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Abstract

Does an increase in competition increase or decrease bank stability? I exploit how the state-specific process of interstate banking deregulation lowered barriers to entry into urban banking markets and find that greater competition significantly increases bank stability. This result is robust to the inclusion of additional fixed effects and other influences, such as merger and acquisitions or diversification. Moreover, I find that greater competition reduces banks' nonperforming loans and increases bank profitability. These findings suggest that competition increases stability as it improves bank profitability and asset quality.

JEL Classification: G21, G28, G32

Keywords: Risk, Stability, Competition, Contestability, Entry, Bank Deregulation, Lending

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1 Introduction

Whether an increase in competition decreases or increases bank risk is an open debate in economic research. Theories highlighting the role of banks' charter values in shaping risk taking incentives argue that greater competition increases bank fragility. Greater competition lowers bank profits, erodes bank charter values and provides incentives for banks to take on more risk (Keeley, 1990; Hellmann et al., 2000; Allen and Gale, 2000). Considering the effect of greater competition on borrowers' risk shifting, however, points to a different conclusion and an increase in competition is thought to improve bank stability (Boyd and de Nicolo, 2005).

Empirical research regarding the link between competition and stability provides mixed results (Claessens, 2009). Evidence from cross-country analyses suggests that systemic crisis are more likely to occur in countries with concentrated, less competitive banking systems (Beck et al., 2006; Schaeck et al., 2009; Boyd et al., 2009). Micro-level evidence from individual banks, however, indicates that bank risk is lower if competition is lower (Beck et al., 2013). Work, examining how changes in competition within a country affect bank stability also provide mixed conclusions. Using data on Spanish banks, Jimenez et al. (2013) find a nonlinear relationship between concentration in the banking market and bank risk taking. Focusing on the U.S. banking sector, Demsetz et al. (1996) find evidence of a negative correlation between banks' charter value and risk taking as banks with higher charter values exhibit lower risk. The removal of geographic restrictions on bank expansion, which also affects competition, seems to improve bank performance (Jayaratne and Strahan, 1998). Studies, analyzing how distortions to bank competition due to government support affects risk also yield mixed results. Duchin and Sosyura (2014) find that a bail-out of U.S. banks during the recent financial crisis increases risk taking, while Gropp et al. (2013) find that a removal of implicit government guarantees reduces risk taking for German banks.

Identifying the causal impact of competition on bank stability is difficult for particularly two reasons: (1) endogeneity of competition and (2) difficulties in measuring competition. With regards to the first problem, greater competition may be the outcome rather than the cause of bank risk: an increase in bank risk may lead to more bank failures and competition among surviving banks may decrease as banks adjust their behavior (Koetter et al., 2012). Measurement errors due to the empirical definition of competition further affects results (Roberts and Whited, 2013). Empirical studies measure competition by obtaining structural parameters, derived from theoretical models or by computing measures of market concentration.[1] While estimates of structural parameters rely on the validity of the underlying model, concentration measures fail to adequately capture competition (Bikker and Haaf, 2002).

In this paper, I address these two concerns and analyze how a shock to competition affects bank stability by examining how the removal of entry barriers to metropolitan banking markets in the U.S. affects banks' risk. Specifically, I follow Goetz et al. (2016) and Jiang et al. (2016) and first determine how the state-specific process of interstate

[1]The employed variables based on concentration are often concentration ratios of large banks or the Herfindahl index of market concentration. Structural parameters rely on insights of the new empirical industrial organization literature to assess competition (e.g. Panzar-Rosse Statistic or Bresnahan method) (Bikker et al., 2012).

banking deregulation gradually lifted bank entry restrictions. Banks in the United States were protected from entry by competitors for many decades due to regulatory restrictions and over a period of several years, states gradually removed these entry restrictions. This process of interstate banking deregulation allowed banks to expand across state borders and removed entry for out-of-state banks, increasing contestability of local banking markets and fostering competition (Baumol et al., 1982). The removal of entry barriers was mainly gradual as states signed bi- or multilateral reciprocal interstate banking agreements, which only deregulated entry barriers for banks headquartered in selected other states. As more states engaged in the enactment of reciprocal banking agreements, the number of competitors that can enter a banking market increased over time. Overall however, the state-specific process of interstate banking deregulation seems somewhat chaotic, rendering the gradual removal of barriers to entry random (Goetz et al., 2013).

Earlier research examined how the process of interstate banking deregulation affects bank value and risk as it allowed banks to diversify geographically (Goetz et al., 2013, 2016), but it has not examined how an increase in competition affects incumbent banks' stability. There is a large literature, however, examining how the state-wide deregulation of interstate banking and branching restrictions in the United States affects bank behavior and performance.[2] Work in this area, however, has not examined how the *process* of interstate banking deregulation affects incumbent's risk by removing barriers to *entry* into banking markets. Focusing on bank entry is important in

[2]See among others: Jayaratne and Strahan (1997); Jayaratne and Strahan (1998); Black and Strahan (2002); Stiroh and Strahan (2003); Cetorelli and Strahan (2006).

this setting since the signing of interstate banking regulations not only allowed entry from out-of-state banks but also allowed incumbent banks to expand geographically. This expansion possibility also affects competition. Hence, analyzing how the statewide deregulation of interstate banking restrictions affects bank risk does not allow inference whether (a) a higher threat of entry by out-of-state banks, or whether (b) an incumbent's possibility to exit drives bank stability.

Controlling for the way how interstate banking deregulation impacts bank competition is important and I find that banks become safer once competition increases. Exploiting the gradual lifting of entry restrictions, I find that an increase in potential entrants significantly increases bank stability. This result is not sensitive to the definition of market contestability as my results indicate a strong and statistically significant effect on bank stability across different measures. Economic magnitudes are large: my estimates suggest that a one standard deviation increase in the size of potential entrants' markets reduces a bank's average annual failure probability by 10%.

The positive effect of competition on bank stability is robust to several influences. Specifically, I find that increasing competition reduces bank risk after accounting for the effect of mergers and acquisitions, banks' geographic expansion and autocorrelation in the dependent variable. Moreover, to capture unobservable time-varying local factors that affect bank stability and competition, I include several fixed effects into my regression model. Because I examine bank stability and competition at the MSA level, I add state-time fixed effects to capture unobservable time-varying changes in competition and stability at the state level. My result are robust to these fixed effects as I continue to find a strong statistical impact of competition on bank stability.

To further examine the channels through which greater competition affects bank risk, I examine how the removal of entry barriers impacts loan performance and bank profitability. Increasing bank competition is found to decrease bank opacity and banks disclose more information in competitive markets (Jiang et al., 2016). Greater competition may thus increase bank stability as competition also disciplines banks to increase monitoring and/or improve their selection of borrowers (Diamond, 1984). Using information on the share of nonperforming loans I find that greater competition indeed increases a bank's asset quality as it reduces the share of nonperforming loans. Further, my results indicate that greater competition increases profitability and lowers banks' earning volatility. This suggests that greater competition makes banks safer as banks improve their asset quality and experience more stable and higher profits in more competitive markets.

The main contribution of this paper is the empirical identification of the impact of competition on bank stability using information from U.S. commercial banks. Further, my analysis complements studies of market structure and bank risk utilizing information from the Great Depression (Calomiris and Mason, 2000; Carlson and Mitchener, 2006). My work also contributes to the literature on effects of interstate banking and branching deregulation in the U.S. on the banking sector (Jayaratne and Strahan, 1997, Stiroh and Strahan, 2003; Subramanian and Yadav, 2012 among others). Similar to Jiang et al. (2016), I explicitly model how the process of interstate banking deregulation affects competition. This allows me to achieve a better identification of the impact of competition on bank stability. Even though my work is related to the literature regarding the real effects of intra- and interstate branching deregulation in the U.S. (Jayaratne and Strahan, 1996; Cornaggia et al., 2015; Rice and Strahan, 2010), I do not address the effects of bank risk or bank failures on the performance of the real economy (Cetorelli and Strahan, 2006; Dell'Ariccia et al., 2008).

The remainder of this paper is organized as follows: in the following section I describe how the process of interstate banking deregulation removed entry barriers and increased competition. Section 3 describes the data, variables and empirical specification. In Section 4 I present results of the impact of competition on U.S. commercial banks' risk. Section 5 examines how greater competition impacts banks' loan performance and profitability. Section 6 concludes.

2 The process of interstate bank deregulation

2.1 Background

U.S. States imposed limits on the location of bank branches and offices in the 19th century. These regulatory restrictions prohibited the geographic expansion of banks for many years and were supported by the argument that allowing banks to expand freely could lead to a monopolistic banking system with detrimental effects for economic development. Additionally, the granting of bank charters was a profitable income source for states, providing further incentives for states to enact regulatory policies, limiting the geographic scope of banks. In addition to restricting the expansion of banks within a state, states also restricted the entry of banks, headquartered in other states.

Starting in the 1970s, technological and financial innovations eroded the value of these regulatory restrictions for banks. Particularly, improvements in data processing weakened the advantages of local banks. This reduced incumbent banks' willingness to fight for the maintenance of restrictions on entry by other banks, triggering deregulation of entry restrictions (Kroszner and Strahan, 1999; Kane, 1996).

Maine was the first state to allow entry by out-of-state banks in 1978 by national reciprocity: banks from other states were allowed to enter Maine if that other state also allowed entry by banks headquartered in Maine. Maine enacted this reciprocal policy in 1978, but no other state changed its entry restrictions for out-of-state banks until 1982, when New York put in place a similar legislation and Alaska completely removed entry restrictions. Over the following 12 years, states gradually removed their entry restrictions for other banks. The process of removing these entry restrictions happened by states either (a) unilaterally opening their state borders, allowing out-of-state banks to enter, or (b) signing reciprocal bilateral and/or multilateral agreements with other states. Only 12 states removed barriers to entry for out-of-state banks unilaterally while the majority of states deregulated entry by signing reciprocal agreements at the state-level. Since entry was often only possible if other states had similar regulations in the place, removing entry barriers was somewhat chaotic and the pattern of removing entry barriers appears to be random (Goetz et al., 2013). The liberalization of interstate banking restrictions culminated in the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994. This act removed all remaining barriers to interstate banking by 1995 and interstate branching by 1997.

2.2 Interstate banking deregulation and entry barriers

Earlier work found that the deregulation of interstate banking and branching restrictions improved transparency (Jiang et al., 2016) and efficiency (Stiroh and Strahan, 2003) of the banking sector, enabled banks to enjoy benefits of geographic diversification (Goetz et al., 2016), spurred economic growth (Jayaratne and Strahan, 1996) and reduced inequality at the state level (Beck et al., 2010). As laid out earlier, the liberalization of entry barriers occurred mainly by states enacting reciprocal regulations, which often only lowered entry barriers slowly over several years. Thus, even though states were considered to have liberalized their interstate banking restrictions, banks were often still protected from entry by out-of-state competitors since other states had no equivalent (reciprocal) policies in place. Accounting for the dynamic process how interstate banking deregulation removed entry barriers is therefore important.

How different the process of interstate banking deregulation can affect entry barriers can be seen when examining how the process of interstate banking deregulation removed entry into the state of Texas and Florida.

Figure 1 plots for Texas (Panel A) and Florida (Panel B) the number of states that were allowed to enter Texas and Florida respectively due to the enactment of interstate banking regulations. Removing barriers to entry into Texas and Florida occurred quite differently: Texas unilaterally removed barriers to entry in 1987, allowing banks from any other state to enter Texas after 1987. Florida on the other hand, started slowly to remove its entry barriers in 1985 by signing a multilateral reciprocal agreement with 12 other states.[3] This form of interstate banking deregulation only allowed banks from other states to enter Florida if their home state also allowed entry from banks, headquartered in Florida. Since not all states had similar policies in place in 1985, the number of states that were allowed to enter Florida in 1985 was 5. Florida did not enact other interstate banking regulations over the following 11 years. The number of states, allowed to enter Florida slowly increased to 12 until the Riegle-Neal Act, which removed all remaining barriers by 1994.

As represented by these two states, the removal of entry barriers took different forms. Hence, the effect of liberalizing interstate banking restrictions on competition should have different effects. In my analysis I account for the dynamic process of deregulating banking entry and exploit the state-specific time pattern to capture the gradual removal of entry barriers.

3 Data, Variables and Sample Construction

3.1 Data Sources

I use accounting data from commercial banks in the United States. These data come from Reports of Condition and Income ('Call Reports'), which all banking institutions regulated by the Federal Deposit Insurance Corporation (FDIC), the Federal Reserve, or the Office of the Comptroller of the Currency need to file on a regular basis. I use

[3]These states are: AL, AR, DC, GA, LA, MD, MS, NC, SC, TN, VA, WV.

annual data from the years 1976 to 2006. Information on bank deposits is provided by the FDIC in the Summary of Deposits statistics. Aggregate MSA level data are from the Bureau of Economic Analysis.

3.2 Sample construction

Following Berger and Hannan (1989), I consider a U.S. Metropolitan Statistical Area (MSA) as the relevant banking markets for commercial banks. MSAs are geographic entities that contain a core urban area of 50,000 or more inhabitants and include adjacent counties that have a high degree of social and economic integration with the urban core. Geographic definitions of MSAs are defined by the Office of Management and Budget (OMB). I employ the 2003 definitions of MSAs throughout the sample because the OMB materially improved its geographic definition of an MSA in 2003 by including more information, such as for instance commuting patterns to determine the contours of an economic area. The process of interstate banking deregulation removed barriers to entry at the state level. I apply the dates of interstate banking deregulation to MSAs within each corresponding state to determine when banks located in out-of-state MSAs were allowed to enter another MSA. Several of the 374 MSAs span more than one state and I consider a multi-state MSA m open to entry from banks, located in MSA k if at least one part of MSA m is open to entry from banks located in MSA k due to the removal of interstate banking restrictions.

I only consider commercial banks, headquartered in a MSA in the United States over the period 1976 to 2007. The sample consists of all commercial banks in a MSA on the contiguous United States. I exclude banks that change their headquarters location over the sample period and also drop banks that operate branches in more than one state. Because of their geographic diversification, multi-state banks tend to be safer ((Goetz et al., 2016)) and are also less affected by a removal of interstate banking restrictions in one state. In robustness tests I include additional fixed effects to capture unobservable time-varying factors at a regional level. To ensure that banks are mapped to specific geographic areas, I therefore only include banks that are located in a MSA that does not span more than one state. Consistent with earlier work on banking deregulation I exclude banks headquartered in the states of South Dakota and Delaware. During the sample period, these two states enacted other regulations that had effects on the structure of the banking sector and hence it is not possible to isolate the effect of a removal of entry restrictions on bank stability.

3.3 Variable definitions

3.3.1 Bank risk

Accounting-based risk measure: Z-Score The majority of banks in the U.S. is not publicly traded and hence market-based measures of risk, such as the volatility of returns are not available. I therefore use balance sheet information to assess bank stability. Assuming that bank profits are normally distributed (Roy, 1952), a bank's probability of default can be approximated by Z-Score (Laeven and Levine, 2009):

$$\text{Z-Score} = \frac{\text{Return-on-assets} + \text{Capital-asset-ratio}}{\text{Standard deviation of Return-on-assets}} \tag{1}$$

Z-Score can be interpreted as the number of standard deviations profit can fall before a bank is bankrupt.

Benchmarking: Accounting-based and market-based risk measures Information on return-on-assets (ROA) and the capital-asset-ratio are available from banks' Call Reports. To calculate Z-Score the standard deviation of ROA needs to be estimated using information on a bank's previously reported ROA. All banks need to file Call Reports on a biannual basis, i.e. in June and December of each year and I can use information on these biannual filings to estimate the volatility of ROA. To determine how many previous observations of ROA should enter the estimation of volatility of bank profits, I examine how the accounting-based measure of earnings volatility is related to a market-based measure of risk, particularly the volatility of weekly market returns (Goetz et al., 2016). Hence, I use information on publicly traded U.S. bank holding companies and first compute the standard deviation of weekly market returns over a year for the years 1986 to 2006. Using balance sheet information from the June and December balance sheets, obtained from regulatory bank holding company filings (FR-Y9C), I then compute the standard deviation of ROA, where I estimate the earnings volatility for each bank and year using varying lags of the bank's previous t reports.

For each bank holding company and year I compute a set of accounting-based measures of risk where I use up to the previous t ROAs to estimate the volatility of earnings. In particular, I construct these accounting-based risk measure starting with 3 biannually (= 1.5 years) reported ROAs and going up to 10 biannually (= 5 years) reported ROAs.[4] To mitigate the effect of outliers, I winsorize the accounting and market-based measures of risk and exclude the top and bottom 1 % of these risk measures and take the natural logarithm.

I then examine the pairwise correlation between the accounting-based measures of risk and the market-based measure of risk. Additionally, I regress the market-based measure on risk on the accounting-based risk measure, conditioning on bank holding company and time effects, to assess the explanatory power of the accounting-based risk measures.

Table 2 reports the pairwise correlation coefficient for each of the accounting-based risk measure and the market-based measure as well as the R^2 from the aforementioned regression. The correlation between the accounting-based risk measures and the market-based risk measure ranges between 25 % and 31 %. The highest pairwise correlation between the two types of risk measures appear using an accounting-based risk measure based on ROA from 4 biannual balance sheet filings. Furthermore, I find that an accounting-based risk measure, based on information of 4 biannual ROA has the highest power in explaining market-based risk as indicated by the highest R^2 in the second column of Table 2.

[4]The accounting-based risk measure with the least information is estimated using ROA from 3 filings (current and previous two filings), while the volatility measure with the most information is based on information from up to 10 filings.

Based on this analysis, I use information on ROA from up to a bank's previous 2 years. Hence, I estimate the standard deviation of bank profits for period t using information from the current and the previous 3 filings of biannual ROA for banks in my sample. To mitigate the effect of outliers, I exclude observations below the 1st and above the 99th percentile of the standard deviation of ROA and use the natural logarithm of Z-Score to capture bank risk. Balance sheet information starts becoming available 1976. Because I compute the standard deviation of ROA using information from two years, my sample starts in 1977.

3.3.2 Deregulating entry restrictions

To examine the effect of removing barriers to entry on bank risk, I use several measures based on the deregulation of interstate banking restrictions (Amel, 2000). First, I use the dates of interstate banking deregulation at the state level (Jayaratne and Strahan, 1996) to classify whether a market is characterized as having removed its interstate banking restrictions. These interstate banking deregulation dates have been widely used in the literature on the effects of banking deregulation. Similar to earlier work (e.g. Jayaratne and Strahan, 1996) I construct a dummy variable, taking on the value of one whether a banking market has liberalized its interstate banking restrictions, and zero otherwise.

Although this indicator variable reflects a significant change in a market's interstate banking regulation, it does not reflect the gradual removal of entry barriers (as highlighted earlier in Panel A of Figure 1). Thus, this dummy variable imperfectly captures the impact of interstate banking deregulation on competition. To address this, I propose four variables to isolate how the process of interstate banking deregulation deregulation indeed lowered barriers to entry and thus made banking markets more competitive.

Specifically, I construct a set of four variables similar to Jiang et al. (2016). First, I compute for each MSA a variable capturing the size of out-of-state banking markets that can enter the bank's home banking market where I use the total deposits, held in a MSA to represent the size of a banking market.[5] In particular, I sum deposits across all MSAs that are allowed to enter MSA m to compute the size of potential entrants' banking markets for MSA m. An increase in this variable reflects that the threat of potential entry is larger as the size of markets that can enter increased. I take the natural logarithm of this variable and refer to it as Ln(Size of potential entrant's markets). This variable measures how the deregulation of entry restrictions changes competition as it increases the threat of potential entry. Second, I weight the size of out-of-state banking markets by distance to account for the fact that the competitive effects due to a removal of entry restrictions are larger if potential entrants are closer to a bank's home market.[6] In particular, I weight every out-of-state banking market by the inverse of its distance from the home banking market to construct Ln(Size of potential entrant's markets, allowed to enter - weighted). This variable captures

[5]My results are qualitatively similar if I use a MSA's personal income or total population as a proxy for the size of the banking market. The total deposit amount, however, may reflect the size of the banking market better.

[6]Goetz et al. (2013) find that distance plays an important role in a bank's decision to expand geographically.

for instance that banks, headquartered in San Francisco, CA are more affected when interstate banking deregulation allows banks from Houston, TX to enter San Francisco, CA than if banks from Boston, MA are allowed to enter.[7] For the third variable, I measure a banking market's relative size as I divide the size of all markets, allowed to enter, by the total deposits held in a bank's home market. The competitive pressure from removing entry barriers should be larger if the liberalization of entry restrictions opened up entry for MSAs that are also relatively larger than a bank's home market. For instance, the effect on competition should be stronger for banks located in San Francisco, CA when barriers to entry for banks located in the Dallas-Fort Worth-Arlington, TX metropolitan area are removed than if banks headquartered in Carson City, NV are allowed to enter San Francisco, CA. I refer to this variable as Ln(Multiple of potential entrants' markets, allowed to enter). The fourth measure utilizes the aforementioned weighting scheme and weights the relative share of deposits to compute (Ln(Multiple of potential entrants' markets, allowed to enter - weighted).

3.3.3 Other factors

To account for bank specific effects, I include the ratio of total loans to total assets, the log of total assets, a dummy variable indicating whether the bank is part of a bank holding company, and the capital asset ratio as control variables. These variables are computed from balance sheet information for every bank and year. Moreover, I include

[7] The closest out-of-state MSA receives a weight of one and the farthest MSA a weight of zero. The relative distance between home MSA i and MSA j is then the distance between i and j, divided by the distance between i and the farthest MSAs.

a dummy variable, taking on the value of one whether that bank is geographically diversified and has branches in another banking market. Furthermore, I account for the structure of a local banking market by including the Herfindahl index of concentration of deposits across banks in a market. States also removed their restrictions on intrastate branching, and I account for this by including a dummy variable indicating whether intrastate branching restrictions are removed (Jayaratne and Strahan, 1998). MSA specific business cycle fluctuations are captured by the annual growth of real MSA personal income.

3.4 Sample Characteristics

My sample contains 99,941 bank-year observations of 7,830 commercial banks. The time period ranges from 1978 to 2006 and includes all commercial banks, headquartered in a single-state MSAs of the contiguous United States.

Table 1 reports summary statistics for the sample. The majority of commercial banks in the United States is small and the average bank in my sample has total assets of 197 million \$. The distribution of bank assets in the sample is skewed and the largest bank in my sample has assets of about 73 billion \$. Over the sample period, the average annual ROA for banks in my sample was about 0.8 %, and banks are sufficiently capitalized, indicated by an average capital asset ratio above 9 %.

4 Interstate banking deregulation and bank risk

4.1 Main results

To assess how a change in banking competition due to an increase in the contestability of markets affects bank stability, I estimate the following regression model:

$$ln(Z_{i,m,t}) = \beta C_{m,t} + \mathbf{X'}_{i,m,t}\rho + \delta_i + \delta_t + \varepsilon_{i,m,t} \qquad (2)$$

where $ln(Z_{i,m,t})$ is the natural logarithm of Z-Score of bank i, located in MSA m in year t; $C_{m,t}$ is one of the aforementioned measures on competition for MSA m in year t; $\mathbf{X'}_{i,m,t}$ is a set of bank and macroeconomic control variables, δ_i are bank fixed effects and δ_t are year fixed effects. The coefficient of interest is β which captures how changes in a MSA's competition affects banks' risk. Standard errors are robust and clustered at the bank level.

Table 3 reports OLS regression results from estimating equation (2). I begin the analysis by using the dates of interstate banking deregulation, provided by Jayaratne and Strahan (1998). Particularly, I include a dummy variable taking on the value of one, whether MSA m has removed its interstate banking restrictions, or zero otherwise. Regression results in column (1) indicate that the liberalization of interstate banking restrictions is associated with an increase in bank stability as reflected by the positive and significant coefficient on the interstate banking dummy. This effect also holds after I add further control variables to account for differences across banks and macroeconomic conditions in column (2).

As mentioned earlier, the process of interstate banking deregulation often led to a gradual removal of entry barriers. Moreover, the liberalization of entry restrictions may have different effects on the local banking competition and risk if potential entrants are located further away. To examine this, I use my aforementioned four variables of market contestability. In column (3), I replace the interstate banking deregulation dummy with the natural logarithm of the size of potential entrants' markets, measured by deposits.[8] Results in column (3) indicate that banks become safer when the size of potential entrants' markets increases because barriers to entry decrease. This variable does, however, not account for the fact that potential entrants may come from markets that are further away. Consider for instance, banks headquartered in Boston, MA: due to geographic proximity a removal of entry restrictions for banks located in Chicago, IL may have a weaker effect on competition in Boston, MA than a removal of entry restriction for banks located in New York, NY. Hence, in column (4) I weight the size of potential entrants' markets by the inverse of the distance to a bank's home market and use this variable as a measure of competition. As before, I find that an increase in the threat of entry is associated with an increase in bank stability. In column (5) I consider the relative measure of potential entrants' market size and divide it by the total deposits of a bank's home market. This variable captures relative differences between a bank's home market and the size of all banking markets that can enter that MSA now. Similar to before, my results indicate that an increase in competition is

[8]Results are qualitatively similar if I use personal income or population to measure the size of a banking market (Table A3 - appendix).

associated with an increase in bank stability. Finally in column (6) I weight the relative size of potential entrants' markets and again find a positive effect of removing entry barriers on stability.

Across all measures of market competition I find that the removal of entry restrictions leads to an increase in bank stability. Moreover, the economic magnitudes are also sizeable. Considering the coefficient in column (6) of Table 3 I find that a one standard deviation increase in the relative size of potential entrants' markets increases a bank's Z-Score by about 5 % of its sample standard deviation. Using information on bank failures in a logit regressions, I compute that a one standard deviation in Z-Score lowers a bank's failure probability by about 1 % (column (5) from Table A1 in the appendix). Thus a one standard deviation increase in the relative size of potential entrants' markets reduces the failure probability of a bank by 5 bp. The annual probability of failure during the sample period is 50 bp as on average 5 out of a thousand banks fail each year. Hence, a one standard deviation increase in the relative size of potential entrants' markets (column (6) from Table 2) reduces the average annual failure probability by 10 %.

In the analysis in Table 3 I include a set of bank and macroeconomic control variables to account for the influence of observable characteristics on risk. Unobservable changes in the level of bank competition at the national level over the sample period are absorbed in the time fixed effects. These fixed effects, however, do not capture unobservable changes in competition at the state level, which may also affect bank risk. For instance, factors, such as the performance of a state's real sector or a state's business cycle affects bank competition, but these factors are not accounted for. I now extend the empirical model and allow the unobservable time effects to vary at the state level. In particular, regression model (2) becomes:

$$ln(Z_{i,m,t}) = \beta C_{m,t} + \mathbf{X'}_{i,m,t}\rho + \delta_i + \delta_{s,t} + \varepsilon_{i,m,t} \tag{3}$$

where $ln(Z_{i,m,t})$ is the natural logarithm of Z-Score of bank i, located in MSA m in year t; $C_{m,t}$ is one of the aforementioned measures of competition for market m during year t; $\delta_{s,t}$ are a set of state specific time dummies that capture unobservable changes in bank stability at the state level.[9] Regression results from estimating model (3) are presented in Table 4. Results, reported in columns (1) to (4) confirm the earlier findings: reducing barriers to entry for banks from other banking markets leads to an increase in bank stability even after accounting for unobservable, time-varying differences.[10] Moreover, this finding is not sensitive to the employed measure of a removal of interstate banking restrictions as the coefficient on the employed measure of removing entry restrictions is highly significant across all variables.

[9]The earlier employed dummy variable based on the removal of interstate banking restrictions at the state level does not vary within a state. Since this dummy variable is explained by the state-year fixed effects I cannot identify the effect of a liberlization of interstate banking restrictions on risk any more when I add state-year fixed effects.

[10]The results are also robust when I capture time-varying changes at the MSA-level by including a linear time-trend at the MSA-level (see Table A2 - Appendix).

4.2 Dynamic effects of removing entry barriers

The OLS results indicate that the removal of entry barriers is associated with an increase in bank stability. I now examine the dynamic effects of removing entry barriers on bank stability by analyzing the evolution of Z-Score prior and after the removal of entry barriers. Since the process of deregulation mostly led to a gradual removal of entry barriers, I focus on banks, headquartered in one of the 12 states that unilaterally removed barriers to entry.[11] Restricting attention to banks headquartered in one of those states allows me to isolate the effect of a large increase in banking market competition on stability. To examine the dynamic effect of a unilateral removal of entry restrictions on bank risk I estimate the following equation:

$$ln(Z_{i,m,t}) = \sum_{p=-10}^{10} \alpha_p Y_{p,s,t} + \mathbf{X'}_{i,m,t}\rho + \delta_i + \delta_t + \varepsilon_{i,m,t}, \quad (4)$$

where $ln(Z_{i,m,t})$ is the natural logarithm of Z-Score of bank i, located in MSA m in year t; $Y_{p,s,t}$ is a dummy variable that takes on the value of one if in year t, state s unilaterally removed its interstate banking restrictions in p years. Consider the state of Texas (TX) as an example. Texas unilaterally removed barriers to entry in 1987 and hence $D_{-1,TX}$ is equal to one only in 1986 and zero otherwise. Similarly, $D_{1,TX}$ is equal to one in 1988 and zero otherwise. I include dummy variables to capture the effects of more than 10 years before or 10 years after deregulation. Hence, $D_{10,s}$ is equal to one for state s for all years that are at least 10 years after the removal of entry

[11]These states are: AZ, CO, ID, ME, NH, NM, NV, OK, OR, TX, UT, WY.

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

Figure 2 plots the estimated coefficients α_p as well as the 95% confidence interval for the coefficients obtained from estimating regression model (4). The dynamic pattern in Figure 2 shows that Z-Score did not change prior to the removal of entry barriers. Once a banking market experiences a shock to competition banks becomes safer as indicated by the constant increase in Z-Score following the removal of all entry barriers for out-of-state banks. This pattern suggests that the increase in competition due to the removal of entry restrictions significantly improves bank stability.

4.3 Additional Robustness Tests

4.3.1 Exclude period after Riegle-Neal Act

My main variables of interest are based on the removal of entry barriers due to the state-specific pattern of interstate banking deregulation. The Riegle-Neal Act of 1994 removed all remaining impediments to interstate banking by 1994 and thus there is no large change to bank competition due to a removal of entry barriers after 1994. To examine whether my results also hold if I restrict attention to the period where interstate banking deregulation led to exogenous changes in competition, I now focus on the period 1978 to 1994.

Regression results from this subsample are reported in Panel A of Table 5. Similar to before, I find that an increase in competition due to the removal of entry restrictions leads to a significant increase in bank stability. The coefficients are of similar magnitude when comparing them to the estimates from the full sample period (Table 3). This suggests that my results are not driven by changes in the independent variables, stemming from the period after the Riegle-Neal Act.

4.3.2 Autocorrelation in the dependent variable

By construction, Z-Score is correlated over time since I use information from up to four biannual ROAs to estimate the volatility of ROA. Hence, Z-Score in year t uses information on profits that are also used for the computation of Z-Score at year $t-1$. To examine whether my results are driven by this autocorrelation, I reconstruct the data and remove all correlation in the dependent variable. Particularly, I define distinct, non-overlapping time periods for each bank over which I compute the volatility of profits. I then compute the average values of all variables in my analysis and use average ROA and capital-asset ratio to compute Z-Score for each of these time periods. This ensures that Z-Score is not correlated over time by construction as information, used to compute the volatility of profits for a period t, is not used in any other period.

In Panel B of Table 5 I present results examining the link between competition and stability using this sample. Similar to before, I find that an increase in competition due to a removal of entry barriers increases bank stability. This suggests that my results are not driven by autocorrelation in the dependent variable.

4.3.3 Mergers & Acquisitions and Diversification

During the sample period, several banks disappear because they fail, get acquired or merge with other institutions. Mergers and/or acquisitions lead to a re-evaluation of balance sheets, affecting my measurement of stability. To examine whether my findings are affected by mergers and/or acquisitions over the sample period, I exlude observations up to one year after an acquisition or merger.[12] Results from this sample are presented in Panel A of Table 6. The regression results indicate that the removal of entry barriers has a positive and statistically strong effect on bank stability even when I consider this subsample. Hence, my findings are robust to the influence of mergers and acquisitions and I find that removing barriers to entry increases bank stability.

Earlier work found that a bank's geographic diversification affects its risk (Deng and Elyasiani, 2008; Goetz et al., 2016). In my sample I only focus on banks that are active within one state and do not include banks that are diversified across states. Geographic diversification across banking markets within the same state however may also affect bank risk. Moreover, geographically diversified banks may react differently to the removal of entry barriers and thus exhibit a different effect of changes in competition on their stability.

To see whether my finding is affected by a bank's geographic diversification, I restrict attention to banks that are active in only one banking market. Using this subsample, I then examine the link between competition and bank stability again.

[12] The volatility of ROA in year t is computed over the current and previous year and I exclude bank-year observations if there was a merger and/or acquisition in the current or previous year.

Results are presented in Panel B of Table 6 and indicate that my finding is not sensitive to banks' geographic diversification. Overall I find that removing entry barriers leads to higher bank stability and this results is not sensitive to the employed measure of a removal of entry barriers.

5 Competition, Profitability and Loan Performance

My findings are not consistent with theories arguing that greater competition increases bank fragility (Keeley, 1990), but support theories that argue that greater competition increases bank stability (Boyd and de Nicolo, 2005).

An important channel through which banks can improve stability is by increasing their asset quality. Particularly, banks may increase their monitoring effort and thus improve their loan portfolio return (Diamond, 1984; Wagner, 2010; Allen et al., 2011). Examining, how the removal of entry restrictions are associated with Italian bank's loan portfolio, Guiso et al. (2006) find that banks' loan performance decreases after the liberalization of entry restrictions. To assess whether banks improve their asset quality once banking markets become more contestable, I use information from banks' balance sheets and compute the share of banks' nonperforming loans in their loan portfolio. Then I examine how the removal of entry barriers affects the share of banks' nonperforming loans in their loan portfolio.

Results are reported in Table 7 and indicate that a bank's asset quality improves once the threat of entry increases. Regression results in columns (1) to (4) show that improving competition by reducing entry barriers significantly decreases the share of nonperforming loans. This result is consistent across all measures of competition as indicated by the negative and statistically significant coefficients. Moreover, since I control for bank and state-year fixed effects, the results show that increasing competition leads to an increase in a bank's loan portfolio even when I condition on unobservable factors, such as changes in a state's economic performance.

The economic magnitudes are also large. Increasing the relative size of banking markets (column (4) of Table 7) by one standard deviation reduces a bank's share of non-performing loans by about 22 basis points, or about 10 % of its sample standard deviation. Due to data limitations I cannot observe changes in a bank's loan portfolio at a more granular level. Thus, I cannot examine whether a bank's borrowers become safer because banks improve their selection mechanism or whether banks increase their monitoring of borrowers. My findings however show that banks increase their asset quality when competition increases.

Additionally, I examine how an increase in competition affects bank profitability. Examining the deregulation of interstate banking restrictions, Stiroh and Strahan (2003) find that the liberalization of banking restrictions made the banking system more efficient and more efficient banks gain market share and profitability. Considering banks' annual ROA, I find that increasing competition also increases the profitability of banks (columns (5) to (8) in Table 7). Across all my measures of competition, I find that a bank's ROA increases when markets become more contestable.

Z-Score is based on a bank's ROA as well as the volatility of ROA. The rise in profitability when markets become more competitive thus contributes to the increase in bank stability. To examine whether a bank's profit also becomes less volatile when competition increases and thus contribute to a safer bank, I now analyse how the standard deviation of ROA changes when the threat of entry increases. Regression results in columns (9) to (12) of Table 7 show that banks experience less volatile ROA once competition intesifies as the threat of entry increases. This reduction in earnings volatility thus also contributes to an increase in bank stability when markets become more competitive.

Overall these findings suggest that greater competition (a) increases the profitability of banks, (b) lowers the volatility of bank profits, and (c) leads to an increase in the asset quality of banks. Thus, greater competition makes banks more stable and provides incentives for banks to improve their loan performance.

6 Conclusion

I examine how an increase in competition due to the removal of entry barriers affects bank stability. To this end, I use information on U.S. commercial banks' stability and exploit how the process of interstate banking deregulation gradually lifted entry barriers for banks from other banking markets. Focusing on how the process of interstate banking deregulation affects potential entry and market contestability is important because interstate banking deregulation also allowed banks to diversify geographically, reducing bank risk (Goetz et al., 2016).

I find that reducing barriers to entry increases bank stability significantly. This result is also robust to several subsamples as well as the inclusion of additional fixed effects, capturing market specific unobservable factors. Because a lowering entry barriers makes markets more contestable and hence increases competition, this finding supports theories that greater competition increases bank stability (Boyd and de Nicolo, 2005) and is not consistent with theories arguing that greater competition leads to greater bank fragility (Keeley, 1990).

Examining how an increase in competition affects a bank's profitability and loan performance, I find that more competition boosts a bank's profits and leads to a reduction in a bank's share of nonperforming loans. This is consistent with the notion that an increase in competition increases loan monitoring and may contribute to the overall finding that greater competition improves bank stability.

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Tables

Table 1: Summary statistics

This table reports descriptive statistics of variables, used in the analysis. The sample covers U.S. commercial banks, headquartered in a single-state county. The time period spans 1977 to 2006. 'Ln(Z-Score)' is the natural logarithm of(Return-on-Assets + Capital-Asset-Ratio)/Standard Deviation of Return-on-Assets. 'Return-on-Assets (%)' is a bank's annual return on assets; 'Loan Losses / Total Loans (%)' is the share (%) of loan losses in a bank's loan portfolio; 'Loan Loss Provisions / Total Loans' is the share (%) of a bank's loan loss provisions in its total loans; 'Loan Interest Rate' is Fee and Interest income on loans divided by total loans and reported in percentages; 'Capital-Asset-Ratio' is the ratio of bank capital to total assets; 'Total Loans / Total Assets' is the ratio of Total Loans to Total Assets, 'Total Assets' is a bank's total assets in million $; 'BHC Indicator' is a dummy variable taking on the value of one whether the bank is part of a BHC; 'Diversification Indicator' is an indicator whether a bank has branches in more than one banking market; 'Intrastate Branching Dummy' is an indicator, taking on the value of one whether a state has removed its intrastate branching restrictions; 'Real Personal Income Growth Rate' is the growth rate of a state's real personal income; 'Herfindahl Index in MSA' is the Hirschmann-Herfindahl Index of bank assets in a MSA.
'Interstate banking Dummy' is a dummy variable taking on the value of one whether a state removed its interstate banking restrictions, or zero otherwise; 'Ln(Size of potential entrants' markets)' is the natural logarithm of the sum of deposits, held in all banking markets that are allowed to enter a bank's home market; 'Ln(Size of potential entrants' markets - weighted)' weights deposits held in markets that are allowed to enter a bank's home market by distance'; 'Ln('Multiple of potentail entrants' markets)' is the natural logarithm of 'Size of potential entrants' markets' divided by total deposits held in a bank's home market; 'Ln(Multiple of potential entrants' markets, weighted)' is 'Size of potential entrants, weighted' scaled by the total deposits, held in a bank's home market.

	N	Mean	St.Dev.	Min	Max	Median
Ln(Z-Score) * 100	100,398	415.16	93.47	25.20	700.59	420.44
Nonperforming Loans / Total Loans (%)	81,480	1.52	1.88	0.00	12.26	0.87
Loan Loss Provisions/ Total Loans (%)	112,130	0.67	0.92	0.00	7.48	0.38
Loan Losses / Equity (%)	115,308	9.25	6.93	0.00	67.61	7.89
Return-on-Assets (%)	113,914	0.84	0.82	-4.04	2.75	0.96
Capital-Asset-Ratio	115,693	8.98	3.11	3.27	28.08	8.28
Total Loans / Total Assets (%)	115,693	57.52	14.53	0.00	100.00	58.80
Total Assets (in million $)	115,693	197	1,255	0	72,967	53
BHC Indicator	115,693	0.60	0.49	0	1	1
Diversification Indicator	115,693	0.16	0.37	0	1	0
Intrastate Branching Dummy	115,693	0.54	0.50	0	1	1
Real Personal Income Growth Rate	115,693	2.79	3.02	-13.28	19.70	2.80
Herfindahl Index in MSA	115,693	0.10	0.05	0.00	0.80	0.09
Interstate Banking Deregulation Dummy	115,693	0.52	0.50	0	1	1
Ln(Size of potential entrants' markets)	115,693	18.27	3.40	9.91	22.30	19.32
Ln(Size of potential entrants' markets, weighted)	115,693	17.96	3.11	9.91	21.91	19.18
Ln(Multiple of potential entrants' markets)	115,693	3.10	3.03	0.00	9.56	3.42
Ln(Multiple of potential entrants' markets, weighted)	115,693	2.79	2.76	0.00	9.13	2.97

Table 2: Relationship between volatility of profits and volatility of stock returns

This table uses information on publicy traded U.S. bank holding companies and reports the pairwise correlation coefficient between the standard deviation of ROA, estimated using semi-annual balance sheet reports and the reports pairwise coefficient coefficients between the natural logarithm of the standard deviation of ROA, obtained from balance sheet information and the natural logarithm of weekly market returns. The sample period ranges from 1986 to 2006. The standard deviation of reported profits utilizes informatin from the previous t balance sheets as reported in the table. R2 is the R2 of a bank and time fixed effects regression of the logarithm of weekly stock returns on the logarithm of the standard deviation of accounting profits.

	Pairwise correlation coefficient	R2
Accounting-based measure of risk based on information from ...		
3 biannual filings	0.289	0.472
4 biannual filings	0.307	0.473
5 biannual filings	0.303	0.470
6 biannual filings	0.297	0.466
7 biannual filings	0.283	0.465
8 biannual filings	0.282	0.462
9 biannual filings	0.257	0.457
10 biannual filings	0.249	0.455

Table 3: Removing entry restrictions and bank stability

This table reports results from an OLS regression at the bank level over the years 1977 - 2006. The dependent variable is the natural logarithm of Z-Score and is defined as (Return-on-Assets + Capital-Asset-Ratio)/Standard Deviation of Return-on-Assets. For illustrative purposes the coefficients are multiplied by 100. 'Interstate banking Dummy' is a dummy variable taking on the value of one whether a state removed its interstate banking restrictions, or zero otherwise; 'Ln(Size of potential entrants' markets)' is the natural logarithm of the sum of deposits, held in all banking markets that are allowed to enter a bank's home market; 'Ln(Size of potential entrants' markets - weighted)' weights deposits held in markets that are allowed to enter a bank's home market by distance'; 'Ln('Multiple of potential entrants' markets)' is the natural logarithm of 'Size of potential entrants' markets' divided by total deposits held in a bank's home market; 'Ln(Multiple of potential entrants' markets, weighted)' is 'Size of potential entrants, weighted' scaled by the total deposits, held in a bank's home market. 'Intrastate Branching Dummy' is an indicator, taking on the value of one whether a state has removed its intrastate branching restrictions; 'Diversification Indicator' is an indicator whether a bank has branches in more than one banking market; 'BHC Indicator' is a dummy variable taking on the value of one whether the bank is part of a BHC; 'Capital-Asset-Ratio' is the ratio of bank capital to total assets; 'Total Loans / Total Assets' is the ratio of Total Loans to Total Assets, 'ln(Total Assets)' is the natural logarithm of bank assets; 'Real Personal Income Growth Rate' is the growth rate of a state's real personal income; 'Herfindahl Index in MSA' is the Hirschmann-Herfindahl Index of bank assets in a MSA. All regressions include bank fixed effects and year fixed effects. Standard errors are clustered at the bank level, and reported in in parentheses. *, **, *** mean significance at ten, five, and one percent, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Interstate Banking Dummy	10.673***	5.563***				
	(2.020)	(1.895)				
Ln(Size of potential entrants' markets)			0.665*			
			(0.368)			
Ln(Size of potential entrants' markets, weighted)				1.490***		
				(0.399)		
Ln(Multiple of potential entrants' markets)					0.767**	
					(0.367)	
Ln(Multiple of potential entrants' markets, weighted)						1.619***
						(0.398)
Intrastate Branching Dummy		10.975***	11.072***	10.836***	10.980***	10.680***
		(1.643)	(1.649)	(1.647)	(1.652)	(1.650)
Diversification Indicator		-12.588***	-12.677***	-12.877***	-12.741***	-12.992***
		(2.461)	(2.458)	(2.456)	(2.459)	(2.457)
BHC Indicator		8.880***	8.832***	8.744***	8.838***	8.757***
		(1.399)	(1.398)	(1.397)	(1.398)	(1.397)
Capital-Asset-Ratio		10.019***	10.019***	10.009***	10.023***	10.016***
		(0.241)	(0.241)	(0.240)	(0.241)	(0.240)
Total Loans / Total Assets		0.075*	0.075*	0.069	0.076*	0.073*
		(0.043)	(0.043)	(0.043)	(0.043)	(0.043)
ln(Total Assets)		27.723***	27.806***	27.844***	27.903***	28.044***
		(1.451)	(1.450)	(1.449)	(1.449)	(1.448)
Real Personal Income Growth Rate		2.476***	2.508***	2.483***	2.508***	2.483***
		(0.141)	(0.141)	(0.141)	(0.141)	(0.141)
Herfindahl Index in MSA		15.757	18.929	21.247	19.888	22.961
		(15.430)	(15.399)	(15.399)	(15.408)	(15.403)
Bank Fixed Effects	x	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x	x
Observations	99,941	99,906	99,906	99,906	99,906	99,906
R-squared	0.428	0.464	0.464	0.464	0.464	0.464

Table 4: Removing entry restrictions and stability - Additional fixed effcts

This table reports results from an OLS regression at the bank level over the years 1977 - 2006. The dependent variable is the natural logarithm of Z-Score and is defined as (Return-on-Assets + Capital-Asset-Ratio)/Standard Deviation of Return-on-Assets. For illustrative purposes the coefficients are multiplied by 100. 'Ln(Size of potential entrants' markets)' is the natural logarithm of the sum of deposits, held in all banking markets that are allowed to enter a bank's home market; 'Ln(Size of potential entrants' markets - weighted)' weights deposits held in markets that are allowed to enter a bank's home market by distance'; 'Ln('Multiple of potential entrants' markets)' is the natural logarithm of 'Size of potential entrants' markets' divided by total deposits held in a bank's home market; 'Ln(Multiple of potential entrants' markets, weighted)' is 'Size of potential entrants, weighted' scaled by the total deposits, held in a bank's home market. All regressions include bank control variables (see Table 2), bank fixed effects and state-year fixed effects. Standard errors are clustered at the bank level, and reported in in parentheses. *, **, *** mean significance at ten, five, and one percent, respectively.

	(1)	(2)	(3)	(4)
Ln(Size of potential entrants' markets)	2.722***			
	(0.961)			
Ln(Size of potential entrants' markets, weighted)		2.727***		
		(0.967)		
Ln(Multiple of potential entrants' markets)			2.556***	
			(0.964)	
Ln(Multiple of potential entrants' markets, weighted)				2.558***
				(0.971)
Bank and Macro Controls	x	x	x	x
Bank Fixed Effects	x	x	x	x
State-Year Fixed Effects	x	x	x	x
Observations	99,900	99,900	99,900	99,900
R-squared	0.490	0.490	0.490	0.490

Table 5: Removing entry restrictions and stability - Subsamples

This table reports results from an OLS regression at the bank level. The sample in Panel A (columns (1) to (4)) ranges from 1977 to 1994. The sample in Panel B (columns (5) to (8)) aggregates the data based on non-overlapping periods of two years. The dependent variable is the natural logarithm of Z-Score and is defined as (Return-on-Assets + Capital-Asset-Ratio)/Standard Deviation of Return-on-Assets. For illustrative purposes the coefficients are multiplied by 100. 'Ln(Size of potential entrants' markets)' is the natural logarithm of the sum of deposits, held in all banking markets that are allowed to enter a bank's home market; 'Ln(Size of potential entrants' markets - weighted)' weights deposits held in markets that are allowed to enter a bank's home market by distance'; 'Ln('Multiple of potential entrants' markets)' is the natural logarithm of 'Size of potential entrants' markets' divided by total deposits held in a bank's home market; 'Ln(Multiple of potential entrants' markets, weighted)' is 'Size of potential entrants, weighted' scaled by the total deposits, held in a bank's home market. All regressions include bank control variables (see Table 2), bank fixed effects, state-year fixed effects. Standard errors are clustered at the bank level, and reported in in parentheses. *, **, *** mean significance at ten, five, and one percent, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A: Sample period 1980 - 1994				Panel B: Non-overlapping periods			
Ln(Size of potential entrants' markets)	2.385**				4.396***			
	(1.023)				(1.159)			
Ln(Size of potential entrants' markets, weighted)		2.408**				4.282***		
		(1.031)				(1.179)		
Ln(Multiple of potential entrants' markets)			2.397**				4.153***	
			(1.039)				(1.169)	
Ln(Multiple of potential entrants' markets, weighted)				2.422**				4.027***
				(1.047)				(1.188)
Bank and Macro Controls	x	x	x	x	x	x	x	x
Bank Fixed Effects	x	x	x	x	x	x	x	x
State-Year Fixed Effects	x	x	x	x	x	x	x	x
Observations	70,083	70,083	70,083	70,083	45,666	45,666	45,666	45,666
R-squared	0.499	0.499	0.499	0.499	0.482	0.482	0.482	0.482

Table 6: Removing entry restrictions and stability - Exclude M&A and diversified banks

This table reports results from an OLS regression at the bank level. The sample in Panel A (columns (1) to (4)) excludes bank-year observations up to four years after a merger/and or acquistion. The sample in Panel B (columns (5) to (8) excludes banks with branches in more than one banking markets. The sample period ranges from 1977 to 2006. The dependent variable is the natural logarithm of Z-Score and is defined as (Return-on-Assets + Capital-Asset-Ratio)/Standard Deviation of Return-on-Assets. For illustrative purposes the coefficients are multiplied by 100. 'Ln(Size of potential entrants' markets)' is the natural logarithm of the sum of deposits, held in all banking markets that are allowed to enter a bank's home market; 'Ln(Size of potential entrants' markets - weighted)' weights deposits held in markets that are allowed to enter a bank's home market by distance'; 'Ln('Multiple of potential entrants' markets)' is the natural logarithm of 'Size of potential entrants' markets' divided by total deposits held in a bank's home market; 'Ln(Multiple of potential entrants' markets, weighted)' is 'Size of potential entrants, weighted' scaled by the total deposits, held in a bank's home market. All regressions include bank control variables (see Table 2), bank fixed effects, state-year fixed effects. Standard errors are clustered at the bank level, and reported in in parentheses. *, **, *** mean significance at ten, five, and one percent, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A: Exclude up to two years after M&A				Panel B: Exclude geographically diversified banks			
Ln(Size of potential entrants' markets)	2.652***				3.927***			
	(0.950)				(0.977)			
Ln(Size of potential entrants' markets, weighted)		2.651***				3.917***		
		(0.957)				(0.984)		
Ln(Multiple of potential entrants' markets)			2.528***				3.987***	
			(0.951)				(0.981)	
Ln(Multiple of potential entrants' markets, weighted)				2.525***				3.978***
				(0.959)				(0.989)
Bank and Macro Controls	x	x	x	x	x	x	x	x
Bank Fixed Effects	x	x	x	x	x	x	x	x
State-Year Fixed Effects	x	x	x	x	x	x	x	x
Observations	98,418	98,418	98,418	98,418	83,431	83,431	83,431	83,431
R-squared	0.495	0.495	0.494	0.494	0.498	0.498	0.498	0.498

Table 7: Removing entry restrictions and loan performance, profitability and volatility of profits

This table reports results from an OLS regression at the bank level and ranges from 1977 to 2006. The dependent variable is given in the first row: 'Nonperforming Loans / Total Loans' is the share (%) of a bank's nonperforming loans it is loan portfolio; 'Return-on-asset' is the annual return on assets (ROA); 'Standard deviation of Return on assets' is the standard deviation of ROA using semi-annual balance sheet information from the current and previous year. 'Ln(Size of potential entrants' markets)' is the natural logarithm of the sum of deposits, held in all banking markets that are allowed to enter a bank's home market; 'Ln(Size of potential entrants' markets - weighted)' weights deposits held in markets that are allowed to enter a bank's home market by distance'; 'Ln('Multiple of potentail entrants' markets)' is the natural logarithm of 'Size of potential entrants' markets' divided by total deposits held in a bank's home market; 'Ln(Multiple of potential entrants' markets, weighted)' is 'Size of potential entrants, weighted' scaled by the total deposits, held in a bank's home market. All regressions include bank control variables (see Table 2), bank fixed effects, state-year fixed effects. Standard errors are clustered at the bank level, and reported in in parentheses. *, **, *** mean significance at ten, five, and one percent, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Nonperforming Loans / Total Loans (%)				Return-on-assets (%)				Standard Deviation of Return-on-assets			
Ln(Size of potential entrants' markets)	-0.071***				0.023***				-0.654***			
	(0.023)				(0.007)				(0.211)			
Ln(Size of potential entrants' markets, weighted)		-0.071***				0.023***				-0.653***		
		(0.023)				(0.007)				(0.213)		
Ln(Multiple of potential entrants' markets)			-0.066***				0.025***				-0.624***	
			(0.023)				(0.007)				(0.210)	
Ln(Multiple of potential entrants' markets, weighted)				-0.066***				0.025***				-0.623***
				(0.023)				(0.007)				(0.211)
Bank and Macro Controls	x	x	x	x	x	x	x	x	x	x	x	x
Bank Fixed Effects	x	x	x	x	x	x	x	x	x	x	x	x
State-Year Fixed Effects	x	x	x	x	x	x	x	x	x	x	x	x
Observations	72,789	72,789	72,789	72,789	99,703	99,703	99,703	99,703	99,900	99,900	99,900	99,900
R-squared	0.497	0.497	0.497	0.497	0.524	0.524	0.524	0.524	0.412	0.412	0.412	0.412

Table A1: Failure and Z-Score

This table reports average marginal effects of a logit regression. The dependent variable is a dummy variable taking on the value of one whether the bank fails within the next two years. LN(Z-Score) is the natural logarithm of Z-Score, defined as (Return-on-Assets + Capital-Asset-Ratio)/(Standard Deviation of Return-on-Assets). All regressions include fixed effects as indicated. Standard errors are clustered at the bank level, and reported in in parentheses. *, **, *** mean significance at ten, five, and one percent, respectively.

	(1)	(2)	(3)	(4)	(5)
LN(Z-Score)	-1.597***	-1.351***	-1.209***	-1.212***	-1.028***
	(0.044)	(0.046)	(0.055)	(0.058)	(0.060)
Year Fixed Effects		x	x		x
MSA Fixed Effects				x	x
Bank and Macro Controls			x	x	x
Observations	100,433	88,668	88,634	62,882	55,824

Table A2: Removing entry restrictions and stability - MSA time trends

This table reports results from an OLS regression at the bank level over the years 1977 - 2006. The dependent variable is the natural logarithm of Z-Score and is defined as (Return-on-Assets + Capital-Asset-Ratio)/Standard Deviation of Return-on-Assets. For illustrative purposes the coefficients are multiplied by 100. 'Ln(Size of potential entrants' markets)' is the natural logarithm of the sum of deposits, held in all banking markets that are allowed to enter a bank's home market; 'Ln(Size of potential entrants' markets - weighted)' weights deposits held in markets that are allowed to enter a bank's home market by distance'; 'Ln('Multiple of potentail entrants' markets)' is the natural logarithm of 'Size of potential entrants' markets' divided by total deposits held in a bank's home market; 'Ln(Multiple of potential entrants' markets, weighted)' is 'Size of potential entrants, weighted' scaled by the total deposits, held in a bank's home market. All regressions include bank control variables (see Table 2), bank fixed effects and time fixed effects as indicated. Standard errors are clustered at the bank level, and reported in in parentheses. *, **, *** mean significance at ten, five, and one percent, respectively.

	(1)	(2)	(3)	(4)
Ln(Size of potential entrants' markets)	2.908**			
	(1.214)			
Ln(Size of potential entrants' markets, weighted)		2.928**		
		(1.225)		
Ln(Multiple of potential entrants' markets)			2.998**	
			(1.226)	
Ln(Multiple of potential entrants' markets, weighted)				3.021**
				(1.237)
Bank and Macro Controls	x	x	x	x
Bank Fixed Effects	x	x	x	x
State-Year Fixed Effects	x	x	x	x
Linear MSA time trend	x	x	x	x
Observations	99,900	99,900	99,900	99,900
R-squared	0.497	0.497	0.497	0.497

Table A3: Banking market contestability and risk - Alternative definitions

This table reports results from an OLS regression at the bank level over the years 1977 - 2006. The dependent variable is the natural logarithm of Z-Score and is defined as (Return-on-Assets + Capital-Asset-Ratio)/Standard Deviation of Return-on-Assets. For illustrative purposes the coefficients are multiplied by 100. 'Ln(Size of potential entrants' markets)' is the natural logarithm of the sum of deposits, held in all banking markets that are allowed to enter a bank's home market; 'Ln(Size of potential entrants' markets - weighted)' weights deposits held in markets that are allowed to enter a bank's home market by distance'; 'Ln('Multiple of potentail entrants' markets)' is the natural logarithm of 'Size of potential entrants' markets' divided by total deposits held in a bank's home market; 'Ln(Multiple of potential entrants' markets, weighted)' is 'Size of potential entrants, weighted' scaled by the total deposits, held in a bank's home market. All regressions include bank control variables (see Table 2), bank fixed effects and time fixed effects as indicated. Standard errors are clustered at the bank level, and reported in in parentheses. *, **, *** mean significance at ten, five, and one percent, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Personal Income					Population	
Ln(Size of potential entrants' markets)	3.015***				3.118***			
	(0.986)				(1.083)			
Ln(Size of potential entrants' markets, weighted)		3.024***				3.126***		
		(0.991)				(1.090)		
Ln(Multiple of potential entrants' markets)			2.760***				2.984***	
			(0.969)				(1.062)	
Ln(Multiple of potential entrants' markets, weighted)				2.763***				2.990***
				(0.975)				(1.068)
Bank and Macro Controls	x	x	x	x	x	x	x	x
Bank Fixed Effects	x	x	x	x	x	x	x	x
State-Year Fixed Effects	x	x	x	x	x	x	x	x
Observations	99,900	99,900	99,900	99,900	99,900	99,900	99,900	99,900
R-squared	0.490	0.490	0.490	0.490	0.490	0.490	0.490	0.490

Figures

Figure 1: Patterns of removing entry barriers

This figure displays how the process of interstate banking deregulation removed entry for out-of-state banks into Texas (Panel a) and Florida (b).

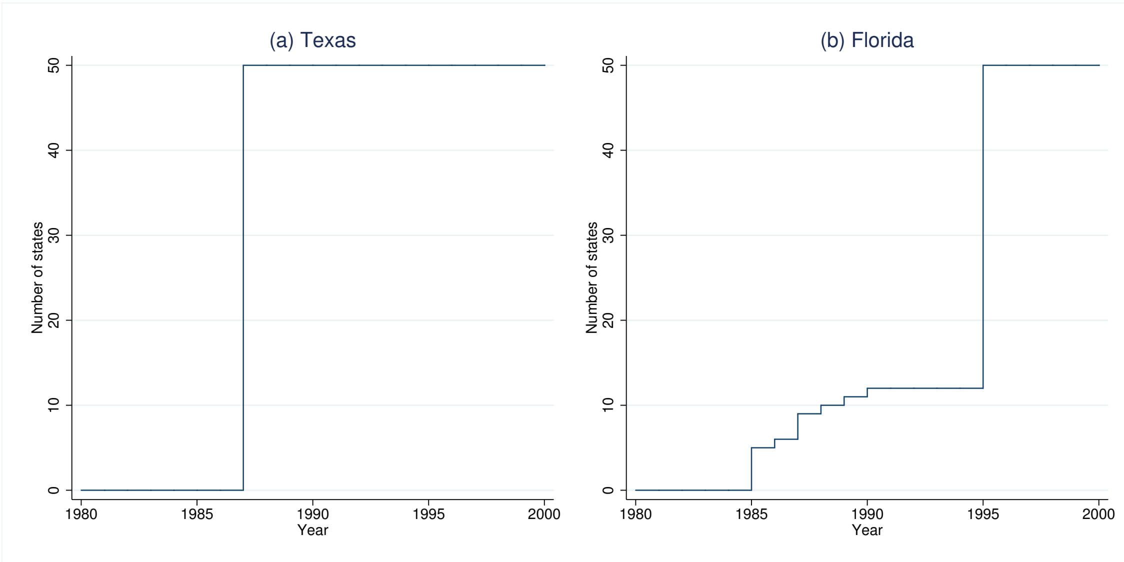

Figure 2: Dynamic effects of removing a removing entry restrictions on bank risk

This figure plots coefficients α_p from the following regression model:

$$R_{i,m,t} = \sum_{p=-10}^{10} \alpha_p Y_{p,s,t} + \mathbf{X'}_{i,m,t}\rho + \delta_i + \delta_t + \varepsilon_{i,m,t},$$

where $R_{i,m,t}$ is the natural logarithm of bank i's Z-Score in year t; $Y_{p,s,t}$ is a dummy variable that takes on the value of one if in year t, state s unilaterally removed its interstate banking restrictions in p years. The effect on bank risk in the year of a removal of entry restrictions is dropped due to collinearity from the analysis. Dashed lines indicate 95%-confidence intervals. The sample consists of banks headquartered in a state that unilaterally removes entry restrictions.

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