GEOGRAPHIC DIVERSIFICATION AND BANKS' FUNDING COSTS

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Abstract

We assess the impact of geographic diversification on a bank's costs of interest-bearing liabilities. We employ a new identification strategy and discover that geographic expansion across U.S. states lowered funding costs. Consistent with expansion facilitating risk diversification, we find that (1) funding costs fall more when banks expand into states whose economies are less correlated with banks' headquarter-state and (2) geographic diversification reduces the costs of uninsured, but not insured, deposits. Consistent with expansion intensifying agency frictions, which puts upward pressures on funding costs, we discover that geographic diversification reduces the costs of interest-bearing liabilities more in better-monitored banks.

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1. Introduction

Research shows that the costs to banks of raising capital, issuing other securities, and attracting deposits can affect, and be affected by, the allocation and pricing of bank credit (e.g., Berger, 1991, Flannery and Nikolova, 2004, and Bliss 2015). These findings motivate research into the determinants of bank funding costs. One potential determinant, which has received considerable attention, is the geographic diversification of bank branches and subsidiaries. Indeed, credit rating agencies and bank analysts use indicators of the geographic dispersion of these bank affiliates in their appraisals of banks (e.g., Moody's, 2014).

The academic literature, however, offers differing perspectives on whether the geographic diversification of bank branches and subsidiaries increases, decreases, or has no effect on the costs to banks of raising deposits and issuing securities. We first discuss these different views and then describe our empirical strategy for addressing this debate. One view questions the value of geographic bank expansion because individual bank liability holders can directly diversify their portfolios by purchasing securities in an assortment of firms and depositors can hold deposits in a diversified portfolio of banks, obviating the value of each bank expanding geographically and minimizing the impact of such diversification on banks' funding costs. However, theories of financial intermediation offer a different perspective. Diamond (1984, 1991) and Boyd and Prescott (1986) explain that information and transactions costs associated with screening and monitoring firms can yield equilibrium in which intermediaries mobilize savings from many entities and allocate those funds, so that individuals rarely lend directly to firms in such models. Similarly, transactions costs associated with holding deposits in many banks—such as the direct and time costs associated with the complexities of managing, transferring, and consolidating funds across banks—increase the appeal of consolidating deposits in one (or a few) banks even if this pushes deposits above deposit insurance levels. Indeed, according to the most recent commercial bank data from the Federal Deposit Insurance Corporation (FDIC), about 43% of U.S. deposits are uninsured.

A related argument that questions whether establishing a geographically dispersed network of bank branches will influence banks' funding costs is that banks can simply invest in a geographically diversified portfolio of firms. Thus, even if market frictions create the need for banks and motivate the consolidation of deposits into a single bank, there may be few, if any, benefits to banks from establishing brick-and-mortar branches across an economy. An extensive banking literature, however, emphasizes that geographic proximity enhances the provision of banking services. For example, Petersen and Rajan (2002), Berger, Bouwman, and Kim (2017), and others stress that screening and monitoring bank loans require the collection of "soft information" about borrowers that cannot be easily collected, transmitted, or verified without direct and often frequent personal contact with borrowers. Consistent with the view that geographic proximity is crucial for effective banking, Petersen and Rajan (2002), Berger et al. (2005), Agarwal and Hauswald (2010), Berger, Bouwman, and Kim (2017), and Nguyen (2019) demonstrate that bank-firm proximity facilitates lending. Furthermore, a parallel literature emphasizes the value of geographic expansion in nonfinancial firms. Morck and Yeung (1991, 1992, and 2003) argue conceptually, and show empirically, that firms are more likely to open physical plants in new locals when there is greater scope to exploit information-related intangible assets, such as superior managerial skills, organizational practices, and procedures for obtaining and processing information. As stressed by the banking literature, these are exactly the types of intangible assets associated with the collection and interpretation of soft information on borrowers and the formation and maintenance of valuable lending relationships. Taken together, this research on banks and firms suggests why banks will expand their brick-and-mortar geographic reach when they diversify their provision of financial services and loans.

Focusing on the adverse effect of geographic diversification, the agency-based models of Jensen (1986), Jensen and Meckling (1976), and Scharfstein and Stein (2000) suggest that if geographic dispersion makes it easier for bank insiders to extract private rents, then expansion will reduce bank valuations and boost the costs of raising funds. Consistent with these predictions, Berger and DeYoung (1991) and Berger et al. (2005) find that geographic distance hinders the ability of a bank's headquarters to manage and monitor its subsidiaries and Goetz, Laeven, and Levine (2013) show that geographic the dispersion of the subsidiaries of bank holding companies increases lending to bank insiders and reduces bank valuations.[1]

In contrast, several models emphasize how geographic expansion can reduce bank risk and therefore lower the costs of raising funds. For example, if banks expand into local economies that are less volatile or

[1] Consistent with the view that geographic diversification boosts funding costs, research finds that geographically diversified banks tend to have less capital (Chong 1991; Demsetz and Strahan 1997) and lend to riskier clients (Acharya, Hasan, and Saunders (2006), and that diversifying banks often acquire risky targets (Berger et al 2017).

are negatively correlated with the bank's other activities, this expansion can (a) diversify away idiosyncratic bank risk and put downward pressures on the costs of equity and interest-bearing liabilities (e.g., Diamond, 1984, and Boyd and Prescott, 1986), and (b) enhance the bank's ability to use its internal capital market to respond to local economic shocks (e.g., Houston, James, and Marcus, 1997, Houston and James, 1998, Billett and Garfinkel, 2004; Gatev, Schuermann, and Strahan, 2009, and Cornett et al., 2011). In empirical evaluations of the overall impact of geographic diversification on bank risk, Deng and Elyasiani (2008) and Goetz, Laeven, and Levine (2016) find that geographic dispersion of bank branches and subsidiaries reduces bank risk and Cortes and Strahan (2016) find that expansion improves the ability of banks to respond to local economic shocks.

What is missing from the literature, however, is an assessment of the impact of geographic expansion on the costs of a bank's interest-bearing liabilities, which account for about 90 percent of total bank liabilities in the United States. Research shows that geographic expansion intensifies agency frictions and reduces bank valuations (e.g. Berger et al. 2005 and Goetz, Laeven, and Levine 2013), which might put upward pressure on banks' costs of interest-bearing liabilities. Other research demonstrates that geographic expansion reduces bank risk (e.g., Goetz, Laeven, and Levine 2016 and Cortes and Strahan 2016), potentially decreasing the costs of issuing securities and raising deposits. We are unaware, however, of research that identifies and quantifies the overall impact of geographic expansion on the costs of banks' interest-bearing liabilities.

To assess the impact of geographic expansion on the costs of a BHC's interest-bearing liabilities, we need measures of geographic expansion and funding costs and a plausible identification strategy. To measure banks' funding costs, we focus on interest-bearing liabilities, and use the ratio of total interest expenses to interest-bearing liabilities, as in Demirgüç-Kunt and Huizinga (2004). To measure geographic expansion across the United States, we use the cross-state distribution of a BHC's branches and weight each branch by its share of deposits in the BHC. To identify the causal effect of geographic expansion on the cost of the BHC's interest-bearing liabilities, we build on Goetz, Laeven, and Levine (2013, 2016) and offer a new procedure for constructing an instrumental variable for geographic expansion.

Identification is a first-order concern since funding costs might shape BHC investment decisions including those related to geographic diversification, and other factors might drive both BHC expansion and funding costs. To address this concern, we implement a two-step procedure for constructing an instrument for geographic expansion. First, we exploit (a) the process of interstate bank deregulation from 1982 through 1994, and (b) the process of removing regulatory restrictions on interstate branching from 1995 through 2005. In terms of interstate bank deregulation, individual states started in 1982 to remove restrictions on BHCs headquartered in specific U.S. states from establishing subsidiaries within the deregulating state's borders. Not only did states start the process of deregulation in different years, they also followed different dynamic paths as states signed bilateral and multilateral reciprocal agreements in a fairly chaotic process until the Riegle-Neal Act eliminated regulatory prohibitions on interstate banking at the end of 1994. In terms of interstate branching, the Riegle-Neal Act did not prohibit states from erecting barriers to out-of-state branch expansion. Since the costs of branching are lower than the costs of establishing subsidiaries, interstate branch deregulation further lowered barriers to the entry of out-of-state banks. The state-specific process of interstate branch deregulation continued to influence branch banking until 2005, as discussed in Johnson and Rice (2008). Goetz, Laeven, and Levine (2013, 2016) ignore interstate branch deregulation in their strategy for identifying shocks to the geographic expansion of banks, so that their approach ends in 1994. We include the interstate branch deregulation and therefore expand the identification strategy through 2005. Hence, our first step yields year-by-year information from 1982 until 2005 both on whether and the costs associated with BHCs headquartered in each state establishing subsidiaries and branches in each other state. This first step, however, does not differentiate among BHCs headquartered within the same state; it does not provide information on why some BHCs expand into a foreign state and others do not.

The second step in constructing an instrument for geographic expansion uses the gravity model to distinguish among BHCs within the same state. As discussed in Tinbergen (1962), Helpman, Melitz, and Rubinstein (2008), and many others, the gravity model predicts, and much empirical work confirms, that the costs of establishing and managing an affiliate increase with distance. Thus, the gravity model predicts that when state *j* allows BHCs from state *i* to establish branches within *j*'s borders, BHCs headquartered in state *i* that are closer to state *j* will face lower costs to expanding into *j*. Since the physical locations of the headquarters of BHCs were determined before the period of interstate bank deregulation, we exploit the distance between the headquarters of each BHC and the capital of each state as an exogenous source of variation in how interstate bank deregulation differentially affects BHCs in a state. Based on these distances, we use the gravity model to estimate each BHC's cross-state deposit holdings.

The integration of the gravity model of BHC investment with the dynamic process of interstate bank and branch deregulation yields a time-varying, BHC-specific instrumental variable of the cross-state dispersion of each BHC's deposits. Specifically, we (1) project the share of each BHC's holdings of deposits in branches in each non-headquarters state *j* using the gravity model of cross-state bank deposits that incorporates interstate bank and branch deregulation and (2) impose a value of zero when interstate bank regulations prohibit a BHC from establishing a subsidiary in state *j*. We then compute the projected Herfindahl index of cross-state deposits and use this as the instrument for a BHC's actual dispersion of deposits. Armed with this instrument, we evaluate the impact of geographic diversification on the costs of interest-bearing liabilities.

With respect to the validity of our identification strategy, we emphasize four points. First, we find that the instrument is strongly correlated with the actual cross-state dispersion of a BHC's deposits. That is, the F-test on the instrument in the first-stage regression is above 30, indicating that we do not have a weak instrument problem. Second, we address the key concern with the traditional, state-year interstate bank deregulation instrument: Is some other factor besides geographic expansion systematically changing when state *j* allows BHCs from state *i* to enter and it is this other factor that affects the costs of interest-bearing liabilities across BHCs in state *i*? [2] We address this concern by integrating the gravity model and the processes of interstate bank and interstate branch deregulation to create a BHC-time instrumental variable of geographic diversification. This allows us to include state-time fixed effects to control for all time-varying state influences on the costs of interest-bearing liabilities. In this way, identification comes from comparing the differential impact of interstate deregulation on BHCs in the same state and year. Third, we address concerns that other BHC-specific factors simultaneously account for both their cross-state dispersion of deposits and their funding costs by (1) including BHC-fixed effects to control for all time-invariant BHC traits and (2) controlling for time-varying BHC characteristics such as the competitiveness of the banking

[2] Past research provides evidence that state economic conditions (e.g., Jayaratne and Strahan, 1996, Kroszner and Strahan, 1999, and Beck, Levine and Levkov, 2010) and banking system profitability, valuations, and risk (Jayaratne and Strahan, 1998, Goetz, Levine, and Levine, 2013, 2016) do not predict interstate bank deregulation.

market in which a BHC is headquartered, as well as BHC size, capital-asset ratio, and profitability. Fourth, we evaluate the theoretical predictions that (a) geographic expansion reduces the costs of interest-bearing liabilities by allowing banks to hold a more diversified portfolio of assets and (b) geographic expansion intensifies agency problems more when BHCs have less effective governance systems, so that geographic expansion has a more adverse effect on the costs of interest-bearing liabilities on poorly governed banks. As discussed in detail below, evaluating these predictions about the cross-BHC response to geographic diversification both provides additional information on the mechanisms linking geographic expansion and funding costs and reduces concerns that the instrument violates the exclusion restriction.

We discover that geographic diversification on average lowers the costs of a BHC's interest-bearing liabilities. Geographic diversification enters the funding cost regressions negatively and statistically significantly at the one percent level. Moreover, the estimated impact is economically large. For example, the estimates imply that a one standard deviation increase in the cross-state dispersion of a BHC's deposits will reduce the total interest expense ratio by 10%. These results hold when using different measures of the cost of interest-bearing liabilities, different subsamples of banks based on the types of products offered by the banks, different estimation periods, and when excluding BHC control variables or when conditioning on additional BHC characteristics. Furthermore, we show that it is crucial to use instrumental variables to identify the impact of the cross-state dispersion of a BHC on its costs of interest-bearing liabilities. When using ordinary least squares (OLS), we find a *positive* (though sometimes insignificant) association between diversification and the costs of interest-bearing liabilities. This positive coefficient estimate might reflect reverse causality: BHCs with higher funding costs expand to other states in search of lower cost funds, so that OLS yields an upwardly biased coefficient estimate on geographic diversification. When employing our instrumental variable, however, we find that an increase in the cross-state dispersion of branch deposits lowers the costs of interest-bearing liabilities.

We next examine how the geographic expansion of banks reduces the costs of interest-bearing liabilities. As discussed above, one mechanism emphasizes that geographic expansion into areas with economies that are less volatile or negatively correlated with other BHC activities can reduce risk by allowing banks to diversify away idiosyncratic risk and to smooth and manage local shocks through more extensive internal capital markets. This mechanism predicts that ceteris paribus, the cost-reducing benefits from geographic expansion should be greater when BHCs expand into local economies that are less correlated with the BHCs' other activities, i.e., where expansion provides greater risk diversification opportunities. We evaluate this prediction by testing whether the cost-reducing effects of geographic diversification are greater when BHCs are located in states with economies that comove less with the economies of the states into which the BHC expands. We use the Federal Reserve Bank of Philadelphia's *Coincident index* to capture the degree to which each state's economy is correlated with each other state's economy.[3]

The results indicate that geographic expansion reduces BHC funding costs more when the BHC is headquartered in a state that has an economy that comoves less with the economies of states where its BHCs face lower entry barriers. This is consistent with the risk-reducing view of how geographic diversification lowers funding costs. The estimated impact is large. The estimates suggest that the cost-reducing effect of a BHC that expands from a home state that is perfectly negatively correlated with the other accessible states into an average state is almost four-times as large as a similar BHC headquartered in a state that is perfectly correlated with the other states' economies.

To shed additional light on the risk reduction view, we assess the differential impact of geographic diversification on the costs of a bank's insured and uninsured deposits. If geographic diversity lowers the costs of interest-bearing liabilities by reducing risk, then the effects should be larger on uninsured liabilities. Our results are consistent with this prediction. We find geographic diversification lowers BHCs' costs of uninsured deposits, but not the costs of insured deposits.

Finally, we test whether the impact of geographic diversification on the costs of interest-bearing liabilities depends on bank governance. As noted above, agency-based theories suggest that geographic diversification intensifies agency frictions by, for example, hindering the ability of headquarters to monitor

[3] Related research sheds additional light on the relationship between financial integration and economic volatility. Morgan, Rime and Strahan (2004) find that interstate banking influences state-level output fluctuations: individual state business-cycles are less volatile and business cycles become more synchronized across states. Similar findings emerge in examinations of financial integration and economic fluctuations across countries, as shown by Otto, Voss, and Willard (2001) and Imbs (2006). Demyanyk, Ostergaard, and Sorensen (2007) discover that the degree to which personal income in a U.S. state fluctuates with state output decreases with financial integration, as measured by a lowering of barriers to interstate banking.

distant affiliates, putting upward pressure on funding costs. If better governance reduces the adverse impact of geographic expansion on agency frictions, then geographic expansion should reduce the costs of interest-bearing liabilities more among better-governed banks. That is, effective bank governance dampens the cost-increasing effects of intensified agency frictions triggered by geographic diversification, so that the cost-reducing effects of risk diversification further lower the costs of interest-bearing liabilities.

We test this using a proxy for the governance of each bank: We measure the degree to which specialized analysts and institutional investors monitor the bank. As suggested by extensive research, analysts generally possess comparative advantages in examining financial statements, interacting with managers in conference calls, and distributing information to investors through research reports (Jensen and Meckling, 1976, Shleifer and Vishny, 1986). Furthermore, institutional shareholders typically play a more active role in overseeing and disciplining managers than disparate outside investors (Gillan and Starks, 2000). Thus, we use analyst coverage and various types of institutional owners (e.g. all institutional owners, non-pension fund owners, or mutual funds) to proxy for the governance of each BHC.

Consistent with the agency theories, we discover that geographic diversification reduces the costs of interest-bearing liabilities more when BHCs are better-governed. Furthermore, geographic expansion actually increases the costs of interest-bearing liabilities among poorly-governed banks: The cost-increasing effects from the intensification of agency frictions triggered by expansion outweigh the cost-reducing effects of diversification in these poorly-governed banks.

Before turning to the data, it is worth highlighting three contributions of our research. First, building on Goetz, Laeven, and Levine (2013, 2016), we develop an augmented identification strategy that integrates interstate bank deregulation, interstate branch deregulation, and the gravity model of investment to assess the impact of geographic diversification on the cost of interest-bearing liabilities. Second, although existing research offers important insights on how geographic diversity intensifies agency frictions and facilitates bank risk diversification, our research provides novel evidence on the impact of geographic diversity on banks' costs of interest-bearing liabilities. Third, we provide new empirical evidence on some of the potential mechanisms through which geographic diversification influences funding costs. We find evidence for both the risk diversification and agency channels. Consistent with geographic expansion facilitating risk diversification, we find that (1) funding costs fall more when banks expand into states whose economies comove less with their headquarter-state and (2) geographic diversification reduces the costs of uninsured deposits, but not of insured deposits. Consistent with the view that geographic expansion intensifies agency frictions, putting upward pressures on funding costs, we discover that geographic diversification reduces the costs of interest-bearing liabilities more in better-governed banks: Better governance dampens the cost-increasing effects of the intensification of agency frictions, so that the cost-reducing effects of risk diversification dominate the overall impact of geographic diversification on the costs of interest-bearing liabilities.

2. Data and interstate bank deregulation

2.1 BHC and bank subsidiary and branch data sources

We use financial and structural information on BHCs and their chartered subsidiary banks and branches to assess the impact of geographic expansion on a BHC's funding costs. For each domestic U.S. BHC, the Federal Reserve collects detailed information on consolidated balance sheets, income statements, and detailed supporting information from the FR Y-9C reports. The data is publicly available on a quarterly basis since June 1986. Individual banking institutions regulated by the Federal Deposit Insurance Corporation (FDIC), the Federal Reserve, or the Office of the Comptroller of the Currency also file Reports of Condition and Income ("Call Reports") that provide financial statements for each banking institution in each quarter. The Call Reports also provide ownership information, so that we can link each bank subsidiary to its parent BHC. In particular, each BHC is considered the parent of a bank subsidiary if it holds at least a 50% ownership stake in the subsidiary. Furthermore, we use the FDIC's Summary of Deposits database, which provides branch-level information on the amount of deposits, physical location, and the affiliated banking institution as of June 30 of each year. By linking the three datasets, we measure a BHC's geographic dispersion of deposits across states. We focus on the ultimate parent holding company, and thus eliminate those that are owned by other financial institutions.

Our initial sample includes all publicly listed BHCs in the Y-9C reports from the third quarter of 1986 through the last quarter of 2007 operating within the 48 contiguous states and the District of Columbia (excluding BHCs headquartered in Alaska and Hawaii). We then eliminate BHCs located in the states of Delaware and South Dakota since the two states changed their laws to encourage the entry of credit card banks shortly before removing branching restrictions. We further drop BHCs that change the location of their headquarters from one state to another during the sample period. This reduces the number of BHCs by about 2%, though the results hold when including them. Our final sample contains 33,758 BHC-quarter observations on 888 public BHCs over the period 1986 – 2007.

2.2 Geographic diversity

We measure a BHC's geographic diversity as the cross-state dispersion of its bank branches, where we weight each branch by the percentage of the BHC's deposits held in that branch. Specifically, *1-Herfindahl index of deposits across states* equals one minus the Herfindahl-Hirschman index of a BHC's deposits held in its branches across states (including the state in which the BHC has its headquarters). Thus, a higher value indicates a more dispersed distribution of branches across states. We construct this measure for each BHC in each quarter. We use cross-state dispersion of bank branches, not the physical location of the entities receiving loans because such information is unavailable. Bank lending, however, tends to be close to the location of bank branches. As shown in Petersen and Rajan (2002), the median distance between bank and borrower is four miles. Using the location of each BHC's bank branches as opposed to its subsidiaries, this measure also helps address concerns that some BHCs convert subsidiaries into branches or establish new branches across state lines in the aftermath of the Riegle-Neal Act.

2.3 Funding costs and other BHC traits

We construct our key measures of BHC funding costs using detailed information from FRY-9C reports. *Total cost of funds* equals a BHC's total interest expense during a quarter divided by interest-bearing liabilities at the beginning of the quarter. As argued by Demirgüç-Kunt and Huizinga (2004), *Total cost of funds* is an implicit interest rate on BHC liabilities, which is inferred from its financial statements. While *Total cost of funds* measures the overall cost of a BHC's debts, it can differ across banks and time due to differences in interest rates or in the maturity and structure of a BHC's debt. We therefore construct a second funding cost measure that focuses only on deposits. We measure the cost of deposits as a BHC's interest expense on domestic deposits during a quarter divided by the stock of domestic deposits at the beginning of the quarter (*Cost of deposits*). Table 1 provides summary statistics for the funding cost measures. *Total cost of funds* ranges from 0.3 to 2 percentage points, with a mean value of 1.1 percentage points. Since banks are highly levered, these non-equity funding costs capture the bulk of funding expenses for BHCs.

We also separately investigate the costs of non-FDIC insured liabilities and the costs of insured liabilities. We examine these subsets of liabilities to provide evidence on one potential channels through which geographic diversification might shape the costs of interest-bearing liabilities: If geographic expansion influences these funding costs by making it easier to diversify and manage bank risk, then expansion should have a particularly pronounced effect on the costs of uninsured interest-bearing bank liabilities. In particular, *Cost of uninsured funds* equals a BHC's interest expense on uninsured liabilities during a quarter divided by uninsured interest-bearing liabilities at the beginning of the quarter, where uninsured liabilities are non-deposit debts plus those deposits not covered by FDIC protection (which had a limit of $100,000 during our sample period). To measure the cost of uninsured liabilities, we treat non-deposit liabilities and time deposits of $100,000 or more as uninsured funds. Although it is safe to treat non-deposit liabilities as uninsured (i.e., not explicitly insured) by the FDIC, there are some problems with treating time deposits of $100,000 as uninsured since the first $100,000 might be insured depending on the other holdings of the individual in the bank. These large time deposits plus non-deposit debts, on average account for 28% of interest-bearing liabilities in our sample, and the associated interest expenses are about 1/3 of the banks' total interest expenses.

Given that the FRY-9C does not provide detailed enough information to isolate the cost of insured deposits, we use individual bank data from the Call reports to measure the cost of insured deposits.[4]

[4] Note that isolating the costs of uninsured and insured liabilities is empirically challenging. Banks are required to report deposit balances based on the types of accounts, not on the insurance coverage. With respect to deposit accounts, banks provided data on transaction deposits, non-transaction savings deposits, total time deposits of less than $100,000, and total time deposits of $100,000 or more. Moreover, simply because a deposit account has less than $100,000 does not necessarily imply that it is FDIC insured because the coverage limit of $100,000 during our sample period applies to the total amount of deposits across all deposit accounts for each depositor in a bank. For example, suppose depositor A owns three types of deposits at Bank M, namely $50,000 of demand deposits, $50,000 of savings deposits, and $50,000 of time deposits. As the deposit insurance limit applies to the total amount of deposits per depositor per insured bank (see, https://www.fdic.gov/deposit/deposits/index.html, for more details), only $100,000 of the total $150,000 deposits

Following the approach in prior research (e.g., Kashyap, Rajan, and Stein, 2002, and Acharya and Mora, 2015), we aggregate the bank-level data from the Call reports to the holding company level. To measure the cost of insured deposits, we treat transaction accounts and small time deposits as covered by the deposit insurance. Thus, *Cost of insured deposits* equals interest expenses on transaction accounts and time deposits less than $100,000 during a quarter divided by the quarterly average of transaction account and time deposits less than $100,000. *Cost of uninsured deposits* equals interest expenses on large time deposits (time deposits more than $100,000) divided by the quarterly average of large time deposits. As shown in Table 1, *Cost of uninsured deposits* ranges from 0.3 to 2.6 percentage points, with a mean value of 1.3 percentage points, whereas *Cost of insured deposits* ranges from 0.1 to 2.2 percentage points, with a mean value of 1.1 percentage points. Thus, the measure of the costs of uninsured deposits is on average higher than the cost on insured deposits by about 20 basis points, reflecting a risk premium required by unprotected creditors.

In assessing the impact of diversification on funding costs, we control for several time-varying bank characteristics. Since funding costs might differ between large and small banks and between those with greater or smaller leverage, we include *Total assets* and the *Capital-asset ratio*. In robustness tests, we further include *Total assets* squared to capture the potential non-linear effect of bank size. To account for differences in BHC profitability, we control for *Return on assets*, which equals net income divided by the book value of total assets. All bank-specific controls are measured at the beginning of a quarter. Furthermore, since research suggests that market competition affects bank risk (e.g., Boyd and De Nicolo, 2005), we control for the competitive pressures facing each BHC by using a measure of the concentration of banks in each Metropolitan Statistical Area (MSA). In particular, *Market concentration (MSA)* equals the Herfindahl-Hirschman index of banking assets in each MSA in each quarter.[5] Appendix Table A1 provides detailed variable definitions and Table 1 reports summary statistics.

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owned by A is entitled to the FDIC insurance, leaving A with a $50,000 uninsured deposits exposure. Thus, while each of the three types of deposits is below the insurance limits, one third of the value on average is unprotected by FDIC. Taken together, the extent of insurance coverage for a type of deposit is jointly determined by the amount of other types of deposits owned by the same depositor at the particular bank, rather than by its own value. In this regard, we can only create imperfect proxies for the costs of uninsured and insured liabilities.

[5] In our sample, about 13% of BHCs are not headquartered in an MSA, which typically means they are headquartered in a rural area. For these non-MSA BHCs, we set *Market concentration (MSA)* equal to one, indicating a highly concentrated banking market. To account for potential problems associated with differences in competition between MSA and non-MSA counties, we construct an *MSA indicator* that equals one when a BHC is headquartered in an MSA,

2.4 The dynamic process of interstate bank deregulation, 1982 - 1994

For much of the 20th century, U.S. states prohibited banks headquartered in other states from establishing subsidiaries (or branches) within their borders. As shown by Jayaratne and Strahan (1998), these regulatory restrictions protected banks from "foreign" competition and allowed banks to earn monopolistic rents, which created a powerful constituency for maintaining restrictions on interstate banking. Kroszner and Strahan (1999) explain that a series of technological innovations that started in the 1970s reduced the rents associated with these regulatory restrictions as automatic teller machines, banking by phone, and improvements in credit scoring models made it easier for banks to attract customers from states where they had no subsidiaries or branches. These innovations triggered a process of interstate bank deregulation that allowed BHCs to expand across state borders.

From 1982 through 1994, states removed restrictions on interstate banking using three types of deregulation: (1) *national nonreciprocal* means the deregulating state unilaterally allowed entry of banks from all other states; (2) *national reciprocal* means the deregulating allowed entry of banks from reciprocating states, i.e., states that also allowed banks from the deregulating state to enter; and (3) *regional reciprocal* means the deregulating state signed bilateral or multilateral reciprocal agreements with specific states that also allowed entry of banks from those states. For instance, Maine was the first state to relax its interstate banking restrictions by enacting a national reciprocal policy in 1978, but no state reciprocated until 1982 when New York adopted a similar nationwide reciprocal agreement and Alaska implemented a national nonreciprocal policy. Over the next 12 years, states started the process of interstate banks deregulation in different years and followed different patterns of deregulation over those years. The Riegle-Neal Act of 1994 repealed regulatory restrictions on ("adequately" capitalized and managed) BHCs headquartered in one state from acquiring banks in other states (after September 29, 1995), as long as the acquisition would not exceed nationwide or statewide deposit concentration limits.

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and zero otherwise. Although not reported in the tables, when we control for *Market concentration (MSA)*, we always simultaneously include the *MSA indicator*.

There is enormous heterogeneity both in terms of when states started removing impediments to interstate banking and in terms of the dynamic process that each state followed in lowering those barriers. For each state and year, Goetz, Laeven, and Levine (2013) provide information on the foreign states into which a state's BHCs were allowed to open subsidiary banks based on information from each state's bank regulatory authority. Figure 1 shows the dynamic process of interstate banking deregulation over the period from 1982 through 1994. In particular, each bar represents the cumulative percentage of state pairs in which one state is allowed to enter the other one. As shown, less than 10% of state-pair deregulations happened before 1986, which is the first year of our sample period. By 1994, 71% of the state pairs allow interstate banking, and the Riegle-Neal Interstate Banking and Branching Efficiency Act allowed interstate banking for all state pairs in 1995.

2.5 The interstate branching restrictions, post-1994

Although the Riegle-Neal Interstate Banking and Branching Act (IBBEA) of 1994 effectively removed restrictions on banks expanding across state lines through the establishment of bank subsidiaries and removed federal barriers to interstate branching, it still granted states considerable authority to limit expansion across state lines through the establishment of bank branches (Johnson and Rice, 2008). Interstate branching can, depending on state regulations, occur through two means: (a) an out-of-state bank can acquire an in-state bank and convert that bank into its branches or (b) an out-of-state bank can either establish new branches within a state ("de novo" branching) or purchase the branch of an in-state bank (Johnson and Rice, 2008).

Following the IBBEA, many states erected barriers to interstate branching from other states, potentially using four types of regulatory restrictions on interstate branching. First, some states imposed minimum age restrictions with respect to how long a target bank has been in existence before it can be acquired and consolidated into branches. These minimum age restrictions, which have a federally set maximum of five years, make cross-state banking more costly. It meant that banks had to purchase an entire older bank, which is more costly than opening a branch, or open new subsidiaries and then wait until the minimum age restriction has been satisfied before converting them into branches. Second, some states prohibited de novo interstate branching, which increases the costs of out-of-state banks operating in a state. Third, some states prohibit the acquisition of a single branch or portions of an institution, which represents an additional barrier to cross-state branching. Fourth, some states imposed limits on the percentage of insured deposits in state that a single bank could hold. This could limit large interstate bank mergers. As with interstate bank deregulation, regulatory restrictions on interstate branching evolved over time.

Building on Johnson and Rice (2008), Rice and Strahan (2010) construct an index of regulatory restrictions on interstate branching. From the time of enactment of IBBEA (September 1994), states began selecting limitations on interstate branching. These statues have evolved since then. Rice and Strahan (2010) provide state-year measures of interstate branching restrictions from 1994 – 2005, and we use their index in our analyses as an indicator of the regulatory costs of expanding banking activities across state lines. Specifically, the Rice and Strahan (2010) index adds one when a state imposes any of the four barriers discussed above. Thus the index ranges from zero to four, with higher values indicating more restrictive provisions on out-of-state entry. We use this index to exploit post-1994, cross-state variations in restrictions on interstate branching.

3. Geographic diversification and BHCs funding cost: Instrumental variable results

In this section, we (1) describe the regression specification and discuss identification concerns, (2) describe the construction of our instrumental variable for the cross-state diversity of BHC branches, (3) present the instrumental variable results on the impact of geographic diversity on funding costs, and (4) analyze the validity of our identification strategy.

3.1 Regression specification and identification concerns

We use the following regression specification to evaluate the relationship between BHC funding costs and geographic diversity:

$$Cost\ of\ funds_{bst} = \beta(1 - Herfindahl\ index\ of\ deposits\ across\ states)_{bt} + \theta X'_{bst} + \delta_b + \delta_{st} + \varepsilon_{bst}, \quad (1)$$

where the dependent variable, *Cost of funds*$_{bst}$, represents the funding costs measure for BHC *b* headquartered in state *s* in quarter *t*. The key explanatory variable, *1 - Herfindahl index of deposits across states*$_{bt}$, denotes the extent to which a holding company *b* diversifies its branches across states over quarter *t*. X'_{bst} is a vector of time-varying characteristics for BHC *b*, headquartered in state *s*, at the beginning of the quarter *t*: *Total assets, Capital-asset ratio,* and *Return on assets*. These controls account for differences in bank size, leverage, and profitability, respectively. We also include *Market concentration (MSA)* to account for time-varying differences in the concentration of banking assets within the MSA of BHC *b*'s headquarters. We also include (1) BHC fixed effects, δ_b, to account for all time invariant BHC-specific factors and (2) state-quarter fixed effects, δ_{st}, to control for all time-varying state-specific factors, such as economic conditions, tax policies, and regulations. Thus, the estimated coefficient, β, indicates the economic relation between changes in a BHC's cost of funds and changes in its geographic dispersion of branches after controlling for this large set of conditioning variables. Following Goetz, Laeven, and Levine (2013), the standard errors are heteroskedasticity-robust and clustered at the state and quarter level.

Identification concerns, however, complicate the ability to draw causal inferences from estimating equation (1) using OLS. First, a BHC's funding costs might influence its decision to expand into other states. For example, BHCs with higher funding costs might be especially motivated to establish subsidiaries and branches in a non-headquarter-state where funds are cheaper. Under these conditions, even if geographic expansion reduces the cost of funds, OLS will yield an upwardly biased coefficient estimate on *1 - Herfindahl index of deposits across states*. Second, while the OLS specification includes an array of BHC controls and fixed effects, omitted variables might drive both the geographic diversification of BHC and its funding costs. We address these endogeneity concerns by employing an instrumental variables approach

3.2 Framework for constructing the gravity-deregulation instrumental variable

To describe the construction of our instrumental variable, we begin with an overview and then give the details. We develop this instrument by integrating (1) the dynamic, state-specific process of interstate bank deregulation, and the state-specific restrictions on interstate branching for the post-1994 period with (2) the gravity model of investment. As explained above, interstate bank deregulation evolved in a rather chaotic manner from 1982 through 1994, where states started removing regulatory restrictions on interstate banking in different years and then followed different dynamic paths of implementing regional reciprocal, national reciprocal, and national nonreciprocal deregulations with other states. This process of interstate bank deregulation provides state-year information on (a) whether BHCs in one state can establish subsidiaries in each other state, and after 1994, (b) the degree to which BHCs in one state can establish branches in each other state. Thus, our modified gravity-deregulation approach exploits (a) the dynamic process of interstate banking deregulation during 1982 – 1994, and (b) the interstate branching restrictions after 1994. This process of interstate bank deregulation, however, does not differentiate among BHCs within the same state, which is crucial for identifying the impact of the cross-state diversification of a BHC on its funding costs.

To differentiate among BHCs within the same state, we use the gravity model of investment. Specifically, an extensive literature finds that the cost of investing varies positively with geographic distance. Applied to banks, the gravity model predicts that it will be less expensive for BHCs to expand into geographically closer markets. Indeed, for the case of banks across the U.S. states, Goetz, Laeven, and Levine (2013) show that among all BHCs headquartered in state *i*, it is those that are closer to state *j* that are more likely to expand into state *j*. For example, they show that a BHC in the southern part of California will tend to have a larger share of assets in Phoenix, Arizona than in Portland, Oregon and a BHC headquartered in northern California will tend to have a larger share of assets in Portland.

Thus, we construct a time-varying, BHC-specific instrumental variable for the cross-state diversity of BHC branches by integrating interstate bank deregulation, interstate branch deregulation, and the gravity model of investment.

3.3 The two-step process for constructing the gravity-deregulation instrument

We develop and use the following two-step process for constructing an instrument for the geographic diversity of BHC branches. In the first step ("zero stage"), we estimate the following gravity model.

$$Share_{bijt} = \alpha Ln(Distance_{bij}) + \beta Ln\left(pop_{it}/pop_{jt}\right) + \gamma Interstate\ Branching\ Index_{jt} + \varepsilon_{bijt}, \quad (2)$$

where the dependent variable, $Share_{bijt}$, is the share of deposits a BHC b headquartered in state *i* holds through its branches in state *j* over quarter *t*, where $j \neq i$. This approach is different from Goetz, Laeven, and Levine (2013, 2016), because we extend the analyses to incorporate interstate branch deregulation.

$Ln(Distance_{bij})$ denotes the natural logarithm of geographic distance between the BHC b's headquarters and the capital city of state *j* (in miles). Since the physical locations of BHC headquarters were almost all determined well before the period of interstate bank deregulation, we exploit distance as an exogenous source of variation in how interstate bank deregulation differentially affects BHCs in a state.[6]

$Ln\left(pop_{it}/pop_{jt}\right)$ equals the natural logarithm of the ratio of the total population of BHC b's home state *i* to the total population of the foreign state *j* in quarter *t*, where U.S. Census Bureau provides population data. We include the population ratio in the gravity model to account for the possibility that BHCs expand into comparatively large markets.

$Interstate\ Branching\ Index_{jt}$ equals the index of interstate branching restrictions in state j in quarter *t* based on Rice and Strahan (2010). As mentioned above, the index ranges from zero to four, with zero indicating most open to out-of-state entry. As shown in Johnson and Rice (2008), these state-specific restrictions on interstate branching had an effect on the entry of out-of-state banks. Following Rice and Strahan (2010), we impose a value of four (least open to out-of-state entry) for states in years before 1995.

In this first step, we proceed as follows. To incorporate the dynamic process of interstate banking deregulation, we only include observations in which it is legally feasible for BHC b headquartered in state *i* to open subsidiaries in a "foreign" state *j* during quarter *t*. To accommodate the quarterly frequency of BHC

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[6] Indeed, only 2% of BHCs change the state in which they are headquartered during our sample period. For these few BHCs, their distances to other states change when they relocate. The results are robust to excluding these BHCs.

data, we assume that deregulation occurs during the last quarter of the year in which state *j* relaxed its entry restrictions with state *i*, i.e., when BHCs headquartered in state *i* are allowed to open bank subsidiaries in state *j*.[7] We provide estimates using both a fractional logit model and OLS. We employ the fractional logit model since (a) the dependent variable is bounded between zero and one, (b) many observations have a value of zero, and (c) the fractional logit ensures that the projected shares are bounded between zero and one. We consider regression specifications that control for quarter fixed effects to condition out all quarter-specific influences, and state-pair fixed effects to condition out all time-invariant features of each state pair. We also consider a specification that controls for state-pair-quarter fixed effects to condition out all time-varying features of each state-pair. In these cases, we use OLS instead of a fractional logit model because the fractional logit model would not converge when we control for a large number of fixed effects. As shown below, the OLS results are consistent with those from the fractional logit model. We use the fractional logit model when constructing the instrumental variable so that we do not have projected share values less than zero.

Table 2 reports the estimation results from this zero-stage regression and shows that geographic distance is negatively associated with the share of a BHC's deposits in a foreign state. As shown in columns (1) and (2), the average marginal effect of *Ln(Distance)* on the share of a BHC's deposits in foreign states enters negatively and statistically significant at the 1% level, suggesting that BHCs tend to expand more in closer states. Consistent with Johnson and Rice (2008), our estimation results also show that the interstate branching index enters negatively and significantly, indicating that regulatory impediments to interstate branching effectively limited the share of deposits that BHCs held in others states. Moreover, there is a significant negative relation between a BHC's investment and the relative size of its home state banking market to the foreign banking market, indicating that a BHC is more likely to diversify into a comparatively large market.

The estimates hold when using OLS with and without additional fixed effects, as shown in columns (3) – (5). Interstate branching index and population remain significantly related to a BHC's expansion in

[7] The results hold when assuming that deregulation occurs in the first quarter of the year.

foreign states when using OLS, or when controlling for state-pair and quarter fixed effects or when including state-pair-quarter fixed effects. When including state-pair fixed effects, the regression controls for the distance between the two states. Thus, it shows that the differential distance between two BHCs headquartered in the same state *i* and state *j* shapes their holdings of branch deposits in state *j*. Specifically, BHCs headquartered in state *i* that are physically closer to state *j* tend to have branches with larger deposit balances in state *j* than BHCs headquartered in state *i* but that are physically farther away from state *j*.

In the second step of the construction of the gravity-deregulation instrument, we use the coefficient estimates from Table 2 to project, for each BHC in each quarter, its dispersion of deposits in branches across all states. Specifically, we use the coefficient estimates from column (2) in Table 2 to predict a BHC's deposit share in each state in each period.[8] We impose a predicted value of zero for states in which the BHC is prohibited from entering these markets for the pre-1994 period. Based on these projected shares, we compute the projected diversity measure, *1 - Herfindahl index of deposits across states (predicted)*, for each BHC in each quarter. This projected diversity measure serves as the time-varying, BHC-specific instrumental variable for a BHC's actual degree of diversification. We show in the Appendix that the results are robust to using the Table 2 estimates from column (1) that are only based on distance and interstate bank deregulation, instead of those from column (2) that are based additionally on relative population, to construct the instrumental variable. This alternative instrument, *1 - Herfindahl index of deposits across states (predicted Distance)*, yields very similar findings.

Several checks advertise the validity of the gravity-deregulation instrumental variable. With respect to the correlation between the instrument and *1 - Herfindahl index of deposits across states*, the instrument is "strong." As shown in the first-stage regression results reported in Panel A (columns (2) and (4)) of Table 3, the F-statistic of the null hypothesis that the instrument is irrelevant is above 30. With respect to the exclusion restriction, we first note that the instrument is explicitly constructed from two plausibly exogenous sources of variation in the ability and cost of a BHC establishing branches in other states: interstate bank (and branch) regulations and geographic distance. Furthermore, although our instrumental variable

[8] We do not include quarter, state-pair, or state-pair-quarter fixed effects in the projection because including them in the construction of the instrument can lead to biased estimates in the two-stage least squares regressions, as explained in Goetz, Laeven, and Levine, 2013, 2016).

specification is exactly identified, so that we cannot employ a test of the over-identifying restrictions, we can provide evidence on specific concerns. One concern is that some other characteristic of state *j* systematically changes when another state, state *i*, deregulates and allows state *j*'s BHCs to enter state *i* and this other factor affects BHC funding costs. However, by using a time-varying, BHC-specific instrumental variable that distinguishes among BHCs within each state and period, we can include state-time fixed effects to condition out the potentially confounding influences of such state-time characteristics. A second concern is that particular characteristics of a BHC, beyond its distance to other states, account for its cross-state expansion and funding costs. These characteristics could include the culture of the BHC, its size, fragility, profitability, or the structure of the local banking market. However, we include BHC-fixed effects to control for all time-invariant BHC traits and control for BHC size, capital ratio, profitability, and bank concentration at the MSA-level to condition out these time-varying factors.[9]

3.4 IV results

The instrument variable results indicate that geographic diversity reduces BHC funding costs. As reported in columns (1) and (3) of Panel A of Table 3, geographic diversity, *1 - Herfindahl index of deposits across states*, enters the funding cost regressions negatively and significantly at the 1% level. The results hold when examining either *Total cost of funds* in column (1) or *Cost of deposits* in column (3). The results are also robust to controlling for time-varying characteristics (bank size, leverage, profitability, and market concentration), BHC fixed effects, and state-quarter fixed effects. Appendix Table A2 shows that the results are robust to excluding all time-varying BHC traits. Moreover, Appendix Table A3 shows that the results hold when using a different zero-stage estimation to construct the instrument. In particular, we use the coefficient estimates from column (1) in Table 2, which excludes *Ln(Population ratio)* in the construction of the alternative instrument.[10]

[9] Furthermore, as noted in the Introduction, many papers show that economic conditions in general and banking conditions in particular do not predict the timing of interstate bank deregulation.

[10] Our results also stay robust if we use an alternative interstate branching deregulation index in our zero-stage projection. In particular, we construct an index of *Interstate branch openness* as five minus the Rice & Strahan's index, so that a higher value of Interstate branch openness indicating more open to out-of-state branch entry. We impose a value of 0 for all states in the years before IBBEA to capture the fact that interstate branch was prohibited before 1995.

The estimated impact of diversity on funding costs is economically large. To illustrate the economic size of the relationship, consider a one standard deviation increase in geographic diversity. The coefficient estimate in column (1) of Table 3 Panel A indicates that a one standard deviation increase in *1 - Herfindahl index of deposits across states* (0.158) reduces *Total cost of funds* by 10.5% (=0.158 * 0.664), corresponding to 11.5 basis points given that the sample mean of *Total cost of funds* (level) equals 1.1 percentage points. The estimated impact of geographic diversity on *Cost of deposits* is in slightly smaller magnitude.

Panel B of Table 3 demonstrates that the reduced form estimates are consistent with the IV results. It reports the reduced-form estimates of BHC funding costs on the gravity-deregulation instrument variable *1 - Herfindahl index of deposits across states (predicted)*, while controlling for BHC and state-quarter fixed effects, market competition (*Market concentration (MSA)*), and the time-varying BHC traits (bank size, capital-asset ratio, and return on assets). The results show that the projected degree of diversity from the gravity-deregulation model is negatively associated with the cost of raising interest-bearing liabilities.

The differences between the OLS results and the IV results in Table 3 advertise the importance of using instrumental variables to evaluate the impact of the geographic diversity of BHC on funding costs. The differences between the OLS and IV results are consistent with the view that BHCs with higher funding costs are more likely to diversify their branches across states, potentially in search of lower funding costs, confounding the ability to identify the impact of geographic diversification on funding costs using OLS. When using the gravity-deregulation instrumental variable to extract the exogenous component of geographic diversity, we find that an increase in a BHC's cross-state diversity of branches materially lowers its funding costs.

These IV results are robust to five additional sensitivity checks, as shown in Table 4. First, since the full implementation of the Riegle-Neal Act was completed in 1997, we redid the analyses over the 1986 through 1997 period, where we only include distance and population in our zero-stage estimation. As shown in column (1), although the number of observations falls by almost half, the coefficient estimates on *1 – Herfindahl index of deposits across states* remain statistically and economically significant using this alternative sample period. Although not reported, our results also obtain if we do the analyses only through 1994, 2005, or 2006. Second, our main results hold when controlling for squared bank size to capture the potential nonlinear effects of bank size. Third, to account for potential differences in the product mixes of BHCs (e.g., Wang and Xia, 2014), we redid the analyses with a subsample of BHCs that earn a minimum of 2/3rd of their total revenues in the form of interest income (in column (3)). To further control for the potential role of different product mixes, we include an additional control variable to account for differences in the structure of BHC earnings. In particular, we control for *Noninterest income,* which equals one minus the absolute difference between net interest income and total noninterest income divided by total operating income.[11] The results hold. Fourth, as shown in column (4), the main findings on geographic diversification are also robust to controlling for an array of bank-specific characteristics that might affect funding costs, namely *Liquid assets*, *C&I loans*, *Loan diversity*, *Loan commitments*, *Letters of credits*, and *Deposit funding* (Ellul and Yerramilli, 2013). Fifth, to better isolate the impact of risk diversification per se on funding costs, and abstract from the potential impact of geographic expansion on a bank's income growth, we do the following. We control for *Operating income growth*, which equals the growth rate of net operating income, and *Interest-earning assets growth*, which equals the growth rate of interest-earning assets, where we measure each of these growth measures at the beginning of each period. As shown in columns (5) and (6) of Table 4, the results hold. Indeed the estimated coefficient on *1 – Herfindahl index of deposits across states* remains statistically significant and economically meaningful when controlling for either *Operating income growth* or *Interest-earning assets growth*. Although not reported, these sensitivity checks are robust to using the other cost measure, *Cost of deposits*.

4. Governance

We now assess whether the impact of geographic expansion on a BHC's costs of interest-bearing liabilities depends on (a) the governance quality and (b) managerial risk-taking incentives of the BHC. According to the agency-based view, geographic diversification will intensify agency frictions and increase the costs of raising interest-bearing liabilities. In response to geographic expansion, therefore, better-governed banks will experience less of an intensification of agency frictions, so that geographic expansion

[11] This variable has been used to assess the diversity of BHC earnings, e.g., Laeven and Levine (2007).

will exert a weaker cost-increasing effect through this agency channel in better-governed banks. Given that geographic diversification puts downwards pressure on the costs of liabilities through the risk diversification channel, the net cost-reducing effects of geographic expansion should be particularly strong among better-governed banks.

To evaluate this view, we use proxies for the governance of each bank. We measure both the degree to which specialized analysts cover the bank and the degree of institutional ownership of the bank. As suggested by extensive research, analysts generally possess comparative advantages in reducing informational asymmetries and thereby enhancing the governance of firms (Jensen and Meckling, 1976, Shleifer and Vishny, 1986). Furthermore, institutional shareholders (such as mutual funds) typically play a more active role in governing managers than small shareholders (Gillan and Starks, 2000). Thus, we use analyst coverage and institutional owners to proxy for the governance of each BHC. Specifically, *Analyst coverage* equals the logarithm of one plus the number of analysts following the bank, and *Institutional investors* equals the logarithm of one plus the number of institutional owners of each BHC. We obtain data on analyst coverage and institutional investors from I/B/E/S and Thomson Reuters Institutional (13f) Holdings, respectively. These datasets categorize institutional investors into five broad groups: (1) banks, (2) insurance companies, (3) investment companies (e.g., mutual funds), (4) investment advisors, and (5) pension funds and other institutions. To mitigate the concern that variation in pension funds dominate our overall measure of *Institutional investors*, and that the interests of pension funds are more aligned with debt holders than with equity holders, we construct another measure of institutional ownership that excludes pension funds. Specifically, *Non-pension fund institutional investors* equals the logarithm of one plus the number of institutional owners excluding the fifth category of institutional investors (pension funds and other institutions). We also consider a third measure that focuses solely on the third category of institutional investors (*Mutual fund investors*). We interpret higher values of *Analyst coverage*, *Institutional investors*, *Non-pension fund institutional investors*, and *Mutual fund investors* as indicating that banks are scrutinized more effectively.

To assess whether the impact of geographic diversification on the costs of interest-bearing liabilities depends on bank governance, we redo the regression analyses while splitting the sample between BHCs with above and below the median levels of *Analyst coverage*, *Institutional investors*, *Non-pension fund institutional investors,* and *Mutual fund investors*. Thus, in Table 5, columns (1) and (2) presents the results for BHCs with above and below the median level of *Analyst coverage,* respectively. Columns (3) and (4) provide the regression results for BHCs with above and below the median level of *Institutional investors,* respectively. Columns (5) & (6) and (7) & (8) report the regression results for BHCs with above and below the median level of *Non-pension fund institutional investors* and *Mutual fund investors,* respectively.

The results in Table 5 indicate that geographic diversification (a) reduces the costs of interest-bearing liabilities in better-monitored BHCs and (b) increases (or has no effect) the costs of interest-bearing liabilities in poorly-monitored banks. These results hold when using *Analyst coverage*, *Institutional investors*, *Non-pension fund institutional investors* or *Mutual fund investors* to proxy for bank governance. For example, as shown in column (1) for the sample of above the median *Analyst coverage* BHCs, the instrumented diversity measure, *1 - Herfindahl index of deposits across states*, enters negatively and significantly at the 1% level, suggesting that the cost-reducing effects of geographic diversity are significant among better governed BHCs. In contrast, in columns (2) for the sample of below the median *Analyst coverage* BHCs, the instrumented diversity measure, *1 - Herfindahl index of deposits across states*, enters positively and significantly, suggesting that geographic expansion increases the costs of interest-bearing liabilities in poorly-governed banks. These findings are consistent with the view that when poorly-monitored banks expand, this tends to intensify agency frictions and boost funding costs. These findings are also consistent with the view that when better-monitored banks expand geographically, funding costs tend to fall because better-monitored banks are less subject to agency frictions and more capable of exploiting the new growth opportunities provided by geographic expansion.

We extend these analyses by examining the risk-taking incentives of managers. To the extent that a bank incentivizes managers through compensation contracts to take risks that do not align with the interests of depositors and other debt holders, these depositors and debt holders will tend to demand higher returns before investing in the bank. Thus, if geographic expansion expands the ability of managers to increase risk, this will mitigate the cost-reducing benefits of geographical diversification of banks. Similarly, to the extent that a bank does not create financial incentives for bank managers to increase risk, then geographic expansion will be less likely to induce bank managers to increase risk and therefore less likely to trigger an increase in funding costs.

To conduct these analyses, we differentiate banks by the degree of managerial risk-taking incentives. Existing research (e.g., Core and Guay 2002, Coles, Daniel, and Naveen 2006) shows a strong, positive link between CEO payoff convexity (sensitivity of managerial wealth to stock price volatility known as "Vega") and risky corporate policies. Consequently, we use bank managers' payoff Vega as the proxy for managerial risk-taking incentives. Specifically, *Vega* equals the change in dollar value of executive's wealth for a 0.01 change in the annualized standard deviation of stock returns. A higher Vega indicates that managers have more option-based compensation packages. We collect data on CEO compensation from the ExecuComp database, which provides data on salary, bonus, and total compensation for the top five executives for firms in the S&P 1500. Given data limitations on executive compensation, we obtain measures for Vega for 143 out of the 879 publicly-listed banks in our sample, accounting for about 20% of the bank-quarter observations.

We find that the impact of geographic diversification on funding costs depends on managerial incentives. We repeat the baseline regression analyses while splitting the sample between BHCs with above and below the median levels of *Vega*. As shown in Appendix Table A4 column (1), the instrumented diversity measure, *1 - Herfindahl index of deposits across states*, enters negatively and significantly among banks with below the median *Vega*. This suggests that the cost-reducing effects of geographic diversity are significant among BHCs that provide weaker risk-taking incentives to their managers. In contrast, for the sample of above the median *Vega* BHCs in column (2), the instrumented diversity measure, *1 - Herfindahl index of deposits across states*, enters positively yet insignificantly, suggesting that the cost-reducing benefits of geographic expansion are muted when a bank strongly incentivizes risk-taking through managerial compensation contracts.

5. Risk diversification

5.1 Economic comovement

If cross-state diversification reduces a BHC's funding costs by lowering risk, then, ceteris paribus, the impact of geographic diversification on funding costs should be greater when the BHC is located in a state with an economy that comoves less with the states into which the BHC expands. That is, geographic expansion should have a bigger impact on funding costs when there are greater opportunities to diversify risk through geographical expansion. In this subsection, we test this potential channel. Furthermore, by isolating and assessing this "risk" channel, we reduce concerns that the instrumental variable violates the exclusion restriction because we further differentiate BHCs by the comovement between the economy of the state in which the BHC has its headquarters and the economies of other states.

To assess this risk reduction channel, we measure the degree to which a state's economy comoves with the economy in other states. Specifically, we construct two measures of the degree to which expanding into a state will provide risk-reducing opportunities for a BHC. First, *Accessible states comovement* measures the degree to which each state's economy comoves with the economy of other states that allowed the BHCs from this state to establish subsidiaries. The Federal Reserve Bank of Philadelphia's *Coincident index* combines four indicators of state-level economic conditions: nonfarm payroll employment, average hours worked in manufacturing, the unemployment rate, and wage and salary disbursements deflated by the consumer price index (U.S. city average). The trend for each state's index is set to the trend of its gross state product (GSP), so long-term growth in the state's index matches long-term growth in its GSP. For each quarter, we compute the average of the correlation between a state's economy and other states that allowed this state to enter using monthly data of the coincident index over the previous three years. Second, *Accessible states comovement-weighted* equals the weighted average of the correlation between a state's economy and its accessible states' economy. We weight by the real GSP of the accessible state and the inverse of physical distance between the two states. A higher value of *Accessible states comovement* (or *Accessible states comovement-weighted*) suggests a higher covariation between a BHC's home state and the other states where the BHC can legally establish a bank subsidiary, and thereby less opportunities to diversify risk through geographical expansion.

To assess whether the impact of geographic diversification on funding costs is greater when the BHC is located in a state with an economy that comoves less with other accessible states, we include the interaction between the cross-state distribution of a BHC's deposits and one of the measures of the degree to which a state's economy comoves with that of other states. Specifically, we estimate the following regressions using instrumental variables:

$$
\begin{aligned}
Cost\ of\ funds_{bst} \\
&= \beta(1 - Herfindahl\ index\ of\ deposits\ across\ states)_{bt} \\
&+ \gamma C_{st} * (1 - Herfindahl\ index\ of\ deposits\ across\ states)_{bt} \\
&\quad + \theta X'_{bst} + \delta_b + \delta_{st} + \varepsilon_{bst}, \qquad (3)
\end{aligned}
$$

where the dependent variable, *Cost of funds*$_{bst}$, represents the funding costs for BHC *b* headquartered in state *s* during quarter *t*. The key explanatory variable, *1 - Herfindahl index of deposits across states*$_{bt}$, denotes the extent to which BHC *b* diversifies its bank branches across states during quarter *t*. C_{st} is one of the two state-time measures of the degree to which a state's economy comoves with the economy in other states, namely *Accessible states comovement*, or *Accessible states comovement-weighted*. Consistent with our previous analyses, X'_{bst} is a vector of time-varying characteristics for BHC *b*, headquartered in state *s*, at the beginning of the quarter *t*: *Total assets*, *Capital-asset ratio*, and *Return on assets*, along with *Market concentration (MSA)* and the *MSA indicator*. We also include BHC fixed effects, δ_b, to account for all time invariant BHC-specific factors, and state-quarter fixed effects, δ_{st}, to control for all time-varying state-specific factors.

If $\beta < 0$ and $\gamma > 0$, then this would suggest that the cost-reducing impact of cross-state deposit diversification is smaller when a BHC is headquartered in a state that comoves more with the accessible states' economy and, hence, where there are correspondingly less diversification benefits. To conduct the instrumental variable analyses with this modified regression model, we use the following instruments: *1 - Herfindahl index of deposits across states (predicted)* and its interaction with *Accessible states comovement* or *Accessible states comovement-weighted*.

The results in Table 6 show that geographic expansion reduces BHC funding costs by an especially large amount when the BHC expands into economically different states. Column (1) of Table 6 repeats the baseline results reported in column (1) of Table 4 Panel A, and columns (2) – (3) of Table 6 show that the linear term, *1 - Herfindahl index of deposits across states*, enters the regression negatively and significantly, whereas its interaction term with *Accessible states comovement* (or *Accessible states comovement-weighted*) enters positively and significantly. That is, geographic expansion, on average, reduces BHCs' funding cost, but the effects are less profound among BHCs located in states where the economic conditions covary highly with the other states' economy. In unreported robustness test, we confirm that these results hold when examining the other measure, *Cost of deposits*.

The differential economic impact of expanding into more, rather than less, economically different states is large. Consider a BHC headquartered in a state where its economy has a correlation of -1 with the economy in states that allow the BHC to enter. The regression estimates from column (2) indicate that a one standard deviation increase in the geographic diversity across states (0.158) reduces the BHC's total funding cost by 36% (= -1.443*0.158 + 0.865*(-1)*0.158). Next, consider another BHC headquartered in a state where its economy has a correlation of +1 with the economy in other states. The regression estimates from column (2) indicate that a one standard deviation increase in the geographic diversity across states reduces the BHC's total funding cost by 9% (= -1.443*0.158 + 0.865*(+1)*0.158). Thus, the cost-reducing benefits of BHC expanding into a perfectly procyclical economy are 75% less than expanding into a perfectly countercyclical economy. The estimation results using *Accessible states comovement-weighted* in column (3) also suggest a larger differential effect. Consider BHCs headquartered in a state where its economy has a correlation of -1 (or +1) with the states that allow the BHCs to enter. The cost-reducing benefits for BHCs in a perfect procyclical economy (4.6% = -1.505*0.158 + 1.217*(+1)*0.158) is about 90% less than in a perfect countercyclical economy (43% = -1.505*0.158 + 1.217*(-1)*0.158).

5.2 Insured vs. uninsured liabilities

We further explore the risk reduction channel by examining the differential impact of geographic diversification on the costs of uninsured and insured deposits. If geographic expansion reduces funding costs by reducing the riskiness of the bank, then, the cost-reducing effects should be larger for uninsured creditors than it is among insured deposits as they are protected by deposit insurance. As described in Subsection 2.3 in detail, we isolate (a) the costs of uninsured interest-bearing liabilities, (b) the costs of uninsured deposits, and (c) the costs of insured deposits. We then examine the differential impact of geographic diversification on the costs of each of these classes of interest-bearing liabilities and report the results in Table 7.

Consistent with the risk reduction channel, Table 7 shows that geographic diversification reduces the cost of uninsured interest-bearing liabilities and the cost of uninsured deposits but does not reduce the costs of insured deposits. That is, when examining the *Cost of uninsured funds* and the *Cost of uninsured deposits* in columns (1) and (2) respectively, *1 - Herfindahl index of deposits across states* enters negatively and significantly. When examining the *Cost of insured deposits*, however, in column (3), *1 - Herfindahl index of deposits* across states enter insignificantly and with a coefficient estimate close to zero.

6. Conclusion

In this paper, we assess (1) the impact of the geographic diversity of a bank's subsidiary and branch network on its costs of raising interest-bearing liabilities, which account for about 90% of total bank liabilities, and (2) two mechanisms through which geographic diversification might shape the costs of raising interest-bearing liabilities. To identify the impact of geographic diversification on these funding costs, we employ a modified gravity-deregulation model to construct an instrument for the distribution of each BHC's branches across states in each year. The time-varying, BHC-specific instrument exploits the dynamic processes of interstate bank deregulation from 1982 through 1994 and interstate branch deregulation from 1995 through 2005, as well as the gravity model of investment that uses the geographic location of each BHC's headquarters.

We discover that on average, geographic diversification lowers the costs of interest-bearing liabilities. With respect to the mechanisms, we find evidence for both the risk diversification and agency channels. Consistent with the view that geographic expansion can reduce risk by allowing banks to diversify away idiosyncratic risk and to smooth and manage local shocks through more extensive internal capital markets, we find that the costs of interest-bearing liabilities fall more when banks expand into states whose economies comove less with the bank's headquarter-state, i.e., states where geographic expansion provides greater risk diversification opportunities. Also consistent with the risk diversification mechanism, we find that geographic diversification reduces the costs of uninsured deposits, but not of insured deposits. We also find evidence consistent with the view that geographic expansion intensifies agency frictions, which puts upward pressures on funding costs. We show that geographic diversification reduces the costs of interest-bearing liabilities more in better-governed banks.

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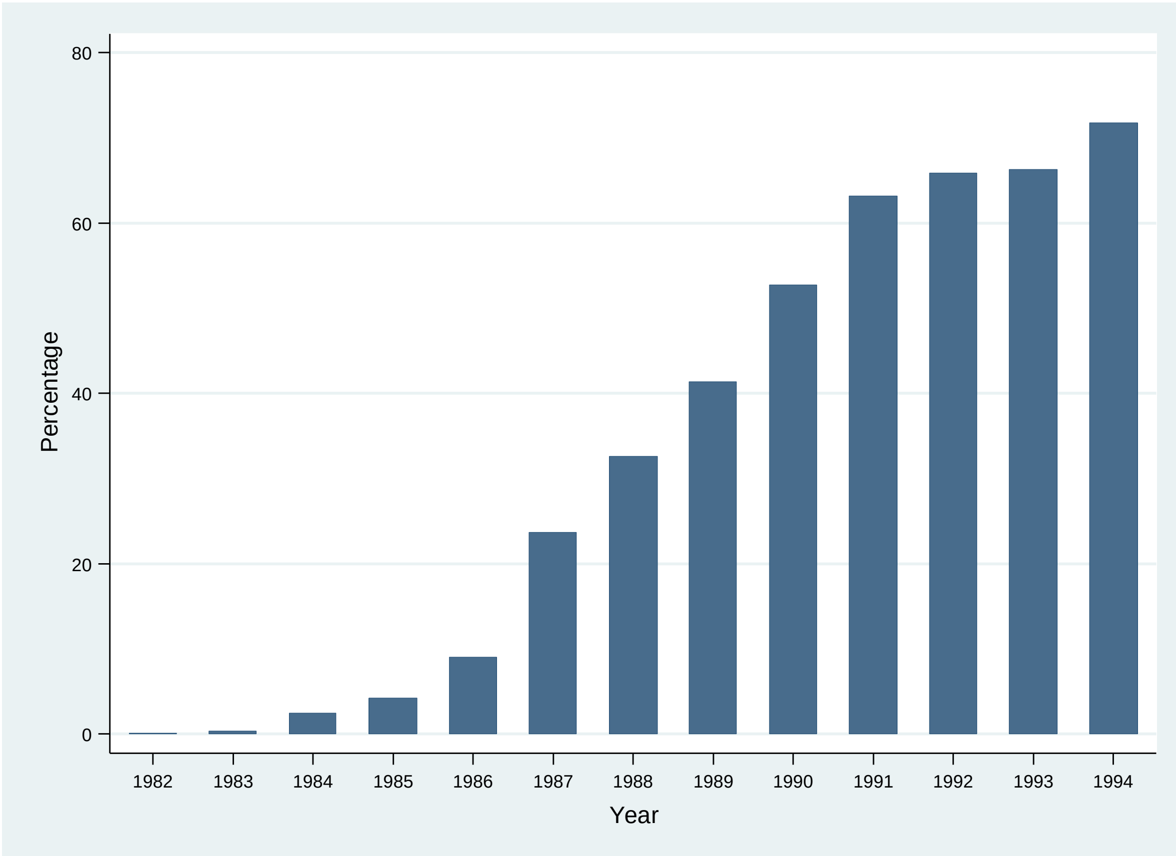

Figure 1. Dynamic process of interstate banking deregulation

This figure shows the cumulative percentage of state pairs when one state is allowed to enter the other state from 1982 through 1994 when the Riegle-Neal Interstate Banking and Branching Efficiency Act passed and removed all the remaining entry barriers across all states. The sample covers all the state pairs among the 48 contiguous states and the District of Columbia. Each bar represents the fraction of state pairs in which BHCs from state A are allowed to enter state B in the indicated year.

Table 1 Summary statistics

For all of the variables used in the analyses, this table provides the following summary statistics: number of observations (N), the average value (Mean), the standard deviation (SD), the minimum value (Min), the Maximum value (Max), and the values at the 25th, 50th, and 75th percentiles. Each of the variables is defined in Appendix Table A1.

Variable	N	Mean	SD	Min	P25	P50	P75	Max
Total cost of funds (level)	33758	0.011	0.004	0.003	0.008	0.011	0.014	0.022
Cost of deposits (level)	33750	0.011	0.004	0.003	0.008	0.010	0.013	0.021
Cost of uninsured funds (level)	33476	0.013	0.005	0.004	0.010	0.012	0.015	0.031
Cost of uninsured deposits (level)	32907	0.013	0.005	0.003	0.010	0.013	0.016	0.026
Cost of insured deposits (level)	33563	0.011	0.005	0.001	0.008	0.011	0.014	0.022
1 - Herfindahl index of deposits across states	33758	0.065	0.158	0.000	0	0	0	0.918
1 - Herfindahl index of deposits across states, diversified BHCs only	7333	0.299	0.211	0.000	0.127	0.262	0.437	0.918
Capital-asset ratio	33758	0.086	0.023	0.040	0.071	0.083	0.097	0.182
Return on assets	33758	0.003	0.002	-0.006	0.002	0.003	0.003	0.007
Total assets	33758	6.919	1.449	4.807	5.837	6.568	7.683	11.850
Noninterest income	33450	0.650	0.119	0.364	0.572	0.642	0.720	0.970
Deposit funding	33758	0.882	0.100	0.454	0.833	0.911	0.958	0.995
Liquid assets	33758	0.288	0.108	0.070	0.212	0.280	0.354	0.609
C&I loans	33757	0.120	0.076	0.000	0.067	0.105	0.157	0.382
Loan commitments	33742	0.148	0.110	0.000	0.079	0.124	0.188	0.674
Letters of credits	33745	0.014	0.021	0.000	0.003	0.007	0.015	0.132
Loan diversity	33756	0.474	0.171	0.024	0.361	0.510	0.607	0.733
Market concentration (MSA)	16452	0.426	0.263	0.030	0.225	0.357	0.560	1.000
Analyst coverage	33758	0.862	0.858	0.000	0.165	0.629	1.256	3.708
Institutional investors	33758	2.335	1.330	0.000	1.291	2.160	3.190	6.293
Accessible states comovement	3560	0.734	0.311	-0.847	0.572	0.904	0.952	1.000
Accessible states comovement-weighted	3560	0.528	0.241	-0.649	0.350	0.617	0.731	0.835

Table 2 Zero-stage estimation for the gravity model

This table shows the regression results of the share of BHC deposits on distance, an interstate branching index, and population. The gravity model includes observations in which it is legally feasible for BHC *b* with headquarters in state *i* to open a subsidiary in state *j* at time *t*. We exclude Alaska and Hawaii from the analyses and focus on the 49 contiguous states. Specifically, we estimate the following model:

$$Share_{bijt} = \alpha Ln(Distance_{bij}) + \beta Ln\left(\frac{pop_{it}}{pop_{jt}}\right) + \gamma Interstate\ Branching\ Index_{jt}\ (+\ \delta_t + \delta_{ij} + \delta_{ijt}\ ) + \varepsilon_{bijt},$$

where the dependent variable, $Share_{bijt}$, is the share of deposits a BHC b headquartered in state *i* holds in its branches in a "foreign" state *j* over the quarter *t*. $Ln(Distance_{bij})$ denotes the natural logarithm of geographic distance between the BHC b's headquarter and the capital city of state j (in miles). $Ln(Population\ ratio)$ equals the natural logarithm of (pop_{it}/pop_{jt}), defined as the ratio of the total population of the BHC b's home state i to the total population of the foreign state j in quarter t. $Interstate\ Branching\ Index_{j,t}$ is the index of interstate branching restrictions in state *j* at time *t* from Rice and Strahan (2010). Note that all the coefficients and standard errors are multiplied by 100 for expositional purposes. Standard errors are heteroskedasticity robust and clustered at the state and quarter, and reported in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%.

	Share of Deposits				
	(1)	(2)	(3)	(4)	(5)
Ln(Distance)	-0.161***	-0.168***	-0.233***	-0.900***	-0.917***
	(0.005)	(0.004)	(0.006)	(0.030)	(0.031)
Interstate Branching Index	-0.005***	-0.005***	-0.005***	-0.010***	
	(0.001)	(0.001)	(0.002)	(0.002)	
Ln(Population ratio)		-0.071***	-0.056***	-0.029	
		(0.002)	(0.002)	(0.026)	
State-pair fixed effects				Yes	
Quarter fixed effects				Yes	
State-pair-quarter fixed effects					Yes
Estimation model	Fractional logit	Fractional logit	OLS	OLS	OLS
Observations	1,305,645	1,305,645	1,305,645	1,305,645	1,305,645

Table 3 Geographic diversification and cost of funds: instrumental variables based on a gravity-deregulation model

This table reports the 2SLS regression results of the effects of geographic diversity on banks' funding costs in Panel A, and the reduced form results in Panel B. The dependent variable in column 1, *Total cost of funds*, is defined as the ratio of Total interest expenses to interest-bearing liabilities at the beginning of a period; and the dependent variable in column 3 is *Cost of deposits*, equal to Interest expenses on domestic deposits divided by interest-bearing domestic deposits at the beginning of a period. We take the natural logarithm of each cost measure. Columns 2 and 4 report the corresponding first-stage regression results, so the dependent variable is the endogenous variable, *1-Herfindahl index of deposits across state*, defined as one minus the sum of squared share of deposits held in different states. The excluded instrument is *1 - Herfindahl index of deposits across states (predicted)*, which is computed as follows: Using the coefficient estimates from the gravity-deregulation model (column 2 in Table 2), we predict the share a BHC holds in a state and year, where we impose that BHCs' projected holdings of deposits as zero in states that they cannot enter because of interstate bank regulations. Finally, we aggregate the information for each BHC at the BHC-quarter level and compute the Herfindahl index of deposits across states (predicted). BHC controls include *Capital-asset ratio*, *Return to assets*, and *Total assets*, all measured at the beginning of a period, along with *Market concentration (MSA)* and *MSA indicator*. Bank holding company fixed effects and state-quarter fixed effects are included throughout the table. Standard errors are heteroskedasticity robust and clustered at the state and quarter, and reported in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%.

Panel A: 2SLS results

	Total cost of funds (1)	First-stage regression (2)	*Cost of deposits* (3)	First-stage regression (4)
1 - Herfindahl index of deposits across states	-0.664***		-0.485***	
	(0.107)		(0.100)	
1 - Herfindahl index of deposits across states (predicted)		1.235***		1.235***
		(0.142)		(0.142)
BHC controls	Yes	Yes	Yes	Yes
Bank holding company fixed effects	Yes	Yes	Yes	Yes
State-quarter fixed effects	Yes	Yes	Yes	Yes
Observations	33,217	33,217	33,205	33,205
R-squared	0.924		0.940	
F-statistics of Weak IV		76.15		76.10

Panel B: Reduced form

	Total cost of funds (1)	*Cost of deposits* (2)
1 - Herfindahl index of deposits across states (predicted)	-0.820***	-0.599***
	(0.129)	(0.114)
BHC controls	Yes	Yes
Bank holding company fixed effects	Yes	Yes
State-quarter fixed effects	Yes	Yes
Observations	33,217	33,205
R-squared	0.938	0.946

Table 4 Geographic diversification and cost of funds: robustness tests

This table reports the second-stage results of the instrumental variable tests on the robustness of the impact of geographic diversification on BHC funding costs. The dependent variable is *Total cost of funds* in all columns. Using the same empirical methods as in Table 3, column 1 reports the results using the sample period from 1986 through 1997, before the full implementation of the Riegle-Neal Act; column 2 adds into the baseline regression a non-linear bank size control; column 3 reports the results on a subsample of BHCs in which interest income accounts for at least 2/3 of total operating income, and further includes the additional control variable, *Noninterest income*, which equals one minus the absolute difference between net interest income and total noninterest income divided by the total operating income; column 4 adds a set of additional bank traits into the baseline regression. These *other traits* include *Liquid assets*, *C&I loans*, *Loan diversity*, *Loan commitments*, *Letters of credits*, and *Deposit funding*, all measured at the beginning of each period. Columns 5 & 6 include additional control variables of banks' growth opportunities, *Operating income growth*, which equals growth rate of net operating income, and *Interest-earning assets growth*, which equals the growth rate of interest-earning assets, all measured at the beginning of each period. BHC controls include the same set of controls as in Table 3, namely *Capital-asset ratio*, *Return to assets*, *Total assets*, *Market concentration (MSA)*, and *MSA indicator*. Bank holding company fixed effects and state-quarter fixed effects are included throughout the table. Standard errors are heteroskedasticity robust and clustered at the state and quarter, and reported in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%.

	Before the full implementation of the Riegle-Neal Act	Non-linear bank size	Product mixes	Additional BHC controls	Control for growth opportunities	
	(1)	(2)	(3)	(4)	(5)	(6)
1 - Herfindahl index of deposits across states	-0.577***	-0.888***	-0.706***	-0.664***	-0.679***	-0.673***
	(0.177)	(0.188)	(0.111)	(0.118)	(0.123)	(0.119)
Additional controls	No	Total assets squared	Noninterest income	Noninterest income & other traits	Operating income growth & other traits	Interest-earning asset growth & other traits
BHC controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank holding company fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
State-quarter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,854	33,217	31,943	32,885	32,233	32,883
R-squared	0.914	0.915	0.925	0.926	0.926	0.926
F-statistics of Weak IV	49.82	51.08	67.02	66.65	61.88	66.20

Table 5 Geographic diversification and cost of funds: governance

This table reports the second-stage results from 2SLS analyses on the effects of geographic diversity on banks' funding costs while differentiating banks by bank governance. The dependent variable is *Total cost of funds* across columns. We use four measures of the quality of bank governance. *Analyst coverage* equals the log of one plus the number of analysts that provide annual earnings forecast on a bank holding company. *Institutional investors* equals the log of one plus the number of institutional investors. *Non-pension fund institutional investors* equals the log of one plus the number of institutional owners excluding pension funds and other institutions. *Mutual fund investors* equals the log of one plus the number of mutual fund investors. High/Low *Analyst coverage* (*Institutional investors*, *Non-pension fund Institutional investors*, or *Mutual fund investors*) represents whether the value of *Analyst coverage* (*Institutional investors*, *Non-pension fund Institutional investors*, or *Mutual fund investors*) is above/below the sample median. The endogenous variable is *1 - Herfindahl index of deposits across state*, defined as one minus the sum of squared share of deposits held in different states. The excluded instrument is *1 - Herfindahl index of deposits across states (Predicted)*, which is computed using the same gravity-deregulation model as described in Table 3. Bank controls include *Capital-asset ratio*, *Return to assets*, *Total assets*, *Market concentration (MSA)*, and *MSA indicator*. Bank holding company fixed effects and state-quarter fixed effects are included throughout the table. Standard errors are heteroskedasticity robust and clustered at the state and quarter, and reported in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%.

	Total cost of funds							
	High Analyst coverage	Low Analyst coverage	High Institutional investors	Low Institutional investors	High Non-pension fund institutional investors	Low Non-pension fund institutional investors	High Mutual fund investors	Low Mutual fund investors
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1 - Herfindahl index of deposits across states	-2.132***	0.335**	-1.885***	0.204*	-1.739***	0.256**	-1.591***	0.0660
	(0.547)	(0.150)	(0.455)	(0.122)	(0.375)	(0.120)	(0.414)	(0.132)
BHC controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank holding company fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-quarter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	15,780	16,542	15,746	16,489	15,897	16,380	13,808	14,727
R-squared	0.780	0.945	0.815	0.945	0.833	0.944	0.843	0.942

Table 6 Geographic diversification and cost of funds: economic comovement

This table reports the second-stage results from 2SLS analyses on the effects of geographic diversity on banks' funding costs while differentiating banks by the economic comovement between their headquartered states and other states. The dependent variable is *Total cost of funds* in all columns. We construct two measures for the economic comovement between a BHC's home state and the rest of the economy. First, *Accessible states comovement* is defined as the simple average of the correlations of the coincident index between a BHC's home state A and the states where state A is legally allowed to enter over quarter *t*. Second, *Accessible states comovement-weighted* equals the weighted average of the correlations of the coincident index between a BHC's home state A and the states where state A is legally allowed to enter over quarter *t*, weighted by (a) the real Gross State Product (GSP) that represent the size of a state's economy, and (b) the inverse of the distance between each state pair. BHC controls include *Capital-asset ratio*, *Return to assets*, *Total assets*, *Market concentration (MSA)*, and *MSA indicator*. Bank holding company fixed effects and state-quarter fixed effects are included throughout the table. Standard errors are heteroskedasticity robust and clustered at the state and quarter, and reported in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%.

		Total cost of funds	
	(1)	(2)	(3)
1 - Herfindahl index of deposits across states	-0.664***	-1.443***	-1.505***
	(0.107)	(0.347)	(0.369)
Accessible states comovement (1 - Herfindahl index of deposits across states)*		0.865***	
		(0.330)	
Accessible states comovement-weighted(1 - Herfindahl index of deposits across states)*			1.217***
			(0.469)
BHC controls	Yes	Yes	Yes
Bank holding company fixed effects	Yes	Yes	Yes
State-quarter fixed effects	Yes	Yes	Yes
Observations	33,217	33,217	33,217
R-squared	0.924	0.915	0.913

Table 7 Geographic diversification and cost of funds: insured vs. uninsured liabilities

This table reports the second-stage results from 2SLS analyses on the effects of geographic diversity on banks' cost of insured vs. noninsured funds. The dependent variable is *Cost of uninsured funds*, *Cost of uninsured deposits*, and *Cost of insured deposits*, in columns (1), (2), and (3), respectively. *Cost of uninsured funds* equals interest expenses on non-deposit liabilities and large time deposits (more than $100,000 during our sample period) divided by the interest-bearing non-deposit liabilities and large time deposits at the beginning of a period. *Cost of uninsured deposits* equals interest expenses on large time deposits divided by the quarterly average of large time deposits. *Cost of insured deposits* equals interest expenses on transaction accounts and time deposits less than $100,000 divided by the quarterly average of transaction account and time deposits less than $100,000. BHC controls include *Capital-asset ratio*, *Return to assets*, *Total assets*, *Market concentration (MSA)*, and *MSA indicator*. Bank holding company fixed effects and state-quarter fixed effects are included throughout the table. Standard errors are heteroskedasticity robust and clustered at the state and quarter, and reported in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%.

	Cost of uninsured funds	*Cost of uninsured deposits*	*Cost of insured deposits*
	(1)	(2)	(3)
1 - Herfindahl index of deposits across states	-0.686***	-0.663**	-0.044
	(0.244)	(0.269)	(0.180)
BHC controls	Yes	Yes	Yes
Bank holding company fixed effects	Yes	Yes	Yes
State-quarter fixed effects	Yes	Yes	Yes
Observations	32,933	32,905	33,556
R-squared	0.699	0.798	0.918
F-statistics of Weak IV	80.20	75.27	78.36

Appendix

Table A1 Variable definition and sources

Variable	Definition	Sources
Total cost of funds	Logarithm of the ratio of total interest expenses (adjusted year-to-date reporting to within quarter) to interest-bearing liability at the beginning of a period.	FR-Y9C, calculated by authors
Cost of deposits	Logarithm of interest expenses on domestic deposits (adjusted year-to-date reporting to within quarter) divided by interest-bearing domestic deposits at the beginning of a period.	
Cost of uninsured funds	Logarithm of interest expenses on non-deposit liabilities and large time deposits (more than $100,000 during our sample period) (adjusted year-to-date reporting to within quarter) divided by the interest-bearing non-deposit liabilities and large time deposits at the beginning of a period.	
Cost of uninsured deposits	Logarithm of interest expenses on large time deposits (adjusted year-to-date reporting to within quarter) divided by quarterly average of large time deposits. This measure is computed using individual bank data aggregated at the holding-company level.	Reports of Condition and Income (Call reports), calculated by authors
Cost of insured deposits	Logarithm of interest expenses on transaction accounts and time deposits less than $100,000 (adjusted year-to-date reporting to within quarter) divided by quarterly average of transaction account and time deposits less than $100,000. This measure is computed using individual bank data aggregated at the holding-company level.	
1-Herfindahl index of deposits across states	BHC diversification measure, equal to one minus the sum of squared share of deposits held in different states via branches.	FR-Y9C, Call reports, Summary of Deposits, calculated by authors
Total assets	Log of the book value of total assets in million US dollars, measured at the beginning of a period.	FR-Y9C, calculated by authors
Capital-asset ratio	The fraction of bank equity over total assets, measured at the beginning of a period.	
Return on assets	Net income divided by the book value of total assets, measured at the beginning of a period.	
Noninterest income	One minus the absolute difference between net interest income and total noninterest income divided by the total operating income.	
Liquid assets	The ratio of bank liquid assets over total assets, measured at the beginning of a period. Liquid assets include cash and balances due from depository institutions, plus marketable securities.	
C&I loans	Commercial and industrial loans over total assets, measured at the beginning of a	

	period.	
Loan diversity	One minus the sum of squared share of loans secured by real estate, C&I loans, consumer loans, and other loans out of total loans, measured at the beginning of a period.	
Loan commitments	Total amount of unused loan commitments as a fraction of total assets, at the beginning of a period.	
Letters of credits	Standby letters of credits as a fraction of total assets, at the beginning of a period.	
Deposit funding	The ratio of total deposits over total liabilities, measured at the beginning of a period.	
Market concentration(MSA)	Herfindahl index of bank asset concentration in a holding company's market, defined as the sum of squared share of total assets among all the bank institutions operated in a Metropolitan Statistical Area (MSA). We impose a value of one for non-MSA.	FR-Y9C, Call reports, U.S. Census Bureau, calculated by authors
Analyst coverage	Log of one plus the number of analysts that provide annual earnings forecast on a bank holding company.	IBES
Institutional investors	Log of one plus the number of institutional investors recorded in Thomson Reuters Institutional (13f) Holdings database.	Thomson Reuters Institutional (13f) Holdings
Accessible states comovement	The average correlations of the coincident index between a BHC's home state A and the states into which state A is legally allowed to enter in a quarter. For each quarter, we estimate the correlations between each state pair using the monthly values of the coincident index over the previous three years. The coincident indexes summarize the economic conditions in a specific state. The indexes combine four state-level variables, namely nonfarm payroll employment, average hours worked in manufacturing, the unemployment rate, and wage and salary disbursements deflated by the consumer price index (U.S. city average). For each quarter, we estimate the correlations between individual states and the US using the monthly values of the coincident index over the previous three years. A higher value indicates a larger correlation between a state and its accessible states.	Federal Reserve Bank of Philadelphia, calculated by authors
Accessible states comovement-weighted	The weighted average of the correlations of the coincident index between a BHC's home state A and the states into which state A is legally allowed to enter in a quarter, weighted by the real Gross State Product (GSP) of the accessible state and the inverse of the relative distance between the two states.	Federal Reserve Bank of Philadelphia, Bureau of Economic Analysis, calculated by authors

Table A2 Geographic diversification and cost of funds: IV tests without BHC controls

This table reports the Instrumental variable test results on the effects of banks' geographic diversity on funding costs, without including BHC specific controls. The dependent variables and explanatory variables are defined the same as in Table 3 in our main text. Bank holding company fixed effects and state-quarter fixed effects are included throughout the table. Standard errors are heteroskedasticity robust and clustered at the state and quarter, and reported in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%.

Panel A: 2SLS results

	Total cost of funds (1)	First-stage regression (2)	*Cost of deposits* (3)	First-stage regression (4)
1 - Herfindahl index of deposits across states	-0.530***		-0.397***	
	(0.097)		(0.090)	
1 - Herfindahl index of deposits across states (predicted)		1.349***		1.349***
		(0.143)		(0.143)
Bank holding company fixed effects	Yes	Yes	Yes	Yes
State-quarter fixed effects	Yes	Yes	Yes	Yes
Observations	34,011	34,011	33,998	33,998
R-squared	0.926		0.941	
F-statistics of Weak IV		88.90		88.91

Panel B: Reduced form

	Total cost of funds (1)	*Cost of deposits* (2)
1 - Herfindahl index of deposits across states (predicted)	-0.715***	-0.536***
	(0.123)	(0.111)
Bank holding company fixed effects	Yes	Yes
State-quarter fixed effects	Yes	Yes
Observations	34,011	33,998
R-squared	0.936	0.945

Table A3 Geographic diversification and cost of funds: Alternative instrumental variable

This table reports the instrumental variable test results that are similar to Table 3 in the main text, except that the instruments are predicted using geographic distance and the interstate bank and branch deregulation, not population. The dependent variables and explanatory variables have the same meaning as in Table 3 in our main text. Bank holding company fixed effects and state-quarter fixed effects are included throughout the table. Standard errors are heteroskedasticity robust and clustered at the state and quarter, and reported in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%.

Panel A: 2SLS results

	Total cost of funds		*Cost of deposits*	
	(1)	(2)	(3)	(4)
1 - Herfindahl index of deposits across states	-1.292***	-1.556***	-0.977***	-1.126***
	(0.220)	(0.259)	(0.184)	(0.212)
BHC controls	No	Yes	No	Yes
Bank holding company fixed effects	Yes	Yes	Yes	Yes
State-quarter fixed effects	Yes	Yes	Yes	Yes
Observations	34,011	33,217	33,998	33,205
R-squared	0.880	0.863	0.918	0.913
F-statistics of Weak IV	55.09	51.47	55.10	51.45

Panel B: Reduced form

	Total cost of funds		*Cost of deposits*	
	(1)	(2)	(3)	(4)
1 - Herfindahl index of deposits across states (predicted Distance)	-1.243***	-1.330***	-0.941***	-0.962***
	(0.139)	(0.145)	(0.127)	(0.135)
BHC controls	No	Yes	No	Yes
Bank holding company fixed effects	Yes	Yes	Yes	Yes
State-quarter fixed effects	Yes	Yes	Yes	Yes
Observations	34,011	33,217	33,998	33,205
R-squared	0.936	0.938	0.945	0.946

Table A4 Geographic diversification and cost of funds: managerial incentives

This table reports the second-stage results from 2SLS analyses on the effects of geographic diversity on banks' funding costs while differentiating banks by bank managerial incentives. The dependent variable is *Total cost of funds* across columns. To measure managerial risk-taking incentives, we use *Vega*, which equals the change in dollar value of executive's wealth for a 0.01 change in the annualized standard deviation of stock returns. High/Low *Vega* represents whether the value of *Vega* is above/below the sample median. The endogenous variable is *1 - Herfindahl index of deposits across state*, defined as one minus the sum of squared share of deposits held in different states. The excluded instrument is *1 - Herfindahl index of deposits across states (Predicted)*, which is computed using the same gravity-deregulation model as described in Table 3. Bank controls include *Capital-asset ratio*, *Return to assets*, *Total assets*, *Market concentration (MSA)*, and *MSA indicator*. Bank holding company fixed effects and state-quarter fixed effects are included throughout the table. Standard errors are heteroskedasticity robust and clustered at the state and quarter, and reported in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%.

	Total cost of funds	
	Low Vega	High Vega
	(1)	(2)
1 - Herfindahl index of deposits across states	-2.111**	0.0159
	(0.877)	(1.121)
BHC controls	Yes	Yes
Bank holding company fixed effects	Yes	Yes
State-quarter fixed effects	Yes	Yes
Observations	3,363	3,212
R-squared	0.821	0.941