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Does the Geographic Expansion of Banks Reduce Risk?

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Abstract: We develop a new identification strategy to evaluate the impact of the geographic expansion of a bank holding company (BHC) across US metropolitan statistical areas (MSAs) on BHC risk. For the average BHC, the instrumental variable results suggest that geographic expansion materially reduces risk. Geographic diversification does not affect loan quality. The results are consistent with arguments that geographic expansion lowers risk by reducing exposure to idiosyncratic local risks and inconsistent with arguments that expansion, on net, increases risk by reducing the ability of BHCs to monitor loans and manage risks.

Keywords: G21; G28; G11
JEL Codes: Banking; Bank Regulation; Financial Stability; Risk; Hedging

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1. Introduction

Economic theory provides conflicting views on a basic question in banking: Does the geographic expansion of a bank's activities reduce risk? Textbook portfolio theory suggests that geographic expansion will lower a bank's risk if it involves adding assets whose returns are imperfectly correlated with existing assets. In addition, Diamond (1984) and Boyd and Prescott (1986) emphasize that diversified banks enjoy cost-efficiencies that can enhance stability. And, if diversification makes a bank too big or interconnected to fail, implicit or explicit government guarantees can lower the risk of investing in the bank (Gropp, Hakenes, and Schnabel, 2011).

Other theories stress that expansion increases bank risk. Agency-based models of corporate expansion (Jensen, 1986; Berger and Ofek, 1995; Servaes, 1996; and Denis, Denis, and Sarin, 1997) suggest that bankers might expand geographically to extract the private benefits of managing a larger "empire" even if this lowers loan quality and increases bank fragility. Furthermore, Brickley, Linck, and Smith (2003) and Berger, Miller, Petersen, Rajan, and Stein (2005) stress that distance can hinder the ability of a bank's headquarters to monitor its subsidiaries, with potentially adverse effects on asset quality. And, to the extent that diversification increases complexity, it could hinder the ability of banks to monitor loans and manage risk (Winton, 1999).

Empirical assessments of these views have yielded mixed results. Demsetz and Strahan (1997) and Chong (1991) find that geographically diversified BHCs hold less capital and choose riskier loans. Acharya, Hasan, and Saunders (2006) find that as BHCs expand geographically, their loans become riskier. In contrast, Akhigbe and Whyte (2003) and Deng and Elyasiani (2008) present evidence that risk falls as BHCs expand geographically. Similarly, Calomiris (2000) argues that branching restrictions in the United States during the early part of the twentieth century inhibited diversification and increased the fragility of the US banking system relative to that in Canada, which permitted nationwide branching.

This ambiguity might reflect the challenge of identifying an exogenous source of variation in geographic diversification. If BHCs increase the riskiness of their assets when they

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expand geographically, then an ordinary least squares (OLS) regression of risk on geographic diversity will yield an upwardly biased estimate of the impact of geographic expansion on risk. That is, OLS estimates will understate any risk-reducing effects of geographic expansion due to attenuation bias. Furthermore, BHCs not only choose whether to expand, they choose the degree to which they diversify across different banking markets.

To address this challenge and assess the impact of geographic diversification on BHC risk, we develop and use a new instrumental variable strategy that identifies exogenous sources of variation in geographic diversity at the BHC-level. To measure risk, we primarily use the standard deviation of a BHC's stock returns, which Atkeson, Eisfeldt, and Weill (2014) show is a sound measure of a firm's risk of default. We also show that our results hold when using the *Z*-score and other risk measures. To measure geographic diversification across different banking markets, we use the distribution of deposits in a BHC's subsidiaries and branches across US Metropolitan Statistical Areas (MSAs). We examine the distribution of deposits, rather than the distribution of assets, because the Federal Deposit Insurance Corporation's (FDIC's) Summary of Deposits provides deposit data across all of a BHC's banking-related entities, i.e., branches *and* subsidiaries. In contrast, data sources from the Federal Reserve and the Office of the Comptroller of the Currency provide only data on assets at the subsidiary level. Since this is a period during which some BHCs transformed some of their subsidiaries into branches, using the distribution of deposits has the advantage that our measure of geographic diversity does not change simply because a BHC changes the legal form of its banking-related entities.

Our identification strategy has two building blocks. First, we exploit the cross-state, cross-time variation in the removal of interstate bank branching prohibitions as an exogenous increase in the ability of BHCs headquartered within a state to enter other states. From the 1970s through the 1990s, individual states of the United States removed restrictions on the entry of out-of-state banks. Not only did states start deregulating in different years, some states also signed bilateral and multilateral reciprocal interstate banking agreements in a

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somewhat chaotic manner over time. There is enormous cross-state variation in the 20-year process of interstate bank deregulation, which culminated in the Riegle-Neal Interstate Banking Act of 1994. This reform eliminated all remaining restrictions on interstate banking by 1995 and branching by 1997. As we discuss and show below, there are good economic and statistical reasons both for treating the process of interstate bank deregulation as exogenous to bank risk and for using it as an exogenous source of variation in BHC diversity. This first building block yields state-time information on the legal ability of BHCs headquartered in one state to enter MSAs in each other's state, but it alone does not differentiate among BHCs headquartered within the same MSA.

The second building block exploits pre-existing variation in the physical location of BHCs within an MSA into a gravity model of individual BHC investments in "foreign" MSAs—MSAs other than the MSA in which the BHC is headquartered. Using information on the exact street address of each BHC's headquarters, we start by calculating the aerial distance from the BHC to all MSAs outside of the BHC's home MSA. Because of their physical location BHCs within the same MSA have different distances to MSAs in other states and the gravity model thus differentiates among the investment behavior of BHCs headquartered within the same MSA.

We then combine the gravity model of BHC investment with the dynamic process of interstate bank deregulation to construct an instrumental variable for the time-varying diversification of each BHC across MSAs. In particular, we use the BHC-specific distance to all other MSAs and estimates from our gravity model to compute the projected share of deposits that each BHC will receive from subsidiaries or branches in each "foreign" MSA and impose a value of zero when there are interstate bank regulatory prohibitions on a BHC owning a subsidiary or branch in that MSA.

This *gravity-deregulation methodology* yields a time-varying, BHC-specific instrumental variable of cross-MSA expansion that explains actual bank expansion well. Even when comparing BHCs headquartered within the same MSA and controlling for MSA-pair-time fixed

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effects, BHCs within the same MSA that are physically closer to a foreign MSA expand more into that market than BHCs headquartered in the same MSA that are further away from that foreign MSA. Based on this instrument, we use two-stage least squares (2SLS) to evaluate whether a BHC's geographic diversification across MSAs reduces its risk.

We start with OLS regressions that confirm past findings and motivate an instrumental variable approach. In regressions of BHC risk on BHC expansion, we find a positive relationship between BHC risk and the expansion of bank activities across MSAs. As stressed above, however, attenuation bias could drive these results. Thus, we next use our instrumental variable based on the gravity-deregulation model.

Using instrumental variables, we find that geographic diversity enters the risk regression with a large, negative, and statistically significant coefficient. This finding holds after controlling for a wide array of time-varying BHC characteristics, such as size, growth, profitability, Tobin's *Q*, operating income, the degree of non-lending activities, and the capital-asset ratio. Because our strategy yields a time-varying, BHC-specific instrument of geographic diversification, we can also include BHC fixed effects to account for time-invariant BHC effects. Moreover, since differences in the location of BHCs headquartered within the same MSA help account for their differential expansion into foreign MSAs, we also include MSA-time fixed effects to condition out all time-varying MSA traits. Across an array of specifications, robustness tests, and when examining the reduced form relationship between BHC risk and the instrument, we find a statistically significant and economically large effect. Holding other things constant, the instrumental variable estimates suggest that the expected reduction in risk from a one-standard deviation increase in the exogenous component of geographic diversification of BHC activity across MSAs is about 23% of the average value of risk, or about 52% of its sample standard deviation.

There may be concerns that the instrumental variable does not satisfy the exclusion restriction. For example, in a typical year, among all state-pairs in which at least one state allowed banks from the other to enter, 30% involved reciprocal agreements in which both states lowered entry restriction while 70% of these state-pairs only involved a unilateral deregulation. In the reciprocal state-pairs, a BHC was not only allowed to expand into a foreign state; it also faced a greater threat of bank entry from that foreign state. Thus, there is the possibility that the gravity-deregulation instrument is associated with BHC risk through this competition channel rather than through its effect on geographic expansion.

We address this concern through two strategies. First, to the extent that the relevant banking market is an MSA, as discussed in Berger and Hannan (1989) and Rhoades (1997), we control for all changes in the overall conditions facing a BHC's home MSA—including time-varying changes in competition from "foreign" banks—by conditioning on MSA-time fixed effects. Second, the results hold when including an array of time-varying BHC traits, including return on assets, Tobin's *Q*, operating income, size, etc. So, if deregulation were simply influencing BHC risk through changes in profitability, then we should not find—as we do—an independent relationship between BHC risk and instrumented diversity after controlling for these other traits.

We also assess one channel through which geographic expansion might influence BHC fragility: changes in loan quality. As noted above, some research suggests that geographic expansion might reduce the quality of bank loans and the monitoring of those loans. We, however, find that an increase in geographic diversity does not have an impact on loan loss provisions, nonperforming loans, or loan charge-offs. Thus, we cannot reject the null hypothesis that geographic expansion has no effect on loan quality.

It is important to emphasize the boundaries of our analyses. We do not assess each of the potential mechanisms linking geographic expansion and risk. Rather, we develop a new identification strategy that allows us to assess the net impact of geographic diversity on BHC risk more precisely than past studies and gauge whether the effects of geographic diversification on risk are driven by changes in loan quality. The findings indicate that geographic expansion materially reduces BHC risk but does not affect loan quality.

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These findings relate to recent research on the valuation effects of BHC diversification. DeLong (2001) and Goetz, Laeven, and Levine (2013) find that the geographic diversification of BHCs' assets destroys shareholder value, which can arise because insiders extract private rents. In turn, we find in this paper that geographic expansion reduces BHC risk. Furthermore, we extend and improve on the identification strategy developed in Goetz, Laeven, and Levine (2013), who focus on the cross-state expansion of BHC assets. We instead examine the cross-MSA expansion of BHCs and develop a BHC-specific instrumental variable for the diversity of BHC deposits across MSAs.

Our findings also contribute to long standing policy deliberations. As emphasized by Bernanke (1983), Calomiris and Mason (1997, 2003a, 2003b), Keeley (1990), Boyd and De Nicolo (2005), and recent financial turmoil, the risk-taking behavior of banks affects financial and economic fragility. In turn, national regulatory agencies have adopted, or are considering adopting, an array of regulations, including geographic concentration limits, to shape bank risk. For instance, no US BHC is permitted to gain more than a 10% share in the market for deposits. And, the Basel Committee on Banking Supervision (2011), in its effort to contain the financial system's systemic risk, has proposed capital surcharges for systemically important banks and considers a bank's global footprint to be an important indicator of its systemic importance. Yet, the literature has not offered conclusive evidence on the impact of restrictions on geographic diversity on bank risk.

The paper is organized as follows. Section 2 summarizes the data, while Section 3 presents OLS regression results of the relation between geographic diversity and bank risk. Section 4 presents (a) the gravity-deregulation model that we use to construct a BHC-specific projection of BHC expansion, (b) reduced form analyses of the relation between risk and this BHC-projection, and (c) instrumental variable results. Section 5 conducts additional robustness tests, including (a) alterations in the gravity-deregulation model and (b) omissions of particular groups of banks, such as those in the New York metropolitan area or BHCs that engage in international banking activities since they might face different competitive

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pressures and have access to other risk management mechanisms. Section 6 considers the effects of geographic diversity on loan quality. Section 7 concludes.

2. Data and interstate bank deregulation

2.1. Sources

We use balance sheet information on BHCs and their chartered subsidiary banks and branches to assess the relationship between BHC risk and the geographic expansion of its activities. The Federal Reserve collects data on a quarterly basis on BHCs and publishes the data in the Financial Statements for Bank Holding Companies. Since June of 1986, the Federal Reserve has provided consolidated balance sheets, income statements, and detailed supporting schedules for domestic BHCs. Furthermore, all banks regulated by the Federal Deposit Insurance Corporation, the Federal Reserve, or the Office of the Comptroller of the Currency file Reports of Condition and Income, known as Call Reports, that include balance sheet and income data. We link bank subsidiaries to their parent BHCs by using the reported identity of the entity that holds at least 50% of a bank's equity (RSSD9364) and exclude subsidiaries that only conduct foreign activities (e.g., Edge corporations). We combine information on the deposit balances at the branch level for all commercial and savings banks, which we obtain from the FDIC's Summary of Deposits. The Summary of Deposits reports detailed information on deposit balances at the most granular level (i.e., branches) as of June 30 of each year. By linking these three data sets together, we measure the geographic dispersion of deposits across all branches of a BHC.

The Center Research in Security Prices (CRSP) provides data on the stock prices of publicly traded BHCs at the daily frequency. We use these data to measure BHC risk as the natural logarithm of the standard deviation of weekly stock returns. We link BHC balance sheet information to stock prices using the CRSP-FRB link from the New York Federal Reserve Bank (FRB) website (http://www.newyorkfed.org/research/banking_research/datasets.html).

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For interstate deregulation, Amel (1993) and the updates by Goetz, Laeven, and Levine (2013) and Goetz and Gozzi (2014) provide information on changes in state laws that affect the ability of commercial banks to expand across state borders. Commercial banks in the U.S. were prohibited from entering other states due to regulations on interstate banking. Over the period from 1978 through 1994, states removed these restrictions by either (1) unilaterally opening their state borders and allowing out-of-state banks to enter or (2) signing reciprocal bilateral and multilateral branching agreements with other states and thereby allowing out-of-state banks to enter. The Riegle-Neal Act of 1994 repealed all remaining restrictions on BHCs headquartered in one state from acquiring banks in other states. Amel (1993) reports for each state and year, the states in which a state's BHC can open subsidiary banks. After confirming this dating, we extended the data for the full sample period using information from each state's bank regulatory authority. Consistent with earlier research on the liberalization of branching restrictions (e.g., Jayaratne and Strahan, 1996), we exclude the states of Delaware and South Dakota from these analyses since both states changed their laws to encourage the formation and entry of credit card banks in 1980, shortly before removing branching restrictions, which makes it difficult to isolate the independent effect of interstate banking deregulation on BHC diversification.

The Bureau of Economic Analysis provides data on social and economic demographics at the MSA level. Defined by the Office of Management and Budget (OMB), 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 (as measured by commuting to work) with the urban core. We use the 2003 definitions of MSAs because the OMB materially improved its geographic definition of an MSA in 2003 by including more information (e.g., commuting patterns) to determine the contours of an economic area, though using the 1993 definition yields similar results. There are 374 distinct MSAs in the contiguous United States. Since a few urban areas span two (or more states), we consider an MSA to have removed its restriction to the entry of banks from other areas if at least one state of the MSA

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removed its entry restrictions.

2.2. Sample construction

We match information on bank branches to their associated commercial bank as reported in the Summary of Deposits. If these banks are subsidiaries of BHCs we use the information from the Call Reports and match them to the ultimate parent company to identify the physical location of a BHC's deposits. Each subsidiary reports its unique parent company, and there can be several layers of subsidiaries and parent companies before reaching the ultimate parent company. We assign a subsidiary to the ultimate parent BHC that owns at least 50% of the subsidiary's equity. We only focus on BHCs located in the contiguous United States and therefore drop holding companies chartered in Alaska, Hawaii, and Puerto Rico. Furthermore, we eliminate BHCs that change the location of their headquarters across MSAs during the sample period.

2.3. BHC risk

We construct three measures of BHC risk. First, we measure the volatility of each BHC's market capitalization in each quarter as the natural logarithm of the standard deviation of weekly returns, ln(stdev of observed weekly returns). In particular, we obtain daily stock prices and outstanding shares from the Center for Research in Security Prices (CRSP) and calculate market capitalization for each BHC over the period from 1986 through 1997. For the few cases in which two different classes of shares for a BHC are traded in a quarter, we use the sum of the capitalizations of each class of share for the BHC. Similar to Gatev, Schuermann, and Strahan (2009), we compute weekly returns from market values observed on Wednesdays, as this is the weekday with the fewest public holidays. For each BHC, we then compute the standard deviation of weekly market returns over a quarter, take the natural logarithm, and use this as our main proxy for BHC risk. To limit the effect of mergers and acquisitions on the volatility of stock prices, we exclude weeks where the BHC engaged in a

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merger or acquisition (Custodio, 2014). Moreover, we set a BHC-quarter observation equal to missing if we do not have stock price data for more than 25% of Wednesdays in a quarter. This reduces the BHC-quarter observations by about 1%. Further, we exclude observations below the 1st and above the 99th percentiles of the standard deviation of weekly returns to mitigate the influence of outliers.

Second, we adjust this measure of stock market volatility by removing two systematic risk factors before constructing weekly returns (Gatev, Schuermann, and Strahan, 2009). Specifically, we run the following regression:

$$r_{b,t} = \alpha_b + \beta_{1,b} r_{m,t} + \beta_{2,b} \Delta(Baa - Aaa)_t + \beta_{3,b} \Delta(3 - month\ T - Bill)_t + \varepsilon_{b,t}, \quad (1)$$

where $r_{m,t}$ is the weekly return on the Standard & Poor's 500; $\Delta(Baa - Aaa)_t$ is a default risk factor as it represents the change in the yield on Baa-rated vs. Aaa-rated corporate bonds; and $\Delta(3 - month\ T - Bill)_t$ is the change in yield on 3-month Treasury bills and thus an interest rate risk factor. Note that we estimate this relationship for each BHC separately to account for the fact that the relationship between these factors and BHC returns differs across banks. Data on these systemic risk factors are obtained from the Federal Reserve Economic Data provided by the Federal Reserve Bank of St. Louis. We then collect the residuals and take the natural logarithm of the standard deviation of these residual market returns as our second risk measure, ln(stdev of residual weekly returns).

Third, we compute each bank's *Z*-score (following Laeven and Levine, 2007) as:

$$Z_{b,t} = \frac{ROA_{b,t} + CAR_{b,t}}{\sigma_{b,t}}, \quad (2)$$

where $ROA_{b,t}$ is the return on assets from BHC b in quarter t, $CAR_{b,t}$is the capital-asset-ratio for BHC b in quarter t, and $\sigma_{b,t}$ is the standard deviation of market returns for BHC b in quarter t. In addition to the standard deviation of market returns, Z includes information

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about a BHC's current level of capital and can therefore be interpreted as the number of standard deviations profit can fall before a bank is bankrupt (Roy, 1952).

2.4. Geographic diversification

For each BHC, in each year, we determine the cross-MSA distribution of its bank branches, weighting each branch by its deposits. We use the location of the BHC's branches across MSAs as reported in the Summary of Deposits and define BHC diversification in terms of the location of its bank branch network, not the physical location of the firms and individuals receiving loans as such information is unavailable. However, bank lending is very close to the location of bank branches—especially for small business lending during our sample period. Petersen (2002) finds that the median distance between a firm and a bank branch in the beginning of the 1990s is about six miles.

We examine the distribution of deposits across branches, rather than the distribution of assets, because the FDIC's Summary of Deposits provides deposit data across all branches and subsidiaries. In contrast, comprehensive data on BHC assets are only available at the subsidiary level. This is important for accurately measuring the geographic expansion of BHCs. During this period, some BHCs convert some of their subsidiaries into branches and open new branches. If we only examine subsidiaries, then our measure of geographic expansion will inappropriately change when a bank converts a subsidiary into a branch and our measure will not appropriately change when a BHC opens a new branch. Thus, we measure the geographic diversity of a BHC using its cross-MSA distribution of deposit-weighted branches.

We consider each MSA to be a distinct banking market as in Berger and Hannan (1989) and Rhoades (1997). We compute a BHC's deposit diversification across MSAs and only consider BHCs headquartered in an MSA. These filters do not exclude much of the US banking system. Publicly traded BHCs headquartered in MSAs held on average about 77% of US commercial banking system deposits in 1997. And, of these BHCs, about 91% of their

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commercial banking deposits are held by branches in MSAs. Thus, we capture about 70% of the US commercial banking industry.

Our measure of geographic diversity is 1 – Herfindahl index of deposits across markets and equals one minus the Herfindahl-Hirschman index of a BHC's deposits across the MSAs in which it has branches. This measures the dispersion of a BHC's deposits across MSAs. Note, the measures of BHC diversification are measured at the MSA level, not at the state level.

2.5. Exposure to liquidity risk

Building on Kashyap, Rajan, and Stein (2002) and Gatev, Schuermann, and Strahan (2009), we control for the liquidity risk of each BHC. Kashyap, Rajan, and Stein (2002) focus on the synergies associated with banks taking deposits and making loan commitments. Banks often provide liquidity to borrowers through loan commitments, but this exposes them to the liquidity risk that a borrower draws down a committed line of credit. By combining loan commitments with deposit-taking, banks can hedge such risks if deposit withdrawals and loan commitment drawdowns are negatively correlated. Gatev, Schuermann, and Strahan (2009) show that on average, a US BHC's risk is higher if it has a greater share of undrawn credit lines, but lower if it has a greater share of demand deposits, indicating that BHCs can hedge liquidity risk. To measure liquidity risk, we follow Gatev, Schuermann, and Strahan (2009) and include three variables: (1) the undrawn, but committed, credit lines as a share of BHC loan volume, (2) transaction deposits as a share of total BHC deposit volume, and (3) the interaction between these two terms (to account for the mitigating effect of a BHCs' liability structure on risk).

2.6. Activity diversity

We account for the diversity of each BHC's financial activities to focus on the independent impact of geographic diversity on risk. Following Laeven and Levine (2007), we use both an index of income diversity and an index of asset diversity. The income diversity index measures the degree to which the income of the bank is diversified between interest and noninterest income. The asset diversity index measures the diversity of assets between interest- and noninterest-generating assets. The indexes take on values between zero and one, where larger values imply that the BHC's income and assets are more diversified.

In particular, $\text{Income Diversity} = 1 - \left|\frac{\text{Net Interest Income} - \text{Total Noninterest Income}}{\text{Total Operating Income}}\right|$, where Net interest income equals total interest income minus total interest expenses. Other operating income includes net fee income, net commission income, and net trading income. And, $\text{Asset Diversity} = 1 - \left|\frac{\text{Net Loans} - \text{Other Earning Assets}}{\text{Total Earning Assets}}\right|$, where Net loans equals gross loans minus loan loss provisions. Other earning assets include all earning assets other than loans (such as Treasuries, mortgage-backed securities, and other fixed income securities).

We also control for whether or not the BHC conducts foreign activities using a dummy variable that takes on the value of one if the BHC has subsidiaries that engage primarily in international activity, and zero otherwise.

2.7. Other factors

We also account for an array of bank-specific and MSA-specific traits that influence bank risk (e.g., Avraham, Selvaggi, and Vickery, 2012). For example, we condition on a BHC's size, as a considerable body of research examines economies of scale in banking (Berger, Hanweck, and Humphrey, 1987, Boyd and Gertler, 1993, and Boyd and Runkle, 1993). We also control for Tobin's *Q*, operating income, the capital-asset ratio, the degree to which each BHC engages in non-lending activities, and the return on assets. In some specifications, we also control for the concentration of banking assets within an MSA and quarter, and the real growth rate of average personal income within an MSA. Note, however, that in most specifications we include MSA-time and BHC-fixed effects to account for all time-varying MSA effects and time-invariant BHC-specific effects. Table 1 provides variable names, definitions, and data sources.

2.8. The sample and summary statistics

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Our final sample contains 12,437 BHC-quarter observations of 485 BHCs. The time period of our sample ranges from the third quarter of 1986 to the last quarter of 1997 and includes all publicly traded BHCs, headquartered in one of the 374 MSAs of the contiguous United States. We start in 1986 due to the data limitations noted above. We end the analyses in 1997 because the Riegle-Neal Interstate Banking and Branching Efficiency Act removed all restrictions on interstate banking at the federal level, including restrictions on interstate branching in 1997. Data on deposits at the BHC-branch level are available annually, reported as the value at the end of the second quarter of each year. We assume that the pattern of deposit holdings is constant within a reporting period, i.e., between the second quarter of year t and the first quarter of year t+1. The results are robust to interpolating the level of deposits linearly over the year, or using a cubic spline function to interpolate changes in deposits over the year.

Table 2 reports descriptive statistics of the main variables, with the sample of 485 BHCs split into diversified and nondiversified BHC-quarter observations. Since BHCs diversify during our sample period, the same entity can appear in both columns of Table 2, being categorized as a nondiversified BHC in the quarters before it diversifies and a diversified BHC afterwards. About 68% of our sample consists of BHC-quarters with deposits in more than one MSA. Furthermore, about 295 BHCs have deposits in more than one banking market over the sample period. Regarding our risk measures, Table 2 indicates that diversified banks exhibit a smaller volatility of stock returns. Moreover, diversified banks tend to (1) be much larger and are also (2) more exposed to liquidity risk due to their greater share of undrawn credit lines. The t-tests indicate that all of these differences are significant at the 1% level.

3. Geographic diversity of BHC deposits across MSAs and risk: OLS results

As a preliminary assessment of the relationship between the risk of a BHC and its geographic diversification across MSAs, we estimate OLS regressions. The baseline regression model is specified as follows:

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$$\ln(\sigma)_{b,m,t} = \beta D_{b,t} + X'_{b,m,t}\phi + \delta_b + \delta_t\left(+\delta_{m,t}\right) + \varepsilon_{b,m,t,} \qquad (3)$$

where $\ln(\sigma)_{b,m,t}$ denotes the natural logarithm of the standard deviation of weekly market returns of BHC b in MSA m during quarter t, $D_{b,t}$ denotes our measures of a BHC's geographic diversification during quarter t (1 – *Herfindahl index of deposits across markets*), $X'_{b,m,t}$ is a matrix of conditioning information on BHC b or MSA m in period t, δ_b are BHC fixed effects, δ_t are quarter fixed effects, and in many specifications we include MSA-quarter fixed effects ($\delta_{m,t}$). Throughout the paper, the reported standard errors are heteroskedasticity robust and adjusted for clustering at the MSA-year level.[1] The BHC fixed effects account for unobserved, time-invariant differences across BHCs and focuses the analysis on how changes in BHC risk vary with changes in BHC diversification.

Table 3 provides regression results on the relationship between BHC risk and (1 – *Herfindahl index of deposits across markets*). We first present results using our main measure of bank risk, ln(stdev of observed weekly returns) and then examine ln(stdev of residual weekly returns) and ln(*Z*-score).

In the first three regressions, we include time and BHC fixed effects to account for unobserved time-invariant features at the BHC-level and time effects at the national level. In models (4) through (6), we include MSA-quarter fixed effects. These MSA-quarter fixed effects control for time-varying characteristics at the MSA-level, such as bank competition within MSAs. In all tables we report standardized coefficients to make the economic magnitudes comparable across different models and methodologies. Specifically, the reported coefficients

[1] We cluster at this level because data from the Summary of Deposits are reported annually in June, so that the measure of geographic diversification is constant for a BHC from the second quarter (June) of year t up until the first quarter of year t+1 (March).

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display how a one-standard deviation change in the independent variable is related to a change in BHC risk in terms of the independent variable's standard deviation.[2]

Our results indicate that geographic diversification (1 – *Herfindahl index of deposits across markets*) and risk are positively correlated across the different regression specifications. For example, the column 4 results show that a BHC's degree of geographic diversification is positively associated with risk even when accounting for BHC and MSA-quarter fixed effects. These findings also hold when using the alternative risk measures, as shown in regressions (5) and (6).

Regarding the ability to hedge liquidity risk by holding more transaction deposits, the findings in Table 3 provide mixed results. Consistent with Gatev, Schuermann, and Strahan (2009), regressions (2) and (3) indicate that BHCs with a greater share of committed, but undrawn, lines of credit tend to have greater risk, but this risk falls for BHCs with a greater share of transaction deposits. However, the significant risk-hedging effect of transaction deposits vanishes when we control for MSA-quarter time fixed effects in models (4) through (6).

Endogeneity and selection might confound the interpretation. First, BHCs choose whether to expand. For instance, assume that diversification lowers risk, and also assume that when BHCs decide to increase the risk profile of their assets they diversify geographically to offset that risk. Under these assumptions, OLS will provide an upwardly biased estimate of the impact of diversity on risk, potentially yielding a positive estimated coefficient on diversification. Second, BHCs not only choose whether to expand, they choose where to expand and hence the degree to which they have diversified across different MSAs. Thus, we employ an instrumental variable strategy to identify the impact of diversification across MSAs on BHC risk.

[2] For instance, if the dependent variable is y, the independent variable is x, and the standardized coefficient on x is 2, then this implies that a one-standard deviation increase in x will increase y by two standard deviations (based on the sample distribution of y).

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4. Instrumental variables based on the removal of interstate banking restrictions

To identify the impact of BHC diversity across MSAs on risk, we need an instrumental variable that is correlated with (1 – *Herfindahl index of deposits across markets*) but not independently correlated with the evolution of BHC risk through other channels. Thus, our first goal is to construct such an instrument. Our second goal is to use this variable in reduced form and instrumental variable evaluations of the impact of the geographic expansion of BHC activity on risk.

4.1. Identification strategy

4.1.1. Overview

There are two key ingredients in our strategy for constructing an instrumental variable of each BHC's geographic diversification. First, we exploit the process through which individual states removed restrictions on interstate banking with each other state. As discussed in detail below, the state-specific dynamic process of eliminating prohibitions on the entry of banks from other states evolved over decades. This first ingredient provides state-year information on the ability of BHCs within each MSA of a state to enter MSAs in each other state. But, the process of interstate bank deregulation alone does not provide an instrument that differentiates among BHCs within an MSA.

The second ingredient involves imbedding this state-specific process of interstate bank deregulation into a gravity model of each BHC's investments in "foreign" MSAs to construct a BHC-specific instrumental variable of BHC expansion that differs across BHCs headquartered within the same MSA. A well-established literature on international trade and foreign direct investment demonstrates that geographic proximity facilitates economic interactions. Applying this to banks, Goetz, Laeven, and Levine (2013) show that BHCs are more likely to expand into geographically closer markets than into more distant ones. BHCs that are close to another banking market might have greater familiarity with its economic conditions and face

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lower costs to establishing and maintaining subsidiaries than farther markets (Aguirregabiria, Clark, and Wang, 2013). From this perspective, a BHC in the southern part of California, e.g., Los Angeles, will tend to invest more in Flagstaff, Arizona than in Portland, Oregon and a BHC in San Francisco (northern part of California) might find it correspondingly more appealing to open a subsidiary in nearby Portland, Oregon. In this paper, we go much farther. We use the exact street address of BHCs within an MSA and compute the distance from each BHC's headquarters to other MSAs, so that we can differentiate among BHCs within the same MSA.[3] Even when comparing BHCs within an MSA, we discover that differences in their geographic distances to MSAs in other states help account for where each of those BHCs tends to expand as state authorities remove barriers to interstate banking. By combining the gravity model with the dynamic process of interstate bank deregulation, we construct an instrument for the time-varying geographic dispersion of each BHC's deposits across MSAs.

4.1.2. The process of interstate bank deregulation

Before describing the construction of the instrument, we provide additional information on the process of interstate bank deregulation. For many decades, banks in the United States were not allowed to expand across states. States imposed limits on the location of bank branches and offices in the 19th century, and these impediments restricted the expansion of banks both within states through branches (intrastate branching restrictions) and across state lines through subsidiaries and branches (interstate banking restrictions). These restrictions were supported by the argument that allowing banks to expand freely could lead to a monopolistic banking system, with detrimental effects for economic development. Furthermore, the granting of bank charters was a profitable income source for states, increasing incentives for states to enact regulatory policies.

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[3] The longitude and latitude of the street address of each BHC are computed using data from the Census Geocoder of the US Census Bureau. The US Census Bureau also provides geographic coordinates (longitude and latitude) for all US counties. Based on the 2003 definitions of MSAs, we compute the geographic midpoint for an MSA by taking the average longitude and latitude across all counties belonging to that MSA.

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Starting in the 1970s, technological and financial innovations eroded the value of these restrictions for banks. Particularly, improvements in data processing, telecommunications, and credit scoring weakened the advantages of local banks, reducing their willingness to fight for the maintenance of restrictions on entry by out-of-state banks and triggering deregulation (Kroszner and Strahan, 1999).

Maine was the first state to allow entry by out-of-state BHCs in 1978. In particular, BHCs from other states were allowed to enter Maine if that other state reciprocated and also allowed entry by BHCs headquartered in Maine. While Maine enacted this policy in 1978, no other state changed its entry restrictions on out-of-state BHCs until 1982, when New York put in place a similar legislation and Alaska completely removed its entry restrictions. Over the following 12 years, states removed entry restrictions by unilaterally opening their state borders and allowing out-of-state banks to enter, or by signing reciprocal bilateral and multilateral agreements with other states to allow interstate banking. The Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994 was the culmination of this liberalization process. In particular, the Riegle-Neal Act allowed both unrestricted interstate banking (effective in 1995) and interstate branching (in effect in 1997). Interstate banking involves the ability of a BHC to own and operate separately capitalized bank subsidiaries in a different state. Interstate branching means that a bank can expand its branch network into another state without establishing subsidiaries in that state.

Fig. 1 illustrates the evolution of the interstate banking deregulation process. For each year, it shows the percentage of state-pairs among the contiguous US states that have removed barriers to interstate banking with each other. It also differentiates by the mode of deregulation, where (a) unilateral deregulation refers to cases in which at least one of the states in a state-pair unilaterally allows entry from the other state; (b) reciprocal deregulation refers to cases in which both states in a state-pair have enacted nationwide reciprocal agreements with all other states that allow BHCs from reciprocating states to enter each

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other's market; and (c) bilateral deregulation refers to cases in which the two states in a pair have signed an agreement allowing each other's banks to enter.

Although Maine opened up its banking system to all states in a reciprocal manner in 1978, the fraction of state-pairs that removed restrictions remained at zero until 1982, when New York reciprocated and put in place similar legislation. The pace of interstate deregulation accelerated significantly in the second half of the 1980s, and by 1994 (before the Riegle-Neal Act removed all remaining barriers at the federal level), 76% of the state-pairs in the contiguous states of the US had removed restrictions to bank entry with each other.

Moreover, Fig. 1 shows that the most common method for removing entry restrictions was the unilateral opening of entry to BHCs from all other states. Averaging across all years, unilateral openings account for about 70% of all openings. National reciprocal agreements were the second most frequent form of deregulating interstate banking, while a much smaller percent of state-pairs involved bilateral banking agreements.

In our analysis, we focus on diversification of deposits across MSAs and therefore apply the dates of interstate banking deregulation at the state level to MSAs within each corresponding state to determine when BHCs located in out-of-state MSAs were allowed to enter that MSA. Several of the 374 MSAs span more than one state. In such cases, we use the state with the earliest entry date when determining the date when BHCs from another MSA can enter the MSA that spans more than one state. For example, the Boston-Cambridge-Newton MSA includes counties from Massachusetts and New Hampshire while the Los Angeles-Long Beach-Anaheim MSA only includes counties from California. BHCs from California were allowed to enter the state of Massachusetts in 1991 and the state of New Hampshire in 1990. Hence, we define the date on which BHCs from Los Angeles were allowed to enter the Boston-Cambridge-Newton MSA as 1990. The results are robust to instead defining the year of interstate banking deregulation for a multi-state MSA as the year in which the last state lowered restrictions on interstate banking.

4.2. The gravity-deregulation model

4.2.1. Step 1 in constructing an instrument: framework

We build on the two-step gravity-deregulation identification strategy developed in Goetz, Laeven, and Levine (2013) to assess the impact of geographic diversification on BHC risk. While they consider the expansion of BHCs across states, we examine the expansion of BHCs across MSAs. Specifically, we use (a) the dynamic process of interstate bank deregulation to differentiate across states and time and (b) the distance between each BHC's headquarters within an MSA and all other MSAs into which that BHC can legally enter. We exploit these two dimensions—a BHC's regulatory ability and geographic tendency to expand across MSAs—to construct a time-varying, BHC-specific instrumental variable for the geographic diversity of BHC deposits across MSAs.

We begin by estimating the following equation ("zero-stage"):

$$share_{b,i,j,t} = \alpha_1 \ln(distance)_{b,j} + \beta \ln\left(\frac{population_{i,t}}{population_{j,t}}\right) + \varepsilon_{b,i,j,t}, \quad (4)$$

where $share_{b,i,j,t}$ is the percentage of deposits of BHC *b*, headquartered in MSA *i*, held in its branches in MSA *j* in year *t*; $\ln(distance)_{b,j}$ is the natural logarithm of the miles between BHC *b*'s headquarters and MSA *j*; and $\ln\left(\frac{population_{i,t}}{population_{j,t}}\right)$ is the natural logarithm of the population differential between BHC *b*'s home MSA *i* and MSA *j* in year *t*. $\ln(distance)_{b,j}$ represents the pure gravity component of the equation. We also include $\ln\left(\frac{population_{i,t}}{population_{j,t}}\right)$ since the "gravitational pull of a market" might vary positively with its economic size, such that BHCs are more attracted to larger markets than smaller ones. In terms of estimating Eq. (4) to construct the instrumental variable, note that the dependent variable is bounded between zero and one and we observe many observations with a value of zero. Thus, we follow Papke and Wooldridge (1996) and use a fractional logit model. When estimating Eq. (4), we only include observations in which it is legally feasible for BHC *b* with headquarters in MSA *i* to enter MSA *j* during year *t*.

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4.2.2. Step 1 in constructing an instrument: results

Table 4 presents regression results on the degree to which distance and market size account for the expansion decisions of BHCs. As noted above, we employ a fractional logit model to construct the instrumental variable since the dependent variable is bounded between zero and one. Column 1 of Table 4 provides average marginal effects from the fractional logit estimation that we use in our zero-stage to construct the instrumental variables at the time-varying, BHC level. We do not include MSA, MSA-pair, or time fixed effects in the zero-stage because Rubinstein (2011) shows that including fixed effects in the construction of the instrumental variable (i.e., the zero-stage) can lead to biased estimates in the second stage.

As reported in Table 4, the gravity model explains BHC investment in "foreign" MSAs. Coefficient estimates for our benchmark model are reported in column 1 where we use a fractional logit to estimate Eq. (4). We find a negative relationship between a BHC's entry into an MSA and distance to that MSA. Similarly, our results show that the size of the "foreign" banking market matters for the investment decisions of a BHC and BHCs invest less in smaller MSAs. Hence, our results indicate that distance and relative market size are significant factors in explaining the expansion pattern of BHCs in the US across different banking markets.

In Table 4, we also assess whether the differential distances across BHCs headquartered within the same MSA account for an economically meaningful proportion of their cross-MSA expansion decisions. That is, we test whether differences in geographic distances among banks within the same MSA to MSAs in other states help account for where each of those banks tend to expand after state authorities remove barriers to interstate banking. To conduct this assessment, we use OLS rather than a fractional logit estimator because we ultimately include over 550,000 fixed effects in making this assessment and the fractional logit would not converge. As shown in columns 1 and 2, where we present the

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fractional logit and OLS results with no fixed effects, the results are consistent across these estimation methods.

As shown in Table 4, even when comparing the expansion behavior of BHCs from the same MSA, their differential distances to other MSAs help account for their cross-MSA diversification decisions. We examine this by including increasingly refined fixed effects. In column 3, we include a fixed effect for a BHC's home MSA to account for unobservable effects at the BHC-home-MSA level and find that distance is still significantly related to BHC expansion. When also including a dummy variable for a BHC's foreign market, distance remains significantly related to a BHC's diversification, while the relative size of banking markets becomes insignificant. Note, however, that within a time period, the relative size of markets does not vary across BHCs within a home-MSA-foreign-MSA pair; thus, it is unsurprising that the effect of relative market size becomes insignificant when including home-MSA and foreign-MSA fixed effects.

Moreover, even when conditioning on MSA-pair-year fixed effects, we find that distance helps explain the differential expansion patterns of BHCs headquartered within the same MSA. In column 7 of Table 4, we include a separate dummy variable for each MSA-pair in each year, which involves including over 550,000 dummy variables, to assess whether there is sufficient variation in distance across BHCs headquartered within the same MSA (home-MSA) to explain variation in the cross-MSA expansion patterns from that home-MSA.[4] These analyses only use variation across BHCs within the same MSA-pair-year. For example, by including MSA-pair-time fixed effects, we examine whether BHCs in Los Angeles, CA that are physically closer to Flagstaff, AZ do indeed have more deposits in Flagstaff, AZ than BHCs from Los Angeles, CA that are located farther away from Flagstaff, AZ. As reflected in the large, negative, and significant coefficient estimate in column 7, we find that distance is negatively related to BHC expansion.

[4] Note that the effect of market size on bank expansion cannot be identified when including MSA-pair-year fixed effects because market size only varies at the MSA-pair-year level.

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As an illustrative example, consider the case of two BHCs, First Alabama Bancshares, Inc. and Amsouth Bancorporation that are headquartered in the metropolitan area of Birmingham, AL. Amsouth Bancorporation is about 110 miles away from the MSA of Jacksonville, FL, while First Alabama is about 120 miles away from Jacksonville. First Alabama, however, is about 110 miles away from Baton Rouge, LA, while Amsouth is about 120 miles from the Baton Rouge MSA. Examining the expansion pattern of these two banks shows the following pattern. In 1994, about 2% of First Alabama's deposits were located in Baton Rouge, LA while Amsouth did not have a subsidiary or branch in that MSA. Similarly, about 1.6% of Amsouth's deposits were located in the MSA of Jacksonville, FL, while First Alabama did not have a subsidiary or branch in that MSA. This is consistent with our earlier estimates that indicate that distance is an important factor in explaining the expansion pattern of BHCs within the same banking market.

The impact of distance on diversification is economically meaningful. The median distance between a BHC and a foreign MSA is 393 miles, and the average distance between BHCs within the same MSA is 11 miles. Based on this information and the coefficient estimates in column 7 of Table 4, we compute that a BHC that is 11 miles closer to a foreign MSA has about 0.03% more deposits in that banking market than a BHC from the same MSA that is 11 miles farther away from that foreign MSA. Considering that we have 374 different banking markets in our analysis, we compute that the BHC that is farther away from other banking markets has in total about 12.6% fewer deposits in foreign markets. Of course, different BHCs within an MSA might be differentially closer to or farther away from the array of foreign MSAs. But, these estimates suggest that even distance within an MSA helps account for BHC expansion into foreign MSAs.

4.2.3. Step 2: constructing the instrument

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In the second step of the gravity-deregulation model, we use the estimates from Table 4's fractional logit model to construct our instrumental variable, i.e., the predicted diversification measure for each BHC in each year (1 - *Herfindahl index of deposits across markets (predicted)*). To create this predicted value, we use the coefficient estimates from column 1 of Table 4 to obtain the projected share of a BHC's deposits in an MSA for periods in which regulations do not prohibit the BHC from investing in the MSA. For observations in which regulations prohibit a BHC from opening a subsidiary in an MSA, we set the projected share equal to zero. Then, we use these projected shares to compute 1 - *Herfindahl index of deposits across markets (predicted)* for each BHC in each period. We use this 1 - *Herfindahl index of deposits across markets (predicted)* as the instrument for actual diversification in our first-stage regression. Hence, based on this instrument we can determine the exogenous component of observed diversification and we can assess the impact of diversification on risk. Furthermore, we also use our instrumental variable in reduced form analyses.

The first-stage results in Panel B of Table 5 suggest that the instrumental variables are closely associated with a BHC's actual level of diversification. As expected, a higher level of a BHC's predicted geographic diversification is positively associated with observed diversification at the 1% level. Note that we also include BHC and MSA-quarter fixed effects in these regressions. Hence, the first-stage regression results indicate that even conditioning on unobservable, time-varying changes at the banking market level, our instrument is able to explain within-BHC changes in diversification very well. This is consistent with our earlier finding that even among BHCs within the same banking market, distance has a significant effect on their expansion. This strong statistical relationship is also reflected in the fact that the *F*-test of the first-stage regression model is always above 6. Overall, the first-stage results show that the gravity-deregulation model explains diversification at the BHC level.

4.3. Results using BHC instruments based on the gravity-deregulation model

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In the second-stage results of the 2SLS estimation presented in Panel A of Table 5, the coefficient on geographic diversity (*1 – Herfindahl index of deposits across markets*) enters the risk regression negatively and significantly. The findings hold when conditioning on BHC and MSA-quarter fixed effects, as well as time-varying BHC characteristics. Furthermore, the negative relationship between BHC risk and geographic expansion from these 2SLS analyses also emerges when using alternative measures of risk. The 2SLS results are consistent with the view that for the average BHC an exogenous increase in geographic expansion reduces bank risk. In Panel C of Table 5, we study the reduced form relationship between BHC risk and the predicted BHC diversification from the gravity-deregulation model. These reduced form results indicate that (1 - *Herfindahl index of deposits across markets (predicted)*) enters the risk regression negatively and significantly.

The estimated economic magnitudes are large. Consider, for example, the estimates from column 1 of Table 5. The 2SLS estimates indicate that a one-standard deviation increase in the *exogenous* component of BHC diversification will, on average, reduce BHC risk (the natural logarithm of the standard deviation of weekly stock returns) by 52% (=0.522) of its sample standard deviation. Furthermore, the estimated economic magnitudes are similar across different measures of risk, as shown by the reported coefficients on diversification across regressions (1) through (3).

The estimates reported in Tables 3 and 4 are consistent with OLS yielding upward biased estimates of the impact of an increase in the geographic diversification of BHC activity on bank risk. In particular, if increases in risk induce BHCs to expand geographically, OLS will provide an upward biased estimate of the impact of diversity on risk. By using instrumental variables, we provide an estimate of the impact of geographic diversity on risk for a randomly selected BHC.

We provide several checks of the exclusion restriction. One concern is that deregulation might have altered competition among BHCs and influenced BHC risk through this competition channel, rather than by shaping geographic expansion. For example, consider

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state-pairs in which at least one state allowed banks from the other state to enter. In a typical year, about 30% of these state-pairs involved reciprocal agreements in which both states allowed banks from the other state to enter. The remaining 70% of these state-pairs involved a unilateral deregulation in which only one state allowed banks from the other to enter. In the reciprocal state-pairs, BHCs were not only permitted to expand into the foreign state; they also faced a greater threat that BHCs from the foreign state would enter their home market. There is the possibility, therefore, that the gravity-deregulation instrument is associated with BHC risk through some channel beyond geographic diversity.

We offer three types of analyses that are consistent with the validity of the gravity-deregulation instrument. First, we condition on BHC and MSA-quarter fixed effects, so that we control for all time-varying factors influencing a BHC's home MSA. To the extent that the relevant banking market is an MSA, this means that we control for all factors influencing a BHC's home banking market—including the threat of entry of foreign banks. With these controls, we find that geographic expansion lowers BHC risk.

Second, the regressions control for the time-varying characteristics of BHCs, such as the BHC's return on assets, Tobin's Q, operating income, size, capital-asset ratio, liquidity position, and diversification into non-lending activities. So, if deregulation were simply influencing BHC risk through changes in profitability, market valuations, earnings, etc., then we would not find the strong, independent relationship between BHC risk and instrumented diversity after controlling for these other traits. As shown, the results reported in Table 5 are robust to controlling for all of these factors.

Third, we employ a set of further robustness tests to examine whether particular banks drive our findings. In particular, we examine whether our results also hold if we (1) exclude New York City, and if we (2) exclude BHCs that also engage in international banking activities.

5. Robustness tests

5.1. Alternative construction of instrumental variable

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Results from the gravity-deregulation model presented in Table 4 indicate that distance is a statistically significant and economically robust factor in explaining the expansion of BHCs into foreign MSAs, but the relation between market size and BHC expansion becomes statistically insignificant when including fixed effects for the home and the foreign MSA. We include market size in the core analyses presented above because we do not include these fixed effects when constructing the projected expansion of BHC assets due to the reasons outlined in Rubinstein (2011) and discussed above.

We now assess, and demonstrate, the robustness of the earlier results to using a more parsimonious gravity-deregulation model that excludes market size. In particular, we exclude market size and only use distance in forming the predicted shares of BHC investment and constructing the instrument (1 - *Herfindahl index of deposits across markets (predicted)*). As before, we then use this instrument in a 2SLS regression to evaluate the impact of geographical diversification on risk. Regression results in Panel A of Table 6 indicate that our findings are robust to using this alternative gravity-deregulation model to construct a BHC-specific instrument of BHC expansion. We continue to find that greater geographic diversification leads to lower risk and the estimated magnitudes are also robust to using this alternative model.

5.2. Exclude BHCs located in New York City

We also confirm the robustness of the findings reported above to dropping BHCs located in the New York metropolitan area. The New York metropolitan area is the financial center of the United States and we were concerned that particular features of this market might shape the overall results. Although the regression results reported above include MSA-quarter fixed effects, we cannot rule out that New York City BHCs exhibit different diversification and risk patterns. Thus, we reassess the relation between geographic expansions and risk while excluding all BHCs located in the New York metropolitan area. Regression results from Panel B in Table 6 indicate that the exclusion of New York-based

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financial institutions does not affect our findings. We find that greater geographic diversification leads to lower risk across different risk measures even if we exclude NY-based BHCs.

5.3. Exclude BHCs that also engage in international banking activities

We were also concerned that BHCs that engage in international banking activities—such as foreign lending, trading in foreign currency, or accepting deposits from foreigners—might face different competitive pressures, different risks, and different diversification opportunities from other BHCs and that such international banks might distort the paper's findings. Based on information contained in Call Reports, we can determine whether a BHC operates a subsidiary that primarily engages in international banking activities, i.e., an Edge or Agreement corporation. In the analyses above, we include a dummy variable that equals one when a BHC operates an Edge or Agreement corporation and zero otherwise. We now exclude all such BHCs and repeat the regressions. As shown in Panel C of Table 6, all of the results hold both in terms of statistical significance and in terms of the economic sizes of the coefficient estimates. We continue to find that greater geographic diversification materially lowers bank risk.

6. Loan quality

Thus far, the 2SLS analyses indicate that for an average BHC, an innovation in the geographic diversity of BHC activity lowers BHC risk. Does this imply that there are pure diversification benefits from geographic expansion, or could it be that risk declines with geographic expansion due to improved asset quality?

A key channel through which banks can improve asset quality is through the monitoring of their loans. If banks that expand geographically improve their monitoring of loans in such a way that it results in lower riskiness of loans, then this could explain the findings thus far. For example, if banks that expand geographically invest in better risk

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management systems, this could enhance their monitoring skills and reduce bank risk. Other work, however, provides a skeptical take on this monitoring channel. Distance matters in relationship lending as it is more costly and difficult to monitor distant loans, and it is likely that the bank's monitoring effectiveness is lower in new geographic areas (Winton, 1999).

We test for the relevance of this monitoring channel using three alternative measures of loan quality: loan charge-offs, nonperforming loans, and loan loss provisions, all expressed as a fraction of total loans. All three measures are decreasing in loan quality. We regress these measures of loan quality on our measure of geographic diversity, using the same approach as above. As above, we include bank fixed effects and MSA-quarter fixed effects and are interested in how diversification changes loan quality within a BHC when that institution expands.

We find no evidence that geographic expansion improves loan quality. The 2SLS results are presented in Table 7. We do not find that the coefficient on 1 - Herfindahl index of deposits between markets enters statistically significantly in the loan charge-off, non-performing loans, or loan loss provision regressions.

7. Conclusions

What is the impact of the geographic expansion of BHC activity on risk? While some theories suggest that geographic expansion makes it more complex for executives to monitor activities and manage risk, other theories advertise the cost-efficiencies and risk-reducing benefits of being geographically diversified.

This paper develops and uses a new identification strategy to evaluate the net impact of the geographic expansion of BHC deposits across MSAs on BHC risk and loan quality. Specifically, we embed cross-state, cross-time variation in interstate bank deregulation into a gravity model of BHC expansion to create a BHC-specific instrumental variable of its deposits across MSAs over time. We then use 2SLS to evaluate the impact of the geographic expansion of each BHC's deposits on BHC risk and loan quality. Although we use this identification

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strategy to evaluate the effect of geographic diversification on BHC risk and loan quality, it can be employed to address other questions about bank behavior.

Our 2SLS estimates suggest that, for the average BHC, an exogenous increase in the geographic diversity of the BHC's deposits across MSAs lowers BHC risk. We cannot, however, reject the null hypothesis that the geographic expansion of BHC activity has no effect on loan quality. These findings are consistent with the view that geographic expansion lowers bank risk by enabling banks to diversify their exposure to idiosyncratic local market risks.

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References

Acharya, V., Hasan, I., Saunders, A., 2006. Should banks be diversified? Evidence from individual bank loan portfolios. Journal of Business 79, 1355 – 1411.

Aguirregabiria, V., Clark, R. C., Wang, H., 2013. Diversification of geographic risk in retail bank networks: evidence from bank expansion after the Riegle-Neal Act. Unpublished working paper. University of Toronto.

Akhigbe, A., Whyte, A. M., 2003. Changes in market assessment of bank risk following the Riegle-Neal Act of 1994. Journal of Banking and Finance 27, 87–102.

Amel, D., 1993. State laws affecting the geographic expansion of commercial banks. Unpublished working paper, Board of Governors of the Federal Reserve System.

Atkeson, A. G., Eisfeldt, A. L., Weill, P., 2014. Measuring the financial soundness of U.S. firms, 1926 – 2012. Unpublished working paper, University of California, Los Angeles.

Avraham, D., Selvaggi, P., Vickery, J., 2012. A structural view of U.S. bank holding companies. Federal Reserve Bank of New York Economic Policy Review, July, 65 – 81.

Basel Committee on Banking Supervision, 2011. Global systemically important banks: assessment methodology and the additional loss absorbency requirement. Rules text, November 2011. Available at: http://www.bis.org/publ/bcbs207.pdf.

Berger, A., Hannan, T. H., 1989. The price-concentration relationship in banking. Review of Economics and Statistics 71, 291 – 299.

Berger, A., Hanweck, G., Humphrey, D., 1987. Competitive viability in banking: scale, scope, and product mix economies. Journal of Monetary Economics 20, 501 – 520.

Berger, A., Miller, N., Petersen, M., Rajan, R., Stein, J., 2005. Does function follow organizational form? Evidence from the lending practices of large and small banks. Journal of Financial Economics 76, 237 – 269.

Berger, P., Ofek, E., 1995. Diversification's effect on firm value. Journal of Financial Economics 37, 39 – 65.

Bernanke, B. S., 1983. Nonmonetary effects of the financial crisis in the propagation of the Great Depression. American Economic Review 73, 257 – 276.

Boyd, J. H., De Nicolo, G., 2005. The theory of bank risk taking and competition revisited. Journal of Finance 60, 1329 – 1343.

Boyd, J. H., Gertler, M., 1993. US commercial banking: trends, cycles, and policy. In: Blanchard, O., Fischer, S. (Eds.),NBER Macroeconomics Annual 1993, vol. 8. MIT Press Cambridge, MA, 319 – 377.

ACCEPTED MANUSCRIPT

Boyd, J. H., Prescott, E. C., 1986. Financial intermediary-coalitions. Journal of Economic Theory 38, 211 – 232.

Boyd, J. H., Runkle, D.E., 1993. Size and performance of banking firms. Journal of Monetary Economics 31, 47 – 67.

Brickley, J., Linck, J., Smith, C., Jr., 2003. Boundaries of the firm: evidence from the banking industry. Journal of Financial Economics 70, 351 – 383.

Calomiris, C., Mason, J., 1997. Contagion and bank failures during the Great Depression: the June 1932 Chicago banking panic. American Economic Review 87, 863 – 883.

Calomiris, C., 2000. U.S. Bank Deregulation in Historical Perspective. Cambridge University Press, New York.

Calomiris, C., Mason, J., 2003a. Consequences of U.S. bank distress during the depression. American Economic Review 93, 937 – 947.

Calomiris, C., Mason, J., 2003b. Fundamentals, panics and bank distress during the depression. American Economic Review 93, 1615 – 1647.

Chong, B. S., 1991. Interstate banking on commercial banks' risk and profitability. The Review of Economics and Statistics 73, 78 – 84.

Custodio, C., 2014. Mergers and acquisitions accounting and the diversification discount. Journal of Finance 69. 219 – 240.

DeLong, G., 2001. Stockholder gains from focusing versus diversifying bank mergers. Journal of Financial Economics 59, 221–252.

Demsetz, R. S., Strahan, P. E., 1997. Diversification, size, and risk at bank holding companies. Journal of Money, Credit and Banking 29, 300 – 313.

Deng, S., Elyasiani, E., 2008. Geographic diversification, bank holding company value, and risk. Journal of Money, Credit and Banking 40, 1217 – 1238.

Denis, D. J., Denis, D. K., Sarin, A., 1997. Agency problems, equity ownership, and corporate diversification. Journal of Finance 52, 135 – 160.

Diamond, D. W., 1984. Financial intermediation and delegated monitoring. Review of Economic Studies 51, 393 – 414.

Gatev, E., Schuermann, T., Strahan, P., 2009. Managing bank liquidity risk: how deposit-loan synergies vary with market conditions. Review of Financial Studies 22, 995 – 1020.

ACCEPTED MANUSCRIPT

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Goetz, M.R., Laeven, L., Levine, L., 2013. Identifying the valuation effects and agency costs of corporate diversification: evidence from the geographic diversification of US banks. Review of Financial Studies 26, 1787 – 1823.

Goetz, M.R., Gozzi, J.C., 2014, Financial integration and the co-movement of economic activity: Evidence from U.S. states. Unpublished working paper, Goethe University Frankfurt.

Graham, J., Lemmon, M., Wolf, J., 2002. Does corporate diversification destroy value? Journal of Finance 57, 695 – 720.

Gropp, R., Hakenes, H., Schnabel, I., 2011. Competition, risk-shifting, and public bail-out policies. Review of Financial Studies 24, 2084 – 2120.

Jayaratne, J., Strahan, P., 1996. The finance-growth nexus: evidence from bank branch deregulation. Quarterly Journal of Economics 111, 639 – 670.

Jensen, M.C., 1986. Agency costs of free cash flow, corporate finance, and takeovers. American Economic Review 76, 332 – 329.

Kashyap, A., Rajan, R., Stein, J., 2002. Banks as liquidity providers: an explanation for the coexistence of lending and deposit-taking. Journal of Finance 57, 33 – 73.

Keeley, M., 1990. Deposit insurance, risk, and market power in banking. American Economic Review 80, 1183 – 1200.

Kroszner, R., Strahan, P., 1999. What drives deregulation? Economics and politics of the relaxation of bank branching restrictions. Quarterly Journal of Economics 114, 1437 – 1467.

Laeven, L., Levine, R., 2007. Is there a diversification discount in financial conglomerates? Journal of Financial Economics 85, 331 – 367.

Papke, L. E., Wooldridge, J. M., 1996. Econometric methods for fractional response variables with an application to 401 (K) plan participation rates. Journal of Applied Econometrics 11, 619 – 632.

Petersen, M., 2002. Does distance still matter? The information revolution in small business lending. Journal of Finance 57, 2533 – 2570.

Rhoades, S., 1997. Have barriers to entry in retail commercial banking disappeared? Antitrust Bulletin 42, 997 – 1013.

Roy, A.D., 1952. Safety first and the holding of assets. Econometrica 20, 431 – 450.

Rubinstein, Y., 2011. Estimating the impact of trade on income: trade volumes and trade partners. Unpublished working paper, London School of Economics.

ACCEPTED MANUSCRIPT

Servaes, H., 1996. The value of diversification during the conglomerate merger wave. Journal of Finance 51, 1201 – 1225.

Winton, A., 1999. Don't put all your eggs in one basket? Diversification and specialization in lending. Unpublished working paper. University of Minnesota.

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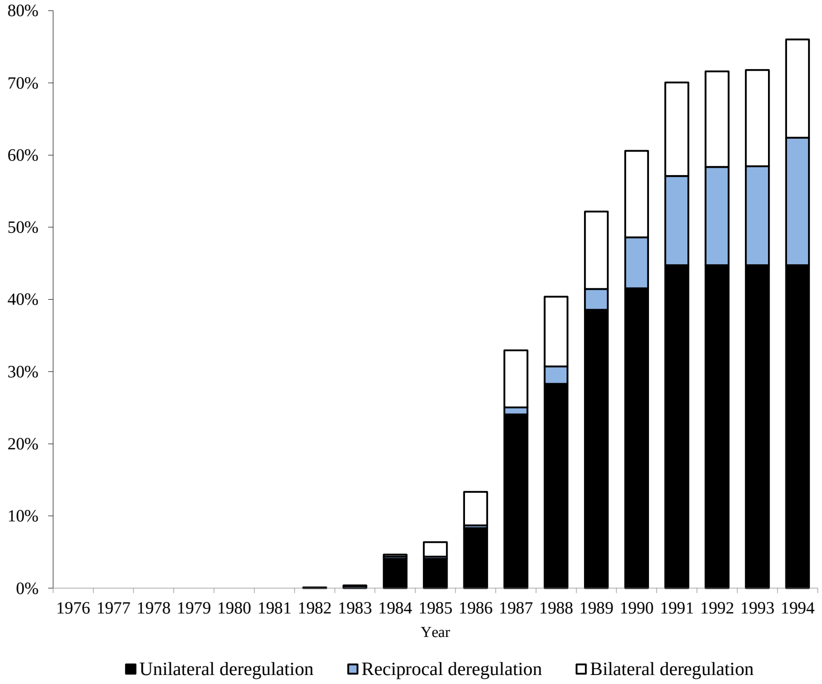

Fig. 1. Evolution of interstate banking deregulation. This figure shows the cumulative fraction of state-pairs in our sample that had removed barriers to bank entry among each other by each year over the period 1976–1994, differentiating between different methods for removing restrictions. Unilateral deregulation refers to cases in which (at least) one of the states in a given pair unilaterally allowed entry by bank holding companies from all other states. Reciprocal deregulation involves cases in which states enacted nationwide reciprocal agreements with all other states. In these cases, the date of effective deregulation for a given state-pair depends not only on the decision of the state that deregulated in a reciprocal manner, but also on the other state's decision to reciprocate. Bilateral deregulation refers to cases in which the two states in a given pair allowed entry by signing a bilateral interstate banking agreement. The sample covers the 48 contiguous states of the United States, excluding Delaware and South Dakota.

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Table 1
Description of the variables.
This table provides variable names, definitions, and data sources.

Variable	Additional explanation	Source
Standard deviation of weekly market returns over quarter	Standard deviation over a quarter of a BHC's weekly market returns. The BHC's weekly market value is measured on Wednesday.	CRSP
Standard deviation of weekly residual market returns over quarter	Standard deviation of a BHC's residual market returns over a quarter (see above), where two systematic risk factors (default risk, interest rate risk) are removed from the BHC's market returns to construct residual market returns.	CRSP
Z-score	(Net income / Assets (book value) + Capital / Assets (book values))/(Standard deviation of weekly market returns over quarter).	FRY-9C; CRSP
1 – Herfindahl index of deposits across markets	One minus the Herfindahl index of a BHC's deposit holdings across the MSAs in which it has branches.	FRY-9C; Call reports; Summary of Deposits
1 - Herfindahl index of deposits across markets (predicted)	One minus the Herfindahl index of a BHC's predicted deposit holdings across the MSAs in which it has branches. Predicted deposit holdings are obtained from the gravity-deregulation model.	FRY-9C; Call reports; Summary of Deposits; Gravity-deregulation model
Ln(Miles between HQ and MSA *j*)	Natural logarithm of the distance in miles between a BHC's headquarters and the geographic midpoint of MSA *j*.	FRY-9C; Census
Population Difference	Ratio of a MSA's total population to the total population of the MSA where the BHC is headquartered	BEA
Tobin's *Q*	(Equity market value + Liabilities book value)/(Equity book value + Liabilities book value).	FRY-9C; CRSP
Income diversity	1 - |(Net interest income – Total noninterest income)/(Total operating income)| .	FRY-9C
Asset diversity	1 - |(Net Loans – Other earning assets)/(Total earning assets)| .	FRY-9C
International activity	This is a dummy variable that equals one if the BHC has subsidiaries that engage primarily in international activities, and zero otherwise.	FRY-9C
Loan commitments / (Loan commitments + Loans)	Share of BHC's loan commitments in total loan volume in quarter	FRY-9C
Transactions deposits / Total deposits	Share of BHC's transaction deposits in total deposits in quarter	FRY-9C
Loan charge offs / Total loans (%)	Share of BHC's loan charge offs in total loan volume in quarter.	FRY-9C
Nonperforming loans / Total loans (%)	Share of BHC's nonperforming loans in total loan volume in quarter.	FRY-9C
Loan loss provisions / Total loans (%)	Share of BHC's loan loss provisions in total loan volume in quarter.	FRY-9C
Herfindahl index of assets in MSA	Herfindahl index of banking asset concentration in MSA and quarter.	FRY-9C; Call reports
Return on assets	Standard definition	FRY-9C
Total equity (in million $)	Standard definition	FRY-9C
Total assets (in million $)	Standard definition	FRY-9C
Net interest income (in million $)	Standard definition	FRY-9C
Total operating income (in million $)	Standard definition	FRY-9C
Capital / assets (%)	Standard definition	FRY-9C
Annual growth of real personal income in MSA	Standard definition	BEA

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Table 2
Summary statistics.

This table shows summary statistics for the sample. Banks are 'nondiversified' if they have branches in only one MSA; 'diversified' banks have branches in at least two MSAs. Further information for each variable is provided in Table 1. The sample ranges from the second quarter of 1986 to the last quarter of 1997.

	Nondiversified bank holding companies						Diversified bank holding companies					
	N	Mean	Std.dev.	Min.	Max.	Median	N	Mean	Std.dev.	Min.	Max.	Median
(Standard deviation of weekly market returns over quarter)*100	3,994	4.24	2.54	0.80	16.39	3.59	8,453	4.00	2.30	0.80	16.41	3.41
(Standard deviation of weekly residual market returns over quarter)*100	3,994	4.24	2.47	0.73	16.88	3.58	8,453	3.85	2.22	0.68	16.38	3.25
Tobin's *Q*	3,816	102.67	4.83	94.66	127.68	101.81	8,327	103.18	4.36	94.67	127.78	102.38
Loan commitments / (Loan commitments + Loans)	3,972	0.15	0.10	0.00	0.64	0.13	8,429	0.21	0.12	0.00	0.97	0.19
Transactions deposits / Total deposits	3,678	0.30	0.12	0.00	1.00	0.29	8,232	0.30	0.08	0.03	0.78	0.29
Return on assets	3,881	0.58	0.44	-1.15	1.88	0.55	8,296	0.58	0.42	-1.12	1.89	0.56
1 - Herfindahl index of deposits across markets	3,994	0	0	0	0	0	8,453	0.47	0.25	0.00	0.95	0.48
Income diversity	3,994	0.63	0.11	0.03	1.00	0.63	8,453	0.71	0.12	0.26	1.00	0.71
Asset diversity	3,994	0.39	0.14	0.08	0.96	0.37	8,453	0.38	0.11	0.08	0.88	0.36
International activity	3,994	0	0	0	1	0	8,453	0	0	0	1	0
Total equity (in million $)	3,994	907	2,345	14	23,950	382	8,453	8,336	20,810	29	217,000	1,986
Total assets (in million $)	3,994	12,005	36,425	726	403,000	4,454	8,453	125,000	317,000	951	3,670,000	26,700
Net interest income (in million $)	3,994	227	528	6	10,340	109	8,453	2,634	7,212	11	115,000	559
Total operating income (in million $)	3,994	663	2,287	21	40,580	231	8,453	7,808	23,672	19	383,000	1,342
Capital / assets (%)	3,994	8.76	3.91	0.39	79.45	8.16	8,453	7.73	2.01	1.11	25.27	7.56
Loan charge offs / Total loans (%)	3,859	0.36	0.48	0.00	3.21	0.19	8,343	0.47	0.51	0.00	3.19	0.30
Nonperforming loans / Total loans (%)	2,747	1.89	1.87	0.08	9.90	1.21	5,721	1.71	1.66	0.08	9.89	1.11
Loan loss provisions / Total loans (%)	3,898	0.35	0.49	0.00	3.71	0.20	8,274	0.43	0.54	0.00	3.76	0.26

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Table 3
Geographic diversification and bank holding company risk - OLS regressions.
This table reports OLS regressions at the bank holding company (BHC) level over the period Q2/1986–Q4/1997. The dependent variable is given in the first row and is the natural logarithm of the standard deviation of weekly stock market returns (columns 1 to 4), the natural logarithm of the standard deviation of weekly residual stock market returns (column 5), or the natural logarithm of *Z*-score (column 6), for BHCs, measured over a quarter. Weekly stock market returns where the BHC was part of a merger and/or acquisition are excluded. Moreover, only BHC-quarters with at least 75% of nonmissing stock market returns are included. See Table 1 for further information on the variables. All coefficients are standardized, i.e., the coefficients display how many standard deviations the dependent variable changes for a one-standard deviation change in the independent variable. All regressions include quarter fixed effects, BHC fixed effects, and MSA-quarter fixed effects as indicated. Standard errors are clustered at the MSA-year level, and reported in parentheses. *, **, *** denote significance at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	ln(stdev of observed weekly returns)				ln(stdev of residual weekly returns)	ln(*Z*-score)
1 - Herfindahl index of deposits across markets	0.033***	0.028**	0.028**	0.052**	0.060***	-0.040*
	(0.011)	(0.011)	(0.011)	(0.023)	(0.023)	(0.021)
ln(Total assets)	0.025	0.026	-0.154***	-0.126	-0.162*	0.113
	(0.017)	(0.017)	(0.050)	(0.088)	(0.091)	(0.088)
Loan commitments / (Loan commitments + Loans)		0.070***	0.057**	0.046	0.037	-0.044
		(0.025)	(0.025)	(0.039)	(0.038)	(0.037)
Transactions deposits / Total deposits		0.009	0.014	0.014	0.016	-0.015
		(0.015)	(0.015)	(0.027)	(0.027)	(0.026)
Commitments / (Commitments + Loans) * Transactions deposits / Total deposits		-0.089***	-0.058**	-0.058	-0.050	0.068*
		(0.025)	(0.024)	(0.038)	(0.038)	(0.036)
Tobin's *Q*			-0.037**	-0.044*	-0.062**	0.034
			(0.015)	(0.030)	(0.031)	(0.027)
Income diversity			0.039***	0.024	0.025	-0.023
			(0.012)	(0.020)	(0.021)	(0.019)
Asset diversity			0.015	-0.005	0.003	-0.003
			(0.010)	(0.020)	(0.020)	(0.019)
International activity			0.005	0.001	0.000	-0.003
			(0.007)	(0.012)	(0.013)	(0.011)
Return on assets			-0.145	-0.118	-0.125	0.229
			(0.014)	(0.025)	(0.026)	(0.024)
Capital / assets			-0.070***	-0.065***	-0.071	0.309
			(0.013)	(0.027)	(0.028)	(0.03)
ln(Total operating income)			0.266***	0.135	0.149	-0.182
			(0.093)	(0.165)	(0.174)	(0.161)
Herfindahl index of assets in MSA			-0.002			
			(0.009)			
Annual growth of real personal income in MSA			-0.019			
			(0.013)			
Annual growth of real personal income in MSA (lag)			-0.035***			
			(0.013)			
Quarter fixed effects	x	x	x	x	x	x
BHC fixed effects	x	x	x	x	x	x
MSA-quarter fixed effects				x	x	x
Observations	12,559	11,978	11,566	11,566	11,554	11,522
R-squared	0.397	0.393	0.395	0.688	0.680	0.776

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Table 4
Gravity Model.
This table reports average marginal effects from a fractional logit regression (column 1) and results from an OLS regression (columns 2 to 7). The dependent variable is the share of deposits a BHC has in an MSA. See Table 1 for further information on the variables. Standard errors are reported in parentheses and clustered at the MSA-year level. *, **, *** denote significance at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ln(Miles between HQ and MSA)	-0.164***	-0.222***	-0.236***	-0.334***	-1.266***	-1.267***	-1.225***
	(0.004)	(0.010)	(0.011)	(0.016)	(0.191)	(0.191)	(0.232)
Population difference	-0.042***	-0.037***	-0.082***	0.023	-0.007	-0.023	
	(0.002)	(0.002)	(0.004)	(0.069)	(0.022)	(0.026)	
Home-market fixed effects			x	x			
Foreign-market fixed effects				x			
Home-foreign pair fixed effects					x	x	
Year fixed effects						x	
Home-foreign-year triple fixed effects							x
Observations	893,694	893,694	893,694	893,694	893,694	893,694	893,694

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Table 5
The impact of geographic diversification on bank holding company risk - 2SLS regressions.
This table reports results from a 2SLS regression at the BHC level over the period Q2/1986–Q4/1997. The dependent variable is given in the first row. See Table 1 for further information on the variables. Panel A reports the second-stage results where the endogenous variable is '1 - Herfindahl Index of deposits across markets.' The employed instrument is based on a gravity-deregulation model. Panel B reports the first-stage results and '1 – Herfindahl Index of deposits across markets (predicted)' is the predicted '1 - Herfindahl Index of deposits across markets' based on fitted values from a gravity-deregulation model. Panel C reports reduced form results where the independent variable is '1 – Herfindahl Index of deposits across markets (predicted).' All coefficients are standardized and display how many standard deviations the dependent variable changes for a one-standard deviation change in the independent variable. All regression models include MSA-quarter fixed effects and BHC fixed effects. Standard errors are clustered at the MSA-year level, and reported in parentheses. *, **, *** denote significance at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)
Panel A: Second stage			
Dependent variable:	ln(stdev of observed weekly returns)	ln(stdev of residual weekly returns)	ln(*Z*-score)
1 - Herfindahl index of deposits across markets	-0.522**	-0.615**	0.396*
	(0.249)	(0.278)	(0.228)
Panel B: First stage			
1 - Herfindahl index of deposits across markets (predicted)	0.082**	0.080**	0.088***
	(0.033)	(0.031)	(0.033)
Observations	8,490	8,477	8,442
F-test	6.629	6.379	7.201
Panel C: Reduced form			
1 - Herfindahl index of deposits across markets (predicted)	-0.022**	-0.026***	0.018*
	(0.009)	(0.009)	(0.009)
Bank and macro controls	x	x	x
MSA-quarter fixed effects	x	x	x
Bank fixed effects	x	x	x
Observations	8,490	8,477	8,442

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Table 6
The impact of geographic diversification on bank holding company risk - robustness.

This table reports results from a 2SLS regression at the BHC level over the period Q2/1986–Q4/1997. The dependent variable is given in the first row. See Table 1 for further information on the variables. The endogenous variable is '1 - Herfindahl Index of deposits across markets.' The employed instrument in Panel A is based on a gravity-deregulation model where we only include distance as a factor in explaining BHC expansion. In Panel B we use the instrumental variable from Table 4 and exclude BHCs located in the New York metropolitan area. Panel C reports results where we use the instrumental variable from Table 4 and exclude BHCs that operate Edge or Agreement corporations. All coefficients are standardized and display how many standard deviations the dependent variable changes for a one-standard deviation change in the independent variable. All regression models include MSA-quarter fixed effects and BHC fixed effects. Standard errors are clustered at the MSA-year level, and reported in parentheses. *, **, *** denote significance at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)
Dependent variable:	ln(stdev of observed weekly returns)	ln(stdev of residual weekly returns)	ln(*Z*-score)
Panel A: Instrumental variable based only on distance			
1 - Herfindahl index of deposits across markets	-0.352**	-0.401**	0.294*
	(0.16)	(0.166)	(0.155)
Observations	8,490	8,477	8,442
F-test	9.759	9.575	10.35
Panel B: Exclude NYC			
1 - Herfindahl index of deposits across markets	-0.590**	-0.671**	0.472*
	(0.288)	(0.318)	(0.271)
Observations	7,237	7,223	7,197
F-test	4.867	4.660	5.353
Panel C: Exclude BHCs with subsidiaries that engage in international banking activities			
1 - Herfindahl index of deposits across markets	-0.873*	-0.974**	0.673*
	(0.452)	(0.493)	(0.377)
Bank and macro controls	x	x	x
MSA-Quarter fixed effects	x	x	x
Bank fixed effects	x	x	x
Observations	7,197	7,194	7,163
F-test	3.054	3.092	3.383

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Table 7
The impact of geographic diversification on loan quality - 2SLS regressions.

This table reports second-stage results from a 2SLS regression at the BHC level over the period Q2/1986–Q4/1997. The dependent variable is given in the first row. See Table 1 for further information on the variables. The endogenous variable is '1 - Herfindahl Index of deposits across markets.' The employed instrument in Panel A is based on a gravity-deregulation model where we only include distance as a factor in explaining BHC expansion. In Panel B we use the instrumental variable from Table 5 and exclude BHCs located in the New York metropolitan area. Panel C reports results where we use the instrumental variable from Table 5 and exclude BHCs that operate Edge or Agreement corporations. All coefficients are standardized and display how many standard deviations the dependent variable changes for a one-standard deviation change in the independent variable. All regression models include MSA-quarter fixed effects and BHC fixed effects. Standard errors are clustered at the MSA-year level, and reported in parentheses. *, **, *** denote significance at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)
Dependent variable:	Loan Charge Offs / Total Loans	Nonperforming Loans / Total Loans	Loan Loss Provisions / Total Loans
Panel A: Instrumental variable based only on distance			
1 - Herfindahl index of deposits across markets	0.092	-1.294	0.008
	(0.11)	(1.123)	(0.134)
Observations	8,611	5,985	8,581
F-test	8.560	3.104	8.857
Panel B: Exclude NYC			
1 - Herfindahl index of deposits across markets	0.094	-0.543	-0.024
	(0.107)	(0.551)	(0.105)
Observations	7,359	5,124	7,306
F-test	6.948	4.248	7.250
Panel C: Exclude BHCs with subsidiaries that engage in international banking activities			
1 - Herfindahl index of deposits across markets	0.156	-1.257	0.182
	(0.161)	(0.97)	(0.211)
Bank and macro controls	x	x	x
MSA-quarter fixed effects	x	x	x
Bank fixed effects	x	x	x
Observations	7,326	5,178	7,286
F-test	4.254	3.276	4.842

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