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ABSTRACT

Although policymakers often discuss tradeoffs between bank competition and stability, past research provides differing theoretical perspectives and empirical results on the impact of competition on risk. In this paper, we employ a new approach for identifying exogenous changes in the competitive pressures facing individual banks and discover that an intensification of competition materially boosts bank risk. With respect to the mechanisms, we find that competition reduces bank profits, charter values, and relationship lending and increases banks' provision of nontraditional banking services.

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Many policymakers seem to think that some curbs on competition may be a price worth paying to improve stability.
(The Economist, 2009)

1. INTRODUCTION

Since 2008, policymakers have reoriented their focus toward financial stability, often expressing willingness to trade-off competition and efficiency for stability. For example, U.S. Federal Reserve Governor Tarullo (2012) explains that the primary aim of the Dodd-Frank Act is to contain systemic risk, even if this reduces the competitiveness and efficiency of banks. The Bank of England (2015) notes that its new, primary responsibility is to foster financial stability, while other considerations are secondary goals.

But, is there a trade-off? Extensive research establishes both the economic costs of bank failures (e.g., Friedman and Schwartz 1963, Bernanke 1983, Ashcraft 2005, Schularick and Taylor 2012, and Chodorow-Reich 2014) and the economic benefits of competitive, efficient banking systems (e.g., King and Levine 1993, Jayaratne and Strahan 1996, Levine and Zervos 1998, and Rajan and Zingales 1998). So, if there is a tradeoff between competition and stability, research highlights the economic importance of finding the optimal balance between the two. But, research has not resolved whether such a trade-off exists. In this paper, we employ a new approach for identifying exogenous changes in the competitive pressures facing individual banks to assess the impact of competition on bank risk. In this way, we contribute both to policy deliberations and research debates.

Economic theory offers differing perspectives on whether competition increases or decreases bank risk. The *competition-fragility* view explains that an intensification of competition can reduce bank profit margins and charter values, encouraging banks to increase the riskiness of their loan portfolios and to provide nontraditional products and services (e.g., Keeley 1990, Hellman, Murdoch, and Stiglitz 2000, and Stiroh 2004). Related research explains that competition can curtail the ability of banks to earn information rents from

relationship lending, reducing their incentives to screen and monitor borrowers with adverse effects on bank stability (e.g., Allen and Gale 2000, Berger et al. 2005, and Dell'Ariccia and Marquez 2006). In contrast, the *competition-stability* view argues that competition reduces risk. Boyd and De Nicoló (2005) show that even when an intensification of competition lowers bank profits and charter values, this also tends to reduce interest rates charged on loans. In turn, these lower rates can attract lower-risk borrowers by reducing adverse selection and lessen risk shifting by reducing moral hazard. Furthermore, competition can make banks more comparable and transparent (Stiglitz and Nalebuff 1983), facilitating the monitoring and curtailment of bank risk.[1]

Existing empirical work also offers conflicting findings on the competition-risk nexus, arguably reflecting challenges to measuring exogenous sources of variation in competition. Researchers have used three broad categories of proxies for competition. First, many researchers use bank concentration measures, with some studies finding a positive and others a negative relation with risk depending on the precise concentration and risk measures as summarized in Beck, Demirgüç-Kunt, and Levine (2006). Concentration, however, does not measure the contestability of banking markets. Indeed, Jayaratne and Strahan (1998) show that the removal of regulatory impediments to bank competition increased bank concentration. Second, researchers estimate the responsiveness of prices to costs and use this as a proxy for competition (e.g., Schaeck, Čihák, and Wolfe 2009 and Anginer, Demirgüç-Kunt, and Zhu 2014). These price-cost measures, however, require both nontrivial assumptions on banks' costs and data that are unavailable for most banks. Besides the measurement problems, identification challenges plague both of these proxies since banking sector stability might influence

[1] Using cross-country comparisons, Ranciere, Tornell, and Westermann (2008) find that countries that experience occasional financial crises grow, on average, faster than countries with stable financial conditions, suggesting that there is not always a trade-off between risk and efficiency.

bank competition and the price-cost indicators and some third factor might drive bank risk and these competition proxies.

A third category of bank competition proxies, and the one to which we contribute, measures regulation-induced changes in the contestability of banking markets and addresses some of the weaknesses with the other two competition measures (e.g., Jayaratne and Strahan 1998 and Dick 2006). In particular, for most of the 20th century, U.S. states prohibited banks from other states from establishing subsidiaries within their borders. During the 1980s and 1990s, individual states started removing these restrictions in different years, allowing banks from other states to enter and compete with local banks. These regulatory changes boosted the contestability of banking markets. While Jayaratne and Strahan (1998) find that deregulation reduced non-performing loans, suggesting a reduction in bank risk, there are concerns with using these state-year deregulation measures to identify the impact of contestability on bank risk: An omitted state characteristic could drive both the timing of deregulation and bank risk.[2]

To better identify the impact of bank competition on risk, we construct measures of the regulation-induced competitive pressures facing individual bank holding companies (BHCs) in the United States. Following Jiang, Levine, and Lin (2016), we construct these new competition measures by adding two features to the regulatory-induced competition measures used in earlier studies. First, past studies code a state as prohibiting or permitting interstate banking, and use the first year that a state deregulates with any other state as when it moves from a prohibiting to a permitting regulatory state. However, as emphasized by Goetz, Laeven, and Levine (2013, 2016), not only did individual states begin interstate deregulation in different years, they followed different dynamic paths. Individual states made unilateral, bilateral, and

[2] In a cross-country study, Barth, Caprio, and Levine (2004) find that economies with bank regulatory systems that impose stronger barriers to entry by new domestic or foreign banks are more likely to suffer systemic banking crises than countries with less protective systems. However, this cross-country approach also has serious identification challenges.

multilateral agreements with other states in a process that evolved in a fairly chaotic manner from 1982 until the Riegle-Neal Act eliminated restrictions on interstate banking in 1995. Thus, for each state and each year, we measure which "foreign" state's BHCs can establish subsidiaries in its borders. Our procedure yields state-year measures of the competitive pressures facing a state's banking system and these measures have richer dynamics than previous studies of competition and stability.

The second step in constructing a time-varying, BHC-specific competition measure involves integrating these state-year interstate bank deregulation measure with the "gravity model" of investment to differentiate among BHCs within a state. The gravity model assumes that the cost of establishing a subsidiary is inversely related to the geographic distance between the BHC's headquarters and the new subsidiary. Consistent with this assumption, Goetz, Laeven, and Levine (2013, 2016) show that BHCs are more likely to expand into geographically close markets. The gravity model, therefore, predicts that a BHC *b* headquartered in state *k* will experience a greater intensification of competition from BHCs in state *j* if BHC *b* is geographically closer to state *j* because it is less costly for state *j*'s BHCs to establish subsidiaries closer to BHC *b* within state *k*. That is, when California relaxes interstate banking restrictions with Arizona, BHCs in southern California will experience a sharper increase in competition than BHCs in northern California. Using this insight, we (a) identify for each bank subsidiary in each year those states whose BHCs can enter the subsidiary's state, (b) weight each of those states by the inverse distance to the subsidiary to calculate the competitive environment facing each subsidiary in each period, and (c) calculate the competitive pressures facing each BHC by weighting these subsidiary-level competition measures by the percentage of each subsidiary's assets in the BHC. We create additional competition measures by further weighting the inverse distance between each subsidiary *i* in state *j* and the states (*k*) whose banks can enter state *j* by the Gross State Product (GSP)

or the number of BHCs in those *k*-states.

These BHC-time competition measures have several appealing features. They measure the contestability of markets, and therefore avoid the complications associated with inferring competition from market structure or price-cost indicators. Furthermore, BHC-time competition measures are built on two plausibly exogenous sources of variation: the geographic distance between banks and other states and the quasi-experimental dynamic process of interstate bank deregulation. Finally, by integrating the process of interstate bank deregulation with the gravity model, the resultant time-varying, BHC-specific measures differentiate among BHCs within the same state and year. This allows us to control for state-year fixed effects, reducing the possibility that omitted variables that vary simultaneously with interstate bank deregulation drive the results.

We also contribute to the competition-risk literature by using market-based rather than accounting-based measures of risk. For example, several authors use risk measures based on nonperforming loans, loan loss provision, loan charge-offs, or profit volatility (e.g., Keeley 1990, Jayaratne and Strahan 1998, and Dick 2006) and others use the Z-score to gauge a bank's distance to insolvency (e.g., Laeven and Levine 2009, and Houston et al. 2010). These accounting based measures, however, are subject to manipulation and may not be consistent across regulatory jurisdictions or over time due to changes in accounting rules. Indeed, Jiang, Levine, and Lin (2016) show that competition reduces the degree to which BHCs manipulate accounting and financial statements.

We use seven market-based measures of individual bank risk and two measures of a BHC's contribution to systemic risk. We focus on two measures: *Total Risk* measures stock return volatility and equals the natural logarithm of the standard deviation of daily stock returns, and *Tail Risk* measures a BHC's expected loss during "bad times," i.e., during the 5% worst return days in a year as in Ellul and Yerramilli (2013). We also use three risk measures based

on the residuals from asset pricing models. Specifically, *Residual Risk-CAPM* equals the natural logarithm of the standard deviation of the residuals from the one-factor capital asset pricing model. *Residual Risk-Fama French* and *Residual Risk-GG* are similarly defined based on the residuals from the Fama French three-factor model and the augmented CAPM that includes information on bond default spreads and interest rates. Furthermore, we use Merton's (1974) option pricing model to estimate the volatility of each BHC's stock price in each year and call this the *Implied Asset Volatility* measure of bank risk (Berger, Klapper, and Turk-Ariss 2009). Seventh, from Berg and Gider (2016), we construct an unlevered equity volatility measure, *Asset Risk*, that equals Total Risk divided by the BHC's book leverage. With respect to measuring a BHC's contribution to systemic risk, *Systemic Risk-MES* is the Acharya et al. (2017) measure of the degree to which a BHC's valuation falls during the aggregate market's worst trading days in a year and *Systemic Risk-*Δ*CoVaR* is the Adrian and Brunnermeier (2016) measure of the degree to which an individual institution's risk contributes to the risk of the entire state's financial system and equals the change in the value at risk of the entire financial system conditional on the single institution being under distress relative to its median state. Although the focus of our study is on assessing the impact of competition on risk at the individual BHC level, we use these *Systemic Risk* measures to check whether a BHC's exposure to competition affects its contribution to systemic risk.

We use panel regressions in which the dependent variable is one of the bank risk measures and the main explanatory variable is one of the time-varying, BHC-specific competition measures. The regressions control for state-year and BHC fixed effects. The state-year effects control for all time-varying state characteristics, including economic output, the volatility of output, and state-level policies and bank regulatory reforms. The BHC fixed effects condition away all time-invariant bank characteristics. We also control for time-varying, BHC-specific characteristics, such as size, the ratios of

deposits to assets, loans to assets, and capital to assets.

We discover that an intensification of bank competition materially boosts bank risk, suggesting an economically large trade-off between competition and risk. Each of the BHC competition measures enters positively and significantly across all of the different bank risk measures. The results hold when including state-year and BHC fixed effects. Furthermore, the results are robust to (a) including or excluding, time-varying BHC traits or (b) altering the sample period. The effects are economically large. For example, consider a BHC when its regulation-induced competition level is "low," i.e., at the 25th percentile of sample distribution, and the same BHC when competition is "high," at the 75th percentile of the distribution. The estimated coefficients suggest that *Total Risk* and *Tail Risk* would each rise by about 50%. The estimated impacts of competition on the other bank risk measures are also large. Taken together, the empirical findings suggest that bank competition exerts a statistically and economically significant impact on bank risk taking.

We also explore potential mechanisms linking bank competition and risk. Although it is beyond the scope of this paper to examine all possible channels through which competition might shape bank risk, we explore three suggested by the research discussed above. First, the competition-fragility view stresses that competition squeezes bank charter values and profits, which in turn induces banks to take actions that boost risk (e.g. Keeley 1990 and Hellman, Murdoch, and Stiglitz 2000). Second, as competition squeezes profit margins on traditional lending services, banks might seek to generate income through new lines of noninterest generating activities that boost bank risk (e.g., DeYoung and Roland 2001 and Stiroh 2004). Third, by making it easier for borrowers to switch banks, competition might impede banks from earning information rents (e.g., Boot and Greenbaum 1993, Berger and Udell 1995, Berger et al. 2005, and Dell'Ariccia and Marquez 2006). Since relationship lending means that banks have invested in acquiring information on borrowers,

a reduction in relationship lending could boost bank risk as banks make less informed loans to new clients. Thus, we evaluate the impact of regulation-induced competition on bank charter values and profits, the proportion of a BHC's income contributed by noninterest generating sources, and the degree to which banks lend to new customers.

Consistent with these views of how competition shapes bank risk, we find that an intensification of competition (1) reduced bank charter values and profitability, (2) increased the proportion of income that BHCs obtain through noninterest generating activities, and (3) boosted the likelihood that BHCs lend to new customers. These findings provide evidence on the mechanisms through competition can influence bank risk. These findings also reduce concerns that some confounding factor drives the finding that regulation-induced competition increases risk, as this confounding factor would also have to account for the findings on these three mechanisms.

The rest of the paper is organized as follows. Section 2 describes data and the construction of key variables. Section 3 explains the empirical methodology, while Section 4 reports our findings. Section 5 explores mechanism tests and Section 6 concludes.

2. DATA

This section describes the sample of banks, nine measures of bank risk, and three measures of the time-varying competitive pressures facing each BHC. We define the other key bank-level variables while presenting the results. Table 1 provides detailed definitions of all variables and Table 2 presents summary statistics.

2.1 Sample of Banks

The Federal Reserve Bank of Chicago provides Condition and Income statements for all consolidated BHCs on a quarterly basis since June 1986. Since our core analyses use annual data, we start in 1987. We match these data

with CRSP/Compustat using the CRSP-FRB Link provided by the Federal Reserve Bank of New York to obtain stock price information on BHCs. We restrict the sample to banks located in the United States, which removes BHCs chartered in Puerto Rico. There are 513 BHCs with daily stock price data. Next, we (a) only include the ultimate parent BHC that owns, but is not owned by, other financial institutions, where ownership is defined as holding 50% or more of outstanding shares and (b) eliminate BHCs that cannot be matched with their subsidiaries using Call Report data provided by The Federal Reserve. This yields 486 BHCs. Finally, we follow the literature and drop Delaware and South Dakota because they have special laws to encourage the entry of credit card banking. After dropping missing values, the final sample includes 2,634 BHC-year observations on 446 BHCs during the period from 1987 to 1995.

2.2 Risk-taking Measures

We use nine market-based measures of risk. We use market-based measures of risk, rather than accounting-based measures such as capital-asset ratios, loan charge-offs, loan loss provisions, and Z-scores, for two reasons. First, banks sometimes manipulate accounting statements, and we do not want to confound the impact of competition on bank risk with its impact on the manipulation of accounting statements. Second, it typically takes several years for a change in bank's environment to shape its loan charge-offs, loan loss provisions, and other accounting-based indicators of risk, and this makes it complicated to match the timing of a change in competition to bank risk. Since asset prices reflect the expected present value of changes in the competitive environment, market-based risk measures are likely to be less subject to manipulation and less prone to lags that complicate the analyses.

Total Risk measures the volatility of stock returns and equals the natural logarithm of the standard deviation of a bank's daily stock returns. Throughout the analyses, we annualize all daily returns. Many banking studies

use stock return volatility, including Brickley and James (1986), Houston and James (1995), and Goetz, Laeven, and Levine (2016), but not in assessing the impact of competition on bank risk.

Tail Risk measures a BHC's expected loss during bad times. Following Ellul and Yerramilli (2013), *Tail Risk* equals the natural logarithm of the negative of the average return on a BHC's stock over the 5% worst return days for the BHC's stock in a year.

We use three measures of *Residual Risk* that gauge the BHC's nondiversifiable risk and equal the natural logarithm of the standard deviation of the residuals from three different asset pricing models. Specifically, *Residual Risk-CAPM* is based on residuals obtained from the standard Capital Asset Pricing Model (CAPM) equation,

$$r_{bt} = r_{ft} + \beta_1(r_m - r_f)_t + \varepsilon_t, \quad (1)$$

where r_{bt} measures the daily stock return of BHC *b* in time *t*, r_{ft} represents risk-free rate in period *t*, and r_m is the daily market return.[3] *Residual-Fama French* is based on the residuals from the Fama-French three-factor model, where the size factor (*SMB*) and the market-to-book factor (*HML*) are added to the standard CAPM equation,[4] so that

$$r_{bt} = r_{ft} + \beta_1(r_{mt} - r_{ft}) + \beta_2 SMB_t + \beta_3 HML_t + \varepsilon_t. \quad (2)$$

Residual GG is based on the augmented CAPM used in the banking studies by Gatev, Schuermann, and Strahan (2009) and Goetz, Laeven, and Levine (2016), where

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[3] The results are robust to using the Dismon (1979) adjustment for non-synchronous trading, which involves adding five leads and five lags of market returns into the market model, i.e. $r_{bt} = r_{ft} + \beta_1(r_m - r_f)_t + \sum_{d=1}^{5} \rho_n (r_m - r_f)_{t+d} + \sum_{d=1}^{5} \delta_d (r_m - r_f)_{t-d} + \varepsilon_t$.

[4] To be more specific, SMB stands for "small minus big" and equals the average return on three portfolios of small firm stocks (i.e., 1/3*(small value + small neutral + small growth)) minus the average return on three portfolios of large firm stocks (i.e., 1/3 * (big value + big neutral + big growth)). HML stands for "high minus low" and is often called the value premium. It equals the average return of two value portfolios (i.e. 1/2*(small value + big value)) minus the average return of the two growth portfolios (i.e. 1/2*(small growth + big growth)).

$$r_{bt} = \alpha + \beta_1 \cdot r_{mt} + \beta_2 \cdot \Delta(Baa - Aaa)_t + \beta_3 \cdot \Delta(3 - month\ T - Bill)_t + \varepsilon_t, \quad (3)$$

and where $\Delta(Baa - Aaa)$ is a default risk factor that representing the change in the yield on Baa-rated vs. Aaa-rated corporate bonds, and $\Delta(3 - month\ T - Bill)$ is the change in yield on 3-month treasury bills representing an interest rate factor. As shown below, we obtain consistent results when using any of these asset-pricing models to obtain measures of idiosyncratic risk.

Implied Asset Volatility provides an options-based measure of BHC risk and equals the natural logarithm of the standard deviation of the asset return implicit in Merton's (1974) option pricing model. Specifically, we estimate the volatility of asset returns by solving the following Black-Scholes-Merton equation:

$$E = V \cdot N(d_1) - e^{-\gamma T} \cdot D \cdot N(d_2), \quad (4)$$

where *E* is the market value of the bank's equity, *V* is the asset value of the bank, *D* is the face value of bank's debt (equal to current liabilities plus one-half of long-term debt), *r* is the risk-free rate, and $N(\cdot)$ is the cumulative standard normal distribution function. d_1 and d_2 are given by:

$$d_1 = \frac{\ln\left(\frac{V}{F}\right) + (r + 0.5\sigma_v^2)T}{\sigma_v \cdot \sqrt{T}}, \quad (5)$$

and

$$d_2 = d_1 - \sigma_v\sqrt{T}, \quad (6)$$

where σ_v is the volatility of bank asset. The Merton model also assumes that the bank has issued just one discount bond maturing in *T* periods.

Asset Risk is the natural logarithm of the standard deviation of daily stock returns over the year divided by book leverage, where book leverage equals one minus the book value of equity divided by total assets. Berg and Gider (2016) propose this as a measure of unlevered equity volatility and we use it to assess the robustness of our findings.

For the eighth and ninth measures, we use two measures of systemic risk: *Systemic Risk-MES* and *Systemic Risk-*Δ*CoVaR*. To construct *Systemic Risk-MES*, we start with the marginal expected shortfall (MES), which was developed by Acharya et al. (2017) as one important component to gauge a BHC's systemic risk. The MES equals the average return on a BHC's stock price multiplied by its market capitalization during the aggregate market's 5% worst trading days in a year. MES measures the degree to which the BHC's value moves closely with the aggregate market during its worst days. The intuition underlying the MES measure of systemic risk is that a bank is more systemically risky if its market value falls when the overall stock market is especially weak. To obtain *Systemic Risk-MES*, we multiply the MES by negative one so that greater values of MES correspond to greater systemic risk, which means that when the market return is low, the individual bank's returns will be low as well.[5]

*Systemic Risk-*Δ*CoVaR* is from Adrian and Brunnermeier (2016) and measures the degree to which an individual institution contributes to the risk of the entire financial system. It equals the change of CoVaR conditional on a single institution being under distress relative to its median state, where CoVaR, or "conditional VaR" is defined as the value at risk of the entire financial system (VaR) conditional on a single financial institution being in a particular state. Thus, there is a separate value for *Systemic Risk-*Δ*CoVaR* for each bank in each period as the change in the *VaR* for the entire financial system differs by bank and over time. As with common measures of the *VaR* of an individual financial institution, *Systemic Risk-*Δ*CoVaR* is computed for a particular "distress" level, and we use the 95% quantile of the worst weekly stock returns.[6]

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[5] Note that we take the natural logarithm of all the risk measures except for the *Systemic Risk*, because a BHC's average return during the market-worst-return-days can be both positive and negative.

[6] Calomiris and Mason (1997, 2003) examine the connections between individual bank and systemic banking sector risk. We simply evaluate whether an intensification of competition has similar effects on both individual bank risk and the bank's contribution to systemic risk.

2.3 BHC-specific Competition Measures: Overview

To create measures of the time-varying competitive pressures facing each BHC, we integrate two sources of variation in competition: the time-varying, state-specific process of interstate bank deregulation and the gravity model of investment, which differentiates among BHCs within each state. We begin with an overview and then provide a detailed explanation of the construction of the competition measures.

First, we exploit the staggered removal of regulatory restrictions on interstate banking. For most of the 20th century, states prohibited interstate banking, i.e., each state prohibited banks from other states from establishing bank subsidiaries (or branches) within its geographic borders. Starting in 1982, individual states begin a chaotic process of removing these restrictions.[7] States both started interstate bank deregulation in different years and followed different paths of deregulation over time. Specifically, some states unilaterally opened their borders to out-of-state banks, while others signed a series of bilateral and multilateral reciprocal agreements with other states over time. For example, Figure 1 illustrates the evolution of interstate bank deregulation for California. It displays the year when California permitted BHCs located in every other state to enter California. As shown, California started interstate banking in 1987 by allowing banks in Alaska, Arizona, Oregon, Texas, Utah, and Washington to enter.[8] This was followed by Idaho in 1988, Nevada and New Mexico in 1989, and so forth. Similarly, Figure 2 illustrates the evolution of interstate bank deregulation for the state of New York. New York started interstate banking in 1982 by allowing Alaska, Maine, and Missouri to enter, followed by Arizona and Kentucky in 1986, and Oklahoma, Texas, Utah,

[7] More specifically, Maine passed legislation permitting out-of-state acquisitions on a national reciprocal basis, i.e., Maine allowed a "foreign" state's banks to buy Maine banks if that foreign state allowed Maine's banks to buy its banks. Since no states reciprocated until 1982, this deregulation process was in fact stalled until 1982, when Alaska and New York passed laws similar to Maine's.

[8] Although California offered regional reciprocal agreements to Colorado, Hawaii, Idaho, Nevada, and New Mexico in 1987, these states did not sign reciprocal agreement with California, so banks from these states were not allowed to enter California in 1987.

Washington, and Wyoming in 1987, and so on. These two figures illustrate the more general point: different states started the process of interstate bank deregulation in different years and followed different patterns until prohibitions on interstate banking were effectively ended across the United States in 1995 by the Riegle-Neal Act.

Thus, we use information on the evolution of each state's exposure to competition from banks headquartered in other states. In particular, when state *j*'s regulators permit the entry of BHCs headquartered in other states, this intensifies the contestability of state *j*'s banking sector. Since state *j* deregulates with different states over time, we construct a measure of competitive pressures facing state *j* in each year. It is worth noting that our measure of regulation-induced competition is different from the traditional measures of interstate bank deregulation. Researchers typically use the first year that a state allowed banks from any other state to enter its borders and establish subsidiaries (either through an acquisition or de novo) as the "treatment." This traditional, discrete indicator of interstate bank deregulation equals zero in the years before the state first allowed out-of-state banks to enter and one afterwards. We, however, examine the year-by-year, state-specific process of the removal of regulatory restrictions on interstate banking. Although this is an improvement over traditional measures, this dynamic interstate bank deregulation measure does not differentiate among BHCs within a state and year.

Second, we exploit the gravity model to construct a time-varying, BHC specific measure of competition. The gravity model predicts that the costs to a BHC of establishing a subsidiary in a location are inversely related to the distance between the BHC's headquarters and the location. This allows us to differentiate among BHCs within a state, as each BHC has a different distance to other states and hence faces different competition from BHCs in those states. By integrating the state-time process of interstate bank deregulation with the gravity model's differentiation across banks in the same state, we

construct time-varying measures of "regulatory-induced competitive pressures" facing each BHC.

2.4 BHC-specific Competition Measures: Details

More specifically, we construct the BHC-specific competition measures as follows. First, for each year *t*, (a) identify all states (*k*'s) whose BHCs are allowed to establish subsidiaries in state *j* and set I_{jkt} equal to one if banks from state *k* can enter state *j* in period *t* and zero otherwise and (b) set DIS_{ik} equal to the natural logarithm of the distance between bank subsidiary *i* within state *j* and state *k*'s capital city.[9]

Second, for each subsidiary *i,* in state *j*, in each year *t*, calculate its exposure to regulation-induced competition from state *k* as follows:

$$Subsidiary\ Competition\ (Distance\ Weighted)_{ijt} = \sum_k \frac{I_{jkt}}{DIS_{ik}}. \qquad (7)$$

Third, calculate the regulation-induced competition facing each BHC *b* in state *s* and year *t* ($Competition\ (Distance\ Weighted)_{bst}$). We do this by aggregating the regulation-induced competition pressures facing each of the BHC's subsidiaries. In performing this aggregation, we weight each subsidiary *i* within BHC *b* in year *t* by the proportion of *i*'s assets in the BHC (P_{ibt}) in year *t*. Thus,

$$Competition\ (Distance\ Weighted)_{bst} =$$
$$Ln \sum_{i \in b} [Subsidiary\ Competition\ (Distance\ Weighted)_{\ it}] * P_{ibt}, \qquad (8)$$

We take the natural logarithm of the sum of the weighted distance measure to improve the interpretability of the coefficient estimates. Note that the state in which subsidiary *i* is physically located might differ from the state where the headquarters of the BHC of which subsidiary *i* is a component is located.

Based on this procedure, we construct two additional measures of each BHC's exposure to regulation-induced competitive pressures in each year.

[9] We measure the distance from bank *i* to the capital city of every other state *k* by computing the road distance in miles between two zip codes using Google maps api.

First, we further weight the regulation-induced competition measure specified in equation (7) by the number of BHCs in state k in year t (Num_{kt}), so that

$$Subsidiary\ Competition\ (Distance\ and\ \#\ of\ BHCs\ Weighted)_{ijt} = \\ = \sum_k \frac{Num_{kt} * I_{jkt}}{DIS_{ik}}. \quad (9)$$

This implies the following competition measure at the BHC level:

$$Competition\ (Distance\ and\ \#\ of\ BHCs\ Weighted)_{bst} = \\ = \sum_{i \in b} [Subsidiary\ Competition\ (Distance\ and\ \#of\ BHCs\ Weighted)_{it}] * P_{ibt}. \quad (10)$$

For the second additional measure, we follow a similar procedure and weight the regulation-induced competition measure specified in equation (7) by the economic size of state k, i.e., by the gross state product of state k in year t (GSP_{kt}) and create $Competition\ (Distance\ and\ GSP\ Weighted)_{bst}$.[10]

3. EMPIRICAL METHODOLOGY

To examine the impact of competition on bank risk, we primarily use a panel regression in which the unit of analysis is a BHC-year observation and where we control for both state-year (θ_{st}) and BHC (θ_b) fixed effects. The state-year fixed effects control for all time-varying state influences. The BHC fixed effects condition out all time-invariant BHC characteristics. In particular, we estimate the following ordinary least squares equation:

$$Log(Bank\ Risk_{bst}) = \beta \cdot Competition_{bst} + \gamma' \cdot X_{bst} + \theta_b + \theta_{st} + \varepsilon_{bst}, \quad (11)$$

where $Bank\ Risk_{bst}$ is the one of the nine measures of risk for BHC b, headquartered in state s in year t (i.e., *Total Risk, Tail Risk, Residual Risk-CAPM, Residual Risk-Fama French, Residual Risk-GG, Implied Asset*

[10] That is, $Subsidiary\ Competition\ (Distance\ and\ GSP\ Weighted)_{ijt} = \sum_k \frac{GSP_{kt} * I_{jkt}}{DIS_{ik}}$, so that the corresponding competition measure at the BHC level is:

$$Competition\ (Distance\ and\ GSP\ Weighted)_{bst} = \\ \sum_{i \in b} [Subsidiary\ Competition\ (Distance\ and\ GSP\ Weighted)_{it}] * P_{ibt}.$$

Volatility, Asset Risk, *Systemic Risk-MES*, and *Systemic Risk-*Δ*CoVaR*). $Competition_{bst}$ is one of the three measures of the competitive pressures facing each BHC *b* in state *s* in year *t* (i.e., *Competition (Distance Weighted)*, *Competition (Distance and # of BHCs Weighted)*, and *Competition (Distance and GSP Weighted)*). X_{bst} represents a vector of time-varying BHC traits: *Log(Total Assets*) is the natural logarithm of the BHC's total assets, *Deposits To Assets* is the ratio of bank deposits to total assets, *Loans To Assets* is the ratio of bank loans to total assets, and *Capital To Asset* is the BHC's capital-asset ratio.[11] In seeking to assess the impact of an intensification of competition on bank risk, we focus on estimating β. We report heteroskedasticity-consistent standard errors that are clustered at the state level.[12]

Our econometric strategy mitigates the concern that bank risk influences the timing of when states remove restrictions on interstate banking. For example, if heightened bank risk within a state induces state officials to lower barriers to the entry of out-of-state banks to improve lending quality, this could confound the ability to identify the impact of competition on bank risk. However, we use a time-varying, BHC-specific measure of competition that differentiates among banks within the same state and year, so that we can control for state-year fixed effects. This reduces the possibility that time-varying, statewide factors impede our ability to assess the differential effects of competition on individual bank risk within a state.

Even with this strategy, it is valuable to note that lagged values of bank risk do not predict the timing of interstate regulatory reforms, as shown in Table 3. For each state, we aggregate the *Total Risk* and *Tail Risk* of individual

[11] In our sample, the average BHC has $6.9 billion of assets (*Total Assets*), while the median BHC has $1.1 billion in total assets. Due to the skewed distribution of assets, we use the natural logarithm of total assets in the regression analyses. Furthermore, in the regressions, we use lagged values of these bank-specific measures. However, all of the results hold when measuring them contemporaneously.

[12] The results hold when clustering the errors at either the state-year level or the state and year levels.

BHCs headquartered in that state and calculate the *n*-year average of *Total Risk* and *Tail Risk* at the state level, where *n* represents one to three years prior to the interstate deregulation. The dependent variable is either (a) the state-year dummy variable, *Deregulation*, that equals one in period *t* for state *s* if state *s* started interstate deregulation by year *t*, or (b) the state-year variable *Num_of_States* that equals the natural logarithm of one plus the number of states, who's BHCs are allowed to enter state *s* in year *t*. We also control for the series of state characteristics used by Kroszner and Strahan (1999) in their assessment of the timing of interstate bank deregulation. These controls include per capita gross state product (GSP), state unemployment rate, an indicator for unit banking law, small firm share in the state, small bank share in the state, capital ratio of small banks relative to large banks, relative size of insurance in states where banks can sell insurance, relative size of insurance in states where banks cannot sell insurance, an indicator for one party control in the state, and share of state government controlled by Democrats.

Table 3 shows that bank risk does not predict the timing of regulatory reforms. For *Total Risk*, columns (1) – (3) provide the results for *Deregulation*, while columns (4) – (6) provide them for *Num_of_States*. Similarly, for *Tail Risk*, columns (7) – (9) give the regression estimates for *Deregulation*, while the results on *Num_of_States* are provided in columns (10) – (12). As evinced by the insignificant coefficients on all of the lagged risk measures, there is no indication that bank risk predicts the timing of interstate bank deregulation.

4. EMPIRICAL RESULTS

The results reported in Table 4 indicate that the regulation-induced intensification of competition increased bank risk. Table 4 reports estimates of equation (11), where the dependent variable is *Total Risk* in columns (1) – (5) and *Tail Risk* in columns (6) – (10). For each of these two bank risk measures, we report regression results with the three BHC-specific competition measures - *Competition (Distance Weighted)*, *Competition (Distance Weighted and # of*

Banks Weighted), and *Competition (Distance Weighted and GSP Weighted)*. In all cases (columns 1–3 and 6–8), each of these three BHC-specific competition measures enters positively and significantly at the one percent significance level. Furthermore, with respect to the BHC-level control variables, banks with higher *Capital To Asset* ratios tend to have lower risk. This is in accordance with the capital buffer theory that bank capital can absorb adverse shocks, reducing risk. Finally, it is worth emphasizing that these results hold when excluding the time-varying BHC traits from the analyses. Although including endogenous BHC-level controls could contaminate the analyses. Appendix Table 1 shows that the estimated coefficients on the competition measures, and their statistical significance, do not change much when excluding these regressors.[13]

The estimated coefficients in Table 4 suggest that the economic impact of competition on bank risk is large. For example, consider the estimates reported in column (1), where the dependent variable is *Total Risk*, the competition measure is *Competition (Distance Weighted)*, and the estimated coefficient on competition is 0.59. Furthermore, consider a BHC when its regulation-induced competition level (*Competition (Distance Weighted)*) is low, i.e., at the 25th percentile of distribution for the entire sample, and the same BHC when competition level is high, i.e., at the 75th percentile. This involves an intensification of regulation-induced competition of 0.82. The column (1) estimates suggest that the BHCs' *Total Risk* would be 48% greater in the high competition environment. The estimated impact is similar when considering the estimates on *Tail Risk* from column (4).

In Table 4, we also highlight the importance of our identification strategy. As emphasized above, our three BHC-specific proxies of competition—*Competition (Distance Weighted)*, *Competition (Distance Weighted and # of BHC Weighted)*, and *Competition (Distance Weighted and GSP Weighted)*—differ across BHCs within the same state and year. This

[13] We also conducted our analyses at the quarterly level. All of the results hold.

allows us to control for state-year fixed effects and eliminate concerns that an omitted state-year variable drives the results, i.e., we are identifying the impact of competition on bank risk by comparing BHCs within the same state and year. To assess the importance of this strategy, we examine two traditional proxies of competition that do not allow us to control for state-year effects. In particular, we examine *Deregulation*, which for state *j* in year *t* is a dummy variable that equals one if the state allows BHCs from at least one other state to enter and establish subsidiaries within its borders and zero otherwise, and *Bank Concentration*, which for state *s* in year *t* equals the summation of the squared share of each BHC's assets headquartered in state *s* in year *t*. Neither *Deregulation* nor *Bank Concentration* differs across BHCs within a state and year, so we cannot include state-year fixed effects to reduce concerns of reverse causality or that omitted state-year factors drive both the risk in state's banking market and the state-specific proxies for competition (*Deregulation* and *Bank Concentration*). For example, a change in the overall riskiness of a state's economy could shape the riskiness of its banking system, the timing of interstate bank deregulation, and bank consolidation, confounding the ability to identify the impact of competition on bank risk. Thus, if the results on these state-specific proxies for competition differ from those on our BHC-specific proxies, this would advertise the value of our strategy of using more granular proxies.

Consistent with our econometric strategy, neither of the state-specific competition proxies enters significantly in the *Total Risk* or *Tail Risk* regressions, as shown in columns 4-5 and 9-10 of Table 4. In these regressions, we include BHC fixed effects and year fixed effects, but we cannot include state-year fixed effects since *Deregulation* and *Bank Concentration* do not differ across states within a year. The differences between the results on the BHC-specific and state-specific competition proxies advertise the importance of conditioning out all time-varying state influences to identify the impact of changes in the competitive pressures facing individual BHCs on their risk

taking.

We next extend the analyses by examining seven additional measures of risk. In the seven columns of Table 5, the dependent variable is one of the three residual risk measures—*Residual Risk – CAPM*, *Residual Risk – Fama French*, *Residual Risk – GG*, *Implied Asset Volatility,* the leverage weighted standard deviation of stock returns (*Asset Risk*), or one of the two systemic risk measures: *Systemic Risk-MES* or *Systemic Risk-*Δ*CoVaR*. For each risk measure, we provide results for the BHC-specific competition proxy, *Competition (Distance Weighted)*. The results hold when using the other BHC-specific proxies, *Competition (Distance Weighted and # of BHC Weighted)* and *Competition (Distance Weighted and GSP Weighted)*, but not when using the state-specific proxies.

Table 5 confirms that regulation-induced competition boosts bank risk across all measures of risk. The results are robust to different measures of individual bank risk. Furthermore, we find that a regulation-induced intensification of the competitive pressures facing an individual bank increase its contribution to the riskiness of the state's banking market, as measured by *Systemic Risk-MES* or *Systemic Risk-*Δ*CoVaR*.

The estimated impacts of regulation-induced competition on these alternative risk measures are large and the magnitudes are of similar sizes to those reported above on *Total Risk* and *Tail Risk*. To illustrate the economic magnitudes, again consider a change in *Competition (Distance Weighted)* from the 25th percentile to the 75th percentile of the sample distribution. For example, the Table 5 results indicate that *Residual-Risk CAPM* would rise by 44%, *Implied Asset Volatility* would jump by 85%, *Asset Risk* would increase by 48%, and *Systemic Risk* would rise by roughly one standard deviation, which equals 0.01 for *Systemic Risk-MES* and 0.002 for *Systemic Risk-* Δ *CoVaR*. Taken together, the estimated positive impact of deregulation-induced competition on bank risk-taking is not only statistically significant, but also economically important.

We next allay two potential concerns with these analyses. First, there might be concerns that the results are driven solely by BHCs expanding into different states and not by regulation-induced competition. In particular, if a BHC faces a greater threat that other banks can establish subsidiaries close by due to interstate bank deregulation, it also means that the BHC can expand into other states. Perhaps, it is BHC expansion, not the intensification of competition that boosts bank risk. This is unlikely since Goetz, Laeven and Levine (2016) show that geographic expansion reduces risk, not increase it. Nonetheless, we test this formally by restricting our sample to banks that do not engage in mergers and acquisitions during the sample period. As reported in columns (1) – (6) of Table 6, we continue to find that an intensification of competition is associated with greater bank risk for the restricted sample of non-expanders. Second, there might be concerns that the results are driven only by large banks, which are more likely to expand into other states. Thus, in columns (7) – (12) of Table 6, we provide the results for the subsample of small BHCs, which we define as BHCs that have total assets below the sample median for the entire sample period. As shown, all of the results hold.[14]

5. MECHANISMS

In this section, we push the analyses beyond our core question of whether competition increases or decreases risk and evaluate potential mechanisms linking bank competition and risk. As described in the Introduction, theory not only provides differing predictions about the effect of competition on risk, it also provides perspectives on how competition affects

[14] There might also be concerns that by cutting the estimation period in 1995, we are ignoring the lagged effect of deregulation on the contestability of banking markets or other factors that shape the relation between competition and risk overtime. For example, Goetz, Laeven, and Levine(2013) show that it often took BHCs several years before they established subsidiaries in other states. Thus, even though the Riegle-Neal Act effectively removed regulatory impediments to interstate banking in 1995, the full effects of this Act on the competitive pressures faced by individual BHCs may have taken several years to materialize. Thus, we extended the sample through 2006, which increases the sample from 446 to 837 BHCs. All of the results hold.

bank risk. Although it is beyond the scope of this paper to examine all possible channels through which competition might shape bank risk, we explore several proposed mechanisms.

A natural starting point is the relation between competition and bank charter values and profits. As emphasized in influential research by Keeley (1990), Hellman, Murdoch, and Stiglitz (2000), and Martinez-Miera and Repullo (2010), the competition-fragility view holds that an intensification of competition reduces bank profit margins and charter values, which can in turn create incentives for banks to increase risk. Thus, we begin by evaluating the impact of regulation-induced competition on bank charter values and profits. To measure BHC charter value, we use the natural logarithm of the market to book value of assets ratio (*Charter Value*). To measure bank profits, we use the ratio of net income to total assets (*Profitability*). We then use these as dependent variables and employ the same regression specification defined above.

The results reported in Table 7 indicate that an intensification of competition is associated with a large reduction in both bank charter values and profits. For *Charter Value* (columns (1) – (3)) and *Profitability* (columns (4) – (6)), we examine each of the three regulation-induced competition measures. As shown, each of the competition measures enters the *Charter Value* and *Profitability* regressions with a negative and statistically significant coefficient. Further, the estimated coefficient is economically large. For example, again consider a BHC that experiences a change in *Competition (Distance Weighted)* from the 25th percentile to the 75th percentile of the sample distribution, which implies an increase in regulation-induced competition of 0.82. Then, the coefficient estimate from column (1) indicates that *Charter Value* would fall by 44%, while the estimate from column (4) suggests that *Profitability* would fall by 0.005 (equivalent to half standard deviation change). These results are consistent with the view that a sharp

intensification of bank competition materially lowers BHC charter values and profits.

Research also suggests two particular actions that banks might take in response to an intensification of competition that would affect risk. First, as competition squeezes profit margins on traditional lending services, banks might seek to generate income through new lines of noninterest generating activities, such as trading and derivatives, fiduciary services, underwriting, etc., that boost bank risk (e.g., DeYoung and Roland 2001 and Stiroh 2004). Second, competition can impede the ability of banks to earn information rents from making costly investments in relationship lending by making it easier for customers to switch between lenders (e.g., Boot and Greenbaum 1993, Berger and Udell 1995, Berger et al. 2005, and Dell'Ariccia and Marquez 2006). Since relationship lenders can better screen and monitor borrowers, competition that reduces relationship lending and induces banks to lend to new customers could increase bank risk. We explore each of these potential actions.

Thus, we first examine whether regulation-induced competition increases the proportion of income that BHCs receive from noninterest generating sources. Specifically, we use two measures of noninterest income that vary over time. *Noninterest Income/Total Income* equals the BHC's ratio of noninterest income to total income. *Noninterest Income/Net Interest Income* equals the BHC's ratio of noninterest income to net interest income. For both ratios, noninterest income equals the aggregate of income from noninterest income from trading assets and liabilities, fiduciary activities, account-based service charges, and other noninterest income. We then use either *Noninterest Income/Total Income* or *Noninterest Income/Net Interest Income* as the dependent variables and employ our standard regression specification to assess whether competition increases the proportion of income that BHCs receive from noninterest generating sources.

As reported in Table 8, an increase in regulation-induced competition is associated with a material increase in the proportion of a BHC's noninterest income. In columns (1) – (3), the dependent variable is *Noninterest Income/Total Income* and the columns provide results for the three competition measures. Correspondingly, in columns (4) – (6), the dependent variable is *Noninterest Income/Net Interest Income*. The estimated coefficient on each of the competition measures is positive and statistically significant, suggesting that a larger proportion of income is generated from noninterest sources when competition intensifies. These results in conjunction with those reported in Tables 4 and 7 are consistent with the competition-fragility view: Regulation-induced competition squeezes profits margins, reduces charter values, induces banks to increase their reliance on noninterest income, and bank risk rises.

Finally, to shed some empirical light on whether competition affects relationship lending, we evaluate whether competition increases lending to new clients. To conduct this test, we construct new data on whether each BHC in each year makes a loan to a new customer and use this as a proxy for a reduction in the degree to which the BHC engages in relationship lending. Although lending to new customers is not a direct measure of relationship lending, one testable implication of the prediction that competition will reduce relationship lending is that banks will seek out new clients and borrowers will switch banks.

More specifically, we hand match our BHCs with the lead lenders of syndicated loans as recorded in Dealscan.[15] Out of the 446 BHCs in our sample, we identify 154 of them that have served as lead lenders during our sample period. Our matching process yields 11,439 BHC-loan observations during the period from 1987 through 1995. The unit of analysis is at the BHC-loan level, because many lenders make loans to multiple borrowers in

[15] We thank Michael Schwert for sharing his BHC-Dealscan Lender Link Table online at https://sites.google.com/site/mwschwert/. Part of our matching is based on this database.

one year, and there are sometimes multiple lead lenders on a single syndicated loan. Based on these data from Dealscan and our matching process, we construct the variable *New Customer*$_{b,t}$, which equals one for BHC *b* in year *t* if the BHC makes a loan to a "new customer," i.e., a borrower who had not previously borrowed from the BHC, and zero otherwise.

In Table 9, we estimate the impact of regulation-induced competition on lending to new customers using both probit and ordinary least squares (OLS) models. Given the binary distribution of the dependent variable *New Customer*$_{b,t}$, we first use a probit regression model and report the marginal effects. We then confirm the results using OLS. In both models, we control for BHC and state-year fixed effects and the same time-varying, BHC-specific traits as in the earlier analyses. As shown in Table 9, each of the BHC-specific competition measures enters positively and significantly, suggesting that exposing a BHC to greater competition sharply increases the likelihood that it lends to a new customer. Again consider a BHC that experiences a change in *Competition (Distance Weighted)* from the 25th percentile to the 75th percentile of the sample distribution, which implies an increase in regulation-induced competition of 0.57, the coefficient estimate on *Competition (Distance Weighted)* from column (1) (0.21) indicates that the likelihood a BHC lends to a new customer would increase by 12%. Because some observations may be automatically dropped due to the lack of within-group variation in the probit model when including BHC and state-year fixed effects, we therefore use OLS regressions to confirm the robustness of our results as shown in columns (4)-(6) of Table 9.

6. CONCLUSIONS

Past research provides differing theoretical perspectives and conflicting empirical results on whether an intensification of competition makes banks less stable. The differing findings might reflect the challenges of

measuring competition, identifying exogenous sources of variation in the competitive pressures facing banks, and measuring bank risk.

In this paper, we construct time-varying, bank-specific measures of the competitive pressures facing individual banks in the United States over the 1980s and 1990s. We do this by (1) exploiting the quasi-random, state-specific process of interstate bank deregulation and (2) integrating these state-year measures of regulatory-induced competition with the gravity model of investment to obtain bank-year measures of competition. Furthermore, we use several market-based measures of bank risk that avoid several shortcomings associated with accounting-based risk measures.

We discover that an intensification of competition among banks increases bank risk. This finding holds across different measures of risk and different measures of the competitive pressures affecting individual banks. Our results also highlight several potential channels connecting competition and bank risk. That is, competition reduces bank profits, lowers bank charter values, increases the provision of nontraditional banking products and services, and diminishes relationship lending.

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Figure 1. Pattern of interstate banking deregulation for California

This map illustrates the evolution of interstate banking deregulation for the state of California. For each state, the figure displays the year when BHCs from that state were allowed to enter California.

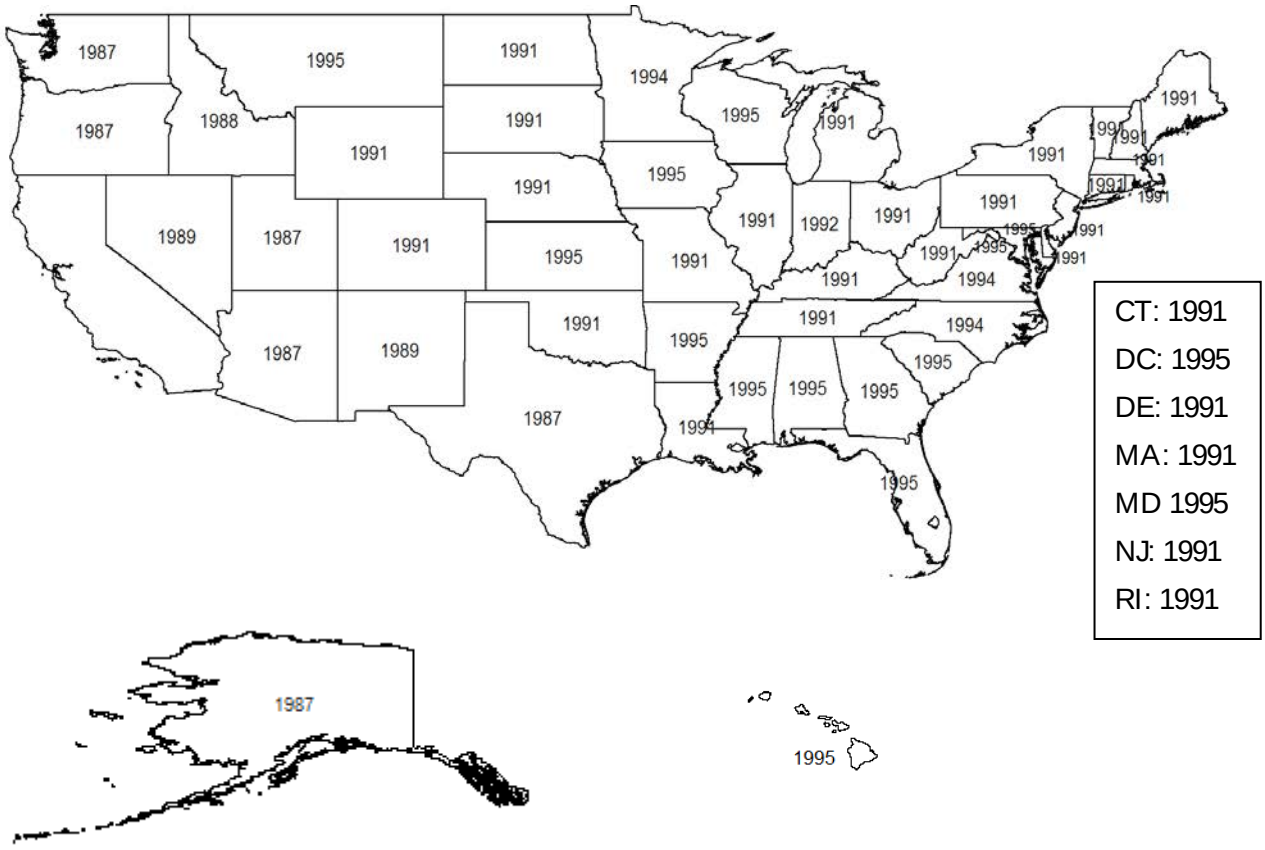

Figure 2. Pattern of interstate banking deregulation for the state of New York

This map presents the evolution of interstate banking deregulation for New York. For each state, the figure displays the year when BHCs from that state were allowed to enter New York.

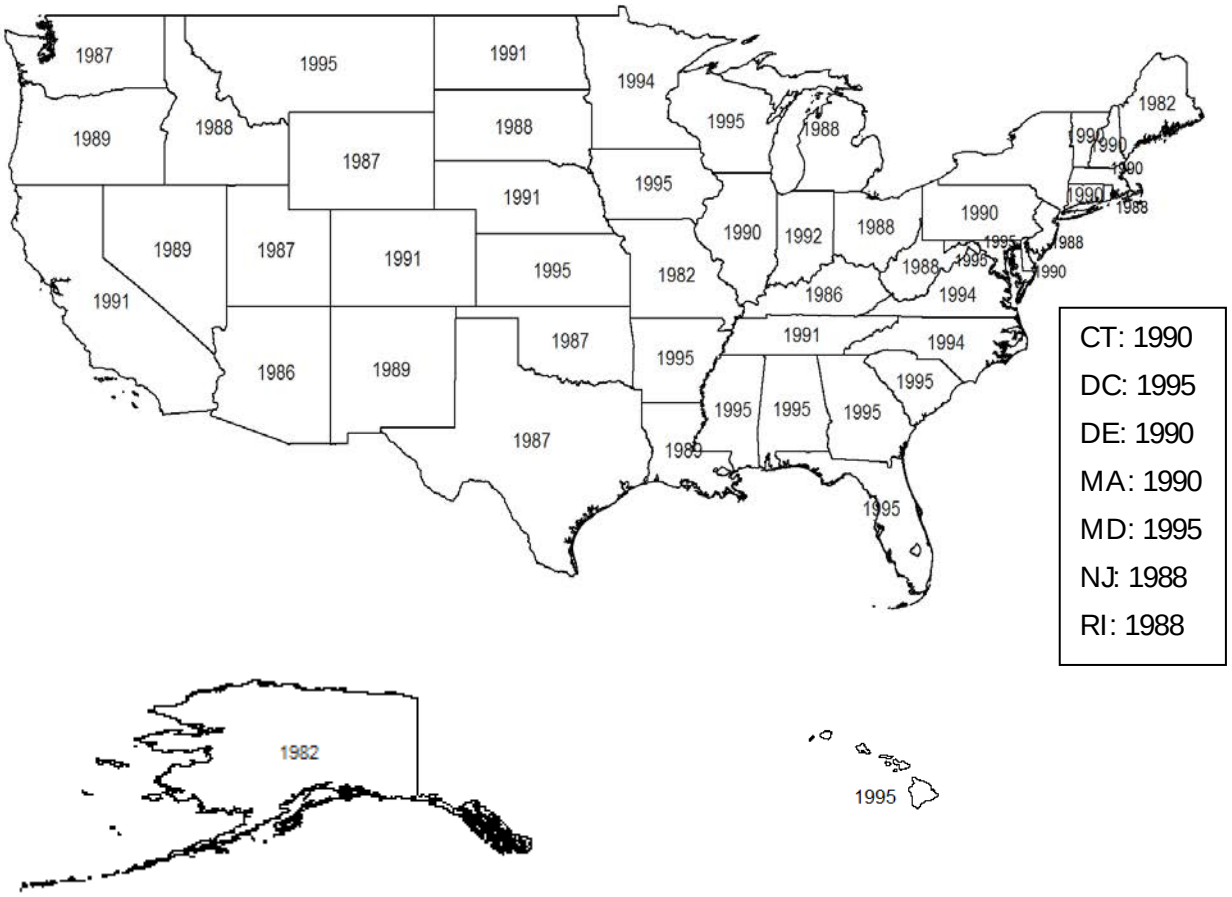

Table 1. Variable Definition

Variable Name	Definition
Risk Measures	
Total Risk	Log(standard deviation of annualized daily stock returns on a BHC's stock over the year *100).
Tail Risk	Log(the negative of the average return on a BHC's stock during its 5% worst return days over the year *100, annualized).
Residual Risk-CAPM	Log(standard deviation of the residuals from the market model*100); The market model is the CAPM one factor model.
Residual Risk-Fama French	Log(standard deviation of the residuals from the market model *100); The market model is the Fama French three factor model.
Residual Risk-GG	Log(standard deviation of the residuals from the market model*100); The market model is the three factor model in Gatev, Schuermann, and Strahan (2009) and Goetz, Laeven, and Levine (2016): $r_{bt} = \alpha + \beta_1 \cdot r_{mt} + \beta_2 \cdot \Delta(\text{Baa} - \text{Aaa})_t + \beta_3 \cdot \Delta(3 - \text{month T} - \text{Bill})_t + \varepsilon$.
Implied Asset Volatility	Log(standard deviation of the asset return implicit in Merton's (1974) option pricing model*100).
Asset Risk	Log(standard deviation of annualized daily stock returns on a BHC's stock over the year *100) divided by (1 – book value of equality/total assets).
Systemic Risk - MES	To measure the degree to which a BHC's value moves closely with the aggregate market during its worst days, we follow Acharya, Pedersen, Philippon, and Richardson (2017) and (a) identify the 5% lowest market return days in a year, (b) compute the annualized average return of a BHC during those days, and (c) multiply this annualized average return by negative one.
Systemic Risk - ΔCoVaR	To measure the degree to which an individual BHC's risk contributes to the risk of the entire financial system, we follow Adrian and Brunnermeier (2016) calculation of ΔCoVaR, equals the change of the CoVaR conditional on a single institution being under distress relative to its median state, where CoVaR, or "conditional VaR" is defined as the value at risk of the entire financial system (VaR) conditional on a single financial institution being in a particular state. As with common measures of the *VaR* of an individual financial institution, *Systemic Risk-*$\Delta CoVaR$ is computed for a particular "distress" level, and we use the 95% quantile of the worst weekly stock returns.
Competition Measures	
Competition (Distance Weighted)	We calculate the interstate bank competitive pressure facing each BHC *b* in year *t* by weighting its assets across all subsidiaries by the regulation-induced competition pressure facing each subsidiary *i*. To calculate the regulatory environment facing each subsidiary in each year, we first identify all states (*k*'s) whose BHCs are allowed (by state *j*'s regulators) to establish subsidiaries in *j*. We then measure the distance from each subsidiary bank to the capital of every other state *k* by computing the road distance between two zip codes using Google maps api. For each subsidiary *i* in state *j* in year *t*, we weight the interstate deregulation between state *j* and *k* in period *t* by that subsidiary's inverse log-distance to the other state.

Competition (Distance and # of BHCs Weighted)	We calculate the interstate bank competitive pressure facing each BHC *b* in year *t* by weighting its assets across all subsidiaries by the regulation-induced competition pressure facing each subsidiary *i*. To calculate the regulatory environment facing each subsidiary in each year, we first identify all states (*k*'s) whose BHCs are allowed (by state *j*'s regulators) to establish subsidiaries in *j*. We then measure the distance from each subsidiary bank to the capital of every other state *k* by computing the road distance between two zip codes using Google maps api. For each subsidiary *i* in state *j* in year *t*, we weight the interstate deregulation between state *j* and *k* in period *t* by that subsidiary's inverse log-distance to the other state. We further weight this regulatory environment index by the number of banks in the other state.
Competition (Distance and GSP Weighted)	We calculate the interstate bank competitive pressure facing each BHC *b* in year *t* by weighting its assets across all subsidiaries by the regulation-induced competition pressure facing each subsidiary *i*. To calculate the regulatory environment facing each subsidiary in each year, we first identify all states (*k*'s) whose BHCs are allowed (by state *j*'s regulators) to establish subsidiaries in *j*. We then measure the distance from each subsidiary bank to the capital of every other state *k* by computing the road distance between two zip codes using Google maps api. For each subsidiary *i* in state *j* in year *t*, we weight the interstate deregulation between state *j* and *k* in period *t* by that subsidiary's inverse log-distance to the other state. We further weight this regulatory environment index by the economic size (GSP per capita in $10,000) of the other state.
Deregulation	A dummy variable that equals zero in the years before the state first allows banks from any other state to enter and equals one otherwise.
Bank Concentration	The summation of squared BHC asset shares in each state *j* and year *t*.
Control Variables	
Log(Total Asset)	The natural logarithm of total assets in '000 $ in year *t-1*.
Deposit To Asset	Ratio of total deposits over total assets in year *t-1*.
Loan To Asset	Ratio of total loans over total assets in year *t-1*.
Capital To Asset	Ratio of book value of equity over total assets in year *t-1*.
Charter Value	The natural logarithm of market value of assets over book value of assets.
Profitability	Net income over total assets.
Noninterest Income/Total Income	The natural logarithm of (income from fiduciary activities + noninterest income from trading assets and liabilities + other noninterest income + account-based service charges)/total income.
Noninterest Income/Net Interest Income	The natural logarithm of (income from fiduciary activities + noninterest income from trading assets and liabilities + other noninterest income + account-based service charges)/net interest income.
New Customer	A dummy variable that equal to one if a borrower has never borrowed loans from the lender, and zero otherwise.

Table 2. Summary Statistics

This table provides summary statistics. Table 1 gives detailed variable definitions.

Variable	N	Mean	SD	P25	Median	P75
Risk Measures						
Total Risk	2634	3.54	0.44	3.23	3.54	3.86
Tail Risk	2634	4.35	0.53	3.98	4.3	4.67
Residual Risk-CAPM	2634	3.53	0.44	3.21	3.52	3.85
Residual Risk-Fama	2634	3.55	0.42	3.22	3.53	3.86
Residual Risk-GG	2634	3.5	0.45	3.18	3.5	3.83
Implied Asset Volatility	1595	3.03	0.80	2.46	3.01	3.56
Asset Risk	2630	3.63	0.44	3.31	3.62	3.94
Systemic Risk - MES	2634	0.01	0.01	0.00	0.01	0.01
Systemic Risk - ΔCoVaR	1864	0.01	0.00	0.00	0.01	0.01
Competition Measures						
Competition (Distance Weighted)	2634	1.53	0.55	1.14	1.77	1.96
Competition (Distance and # of BHCs Weighted)	2634	3.49	0.96	3.07	3.88	4.14
Competition (Distance and GSP Weighted)	2634	2.5	0.75	2.08	2.79	3.03
Deregulation	2634	0.97	0.16	1.00	1.00	1.00
Bank Concentration	2634	0.33	0.20	0.18	0.25	0.40
Bank Controls						
Total Asset (in billion)	2634	6.88	20.85	0.41	1.10	3.79
Log(Total Asset)	2634	14.19	1.57	12.92	13.91	15.15
Deposit To Asset	2634	0.83	0.08	0.79	0.85	0.88
Loan To Asset	2634	0.62	0.11	0.56	0.63	0.69
Capital To Asset	2634	0.08	0.02	0.06	0.08	0.09
Other Variables						
Charter Value	2626	4.43	0.62	4.13	4.52	4.84
Profitability	2630	0.02	0.01	0.01	0.02	0.02
Noninterest Income/Total Income	2573	-2.55	0.60	-2.84	-2.50	-2.22
Noninterest Income/Total Income (ratio)	2573	0.09	0.06	0.06	0.08	0.11
New Customer	11436	0.32	0.46	0.00	0.00	1.00

Table 3. Validation Test: Banking Deregulations and Lagged Bank Risks

This table presents OLS regression results of the timing and intensity of interstate bank deregulation on lagged measures of the riskiness of state banking systems. The sample consists of state-year observations from 1980 to 1995. The dependent variable in columns 1-3 and 7-8 is *Deregulation*, which is a dummy variable that equals zero in the years before the state first allows banks from any other state to enter and equals one otherwise. The dependent variable in columns 4-6 and 10-12 is *Num_of_States*, which represents for each state *j* and year *t* the natural logarithm of one plus the number of states that are allowed to enter into state *j*. The explanatory variables measure the riskiness of the state's banking system. Specifically, *State Total Risk* (*State Tail Risk*) *n year average before interstate deregulation* is *n*-year average risk of a state's banking system, which is the weighted average of *Total Risk* (*Tail Risk*) across all BHCs in the state, where the weights are the assets of the BHCs, and where the aggregation is done over *n* years before the interstate deregulation variable (*Deregulation* or *Num_of_States*). Control variables include GSP per capita, state level unemployment rate, unit banking laws, small firm share in the state, small bank share in the state, capital ratio of small banks relative to large banks, relative size of insurance in states where banks can sell insurance, relative size of insurance in states where banks cannot sell insurance, an indicator for one party control in the state, and share of state government controlled by Democrats. Heteroskedasticity robust standard errors are provided in parentheses. *, **, and *** indicate significant at 1%, 5%, and 10%.

	(1)	(2)	(3)	(4)	(5)	(6)		(7)	(8)	(9)	(10)	(11)	(12)
Dep Var	Deregulation			Num_of_States			Dep Var	Deregulation			Num_of_States		
State Total Risk one year average before interstate deregulation	-0.0463			1.1767			State Tail Risk one year average before interstate deregulation	-0.0026			0.4851		
	(0.0383)			(1.6793)				(0.0252)			(0.9973		
State Total Risk two year average before interstate deregulation		-0.0549			2.1025		State Tail Risk two year average before interstate deregulation		0.0016			1.2770	
		(0.0429)			(1.8826)				(0.0297)			(1.1844	
State Total Risk three year average before interstate deregulation			-0.0449			3.0033	State Tail Risk three year average before interstate deregulation			-0.0083			0.7726
			(0.0490)			(2.0895				(0.0321			(1.2618)
Year Fixed Effects	yes	yes	yes	yes	yes	yes	Year Fixed Effects	yes	yes	yes	yes	yes	yes
State Fixed Effects	yes	yes	yes	yes	yes	yes	State Fixed Effects	yes	yes	yes	yes	yes	yes
Controls	yes	yes	yes	yes	yes	yes	Controls	yes	yes	yes	yes	yes	yes
N	696	696	696	696	696	696	N	696	696	696	696	696	696
R-sq	0.7910	0.7910	0.7908	0.8029	0.8032	0.8034	R-sq	0.7906	0.7906	0.7906	0.8029	0.8031	0.8029

Table 4. Competition and Bank Risk-Taking: Total Risk and Tail Risk

This table presents regression results of bank risk on bank competition. The sample consists of BHC-year observations from 1987 through 1995. The dependent variables in columns 1-5 and 6-10 are *Total Risk* and *Tail Risk*, respectively. The regressions report the results for five indicators of bank risk: *Competition (Distance Weighted)*, *Competition (Distance and # of BHCs Weighted)*, *Competition (Distance and GSP Weighted)*, *Deregulation*, and *Bank Concentration*. Control variables include *log(Total Asset)*, *Deposit to Asset*, *Loan to Asset*, and *Capital to Asset*. All the control variables are lagged one year prior to the observation of the dependent variable. Detailed definitions of all the variables can be found in Table 1. Heteroskedasticity robust standard errors clustered at the state level are reported in parentheses. *, **, and *** indicate significant at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dep Var	Total Risk					Tail Risk				
Competition (Distance Weighted)	0.5863***					0.6516***				
	(0.2023)					(0.1918)				
Competition (Distance and # of BHCs Weighted)		0.2903***					0.2965***			
		(0.0930)					(0.0805)			
Competition (Distance and GSP Weighted)			0.4400***					0.4919***		
			(0.1620)					(0.1522)		
Deregulation				-0.0201					-0.0023	
				(0.0326)					(0.0409)	
Bank Concentration					0.1225					0.2197
					(0.2029)					(0.2279)
Log(Total Asset)	-0.1504*	-0.1522*	-0.1501*	-0.0651	-0.0621	-0.1214	-0.1232	-0.1211	-0.0391	-0.0337
	(0.0768)	(0.0785)	(0.0767)	(0.0708)	(0.0691)	(0.0976)	(0.0991)	(0.0975)	(0.0885)	(0.0870)
Deposit To Asset	0.2570	0.2763	0.2566	0.1052	0.0971	-0.1355	-0.1183	-0.1357	-0.1553	-0.1731
	(0.2905)	(0.2816)	(0.2902)	(0.2427)	(0.2490)	(0.3483)	(0.3418)	(0.3480)	(0.3019)	(0.3103)
Loan To Asset	-0.2371	-0.2435	-0.2350	0.1534	0.1683	0.0212	0.0166	0.0234	0.4565**	0.4840**
	(0.2137)	(0.2088)	(0.2131)	(0.1756)	(0.1828)	(0.2167)	(0.2156)	(0.2160)	(0.2161)	(0.2266)
Capital To Asset	-3.7985***	-3.7735***	-3.7958***	-3.7265***	-3.7425***	-4.5203***	-4.4994***	-4.5169***	-4.7230***	-4.7395***
	(0.8163)	(0.7973)	(0.8147)	(0.7504)	(0.7616)	(1.2081)	(1.1949)	(1.2075)	(0.9504)	(0.9649)
BHC fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	no	no	no	yes	yes	no	no	no
State-Year fixed effects	no	no	yes	yes	yes	no	no	yes	yes	yes
N	2634	2634	2634	2634	2634	2634	2634	2634	2634	2634
R-sq	0.6932	0.6936	0.7716	0.7715	0.7715	0.6968	0.6977	0.7733	0.7729	0.7732

Table 5. Competition and Bank Risk-Taking: Residual Risk, Implied Asset Volatility, Asset Risk, and Systemic Risk

This table presents regression results of bank risk on bank competition using seven alternative measures of bank risk. The sample consists of BHC-year observations from 1987 through 1995. The dependent variables are *Residual Risk –CAPM*, *Residual Risk –Fama French*, *Residual Risk –GG* (in columns 1-3), *Implied Asset Volatility* (column 4), *Asset Risk* (column 5), *Systemic Risk-MES* (column 6), and *Systemic Risk-*Δ*CoVaR95* (column 7), respectively. *Residual Risk –CAPM* equal to Log(annualized standard deviation of the residual from the market model*100). *Residual Risk –Fama French* equal to Log(annualized standard deviation of the residual from the market model *100); The market model is the Fama French three-factor model. *Residual Risk –GG* equal to Log(annualized standard deviation of the residual from the market model*100), where the market model is the three factor model in Gatev, Schuermann, and Strahan (2009) and Goetz, Laeven, and Levine (2016): $r_b = \alpha + \beta_1 \cdot r_m + \beta_2 \cdot \Delta(Baa - Aaa) + \beta_3 \cdot \Delta(3 - month\,T - Bill) + \varepsilon$. *Implied Asset Volatility* equal to Log(annualized standard deviation of the asset return implicit in Merton's option pricing model*100). *Asset Risk* is the standard deviation of daily stock return over the year divided by (1 – book value of equality/total assets). *Systemic Risk-MES* is defined as the marginal expected shortfall that we take the 5% worst days for the market returns in a given year, compute the average return of a BHC during those days and then times negative one. *Systemic Risk-ΔCoVaR* is defined as the difference between the CoVaR conditional on the distress of an institution and the CoVaR conditional on the median state of that institution, where distress CoVaR is calculated as the 95% quantile of value at risk (VaR value) for the financial system conditional on BHC *i* is at its 95% quantile VaR. The regressions report the results for the *Competition (Distance Weighted)* measure of bank risk. Control variables include *Log(Total Asset)*, *Deposit to Asset*, *Loan to Asset*, and *Capital to Asset*. All the control variables are lagged one year prior to the observation of the dependent variable. Detailed definitions of all the variables can be found in Table 1. Heteroskedasticity robust standard errors clustered at the state level are reported in parentheses. *, **, and *** indicate significant at 10%, 5%, and 1%, respectively.

Dep Var	(1) Residual Risk – CAPM	(2) Residual Risk – Fama French	(3) Residual Risk – GG	(4) Implied Asset Volatility	(5) Asset Risk	(6) Systemic Risk - MES	(7) Systemic Risk - ΔCoVaR
Competition (Distance Weighted)	0.5407**	0.5257**	0.5933***	1.0332*	0.5860***	0.0119**	0.0022**
	(0.2054)	(0.2019)	(0.2080)	(0.5376)	(0.1993)	(0.0049)	(0.0009)
BHC controls	yes	yes	yes	yes	yes	yes	yes
BHC fixed effects	yes	yes	yes	yes	yes	yes	yes
State-Year fixed effects	yes	yes	yes	yes	yes	yes	yes
N	2634	2634	2634	1595	2630	2634	1864
R-sq	0.7786	0.7911	0.7765	0.7899	0.7714	0.5920	0.9675

Table 6. Competition and Bank Risk-Taking: Alternative Samples

This table presents regression results of bank risk on bank competition using two subsamples of BHCs: 1) BHCs that have not been involved in any merger and acquisition activities from 1987 through 1995 (columns 1-6) and 2) small BHCs, i.e., those with total assets that remain below the sample median over the entire sample period (columns 7-12). The dependent variables are *Total Risk* (columns 1-3 and 7-9) and *Tail Risk* (columns 4-6 and 10-12). The regressions report the results for three bank risk measures: *Competition (Distance Weighted)*, *Competition (Distance and # of BHCs Weighted)*, and *Competition (Distance and GSP Weighted)*. Control variables include *Log(Total Asset)*, *Deposit to Asset*, *Loan to Asset*, and *Capital to Asset*. All the control variables are lagged one year prior to the observation of the dependent variable. Detailed definitions of all the variables can be found in Table 1. Heteroskedasticity robust standard errors clustered at the state level are reported in parentheses. *, **, and *** indicate significant at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Sample for non-expanders only						*Sample for small BHCs*					
Dep Var	Total Risk			Tail Risk			Total Risk			Tail Risk		
Competition	1.3066***			1.6391***			1.2324***			1.2723***		
(Distance Weighted)	(0.4584)			(0.3553)			(0.3159)			(0.3675)		
Competition (Distance		0.6418*			0.8434***			0.7410*			0.7762**	
and # of BHCs Weighted)		(0.3186)			(0.3058)			(0.3814)			(0.3792)	
Competition (Distance			0.9451**			1.2482***			0.7894*			0.8374*
and GSP Weighted)			(0.3806)			(0.3079)			(0.4438)			(0.4644)
BHC controls	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
BHC fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
State-Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
N	1279	1279	1279	1279	1279	1279	1088	1088	1088	1088	1088	1088
R-sq	0.8003	0.7999	0.8001	0.7983	0.7981	0.7983	0.7796	0.7795	0.7793	0.7776	0.7775	0.7774

Table 7. Competition Effect on Bank Charter Value and Profitability

This table presents regression results of charter value and profitability on bank competition. The sample consists of BHC-year observations from 1987 through 1995. The dependent variables in columns 1-3 and 4-6 are *Charter Value* and *Profitability*, respectively. *Charter Value* is defined as the natural logarithm of market value of assets over book value of assets. *Profitability* is defined as net income over total assets. The regressions report the results for three bank risk measures: *Competition (Distance Weighted)*, *Competition (Distance and # of BHCs Weighted)*, and *Competition (Distance and GSP Weighted)*. Control variables include *Log(Total Asset)*, *Deposit to Asset*, *Loan to Asset*, and *Capital to Asset*. All the control variables are lagged one year prior to the observation of the dependent variable. Detailed definitions of all the variables can be found in Table 1. Heteroskedasticity robust standard errors clustered at the state level are reported in parentheses. *, **, and *** indicate significant at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Dep Var	Charter Value			Profitability		
Competition (Distance Weighted)	-0.5427**			-0.0061**		
	(0.2376)			(0.0026)		
Competition (Distance		-0.2993***			-0.0037**	
and # of BHCs Weighted)		(0.1071)			(0.0014)	
Competition (Distance			-0.4105**			-0.0044**
and GSP Weighted)			(0.1900)			(0.0021)
BHC controls	yes	yes	yes	yes	yes	yes
BHC fixed effects	yes	yes	yes	yes	yes	yes
State-Year fixed effects	yes	yes	yes	yes	yes	yes
N	2626	2626	2626	2630	2630	2630
R-sq	0.8333	0.8335	0.8333	0.7423	0.7428	0.7422

Table 8. Competition Effect on Noninterest Income

This table presents regression results of noninterest income on bank competition. The sample consists of BHC-year observations from 1987 through 1995. The dependent variable is *Noninterest Income/Total Income* in columns 1-3, defined as the natural logarithm of (income from fiduciary activities + noninterest income from trading assets and liabilities + other noninterest income + account-based service charges)/total income, or *Noninterest Income/Net Interest Income* in columns 4-6, defined as the natural logarithm of (income from fiduciary activities + noninterest income from trading assets and liabilities + other noninterest income + account-based service charges)/net interest income. The regressions report the results for three bank risk measures: *Competition (Distance Weighted)*, *Competition (Distance and # of BHCs Weighted)*, and *Competition (Distance and GSP Weighted)*. Control variables include *Log(Total Asset)*, *Deposit to Asset*, *Loan to Asset*, and *Capital to Asset*. All the control variables are lagged one year prior to the observation of the dependent variable. Detailed definitions of all the variables can be found in Table 1. Heteroskedasticity robust standard errors clustered at the state level are reported in parentheses. *, **, and *** indicate significant at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Dep Var	Noninterest Income /Total Income			Noninterest Income /Net Interest Income		
Competition (Distance Weighted)	0.1702**			0.2591**		
	(0.0785)			(0.0974)		
Competition (Distance and # of BHCs Weighted)		0.0694**			0.0916**	
		(0.0309)			(0.0406)	
Competition (Distance and GSP Weighted)			0.1339**			0.1996***
			(0.0584)			(0.0738)
Log(Total Asset)	-0.1124	-0.1128	-0.1123	-0.0635	-0.0640	-0.0633
	(0.0677)	(0.0680)	(0.0677)	(0.0671)	(0.0675)	(0.0671)
Deposit To Asset	-0.1103	-0.1068	-0.1098	-0.7441**	-0.7409**	-0.7437**
	(0.3075)	(0.3092)	(0.3075)	(0.3353)	(0.3375)	(0.3352)
Loan To Asset	-0.0854	-0.0861	-0.0850	-0.1891	-0.1890	-0.1884
	(0.1900)	(0.1895)	(0.1902)	(0.2417)	(0.2404)	(0.2419)
Capital To Asset	-2.6463	-2.6420	-2.6444	-4.1764**	-4.1731**	-4.1738**
	(1.8989)	(1.8978)	(1.8980)	(1.8331)	(1.8316)	(1.8320)
BHC fixed effects	yes	yes	yes	yes	yes	yes
State-Year fixed effects	yes	yes	yes	yes	yes	yes
N	2573	2573	2573	2573	2573	2573
R-sq	0.8718	0.8717	0.8718	0.8817	0.8816	0.8817

Table 9. Competition Effect on Lending to New Customers

This table presents regression results of lending to new customers on bank competition. The sample consists of loan-year observations from 1987 through 1995. The dependent variable is *New Customer* defined as a dummy variable that equal to one if a borrower has never borrowed loans from the lender, and zero otherwise. Columns 1-3 (4-6) present results using Probit (OLS) model. The marginal effects (dy/dx) of the probit regressions are presented. The marginal effect of a dummy variable is calculated as the discrete change in the expected value of the dependent variable as the dummy variable changes from 0 to 1. The regressions report the results for three bank risk measures: *Competition (Distance Weighted)*, *Competition (Distance and # of BHCs Weighted)*, and *Competition (Distance and GSP Weighted)*. Control variables include *Log(Total Asset)*, *Deposit to Asset*, *Loan to Asset*, and *Capital to Asset*. All the control variables are lagged one year prior to the observation of the dependent variable. Detailed definitions of all the variables can be found in Table 1. Heteroskedasticity robust standard errors clustered at the state level are reported in parentheses. *, **, and *** indicate significant at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Dep Var	New Customer					
Model	Probit			OLS		
Competition (Distance	0.2108***			0.0862***		
Weighted)	(0.0414)			(0.0249)		
Competition (Distance		0.1303***			0.0457***	
and # of BHCs Weighted)		(0.0264)			(0.0034)	
Competition (Distance			0.1785***			0.0723***
and GSP Weighted)			(0.0246)			(0.0140)
Log(Total Asset)	0.2791**	0.2786**	0.2793**	0.0605*	0.0605*	0.0605*
	(0.1339)	(0.1283)	(0.1334)	(0.0335)	(0.0321)	(0.0333)
Deposit To Asset	0.2637	0.2979	0.2715	0.0506	0.0598	0.0540
	(0.2299)	(0.2347)	(0.2298)	(0.0601)	(0.0620)	(0.0605)
Loan To Asset	-1.5296***	-1.5965***	-1.5391***	-0.4020***	-0.4187***	-0.4053***
	(0.3461)	(0.3695)	(0.3516)	(0.0990)	(0.0995)	(0.0995)
Capital To Asset	2.9568	2.9124	2.9479	1.0658**	1.0526**	1.0599**
	(2.1058)	(2.0279)	(2.0923)	(0.4603)	(0.4525)	(0.4590)
BHC fixed effects	yes	yes	yes	yes	yes	yes
State-Year fixed effects	yes	yes	yes	yes	yes	yes
N	10735	10735	10735	11436	11436	11436
R-sq	0.0867	0.0867	0.0868	0.1274	0.1275	0.1274

Appendix Table 1. Competition and Bank Risk-Taking:

Total Risk and Tail Risk (Without BHC Controls)

This table presents regression results of bank risk on competition without including BHC controls. The sample consists of BHC-year observations from 1987 through 1995. The dependent variables in columns 1-3 and 4-6 are *Total Risk* and *Tail Risk*, respectively. Detailed definitions of all the variables can be found in Table 1. Heteroskedasticity robust standard errors clustered at the state level are reported in parentheses. *, **, and *** indicate significant at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Dep Var		Total Risk			Tail Risk	
Competition (Distance Weighted)	0.5797***			0.6686***		
	(0.1986)			(0.2048)		
Competition (Distance and # of BHCs Weighted)		0.2815***			0.3072***	
		(0.0826)			(0.0819)	
Competition (Distance and GSP Weighted)			0.4371***			0.5064***
			(0.1596)			(0.1625)
BHC fixed effects	yes	yes	yes	yes	yes	yes
State-Year fixed effects	yes	yes	yes	yes	yes	yes
N	2634	2634	2634	2634	2634	2634
R-sq	0.7643	0.7642	0.7643	0.7681	0.7678	0.7681

Appendix Table 2. Summary Statistics for Sample Until Year 2006

This table provides summary statistics of key variables for sample from 1987 through 2006. Table 1 gives detailed variable definitions.

Variable	N	Mean	SD	P25	Median	P75
Risk Measures						
Total Risk	6667	3.45	0.39	3.2	3.45	3.7
Tail Risk	6667	4.26	0.5	3.95	4.22	4.52
Competition Measures						
Competition (Distance Weighted)	6667	1.89	0.45	1.85	2.11	2.14
Competition (Distance and # of BHCs Weighted)	6667	3.94	0.71	4	4.23	4.29
Competition (Distance and GSP Weighted)	6667	3.06	0.65	2.89	3.34	3.44
Bank Controls						
Total Asset (in billion)	6667	8.27	47.12	0.42	0.96	2.98
Log(Total Asset)	6667	14.11	1.53	12.96	13.77	14.91
Deposit To Asset	6667	0.79	0.1	0.74	0.81	0.87
Loan To Asset	6667	0.64	0.12	0.58	0.65	0.72
Capital To Asset	6667	0.09	0.02	0.07	0.08	0.1