ie.* $\frac{\partial z^*}{\partial N} > 0$.

3.4 Market Structure and Equilibrium

Suppose a banking market consists of two bank branches. These branches only differ in their organizational structure. I consider the following three cases:

1. Both branches are independent (two single-market banks)
2. Both branches are part of a bigger branch network (two multi-market banks)
3. One single-market bank branch, one multi-market bank branch (mix)

Table 1 shows the possible market setting and equilibria.

Table 1: Market setting

		Loan officer j	
	organizational form:	single-market	multi-market
Loan Officer i	single-market	$z_i = z_j = z_S^*$ $e_i =_j = e_S^*$	$z_i < z_j$ $e_i > e_j$
	multi-market	$z_i > z_j$ $e_i < e_j$	$z_i = z_j = z_M^*$ $e_i =_j = e_M^*$

Change in branch network An expansion of a bank into other markets has effects on loan portfolio and effort. Depending upon a bank's loan portfolio information z, the effects can be different. Table 2 summarizes the effects on effort and loan portfolio as one bank expands into other markets:

Table 2: Loan officer j expands branch network

		Loan officer j expands network $\Rightarrow z_j \uparrow$	
		$z_j < \bar{z}$	$z_j > \bar{z}$
Loan Officer i does not change network $\Rightarrow z_i \downarrow$	$z_i < \bar{z}$	$e_i \downarrow$ $e_j \uparrow$	$e_i \downarrow$ $e_j \downarrow$
	$z_i > \bar{z}$	$e_i \uparrow$ $e_j \uparrow$	$e_i \uparrow$ $e_j \downarrow$

3.5 Empirical Predictions

The theoretical framework leads to several empirical predictions. Specifically, I am interested in the following hypotheses:

Hypothesis 1 *As bank j expands its branch network, ...*

1. *... it will shift lending towards relatively "harder" information borrowers.*
2. *... it will experience an increase or decrease of bank risk.*

3. *... competing (single-market) banks will shift lending towards relatively "softer" information borrowers.*

4. *... competing (single-market) banks will experience a decrease or increase in risk.*

Effects of a bank's expansion are ambiguous. A priori it is not clear if loan officers will increase their monitoring effort as banks expand. The model shows, than an expansion is associated with an increase in effort if the level of loan portfolio information is sufficiently "soft", ie. below a certain threshold ($\bar{z}$). If the expanding banks optimally choose to lend to borrowers that exceeds $\bar{z}$ then effort decreases as the bank expands. If the chosen borrower is of "soft" enough information, then effort increases as banks expand. This then might lead to a decrease in risk.

By assumption, a bank's loan return is increasing as its competitor is choosing a loan portfolio with "harder" information. As explained earlier, banks choose a loan portfolio with a higher level of information as they expand their branch network. As a response, competing banks have an incentive to lower the informational level of their loan portfolio.

4 Econometric Methodology

4.1 Reduced Form Analysis

Important for identification is the assumption that intrastate branching deregulation is exogenous to bank risk. In order to identify the effect of geographical restrictions on bank risk, I use the timing of deregulation across states:

Econometric Model The econometric model can be written as:

$$R_{ist} = \beta B_{st} + \alpha_i + \delta_t + \varepsilon_{ist}, \tag{R}$$

where α_i is a vector of bank fixed effects, δ_t is a vector of year fixed effects and ε_{ist} is a bank specific idiosyncratic shock. B_{st} is an indicator variable that takes on the value of one the year after intrastate branching deregulation and zero before. The parameter of interest is β which shows the relationship between intrastate branching deregulation and bank risk.

Identification The underlying assumption for an unbiased estimation of the reduced form model is that B_{st} is uncorrelated with ε_{ist}.

4.2 Mechanism: Bank Organization and Market Structure

The reduced form analysis does not allow any causal interpretation. In order to analyze the underlying mechanism of intrastate branching deregulation, I follow the theoretical framework. The model hypothesizes that lending will shift toward borrowers with "hard" information as banks expand their branch network. This is associated with a decrease risk if banks increase their monitoring effort. Further, banks that don't change their organizational structure and branch out into other banking markets are affected by the expansion of competitors: As expanding banks tend to lend towards borrowers with relatively "hard" information, competing banks shift their lending behavior toward borrowers with "softer" information. If these banks then also increase their monitoring effort, they experience a decrease in risk.

The question I am concerned with is: "What happens to the risk of banks as its competitors branch into other markets?" In order to test the hypotheses empirically, I will use two-stage-least squares (2SLS) estimation.

Two Stage Least Squares Prior to intrastate branching deregulation banks were not allowed to branch freely within a state. I expect that intrastate branching deregulation is followed by an increase in the branch network of banks. Because of the timing of deregulation, I am able to test this and the underlying theoretical framework using 2SLS estimation:

1. First stage:
   The theoretical framework relates risk of bank i to its competitor's (= j's) choice of organizational form. Specifically j's focus across banking markets is important. This means, that for bank i, I need a variable that captures its competitor's choice of organization. This first stage regression model then can be written as:

$$D_{ist} = \gamma B_{st} + \pi_i + \pi_t, \tag{2SLS-1}$$

   where D_{ist} captures the organizational form (= focus across banking markets) of bank i's competitor at time t. Specifically, D_{ist} is constructed such that it takes on low values if i's competitor focus on very few banking markets (= close to single-market bank). π_i/π_t measures bank-specific/ time-specific characteristics that affect the degree of competitor's organizational form for bank i in state s at time t.

2. Second stage:

$$R_{ist} = \beta \hat{D}_{ist} + \tilde{\delta}_i + \tilde{\delta}_t + \eta_{ist}, \tag{2SLS-2}$$

where $\hat{D}_{ist}$ is the predicted value of i's competitor's organizational form (from the first stage regression), $\eta_{ist} = \beta B_{st}(\gamma - \hat{\gamma}) + \varepsilon_{ist}$, and $\tilde{\delta}_i = \delta_i + \beta\pi_i$, $\tilde{\delta}_t = \delta_t + \beta\pi_t$.

The important underlying assumption for the causal relationship is that intrastate branching deregulation (B_{st}) has no other effect on risk beyond the hypothesized link between competitor's organization and bank i's risk.

5 Data and Implementation of Econometric Design

5.1 Data Sources

I use individual bank accounting data in order to proxy for risk and bank observable characteristics. Information on bank balance sheets is obtained from Report of Condition and Income data ('Call Reports'). The geographical location of bank branches is given in the Summary of Deposits forms.[5] Aggregate state and county level data are obtained from the Bureau of Economic Analysis. Information regarding the timing of deregulation is obtained from Amel and Liang (1992) and Jayaratne and Strahan (1996).

5.1.1 Call Reports

All banking institutions regulated by the Federal Deposit Insurance Corporation, the Federal Reserve, or the Office of the Comptroller of the Currency need to file these reports on a regular basis. These reports include complete balance sheet and income statement data for each bank. Besides balance sheet information the 'Call Reports' also report changes in the ownership structure of banks.[6] I use semiannual data from the second and fourth quarter of each year from 1976 to 2007. Furthermore I only consider commercial banks in the 50 states of the U.S. and the District of Columbia for my analysis.

5.1.2 Summary of Deposits

I obtain information on the number and location of bank branches using the 'Summary of Deposits' data for the years 1976 to 2006. The 'Summary of Deposits' contains deposit data for branches and offices of all FDIC-insured institutions and is collected

[5] I am very thankful to the Federal Reserve Board for providing me with this data.

[6] I am very thankful to Susan Yuska from the Federal Reserve Bank of Chicago for providing me with this data.

for banks as of June 30 of each year. Besides information on deposits, it also reports the location of each branch or office.

5.1.3 State level information on intrastate branching deregulation

Dates of intrastate branching deregulation is collected by Amel and Liang (1992). Most states removed their intrastate branching restrictions by 1994 when the passage of the Riegle-Neal Act removed all remaining barriers. The timing of deregulation is reported in table A.I in the appendix.

5.2 Implementation of Econometric Design

5.2.1 Bank Risk

Following other research on bank risk (Boyd and Graham (1996), Laeven and Levine (2007), Cihak and Hesse (2007) and Jimenez et al. (2007)), I use *Inverse Z-Score* as a measure of bank risk. By assuming that profits are normally distributed, the Inverse Z-score is given as

$$\text{Inverse Z-Score} = \frac{\text{Standard Deviation of ROE}}{\text{ROE} + 1}$$

Higher values of Inverse Z-Score imply greater bankruptcy risk.

5.2.2 Organizational Form

The theoretical framework models the expansion of banks in other banking markets. I thereby do no model the expansion of banks within the same banking market, ie. the opening of new branches in the same market.[7] For my analysis I consider counties as distinct markets in the United States. Earlier research (Hannan and Prager (2004) and Berger and Hannan (1989)) on banking markets and bank behavior shows that this is a valid definition.

For each individual bank (i) in a county and year, I determine measures of organizational form that capture the activity of banks across markets.

- *Natural logarithm of active banking markets*:
  For each bank I count the number of banking markets it is active in and take the natural logarithm of this value.

[7] In the model I assume that each bank only has one branch in each market. Competition within the organization is only for funds across banking markets by the CEO.

- *Herfindahl Index of deposits across banking markets for all banks that are active in the banking market*:
  I compute the share of deposits a bank has in each county. Following this, I calculate a Herfindahl Index of deposits across banking markets. This variable is defined between zero and one, with larger values characterizing greater focus on one single market. Smaller values thereby indicate that a bank is more evenly active across banking markets.

Since I focus on competing banks, I take the average of each measure without bank i for a banking market and year and assign it to bank i. By doing this I am able to determine for each bank, a measure of its competitor's organizational form.

5.2.3 Control Variables

In order to control for bank specific effects the ratio of total loans to total assets, the log of total assets, a dummy indicating whether the bank is part of a bank holding company as well as the capital-asset-ratio. These variables are computed from balance sheet information for every bank in every year. Overall, county specific business cycle fluctuations are captured by the inclusion of the growth of local area personal income from year t to year $t-1$ as well as a lag thereof.[8] Banking market specific effects are captured by the following control variables: Log number of branches in market, log number of banks in market, the concentration of deposits across banks (Herfindahl Index) in market and the number of people per branch in market. Apart from intrastate branching deregulation, states also relaxed their restrictions on branching across state lines (=interstate branching deregulation). Since this might also have effects on the risk characteristics of banks within a state, a dummy variable capturing this is included as a control.

5.3 Sample Construction

I compute Inverse Z-Score using semiannual information of profits (Return on Equity) obtained from the 'Call Reports'. Thereby I compute a 5 period moving average of the standard deviation of Return on Equity: The computation of standard deviation for period t uses information for periods $t-2$ to $t+2$. Because of this, I am not able to compute it for the first and last two periods. Following this, I merge this information with 'Summary of Deposits' data. 'Summary of Deposits' are available on an annual

[8] The growth of personal income in year t is equal to (personal income in year t - personal income in year $t-1$)/personal income in year $t-1$

basis until 2006. This step limits the sample to annual bank observations for the years 1977 to 2006. Following previous research on intrastate branching deregulation, I further drop Delaware and South Dakota from the analysis. The structure of the banking system in these two states was heavily affected by other laws. Therefore it is not possible to isolate the effect of intrastate branching deregulation. Furthermore, Inverse Z-Score exhibit very large volatility within the sample. Because of this I trim the sample with respect to the 1st and 99th percentile of Inverse Zscore. This eliminates all outliers from the sample.

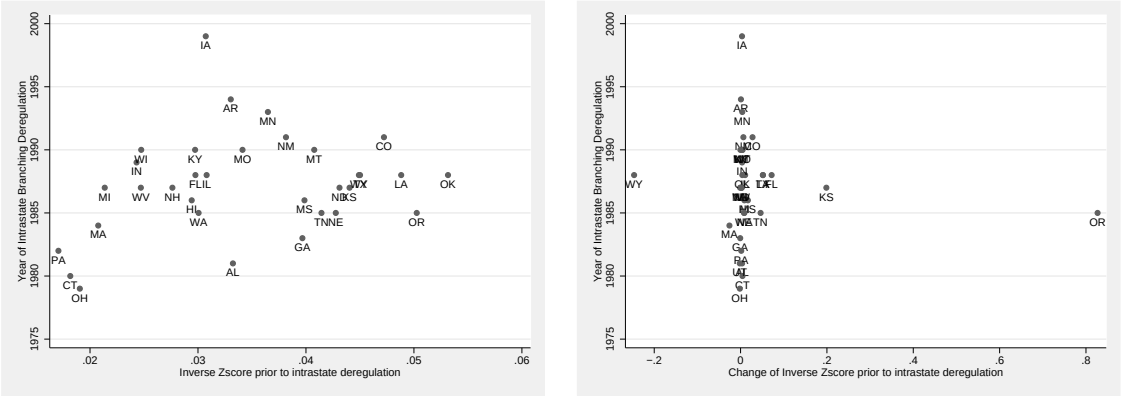
6 Results

6.1 Preliminaries

The identification of the effect of deregulation on risk rests on the assumption that the timing of deregulation is not affected by bank risk. This means that states did not deregulate because of a certain level of bank risk in a state. In order to graphically examine this situation, I plot the following two graphs:

Figure 4(a): Year of intrastate deregulation against the average Inverse Z-Score in each state before deregulation

Figure 4(b): Year of intrastate deregulation against the average change of Inverse Z-Score in each state before deregulation



(a) Level of Bank Risk

(b) Change of Bank Risk

Figure 4: Timing of Deregulation and Bank Risk
Note: This figure plots the year of Intrastate Deregulation against the level/ change of Bank Risk. Bank Risk is measured by Inverse Zscore.

According to figure 4(a) it seems that there is no relationship between the timing of deregulation and the level of bank risk in a state. Similarly it seems that there is no

relationship between changes in bank risk before deregulation and the year of intrastate branching deregulation.

6.2 Intrastate Branching Deregulation and Bank Risk

6.2.1 Reduced Form Estimate

Basic Result Regression results from the reduced form model are presented in table 3.

Table 3: Effect of Intrastate Branching Deregulation on Risk

	Dependent Variable: Inverse Z-Score				
	(1)	(2)	(3)	(4)	(5)
Intrastate Branching Deregulation	-0.005***	-0.003***	-0.003***	-0.003***	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
(Intrastate Branching Deregulation) × (=1 if bank active in more than one market)				0.005***	0.004***
				(0.001)	(0.001)
=1 if bank active in more than one market				-0.003**	-0.002
				(0.001)	(0.001)
Constant	0.121***	0.114***	0.069***	0.076***	0.128
	(0.002)	(0.001)	(0.007)	(0.007)	(.)
Average Effect of Intrastate Branching Deregulation if bank active in more than one market				0.002	0.002
				(0.001)	(0.001)
Controls			Bank and Macro	Bank and Macro	Bank and Macro
Observations	295737	150167	145149	145149	145149
R^2	0.053	0.090	0.106	0.107	0.116
Banks	18938	6789	6787	6787	6787

This table reports regression results from a bank fixed effects OLS analysis. Time dummies are used. Standard errors are robust, clustered at the bank level and are reported in parentheses below. See section 5.2.3 for Bank and Macro control variables. Model (5) also includes region-specific time dummies. Significance stars are: * p<0.10, ** p<0.05, *** p<0.01.

The results indicate that intrastate branching deregulation is associated with a decrease in bank risk. The coefficient on the intrastate deregulation dummy is negative and significant at the 1% level. In order to gauge the effect of intrastate deregulation on bank risk, I compute the decrease in bank risk as a share of its sample standard deviation: Deregulation of intrastate branching restriction is followed by a decrease in the level of bank risk of approximately 8 % of its standard deviation.

Survivorship Bias Carlson and Mitchener (2005) argue that deregulation is associated with a weeding out of risky banks which leads to a more stable banking system. As laid out earlier, intrastate branching deregulation is supposed to be an important

factor for the consolidation in the banking sector in the late 20th century (Berger et al. (1999), Boyd and Graham (1991)). During the sample period, many banks cease to exist because they fail, get acquired or merge with other institutions. It is possible that the weeding out of risky banks affects the overall finding. In order to account for this I restrict the sample to banks that do not exit the sample because of failure, acquisition or merger. The regression results from this subsample are given in column (2). The liberalization of intrastate branching restrictions is still associated with a significant decrease in bank risk.[9]

Further Control Variables In models (3) to (5), I include additional control variables that capture bank specific and macroeconomic characteristics. Intrastate branching deregulation is significantly associated with lower bank risk in all regression results. In model (4) I include a dummy variable indicating whether a bank is a multi-market bank or not. The regression results indicate that after intrastate branching deregulation, risk only declines for banks that are not active in more than one market. In model (5), I also include region specific time dummies in order to capture time-variant, region-specific effects.[10] The aforementioned findings are robust to this inclusion.

6.2.2 Dynamic Analysis

In order to clarify the dynamic effects of deregulation, I include a series of dummy variables for each state that capture the effect of deregulation on bank risk for each year before and after deregulation. I use the following regression model:

$$R_{ist} = \sum_{p=-10}^{15} \alpha_p Y_{pst} + \tilde{\delta}_i + \tilde{\delta}_t + \tau_{ist}$$

where Y_{pst} is a dummy variable that takes on the value of one if in year t, state s liberalizes its intrastate branching restriction in p years.

Consider the state of Massachusetts (MA) as an example where intrastate branching deregulation occurred in 1984: D_{-1MA} is equal to one only in 1983 and zero otherwise. Similarly, D_{1MA} is equal to one in 1985 and zero otherwise. There is no dummy variable in order to capture the effects of more than 10 years before or 15 years after deregulation. This implies that D_{15s} is equal to one for state s for all years that are

[9] However, the selection of banks out of the sample has some impact: The coefficient on intrastate branching deregulation is smaller than in the previous estimation.

[10] The regions are Midwest (IA, IL, IN, KS, MI, MN, MO, ND, NE, OH, WI), Northeast (CT, MA, MD, ME , NH, NJ, NY, PA, RI, VT, WV), South (AL, AR, DC, FL, GA, KY, LA, MS, NC, OK, SC, TN, TX, VA) and West (AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY).

at least 15 years after deregulation. Likewise, D_{-10s} is equal to one for state s for all years that are at most 10 years before deregulation. The effect on bank risk in the year of deregulation D_{0s} is dropped due to collinearity from the analysis; the coefficients α_p are relative to the year of intrastate deregulation.

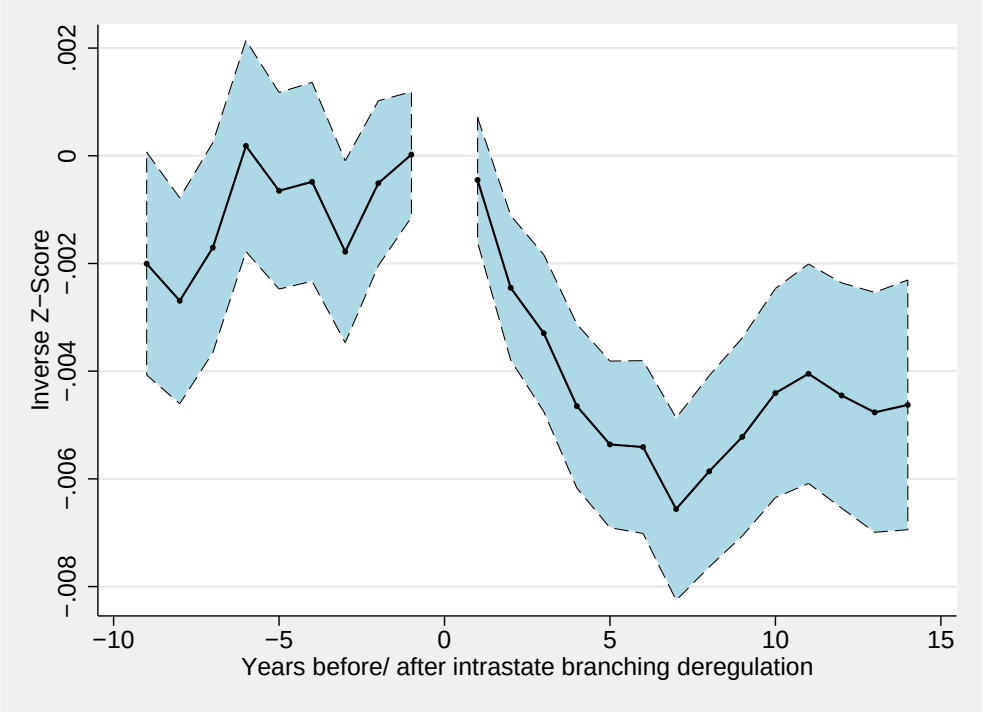


Figure 5: Dynamic Effects of Intrastate Branching Deregulation
Note: This figure illustrates the dynamic effects of intrastate branching deregulation on Inverse Z-score. The used regression model is given as $R_{ist} = \sum_{p=-10}^{15} \alpha_p Y_{pst} + \tilde{\delta}_i + \tilde{\delta}_t + \tau_{ist}$ where Y_{pst} is a dummy variable that takes on the value of 1 if in year t deregulation in a state s is in p years. The figure plots the estimates on the dummy variables (α_p) as well as the 95% confidence interval for these estimates. The regression adjusts for bank-level clustering and centers around year 0, ie. the year of deregulation.

Figure 5 plots the estimated coefficients α_p as well as the 95% confidence interval for these coefficients. The results show that bank risk significantly decreases following intrastate deregulation. The effect reaches its maximum approximately 7 to 8 years after deregulation and remains significantly different from zero after deregulation.

6.3 Underlying mechanism: Organizational Form and Bank Risk

The theoretical framework argues that risk is affected as banks change their organizational structure. In light of intrastate branching deregulation this is the case if deregulation changes the organizational form of banks. The model also theorizes that banks that do not change their organizational structure experience a change in risk as

competing banks expand into other markets.

Also, the reduced form regression results (table 3) show that the effect of deregulation is different for banks that expand into other markets.

6.3.1 Effect of Intrastate Branching Deregulation

Branch Network: Active banking markets

Average Effect In the first stage, I analyze how intrastate branching deregulation affects the organizational form of banks. The model theorizes a link between organizational form and bank risk. I am primarily interest in this relationship. Therefore I focus on the effects of intrastate branching deregulation on bank i s competitors' choice of organizational form. As explained in section 5.2.2 I determine for each bank a measure that captures the organizational form of its competitors: The log of banking markets, a bank's competitor is active in.

Table 4: Effect of intrastate branching deregulation on competitors' organizational form

	Dependent Variable: Ln(Number of competitor's banking market)			
	(1)	(2)	(3)	(4)
Intrastate Branching Deregulation	0.012*	0.016***		
	(0.006)	(0.005)		
Ln(1 + Years since Intrastate Branching Deregulation)			0.033***	0.035***
			(0.004)	(0.005)
Constant	-0.129	-21.292***	0.094	-15.967***
	(0.084)	(1.315)	(0.097)	(1.575)
Additional Controls		linear, state specific trend		linear, state specific trend
Observations	115848	115848	119969	119969
R^2	0.329	0.346	0.331	0.348
Banks	6504	6504	6506	6506

This table reports regression results from a bank fixed effects OLS regression. The dependent variable is the natural log of bank i's competitors banking markets. Bank and Macro-Controls (see section 5.2.3) are used. Time dummies are employed. Standard errors are robust and clustered at the bank level. Significance stars are: * < 0.10, ** < 0.05, *** < 0.01

Table 4 shows that intrastate branching deregulation is positively associated with an increase in the number of banking markets of i's competitors.

Dynamic Effect Following the same methodology as in section 6.2.2, I analyze what happens to the number of banking markets, i's competitor is active in as states liberalize their branching restrictions.

Figure 6: Effects of Intrastate Branching Deregulation on competitor's number of markets

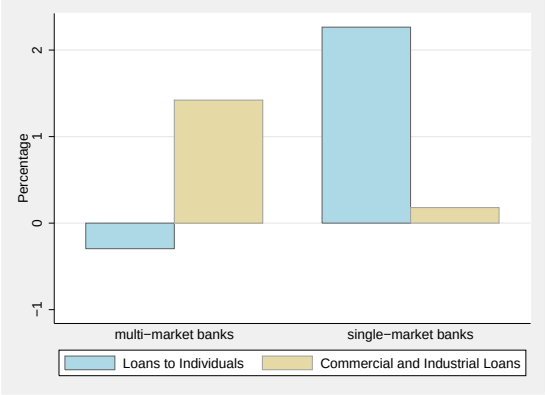
Note: This figure illustrates the dynamic effects of intrastate branching deregulation on the natural log of the competitors number of markets. The used regression model is given as $ln(M_{ist}) = \sum_{p=-10}^{15} \alpha_p Y_{pst} + \delta_i + \delta_t + \tau_{ist}$ where Y_{pst} is a dummy variable that takes on the value of 1 if in year t deregulation in a state s is in p years. The figure plots the estimates on the dummy variables (α_p) as well as the 95% confidence interval for these estimates. The regression adjusts for bank-level clustering and centers around year 0, ie. the year of deregulation.

Figure 6 shows that a bank's competitor branches out into other markets following deregulation: Ten years after deregulation, a bank increases its number of banking markets by approximately 10%. This seems to suggest that deregulation has an effect on the organizational form of banks: Following deregulation banks extend their branch network and enter new markets.

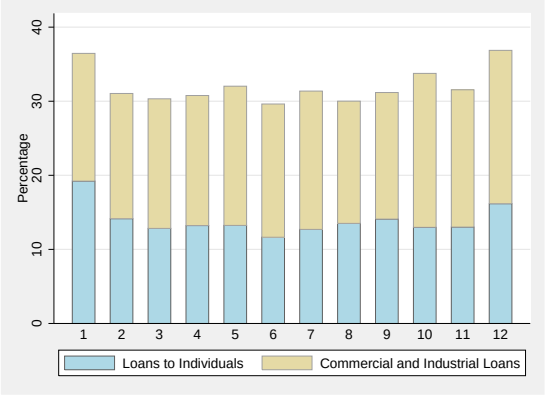
Loan Portfolio The theoretical model also argues that banks change their lending strategy as they extend their branch network. Specifically, banks tend to increase their lending to "soft" borrowers as competing banks branch out. As a first test, I analyze what happens to lending of single-market banks (=banks that are active in only one market) following intrastate branching deregulation. Since deregulation is followed by an expansion of competing banks, single-market banks should shift their lending towards borrowers that are "softer". Compared to these single-market banks, banks that expand their branch network (=multi-market banks) should shift lending toward borrowers with relatively "harder" information.

To see whether this is the case, I analyze the share of loans to two different sub-

groups: loans to business enterprises (= "hard" borrowers) and loans to individuals (= "soft" borrowers).[11]



(a) Effects of Deregulation on Loan Portfolio



(b) Loan Portfolio across banking markets

Figure 7: Loan Portfolio and Deregulation/ branch network
Note: Figure 7(a) plots the regression results from a bank-fixed OLS regression. Figure 7(b) shows the average composition of loan portfolios across banks with different number of active markets.

Figure 7(a) plots the average effect of intrastate branching deregulation on the share of loans to individuals and share of commercial and industrial loans. It shows that following deregulation, banks change their lending behavior: Banks that are active in only one market increase their share of lending to individuals. Multi-market banks on the other hand increase their lending toward business enterprises. Similarly, figure 7(b) shows the distribution of these two loan types across banks with different number of markets they are active in. It seems that banks that are active in more markets have a larger share of commercial and industrial loans than single-market banks.

These findings are consistent with the theoretical predictions that banks with bigger branch networks across markets have a larger share of "hard" information borrowers.

6.3.2 Estimation: Two Stage Least Squares Estimation

In the following, I test whether changes in competitor's number of markets has an effect on the risk of banks. Using 2SLS estimation, I am able to identify this effect. Table 5 reports regression results from a 2SLS estimation using intrastate branching deregulation as an exogenous instrument.

In order to compare the findings to results from an OLS regression, I report the estimated coefficients from an OLS estimation in column (1). In column (2), I use a dummy variable that takes on the value of one as a state allows banks to branch

[11] A definition of 'Loans to Individuals' and 'Commercial and Industrial Loans' is given in the appendix.

freely as excluded instrument. In column (3) to (6), I use the natural log of years since intrastate branching deregulation as an instrument for the level of competitor's organizational form. The rationale for this variable as an instrument comes from the inspection of figure 6 which shows that the expansion of banks across time seems to follow a logarithmic function.

Table 5: Effect of competitors' organizational form on bank risk

	Dependent Variable: Inverse Z-Score					
	(OLS)	(2SLS)				
	(1)	(2)	(3)	(4)	(5)	(6)
Ln(Number of competitors banking markets)	0.001	-0.071**	-0.037***	-0.044***	-0.033***	
	(0.001)	(0.032)	(0.010)	(0.013)	(0.012)	
Competitors' HHI across markets						0.020***
						(0.006)
Controls				Bank and Macro	Bank and Macro linear, state specific trend	Bank and Macro
Instrument		Intrastate Branching Deregulation	Ln(1+ Years since deregulation	Ln(1+ Years since deregulation	Ln(1+ Years since deregulation	Ln(1+ Years since deregulation
Observations	124,775	120,308	124,546	119,740	119,740	146,437
R^2	0.088	-0.170	0.018	0.012	0.059	0.106
Banks	6,535	6,302	6,306	6,277	6,277	6,592
F-Test of excluded instrument		16.10	98.35	65.44	72.91	1136
Partial R^2 of excluded instrument		0.000627	0.00493	0.00330	0.00321	0.0436

This table reports second stage regression results from a bank fixed effects Two-Stage-Least-Squares analysis. The sample includes only banks that are not failing or merged/acquired.
Time dummies are used. Standard errors are robust, clustered at the bank level and are reported in parentheses below. Bank and Macro-Controls (see section 5.2.3) are used. Significance stars are: * p<0.10, ** p<0.05, *** p<0.01.

The instruments pass the validity test: They explain a competitor's organizational form as shown by the reported values of a F-test of the excluded instruments in table 5.

The results suggest that the expansion of competitors into more markets has significant effects on risk: Banks become less risky as competitors branch out into other markets. This relationship is also robust to the inclusion of bank-specific and macroeconomic control variables as shown in column (4). In column (5) I also include a linear state specific time trend into the regression model. These variables capture linear time trends that are specific to each individual state. The coefficient on the log of competitor's number of markets stays significant at the 1% level and is robust to this inclusion. In column (6), I use the competitor's Herfindahl index of deposits across banking markets as a measure of organizational form. Larger values of this variable thereby indicate that competitors are more concentrated on one single banking market.

In line with the aforementioned result, I find that bank risk decreases as competitors shift their focus away from one single market.

6.3.3 Single-Market vs. Multi-Market Banks

The model also states that the effect is different if banks are active are already active in more markets or not. Also, the reduced form results (table 3) show that intrastate branching deregulation has different effects on risk depending whether banks are single- or multi-market banks. To see if this is the fact, I split my sample according to the number of markets a bank is active in: First, I identify whether banks were active in more than one market or not before deregulation (models (2) and (3) in table 6). Additional to that I split the sample according to the number of banking markets a bank is active in at time t (models (4) and (5) in table 6).

This methodology is similar to an "Identification at Infinity" approach: By restricting attention to banks that do not expand into new markets, I am able to isolate different effects, since I only evaluate what happens as competitors expand into other markets. Changes in the organizational form of bank i are ignored. Table 6 reports regression results.

Table 6: Effect of competitors' organizational form on bank risk

	Dependent Variable: Inverse Z-Score				
	(1)	(2)	(3)	(4)	(5)
Ln(Number of competitors banking markets)	-0.033***	0.045	-0.062***	0.093	-0.057***
	(0.012)	(0.036)	(0.022)	(0.115)	(0.022)
Sample		Multi-Market banks	Single-Market banks	Multi-Market banks	Single-Market banks
Observations	119740	6232	113508	11057	108200
R^2	0.059	0.059	-0.074	-0.824	-0.021
Banks	6277	473	5804	2160	5825
F-Test	72.91	5.263	31.20	1.174	30.44
Partial R^2	0.00321	0.00451	0.00113	0.000263	0.00139

This table reports second stage regression results from a bank fixed effects Two-Stage-Least-Squares analysis. The sample is split according the rule given in row 'Sample'.The excluded instrument is 'Ln(Years since Intrastate Branching Deregulation +1)'. The aforementioned Bank and Macro-Controls are used. Time dummies and a state-specific linear time trend are employed. Standard errors are robust and clustered at the bank level. Significance stars are: * < 0.10, ** < 0.05, *** < 0.01

The results seem to suggest that risk only reduces for single-market banks as competitors expand into more markets. Changes in competitors' organizational form does not have an effect for banks that are already active in more markets before deregulation (column 3). A similar conclusion can be drawn when splitting the sample into banks that are not active in more than one market in that year (columns 4 and 5).

6.3.4 "Soft" versus "Hard" Information Counties

Building on this finding, I test whether the effect is different across counties. Following the theoretical framework, banks should experience a larger effect in counties with more "soft" information borrowers. As there are more soft borrowers available, banks that don't branch out into other markets will experience a larger effect on their bankruptcy risk. In the following I will present four measures that shall capture the level of information (soft versus hard) within counties.

Measures of information

Opaqueness

1. Earlier research on the opaqueness of firms across industries by Morgan (2002) found that for instance the banking sector is characterized by a greater degree of informational asymmetries. He finds that bond rating agencies more often disagree about their assessment of banks' bond issues than about their assessment of other industries.[12] He reports for each industry a statistic (*Kappa*) which is a measure of disagreement. For my analysis I use the inverse measure (1 - *Kappa*): Sectors with lower values are supposed to be less opaque since rating agencies disagree about their bond issues less.

2. Another strand of the literature uses the share of intangible assets reported in balance sheet by firms as a proxy for opaqueness. Claessens and Laeven (2003) and Braun (2003) argue that because of technological reasons, some industries need to operate with a larger share of intangible assets than others. Since intangible assets are hard to assess from outsiders, a larger share of intangible assets implies also a larger opaqueness for certain industries. Similarly, industries with a lower share of intangible assets are therefore supposed to be less opaque. For my analysis, I compute the share of intangible assets for each SIC-code using information from Compustat.[13]

I use information reported in the 'County Business Patterns' (CBP) provided by the U.S. Census to determine the opaqueness of counties. The CBP reports the number of employees and establishments by Standard Industry Classification (SIC) code for each county and year in the US. For each county, I determine the share of establishments in

[12] He compares bond issues in the following industries: Bank, Manufacturing, Mining, Trade, Services, Transportation, Public utilities, Insurance, Other finance and Real Estate

[13] See the appendix (table A.II) for further information.

each SIC code whereas I exclude the financial sector. I then multiply this share with the aforementioned opaqueness variables in order to aggregate the information at the county level.

Average Firm Size and Proprietors Income In addition to these two measures, I use the average firm size and share of proprietors income for each county to assess the level of information.

1. Larger firms are on average organized as incorporations which means that these firms compile and report balance sheet information. Balance sheet information are considered to be hard information. Hence, counties with larger firms can be seen as being "harder" with respect to their borrower's informational level. I compute the average firm size (= average number of employees per establishments) using information from the county business patterns. To have a measure of opaqueness, I invert this variable: Larger values of this variable then indicate more opaque borrowers.

2. Proprietors income is the current-production income of sole proprietorships, partnerships, and tax-exempt cooperatives. A sole proprietorship is usually a business entity that is run only by an individual. Hence, there is no legal distinction between the owner and the business. Compared to businesses that are structured as legal entities, proprietorships can be seen as being more opaque. Their possibility to provide information depends upon the owner of the proprietorship, which is considered to be "soft". A larger share of proprietors income in a county's total earnings indicates that the county holds more "soft" information borrowers. For each county, I determine the share of proprietors income in 'Earnings by place of work' as reported by the Bureau of Economic Analysis in its Local Area Personal Income Statistic.[14]

The correlation of these opacity measures is given in table A.IV in the appendix. All proxies are positively correlated: The pairwise correlation coefficient between 'Asset Intangbility' and 'Inverse Kappa' is 0.608. Furthermore, counties with a larger share of proprietor's income in total personal income tend to have - on average - small firms, as the correlation between these two variables shows. The spatial distribution of counties by their opacity is shown in figure B. Darker values in this map indicate a larger value of Inverse Kappa for the county before deregulation. This means that these counties

[14]Earnings by place of work is the sum of wage and salary disbursements, supplements to wages and salaries, and proprietors' income.

have more opaque borrowers. Figure B suggests that there is no spatial clustering of opaque counties in certain areas.

Results For each county, I determine the level of opaqueness before states decide to liberalize their intrastate branching restrictions. I then interact this measure with my measure of organizational form (= log of competitors' number of banking markets). Additionally, I restrict attention to banks that are single-market banks prior to deregulation. Regression results are given in table 7.

Table 7: Effect of competitors' organizational form on bank risk

	Dependent Variable: Inverse Z-Score			
Information Index:	Inverse Kappa	Intangibility	Inverse average firm size	Share of proprietors income
	(1)	(2)	(3)	(4)
Ln(Number of competitors banking markets	0.026***	0.016**	0.013	-0.013
	(0.009)	(0.007)	(0.008)	(0.013)
Ln(Number of competitors banking markets) × 'Information Index'	-0.227***	-0.222**	-0.766***	-0.003***
	(0.083)	(0.094)	(0.214)	(0.001)
'Information Index'	0.128**	0.086	0.229	0.001*
	(0.056)	(0.053)	(0.190)	(0.001)
Observations	105922	105919	106231	106692
R^2	-0.445	-0.392	-0.045	-0.052
Banks	5143	5147	5157	5226
F-Test	113.0	152.7	113.8	116.4
Partial R^2	0.0284	0.0419	0.0259	0.0250

This table reports second stage regression results from a bank fixed effects Two-Stage-Least-Squares analysis. 'Information index' captures the level of information (soft vs. hard) in each county before intrastate branching deregulation. The sample only includes banks that were single-market banks before deregulation. The excluded instrument is 'Ln(Years since Intrastate Branching Deregulation +1)'. Bank and Macro-Controls (see section 5.2.3) are used. Time dummies and a state-specific linear time trend are employed. Standard errors are robust and clustered at the bank level. Significance stars are: * < 0.10, ** < 0.05, *** < 0.01

Consistent with the theoretical framework, I find that the effect of competitors' organizational form on risk is different according to the level of opaqueness in a county. Specifically, I find that risk is more affected by competitor's choice of organization in counties with more opaque firm (see table 7). Single-market banks that are located in more opaque counties (as measured by Inverse Kappa or the share of intangible assets) experience a larger decrease in their risk as competitors expand into other markets. The same holds when using the inverse of average firm size (column 3) or share of proprietors income (column 4) in a county as an indicator for opaqueness.

7 Conclusion

Mishkin and Eakins (2006) provide a list of eleven major banking legislation for the US banking industry in the twentieth century in their undergraduate textbook "Financial Markets and Institutions". One of these eleven is the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994, which removed all remaining barriers on branching for banks within and across states. As a result banks could expand freely within and across state lines. In this paper, I analyze how this geographical expansion of banks affects banks' risk of failure.

Therefore I develop a theoretical framework along the lines of Stein (2002). I show that, bankruptcy risk of banks does not need to decrease as banks expand geographically. By breaking up the black box 'bank' and considering the incentive structure within a bank's organizational form, I show that expanding banks will shift lending to borrowers with "hard", verifiable information. Loan officers in expanding banks do not necessarily increase their monitoring effort as lending changes. Hence, risk does not need to decline. Further, single-market banks, that don't change their geographical range are also affected: As competitors branch out (and therefore focus on different borrowers), single-market banks will differentiate themselves by lending to borrowers with soft information. Again, the effect on their risk is ambiguous: It might increase or decrease depending on whether loan officers in these banks exert more or less monitoring.

I test this empirical predictions for the US commercial banking sector. The US provide a unique possibility to answer this question since states deregulate their restrictions on branching within states at different points in time. My results indicate that the deregulation of intrastate branching restrictions leads to a significant decrease in bankruptcy risk for banks. A closer inspection reveals that only banks, that do not branch out into other banking markets experience a decrease in risk. In 2SLS estimation, I am able to identify one underlying channel. First I show that intrastate branching deregulation is followed by a significant expansion of competitors into other banking markets. Building on this, I then present evidence that bank risk declines as competitors branch out. Splitting the sample into banks that branch and and banks that do not branch out, I find the effect only for single-market banks. Banks that expand geographically do not experience a decrease in their bankruptcy risk. This is consistent with the theoretical framework as well as the reduced form results. Additionally, I find that the effect is larger in banking markets that are characterized by a larger share of borrowers with soft information.

What can we learn from that? The interplay among banks in the banking market is

an important part when analyzing bank risk. In addition to earlier theories of Keeley (1990) or Boyd and de Nicolo (2005), it is also important to consider the organizational structure of banks for this question. 'Theories of the firm' establish that incentives within firms depend heavily upon the hierarchical structure of firms. This theoretical insight is usually not considered in this literature.

However, care has to be taken when drawing an interpretation: The results seem to suggest that the aforementioned mechanism is at work as US states deregulate their intrastate branching restrictions. However, it might be the case that other channels also affect bank risk as states liberalize their restrictions.

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A Tables

Table A.I: Timing of Intrastate Branching Deregulation

State	Name	Year of Deregulation
AK	Alaska	1960
AL	Alabama	1981
AR	Arkansas	1994
CA	California	1960
CO	Colorado	1991
CT	Connecticut	1980
DC	District of Columbia	1960
FL	Florida	1988
GA	Georgia	1983
HI	Hawaii	1986
IA	Iowa	1999
ID	Idaho	1960
IL	Illinois	1988
IN	Indiana	1989
KS	Kansas	1987
KY	Kentucky	1990
LA	Louisiana	1988
MA	Massachusetts	1984
MD	Maryland	1960
ME	Maine	1975
MI	Michigan	1987
MN	Minnesota	1993
MO	Missouri	1990
MS	Mississippi	1986
MT	Montana	1990
NC	North Carolina	1960
ND	North Dakota	1987
NE	Nebraska	1985
NH	New Hampshire	1987
NJ	New Jersey	1977
NM	New Mexico	1991
NV	Nevada	1960
NY	New York	1976
OH	Ohio	1979
OK	Oklahoma	1988
OR	Oregon	1985
PA	Pennsylvania	1982
RI	Rhode Island	1960
SC	South Carolina	1960
TN	Tennessee	1985
TX	Texas	1988
UT	Utah	1981
VA	Virginia	1978
VT	Vermont	1970
WA	Washington	1985
WI	Wisconsin	1990
WV	West Virginia	1987
WY	Wyoming	1988

Table A.II: Variable Definitions

Variable	Description	Source
BANK		
Net Income (Loss)	RIAD4340 (Item Number)	Call Reports
Equity	1976 - 1989: RCFD3230 + RCFD3240 + RCFD3247 1990 - 1993: RCFD3230 + RCFD3839 + RCFD3632 - RCFD0297 1994 - 2006: RCFD3230 + RCFD3839 + RCFD3632 + RCFD8434	Call Reports
Return on Equity	'Net Income (Loss)' divided by 'Bank Capital'	
Inverse Z-score	Standard Deviation of Return on Equity divided by (Return on Equity +1)	
Ln(number of competitor's banking markets)	Log of average number of markets in which competitors operate branches	Summary of Deposits
Competitor's HHI across markets	Average sum of squared share of deposits for each banking company in county except bank	Call Reports and Summary of Deposits
Total Assets	RCFD2170	Call Reports
Total Loans	RCON1400 (1976 - 1984) RCON1400 - RCON2165 (1984 - 2006)	Call Reports Call Reports
Capital-Asset-Ratio	'Equity' divided by 'Total Assets'	
=1 if bank part of bank holding company	Indicator whether banking company is part of a bank holding company (RSSD9347)	Call Reports
Loans-Assets-Ratio	'Total Loans' divided by 'Total Assets'	
Loans to Individuals	Loans to Individuals for household, family, and other personal expenditures (RCON1975)	Call Reports
Commercial & Industrial Loans	(RCON1766)	Call Reports
BANKING MARKET		
Ln(number of banks in county)	Log of number of banking companies in county	Summary of Deposits
Ln(number of branches in county)	Log of total number of branches in county	Summary of Deposits
Herfindahl Index of deposits in county	Sum of squared share of deposits for each banking company in county	Summary of Deposits, own calculations
Inhabitants per branch in county	County population estimates divided by number of branches in county	Summary of Deposits and Local Area Personal Income (BEA)
Growth of personal income in county	Change in Personal County Income divided by last year's Personal County Income	Local Area Personal Income (BEA)
Growth of personal income in county (lag)		
Average firm size	Number of employees per establishments in county	County business patterns (CENSUS)
Share of proprietors income	Share of proprietors income in Earnings by place of work	Local Area Personal Income (BEA)
DEREGULATION		
=1 if Intrastate Branching Deregulation	Indicator whether states allow in-state branching	Amel and Liang (1992)
=1 if Interstate Branching Deregulation	Indicator whether states allow out-of-state branching	Amel and Liang (1992)
INFORMATION		
Inverse Kappa	Disagreement of rating agencies about bond issue ratings. Ranges from complete disagreement (=1) to complete agreement (=0)	Morgan (2002)
Asset Intangibility	Average Ratio of intangible assets-to-net fixed assets of U.S. firms by SIC sector over the period 1980 to 1999	Compustat

Table A.III: Summary Statistics

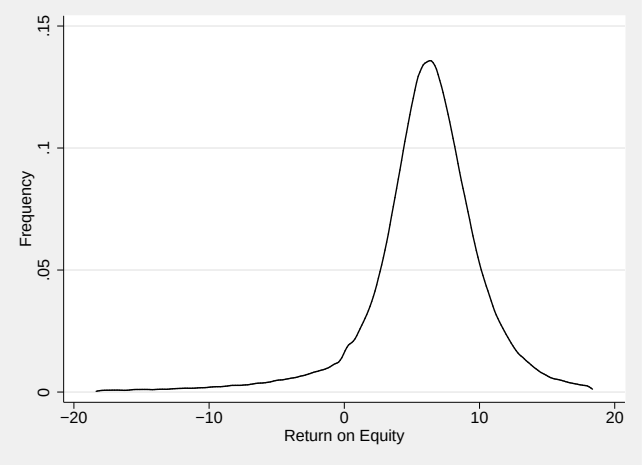
Variable	N	Mean	Std.Dev.	Min	Max	Median
FULL SAMPLE						
Inverse Z-score	295,737	0.0291893	.0428857	.0022022	.4656421	.0162337
ln(number of competitor's banking markets)	243,281	0.2321057	.4277964	0	5.631212	0
Competitor's HHI across markets	291,931	0.7992925	.2283843	0	1	.8849146
=1 if Intrastate Branching Deregulation	295,737	0.5444365	.4980223	0	1	1
=1 if Interstate Branching Deregulation	283,837	0.5424839	.4981927	0	1	1
ln(Total Assets)	295,737	10.77994	1.324008	4.718499	20.76972	10.65709
Capital-Asset-Ratio	295,737	0.0945145	.0442021	-.3512438	1	.08611
=1 if bank part of bank holding company	295,737	0.6042768	.4890063	0	1	1
Loans-Assets-Ratio	295,616	0.5600853	.1463298	0	.9998202	.5750703
ln(number of banks in market)	295,651	2.265527	1.056198	0	5.666427	2.079442
ln(number of branches in market)	295,651	3.178134	1.394349	0	7.281386	2.890372
HHI of deposits in market	295,651	0.3275426	.2642685	0	1	.2547383
Inhabitants per branch in market	292,830	3,391.997	2,153.656	244.5	30,032.67	2,839
Growth of personal income in market	292,888	0.0719905	.065131	-.682412	2.640658	.0662196
Growth of personal income in market (lag)	292,886	0.0737829	.0659686	-.682412	2.640658	.0684526
ONLY SURVIVING BANKS						
Inverse Z-score	150,167	.0255501	.03619	.0022025	.465042	.0149006
ln(number of competitors banking markets)	120,539	.2662157	.4497489	0	5.631212	0
Competitor's HHI across markets	147,872	.7616419	.238179	0	1	.8176943
=1 if Intrastate Branching Deregulation	150,167	.6463737	.4780965	0	1	1
=1 if Interstate Branching Deregulation	145,217	.6641647	.4722833	0	1	1
ln(Total Assets)	150,167	10.76381	1.272755	4.718499	20.76972	10.65921
Capital-Asset-Ratio	150,167	.1004748	.0466276	-.119351	1	.0911976
=1 if bank part of bank holding company	150,167	.6039543	.4890758	0	1	1
Loans-Assets-Ratio	150,095	.5560576	.1527447	0	.9998202	.5699409
ln(number of banks in market)	150,140	2.110361	.9561694	0	5.666427	1.94591
ln(number of branches in market)	150,140	2.965926	1.321647	0	7.281386	2.70805
HHI of deposits in market	150,140	.3388941	.2685967	0	1	.2643856
Inhabitants per branch in market	149,204	2,940.864	1,813.416	244.5	22,883.75	2,517.444
Growth of personal income in market	149,219	.0647246	.0657279	-.682412	2.640658	.0592661
Growth of personal income in market(lag)	149,218	.0654606	.0661051	-.682412	2.640658	.0601439

Table A.IV: Correlation of Information Measures

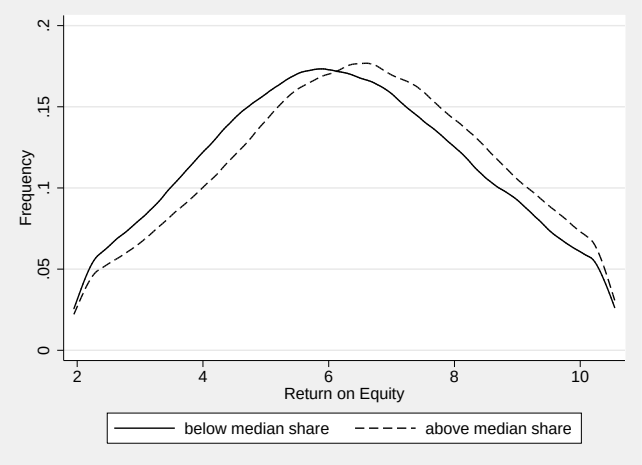
	Inverse Kappa	Asset Intangibility	Inverse Average Firm Size	Share of Proprietors Income
Inverse Kappa	1.000			
Asset Intangibility	0.608	1.000		
Inverse Average Firm Size	0.246	0.375	1.000	
Share of Proprietors Income	0.270	0.338	0.624	1.000

This table shows the pairwise correlation coefficient among the information variables at the county level.

B Figures



(a) Return on Equity in full sample



(b) Return on Equity in sample for subgroups

Figure B.I: Distribution of Return on Equity in sample

This figure plots kernel density estimates of Return on Equity in the sample. In figure 1(a), the distribution of ROE in the whole sample is plotted; figure 1(b) shows the distribution of ROE for banks with below and above the sample median share of loans to individuals.

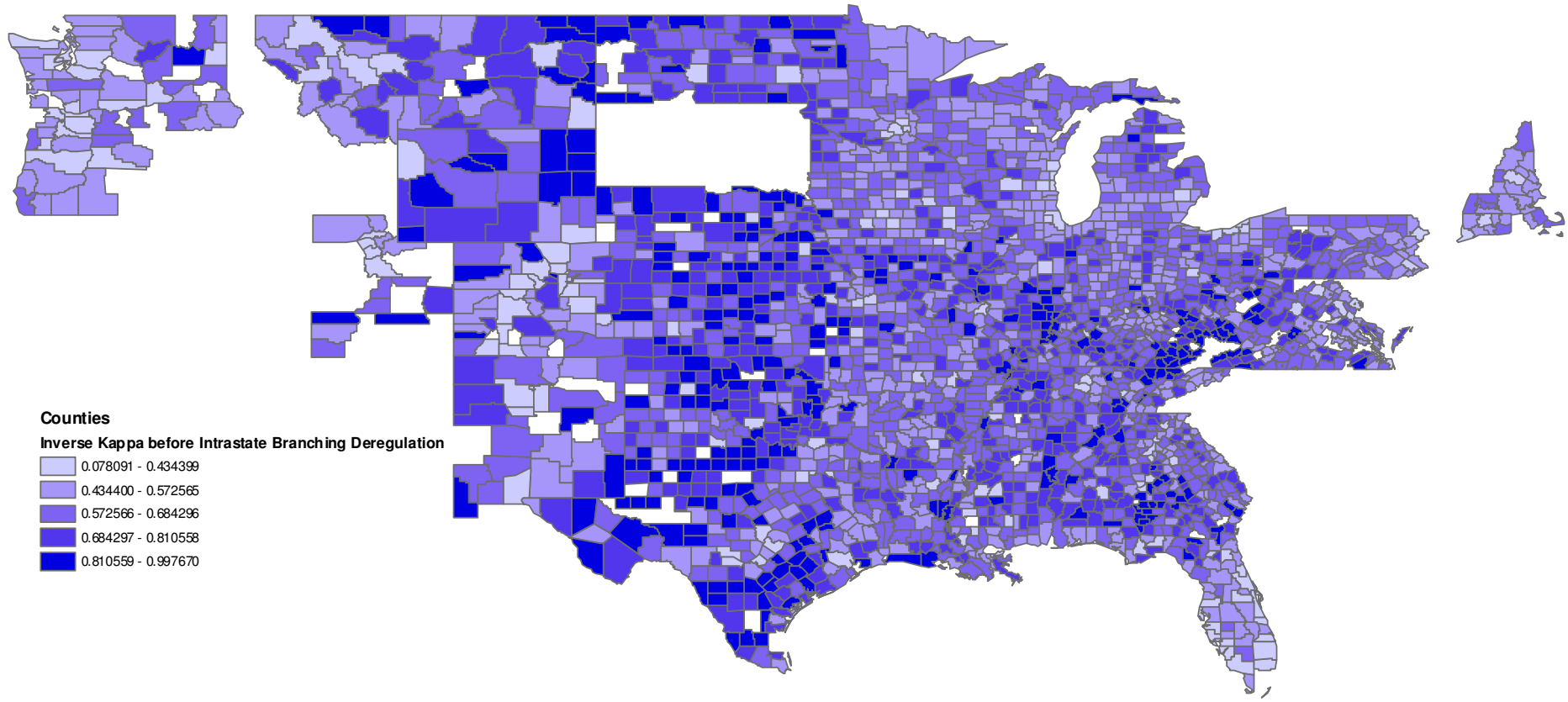


Figure B.II: Distribution of Counties with soft information before intrastate branching deregulation