Geographic Diversification and Banks' Funding Costs

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Abstract

We assess the impact of a bank expanding its assets geographically on the cost of its interest-bearing liabilities. Existing research suggests that expansion can both intensify agency problems that increase funding costs and facilitate risk diversification that decreases funding costs. Using a newly developed identification strategy, we discover that the geographic expansion of banks across U.S. states lowered their funding costs. These results are especially strong when banks are headquartered in states with lower macroeconomic covariance with the states into which they can legally expand and when banks are more transparent, allowing investors to assess the effects of expansion. The results are consistent with the view that geographic expansion offers large risk diversification opportunities that reduce funding costs.

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1. Introduction

Does the geographic diversification of a bank's assets increase or decrease its funding costs? The agency-based models of Jensen (1986), Jensen and Meckling (1976), and Scharfstein and Stein (2000) suggest that if geographic dispersion creates barriers to shareholders and creditors governing banks, then bank insiders can more easily extract private rents, reducing bank valuations and boost funding costs. In contrast, risk-focused models emphasize that if geographic expansion adds assets to a bank's portfolio that are imperfectly correlated with existing assets, this can reduce funding costs both by diversifying away idiosyncratic asset specific risk (e.g., Diamond 1984 and Boyd and Prescott 1986) and by enhancing the bank's ability to use its internal capital market to respond to local economy shocks (e.g., Houston, James, and Marcus, 1997, Houston and James, 1998, Gatev, Schuermann, and Strahan, 2009, and Cornett et al., 2011).

Existing empirical work provides valuable insights into how the geographic expansion of bank assets influences agency frictions, risk diversification, and the operation of internal capital markets. Consistent with agency-based models, Goetz, Laeven, and Levine (2013) discover that geographic expansion increases lending to bank insiders and reduces bank valuations, and Brickley, Linck, and Smith (2003) and Berger et al. (2005) find that geographic distance can hinder the ability of a bank's headquarters to monitor its subsidiaries, which tend to increase funding costs. Consistent with risk-focused models, geographic diversification reduces overall bank risk (e.g., Deng and Elyasiani, 2008, and Goetz, Laeven, and Levine, 2016) and improves the ability of banks to respond to local economic shocks (Cortes and Strahan, 2016),[1] which tend to reduce funding costs. What is missing from the literature, however, is an assessment of how geographic expansion influences overall funding costs.

[1] See also Chong (1991) and Demsetz and Strahan (1997), who find that geographically diversified banks have less capital, and Acharya, Hasan, and Saunders (2006), who show that geographically diversified banks lend to riskier clients.

In this paper, we evaluate the impact of the geographic expansion of a bank's assets on the cost of its interest-bearing liabilities, where interest-bearing liabilities account for about 90% of total bank liabilities. More specifically, we examine the geographic expansion of bank holding company (BHC) assets across the U.S. states. To measure funding costs, we use the implicit interest rate on a bank's interest-bearing liabilities, i.e., total interest expenses divided by interest-bearing liabilities (Demirgüç-Kunt and Huizinga, 2004). To measure geographic expansion, we use the cross-state distribution of its subsidiaries and weight each subsidiary by its share of assets in the BHC. To identify the causal effect of geographic expansion on funding costs, we follow the Goetz, Laeven, and Levine (2013) procedure for constructing an instrumental variable for geographic expansion.

Identification is a first-order concern since funding costs might shape the BHC investment decisions and other factors might drive both BHC expansion and funding costs. To address this concern, we implement a two-step procedure for constructing an instrumental variable for geographic expansion. First, we exploit the dynamic process of interstate bank deregulation across the U.S. states from 1982 through 1995. Starting in 1982, individual states removed restrictions on BHCs headquartered in "foreign" states from establishing subsidiaries within the deregulating state's borders. Not only did states start the process of interstate bank deregulation in different years, they also followed very different dynamic paths as states signed bilateral and multilateral reciprocal agreements in a fairly chaotic process over many years. Thus, there is substantial cross-state heterogeneity in the start and dynamics of interstate bank deregulation. The passage of the Riegle-Neal Act in 1994 eliminated all remaining restrictions on interstate banking starting in 1995. An extensive body of research provides evidence that interstate bank deregulation is exogenous to state economic conditions (e.g., Jayaratne and Strahan, 1996, Kroszner and Strahan, 1999, Morgan, Rime and Strahan, 2004, and Beck, Levine and Levkov, 2010) as well as to banking system profitability, valuations, and risk (Jayaratne and Strahan, 1998, Goetz, Levine, and Levine, 2013, 2016). This first step yields year-by-year

information on whether BHCs headquartered in one state can establish subsidiaries in each foreign state. This first step, however, does not differentiate among BHCs headquartered within the same state; that is, it does not provide information on why some BHCs in a state expand into foreign states 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.[2] The gravity model predicts that the costs of conducting economic transactions, including the costs of establishing bank subsidiaries, vary positively with distance. Thus, the gravity model predicts that when state *j* allows BHCs from state *i* to establish subsidiaries 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 pre-determined before the period of interstate bank deregulation, we exploit this as an exogenous source of variation in how interstate bank deregulation differentially affects BHCs in a state. Indeed, only 2% of BHCs change the state in which they are headquartered during our sample period and the results are robust to including or excluding them. Specifically, we calculate the aerial distance between the headquarters of each BHC and the capital of each foreign state and use this distance to differentiate among BHCs headquartered in the same state. Based on these distances, we use the gravity model to estimate each BHC's cross-state asset holdings in foreign subsidiaries.

The integration of the gravity model of BHC investment with the dynamic process of interstate bank deregulation yields a time-varying, BHC-specific instrumental variable of the cross-state dispersion of each BHC's assets. Specifically, we (1) project the share of each BHC's holdings of assets in subsidiaries in each foreign state *j* using the gravity model and (2) impose a value of zero when interstate bank regulations prohibit a BHC from establishing a subsidiary in state *j*. Thus, we use these exogenous sources of variation to project the cross-state holdings of

[2] The gravity model has been heavily used in international economics, as exemplified by Tinbergen (1962) and Helpman, Melitz, and Rubinstein (2008).

assets for each BHC in each period and then compute the projected Herfindahl index of cross-state asset holdings. We use this as the instrument for a BHC's actual dispersion of assets and evaluate the impact of the geographic expansion on the costs of interest-bearing liabilities.

With respect to the validity of our identification strategy in general and the instrumental variable in particular, we emphasize five points. First, we find that the instrument is strongly correlated with the actual cross-state dispersion of a BHC's assets. That is, the F-test on the instrument in the first-stage regression is above 25, indicating that we do not have a weak instrument problem. Second, in terms of the exclusion restriction, it is valuable to first note that the instrument is constructed from two plausibly exogenous sources of variation: the dynamic process of interstate bank deregulation and pre-determined geographic distance. Third, since the instrumental variable differentiates among BHCs within each state and time period, we address the key concern that perhaps some other factor besides geographic expansion is systematically changing when state *j* allows BHCs from state *i* to enter and it is this other factor that affects funding costs across BHCs in state *i*. We address this concern by including state-time fixed effects to control for all time-varying state influences on funding costs. In this way, identification comes from comparing the differential impact of interstate bank deregulation on BHCs in the same state. Fourth, we address concerns that other BHC-specific factors simultaneously account for both their cross-state dispersion of assets 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 market in which a BHC is headquartered, as well as BHC size, capital-asset ratio, and profitability. Fifth, we evaluate the particular theoretical prediction that geographic expansion reduces funding costs by allowing banks to hold a more diversified portfolio of assets and to manage local economic shocks more effectively. As discussed in detail below, this evaluation both provides information on one potential mechanism linking geographic expansion and funding costs and reduces concerns that

the instrument violates the exclusion restriction because our evaluation further differentiates BHCs by a measure of the economic diversification of their assets.

We discover that geographic diversification materially lowered BHC funding costs. Geographic diversification enters the funding cost regression 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 assets will reduce the total interest expense ratio by 20% in our sample. Furthermore, we show that it is crucial to use instrumental variables to identify the impact of the cross-state dispersion of BHC assets on funding costs. When using ordinary least squares (OLS), we find a *positive* association between diversification and funding costs, which might reflect reverse causality: BHCs with higher funding costs expand to other states in search of lower funding costs, 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 assets lowers funding costs.

The results are robust to several sensitivity analyses. First, the results hold when using alternative measures of the cost of interest-bearing liabilities as the dependent variable, including a measure that focuses only on uninsured liabilities. Second, the results are robust to measuring a BHC's geographic diversity based on branch-level deposits (rather than subsidiary-level assets). Third, the findings obtain when including or excluding time-varying BHC controls, for different subsamples of banks based on the types of products that they offer customers, and for different estimation periods.

We also examine whether geographic expansion reduces funding costs by allowing banks to diversify away idiosyncratic risk and better manage localized economic shocks. Specifically, if geographic diversification reduces funding costs by lowering risk, then its impact on funding costs should be greater when BHCs expand into states that offer 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 have lower correlations with (a) the U.S. economy, and (b) the economy of states where it is feasible for a BHC to establish subsidiaries. We use the Federal Reserve Bank of Philadelphia's *Coincident index* to capture the degree to which each state's economy is correlated with the overall U.S. economy or with each other state's economy.

The results indicate that geographic expansion reduces BHC funding costs more when the BHC is headquartered in a state that has an economy with a lower correlation with the overall U.S. economy or the economies of states where its BHCs can establish subsidiaries. This is consistent with the risk-reducing view of how geographic diversification lowers funding costs. Furthermore, 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 U.S. economy into an average state is about twice as large as that of a similar BHC headquartered in a state that is perfectly correlated with the U.S. economy that expands into the same state. The results in this paper highlight a material cost of restricting banks from using geographic expansion to diversify their risks.

Research on financial accounting offers an additional testable prediction that relates to both agency-based and risk-focused perspectives on how geographic expansion shapes funding costs. Bushman and Williams (2012), Beatty and Liao (2014) and Acharya and Ryan (2016), stress that financial reporting and disclosure shape the ability of outside investors to assess firm and executive performance actions and performance. In our context, this insight suggests that geographic diversification will reduce funding costs more when there is more informative disclosure so that bank creditors are able to properly evaluate changes in the BHC's exposure to risk and local economic conditions. With respect to agency problems, the research on financial reporting and disclosure suggests that geographic expansion will increase funding costs less when greater financial reporting and disclosure facilitates effective corporate governance (e.g., Bushman et al., 2004; Goetz, Laeven, and Levine, 2013). Thus, from both the agency and risk

perspectives, research on financial disclosure suggests that greater transparency by a BHC will increase the extent to which geographic diversification reduces its funding costs relative to less transparent BHCs making the same geographic investment decisions.

In an exploratory examination, we confirm this prediction. To measure the extent to which a BHC discloses financial and operational information to the public, we use the quantity and richness of each BHC's 8-K filings (or "current reports"). Compared with other measures of information disclosure, such as financial reporting quality (e.g., Beatty and Liao, 2014), using 8-K filings does not rely on model specific assumptions and provides direct measures of the amount of information available to investors for a large sample of BHCs. The results show that the cost-reducing benefits of geographic diversity are significant only among BHCs with above the median levels of information disclosure quality.

The rest of the paper proceeds as follows. Section 2 describes the data and the process of interstate banking deregulation. Section 3 provides ordinary least squares results on the relation between funding costs and geographic diversification. Section 4 describes the construction of the instrumental variable for geographic diversification, presents the instrumental variable results, and assesses the validity of the instrument. Section 5 conducts additional tests on the mechanisms linking geographic diversity and funding costs. Section 6 explores the role of banks' accounting transparency on the cost-reducing benefits of diversification, and section 7 concludes.

2. Data and interstate bank deregulation

2.1 BHC and bank subsidiary data sources

We use financial and structural information on BHCs and their chartered subsidiary banks 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. We focus on the ultimate parent holding company, and thus eliminate those that are owned by other financial institutions. Furthermore, the Call Reports give the location of each banking institution. In this way, we can measure a BHC's geographic dispersion of assets across states via its bank subsidiaries.

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 35,741 BHC-quarter observations on 915 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 subsidiaries, where each subsidiary is weighted by the book value of its assets. Specifically, *1-Herfindahl index of assets across states* equals one minus the Herfindahl-Hirschman index of a BHC's assets in subsidiaries located in other states besides the state in which the BHC has its headquarters. Thus, a higher value indicates a more dispersed distribution of assets across states. We construct this measure for each BHC in each quarter.

We construct an alternative geographic diversity measure, *1-Herfindahl index of branch deposits across states*, defined as one minus the Herfindahl-Hirschman index of a BHC's deposits held in its branches across states (including its headquartered state). Using the location of each BHC's bank branches provided in the FDIC's Summery of Deposits (SOD), this measure determines a BHC's cross-state diversity by its bank branch network, as opposed to its subsidiaries. This measures helps address concerns with the *1-Herfindahl index of assets across states* measures since some BHCs convert subsidiaries into branches or establish new branches across state lines in the aftermath of the Riegle-Neal Act (Goetz, Laeven, and Levine, 2016).[3]

2.3 Funding costs and other BHC traits

We construct two key measures of BHC funding costs. First, *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. Following Gilje, Loutskina, and Strahan (2016), 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 domestic deposits*). Table 1 provides summary statistics for the funding cost measures. The *Total cost of funds* and *Cost of domestic deposits* both range 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.

[3] Given that the branch data from SOD is available since 1994, we are able to precisely measure a BHC's cross-state dispersion of branches only for periods in and after 1994. For the earlier period before 1994, we use the historical date when a branch becomes affiliated with a BHC to estimate the BHC's earlier bank branch network.

In robustness tests, we examine the costs of funding non-FDIC insured liabilities. We examine this subset of liabilities since diversification could have a particularly pronounced effect on individuals and institutions making uninsured investments in banks. *Cost of uninsured funds* equals a BHC's interest expense on uninsured funds 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).

Isolating the cost of funding non-insured liabilities is empirically challenging due to data limitations. First, banks are required to report deposits 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. Second, simply because a deposit account has less than $100,000 does 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.[4] Third, BHCs only provide information on interest expenditures on time deposits of $100,000 or more, and interest on "other deposits" during the 1986–1996 period. After 1997, they also provide information on interest expenses on time deposits of less than $100,000. Thus, we can only create an imperfect proxy for the cost of non-insured interest liabilities.

We proceed as follows. 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 (explicitly) by the FDIC, there are some problems with treating time deposits of $100,000 as

[4] 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 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 deposits 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.

uninsured since the first $100,000 might be insured depending on the other holding of the individual entity in this bank. These time deposits plus non-deposit debts, on average account for 28% of interest-bearing liabilities in our sample, and the associated interest expense are about 1/3 of the banks' total interest expense. As shown in Table 1, *Cost of uninsured funds* ranges from 0.4 to 3 percentage points, with a mean value of 1.3 percentage points. Thus, although imperfect, this measure of cost on uninsured funds is on average higher than *Total cost of funds* by about 20 basis points, reflecting a risk premium required by unprotected creditors. We show that our main results are robust to the *Cost of uninsured funds*.

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*, which equals the book value of total assets in billions of US dollars, and the *Capital-asset ratio*, which equals the book value of BHC equity divided by total assets. 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 describes detailed variable definitions and Table 1 reports summary statistics.

2.4 The dynamic process of interstate bank deregulation

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

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 1995, 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 all remaining regulations restricting BHCs headquartered in one state from acquiring banks in other states (starting in 1995).

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 Act allowed interstate banking for all state pairs in 1995.

3. Geographic diversity and BHC funding costs: OLS regression results

We first use ordinary least square (OLS) regressions to estimate the association between BHC funding costs and geographic diversity. The model specification is as follows.

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

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, $1 - Herfindahl\ index\ of\ assets\ across\ states_{bt}$, denotes the extent to which a holding company *b* diversifies its banking subsidiaries assets across states over quarter *t*, as measured by *1-Herfindahl index of assets across states*. 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. θ is a vector of coefficients on these BHC characteristics. 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 assets 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.

As shown in Table 2, the OLS estimates indicate a positive relation between a BHC's cost of funds and its diversity of assets in subsidiaries across states. The geographic diversity measure, *1-Herfindahl index of assets across states*, enters positively and significantly when the dependent variable is either *Total cost of funds* in column (1) or *Cost of domestic deposits* in column (2). The results hold when conditioning on quarter and BHC fixed effects (though not reported) or when controlling for BHC and state-quarter fixed effects.

Identification concerns, however, complicate the interpretation of these OLS estimates. 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 in a foreign 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 assets across states*. Second, while the specification of Table 2 includes an array of BHC controls and fixed effects, omitted variables might drive both the geographic diversification of BHC assets and its funding costs. We address these endogeneity concerns by employing an instrumental variables approach.

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

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

4.1. Identification strategy: Constructing gravity-deregulation instrumental variable

4.1.1 Framework

To describe the construction of the 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 with (2) the gravity model of investment. As explained above, interstate bank deregulation evolved in a rather chaotic manner from 1982 through 1995, 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 whether BHCs in one state can establish subsidiaries in each other state. 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's assets 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 BHCs headquartered in a state that have their headquarters geographically closer to another state than other BHCs in the same state are more likely to expand into that state. 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 assets by integrating the interstate bank deregulation with the gravity model of investment, where interstate bank deregulation provides state-year

information on the states into which BHCs in a state can expand and the gravity model distinguishes among BHCs within each state.

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

Following Goetz, Laeven, and Levine (2013, 2016), we use a two-step process for constructing an instrument for the geographic diversity of BHC assets. In the first step ("zero stage"), we estimate the following gravity model.

$$Share_{bijt} = \alpha Ln(Distance_{bij}) + \beta Ln\left(pop_{it}/pop_{jt}\right) + \delta_t + \delta_i + \delta_j + \delta_{ij} + \delta_{ijt} + \varepsilon_{bijt}, \quad (2)$$

where the dependent variable, $Share_{bijt}$, is the share of assets a BHC b headquartered in state i holds through its subsidiaries in a foreign state j over quarter t. $Ln(Distance_{bij})$ denotes the natural logarithm of geographic distance between the BHC b's headquarters and the capital city of state j (in miles). $Ln\left(pop_{it}/pop_{jt}\right)$ 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. To assess the independent link between the geographic diversity of a BHC's assets and distance, we consider regression specifications that control for (a) quarter fixed effects, δ_t, to condition out all quarter-specific influences, (b) a BHC's home state fixed effects, δ_i, to control for all time-invariant features of the BHC's home state, (c) fixed effects for each other state, δ_j, or (d) state-pair fixed effects, δ_{ij}, to condition out all time-invariant features of each state pair. We also consider a specification that controls for state-pair-quarter fixed effects, δ_{ijt}, to condition out all time-varying features of each state-pair.

In this first step estimation of the impact of distance and population ratios on the share of assets that BHCs hold in different states, we proceed as follows. 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 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 subsidiaries in state *j*.[6] 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. In some 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 when we can use both estimation methods. We use the fractional logit model when constructing the instrumental variable so that we do not have projected share values less than zero.

Table 3 reports the estimation results from this zero-stage regression and shows that geographic distance is negatively associated with the share of a BHC's assets 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 assets in foreign states enters negatively and statistically significant at the 1% level, suggesting that BHCs tend to invest more in closer 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 adding quarter fixed effects in column (3) or when using OLS, as shown in columns (4) and (5). Moreover, we continue to find that both distance and population remain significantly related to a BHC's investments in foreign states when controlling for home state fixed effects and foreign state fixed effects, or when including state-pair fixed effects or state-pair-quarter fixed effects, as shown in columns (6) – (9),

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

respectively. 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 state *i* and state *j* shapes their holdings of bank assets in state *j*. Specifically, BHCs headquartered in state *i* that are physically closer to state *j* tend to have subsidiaries with larger asset holding in state *j* than BHCs headquartered in state *i* but 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 3 to project, for each BHC in each quarter, its dispersion of assets in subsidiaries across all states. Specifically, we use the coefficient estimates from column (2) in Table 3 to predict a BHC's asset share in each state in each period.[7] We impose a predicted value of zero for states in which the BHC is prohibited from establishing a subsidiary. Based on these projected shares, we compute the projected diversity measure, *1 - Herfindahl index of assets 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 below that the results are robust to using the Table 3 estimates from column (1) that are only based on distance, instead of those from column (2) that are based on distance and relative population, to construct the instrumental variable. This alternative instrument, *1 - Herfindahl index of assets across states (predicted Distance only)*, 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 assets across states*, the instrument is "strong." As shown in the first-stage regression results reported in Panel A (columns (2) and (4)) of Table 4, 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

[7] We do not include quarter, home state, foreign state, 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).

is explicitly constructed from two plausibly exogenous sources of variation in the ability and cost of a BHC establishing subsidiaries in other states: interstate bank regulations and geographic distance. Furthermore, although our instrumental variable 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.[8]

[8] 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.

4.2 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 4, geographic diversity, *1-Herfindahl index of assets 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 domestic 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 the time-varying BHC traits. Moreover, the results are robust to using a different zero-stage estimation to construct the instrument. In particular, we use the coefficient estimates from column (1) in Table 3, where only *Ln(Distance)* is included while *Ln(Population ratio)* is excluded, to construct a different instrument, *1-Herfindahl index of assets across states (predicted Distance only)*. All the results in Table 4 remain highly robust to this alternative instrument. The corresponding robustness tests are reported in Appendix Table A3.

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) indicates that a one standard deviation increase in *1-Herfindahl index of assets across states* (0.128) reduces *Total cost of funds* by 20.7% (=0.128 * 1.615), corresponding to 22 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 domestic deposit* is in slightly smaller magnitude.

Panel B of Table 4 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 assets 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. Consistent with classical discussions on the differences between the "intent to treat" effects (reduced form results) and the "treatment" effects (IV results), the estimated coefficients from the reduced from regressions are smaller in absolute value terms than those from the IV regressions.

The differences between the OLS results in Table 2 and the IV results in Table 4 advertise the importance of using instrumental variables to evaluate the impact of the geographic diversity of BHC assets 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 subsidiaries across states, potentially in search of lower funding costs, confounding the ability to identify the impact of the geographic diversity of BHC assets 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 asset holdings materially lowers its funding costs.

These IV results are robust to four additional sensitivity checks, as shown in Table 5. First, since the full implementation of the Riegle-Neal Act, including the relaxation of interstate branching restrictions, was completed in 1997, we redid the analyses over the 1986 through 1997 period. As shown in column (1), although the number of observations falls by almost half, the coefficient estimates on *1-Herfindahl index of assets across states* remain statistically and economically significant using this alternative sample period. Second, to account for potential differences in the product mixes of BHCs, 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 (2)). 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.[9] Third, we redid the analyses using an alternative geographic diversity measure, *1-Herfindahl index of branch deposits across states*, which measures a BHC's geographic diversity using cross-state dispersion of branch deposits (column (3)). Fourth, to shed light on the risk reduction view, we focus on a proportion of liabilities that are unprotected by FDIC's deposit insurance, and redid the analyses using *Cost of uninsured funds* as the dependent variable. If geographic diversity changes banks' funding costs via risk reduction, the effects should reflect on uninsured creditors, who are expected to be responsive to changes in bank risk.[10] As shown, the results are highly robust to these four tests.

5. Mechanisms: Risk diversification

If the cross-state diversification of a BHC's assets reduces funding costs by lowering risk, then the impact of geographic diversification on funding costs should be greater when the BHC is located in a state with an economy that commoves less with the rest of the economy. 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 from cross-state diversification to funding costs. 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 economy of other states.

To assess this risk reduction channel, we use three measures of the degree to which a state's economy commoves with the economy in other states. To measure the degree to which expanding into a state will provide risk-reducing opportunities, we construct three measures using the degree to which the state's economy is correlated with the other states' economy. First,

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

[10] The risk reduction view also predicts that the cost of insured deposits should be immune to changes in bank risk. However, we are unable to empirically test this prediction given the data limitation on measuring the cost of insured deposits. As described in Subsection 2.3 in detail, two key components for constructing the cost of insured deposits, namely (a) interest expense on insured deposits, and (b) total insured deposits, are both unavailable from the financial reports of BHCs.

US/State comovement equals the Federal Reserve Bank of Philadelphia's *Coincident index* of the degree to which each state's economy commoves with the overall U.S. economy. The 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 correlation between a state's economy and the U.S. using monthly data of the coincident index over the previous 12 quarters. Thus, a higher value of *US/State comovement* suggests a higher covariation between a BHC's home state and the rest of U.S. economy. Second, *Accessible states comovement* measures the degree to which each state's economy commoves with the economy of other states that allowed the BHCs from this state to establish subsidiaries. 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 12 quarters. Third, *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 Gross State Product (GSP) of the accessible state divided by 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.

Given these comovement measures, we modify the core regression model 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 commoves less with the rest of the economy. Thus, we add the interaction term between *1-Herfindahl index of assets across states* (which is measured at the BHC-time level) and one of the three measures of the degree to which a state's economy

commoves with the economy in other states, namely *US/State comovement*, *Accessible states comovement*, and *Accessible states comovement-weighted* (which is measured at the state-time level). If the coefficient on this interaction term is positive, it suggests that the cost-reducing impact of cross-state asset diversification is smaller when the BHC is headquartered in a state that comoves more with the overall U.S. economy (or with the accessible states' economy) and, hence, where there are correspondingly more modest diversification benefits. To conduct the instrumental variable analyses with this modified regression model, we use the following instruments: *1-Herfindahl index of assets across states (predicted)* and its interaction with *US/State comovement* (or *Accessible states comovement* and *Accessible states comovement-weighted*).

The results show that geographic expansion reduces BHC funding costs by an especially large amount when the BHC expands into economically different states. Columns (1) – (3) of Table 6 Panel A show that the linear term, *1-Herfindahl index of assets across states*, enters the regression negatively and significantly, whereas its interaction term with *US/State comovement* (and *Accessible states comovement* and *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 U.S. economy. As shown, these results hold when examining either *Total cost of funds* or *Cost of domestic deposits* (see Appendix Table A5). Furthermore, these IV findings are consistent with the reduced-form analyses reported in Panel B of Table 6, where *1-Herfindahl index of assets across states (predicted)* enters negatively and significantly, while its interaction with *US/State comovement* (and *Accessible states comovement* and *Accessible states comovement-weighted*) enters positively and significantly. Taken together, the results reported in Table 6 suggest that risk diversification is an important mechanism through which geographic expansion reduces funding costs.

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 rest of the U.S. economy. The regression estimates from column (1) of Panel A indicate that a one standard deviation increases in the geographic diversity across states (0.128) reduces the BHC's total funding cost by 40% (= -2.356*0.128 + 0.790*(-1)*0.128). Next, consider another BHC headquartered in a state where its economy has a correlation of +1 with the rest of the U.S. The regression estimates from column (1) indicate that a one standard deviation increases in the geographic diversity across states (0.128) reduces the BHC's total funding cost by 20% (= -2.356*0.128 + 0.790*(+1)*0.128). Thus, the cost-reducing benefits of BHC expanding into a perfectly procyclical economy are 50% less than expanding into a perfectly countercyclical economy. The estimation results using *Accessible states comovement* in column (2) also suggest a large 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 (23% = -3.895*0.128 + 2.136*(+1)*0.128) is about 70% less than in a perfect countercyclical economy (77% = -3.895*0.128 + 2.136*(-1)*0.128).

6. Accounting transparency and the benefits of risk diversification

We now assess whether the impact of geographic expansion on a BHC's funding costs depends on the transparency of the BHC. When a bank discloses more information to the public, this makes it easier for creditors both to exert sound governance and to assess the degree to which geographic expansion diversifies the bank's portfolio of assets. The implication is that geographic diversification will reduce funding costs more when there is more transparency. First, with greater transparency, a bank's creditors can more accurately assess the risk reducing effects of the BHC's diversification, boosting the negative effect of diversification on funding costs. Second, greater transparency tends to enhance corporate governance, and stronger governance

can weaken the adverse effects of geographic expansion on agency frictions. Thus, from both the risk-based and agency-based views, geographic diversification will tend to reduce funding costs more among more transparent BHCs.

To measure BHC transparency, we follow a rich literature that uses textual analyses of accounting and financial statements to gauge differences in the information contents of these reports (e.g., Loughran and McDonald, 2016). We examine each BHC's 8K filings ("current reports") with the Securities and Exchange Commission (SEC). The SEC mandates that publicly listed companies disclose material corporate events, including an acquisition or disposition of assets, entry into bankruptcy or receivership, changes in control of the registrant, changes in registrant's directors and officers, and other events deemed important to investors (Carter and Soo, 1999, Leuz and Wysocki, 2016). Wharton Research Data Services SEC Analytics database provides ready-to-use parsed contents for millions of regulatory reports, from which we retrieve information including the filing date and time, the full list of exhibits, and filing size. Prior research suggests that the information contents of 8-K filings contain information that is valuable to investors (Boone and White, 2015). Specifically, we do the following to create three proxies for bank disclosure. For each BHC in each quarter, we calculate (a) *8-K frequency* as the total number of 8-K filings, (b) *8-K size* as the cumulative length of these 8-K filings, and (c) *8-K exhibits* as the number of exhibits in these 8-K filings (e.g., press releases, contracts, supplemental tabulated financial information, etc.), to capture the quantity and richness of the disclosure environment. Higher values of these three transparency indicators suggest greater BHC transparency. Next, for each BHC, we take the average value of its *8-K frequency* (or *8-K size* or *8-K exhibits*) over the sample period, and partition the sample based on the median value of *8-K frequency* (or *8-K size* or *8-K exhibits*).

The results reported in Table 7 show that the cost-reducing effects of geographic diversity are significant only among BHCs with greater than the median levels of our transparency indicators. To conduct these assessments, we use the same baseline regression

model as in Table 4 and split the sample based on BHCs with above or below the median transparency indicators. As shown in columns (1), (3) and (5) of Table 7 Panel A, the instrumented diversity measure, *1-Herfindahl index of assets across states*, enters negatively and significantly at the 1% level. In contrast, columns (2), (4) and (6) show that the coefficient estimates on *1-Herfindahl index of assets across states* are insignificant. The split-sample analyses suggest the critical role of transparency. Geographic expansion has a much bigger impact among BHCs that provide greater information to the public in 8-K filings. The findings are robust to alternative dependent variables, *Total cost of funds* or *Cost of domestic deposits* (see Appendix Table A6). Moreover, we find consistent results in the reduced-form analyses. Panel B of Table 7 shows that the coefficient estimate on *1-Herfindahl index of assets across states (predicted)* is negative and statistically significant at the 1% level in the high transparency group, whereas that in the corresponding low transparency group is economically smaller and statistically less significant.

7. Conclusion

This paper assesses how cross-state diversity of BHC assets affects the cost of raising external funds. To identify the impact of geographic diversification on BHCs funding costs, we employ a gravity-deregulation model to construct an instrument for the distribution of BHC assets across states. The time-varying, BHC-specific instrument exploits (1) the dynamic process of interstate banking deregulation that varies at the state-time level, and (2) the BHC-specific geographic tendency to diversify across state borders.

We discover that geographic diversification materially lowers BHC funding costs. The results hold when we control for state-quarter fixed effects, BHC fixed effects, market concentration at the MSA level, and time-varying BHC traits (size, capital-asset ratio, and profitability). The results are also robust to using different subsamples of BHCs and sample periods, measuring geographic dispersion based on branch-level deposits rather than subsidiary

assets, and using a proxy for the interest expense on uninsured funds. Moreover, the cost-reducing effects of geographic diversification are more profound when the BHC expands into state economies that have a lower correlation with the BHCs home state. In an exploratory extension, we also find that the cost-reducing effects of geographic expansion are significant only among BHC's with high informational transparency, which is consistent with both the agency-based and risk-focused views of how geographic diversity influences funding costs.

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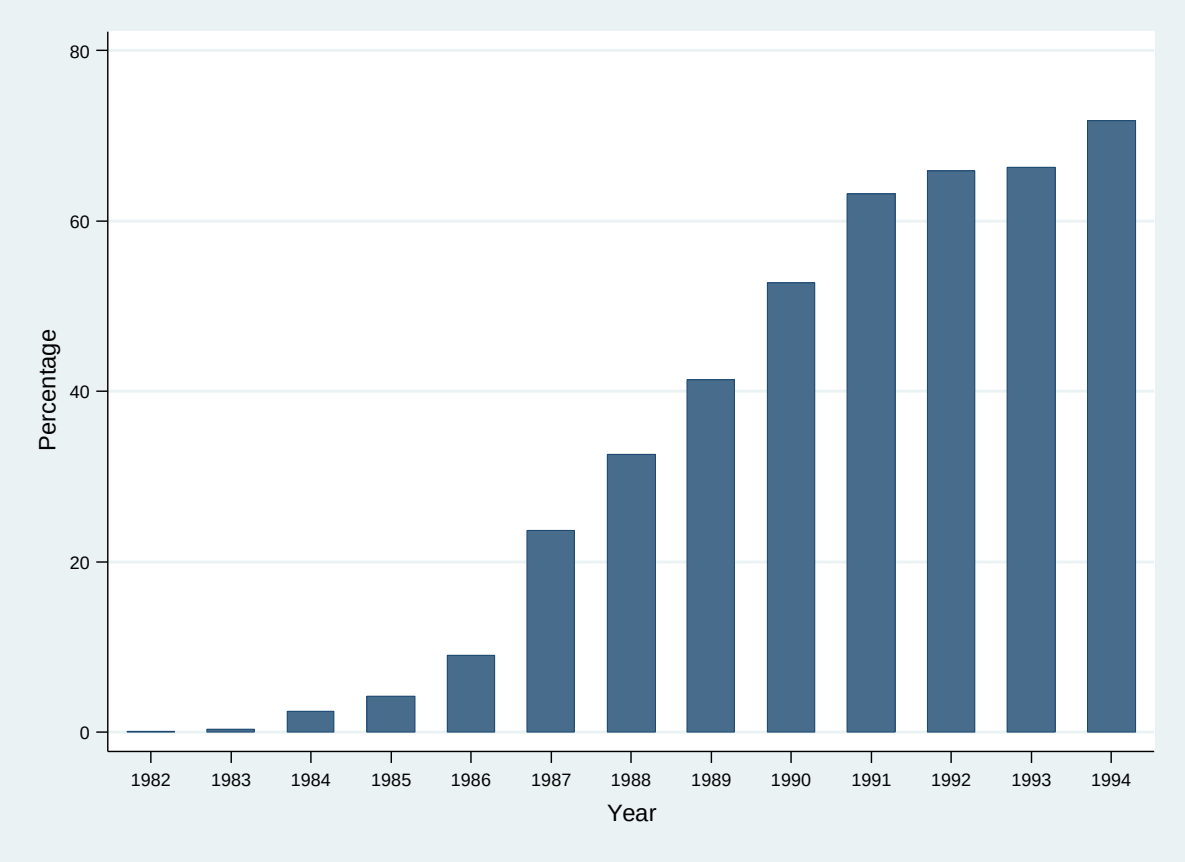

Figure 1. Dynamic process of interstate banking deregulation

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 A.1. "All" represents the full sample of BHC-quarter observations, while "Non-Diversified BHCs" represents the subsample of BHC-quarter where a BHC owns zero out-of-state bank subsidiary in a particular quarter, and "Diversified BHCs" refers to the subsample of BHC-quarter where a BHC has at least one out-of-state bank subsidiary in a given quarter.

Variable	N	mean	sd	min	p25	p50	p75	max
				All				
Total cost of funds (level)	36611	0.011	0.004	0.003	0.008	0.011	0.014	0.022
Cost of domestic deposits (level)	36601	0.011	0.004	0.003	0.008	0.010	0.014	0.021
Cost of uninsured funds (level)	36286	0.013	0.005	0.004	0.010	0.012	0.015	0.031
1-Herfindahl index of assets across states	36611	0.044	0.128	0	0	0	0	0.852
1-Herfindahl index of branch deposits across states	33793	0.068	0.160	0	0	0	0	0.919
Capital-asset ratio(lag)	35741	0.085	0.023	0.040	0.070	0.083	0.097	0.182
Return on assets(lag)	35741	0.003	0.002	-0.006	0.002	0.003	0.003	0.007
Total assets(lag)	35741	5.665	18.238	0.122	0.342	0.731	2.371	140.085
Noninterest income	35405	0.652	0.120	0.364	0.574	0.645	0.723	0.970
Market concentration (MSA)	16960	0.424	0.262	0.030	0.224	0.356	0.557	1.000
US/State comovement	3511	0.816	0.439	-0.978	0.949	0.992	0.998	1.000
Accessible states comovement	3587	0.746	0.310	-0.900	0.599	0.910	0.963	1.000
Accessible states comovement-weighted	3587	0.536	0.240	-0.690	0.360	0.634	0.731	0.814
				Non-Diversified BHCs				
Total cost of funds (level)	30340	0.011	0.004	0.003	0.008	0.011	0.014	0.022
Cost of domestic deposits (level)	30334	0.011	0.004	0.003	0.008	0.010	0.014	0.021
Cost of uninsured funds (level)	30063	0.013	0.005	0.004	0.010	0.012	0.015	0.031
1-Herfindahl index of assets across states	30340	0	0	0	0	0	0	0
1-Herfindahl index of branch deposits across states	26050	0	0	0	0	0	0	0
Capital-asset ratio(lag)	29519	0.086	0.023	0.040	0.071	0.084	0.098	0.182
Return on assets(lag)	29519	0.003	0.002	-0.006	0.002	0.003	0.003	0.007

Total assets(lag)	29519	2.700	11.027	0.122	0.308	0.580	1.354	140.085
Noninterest income	29212	0.636	0.114	0.364	0.563	0.632	0.703	0.970
Market concentration (MSA)	15218	0.419	0.260	0.030	0.223	0.355	0.547	1.000
US/State comovement	3292	0.808	0.449	-0.978	0.946	0.992	0.998	1.000
Accessible states comovement	3359	0.743	0.313	-0.900	0.598	0.909	0.962	1.000
Accessible states comovement-weighted	3359	0.540	0.243	-0.690	0.361	0.646	0.736	0.814
				Diversified BHCs				
Total cost of funds (level)	6271	0.012	0.004	0.003	0.009	0.011	0.015	0.022
Cost of domestic deposits (level)	6267	0.011	0.004	0.003	0.009	0.011	0.015	0.021
Cost of uninsured funds (level)	6223	0.013	0.005	0.004	0.010	0.013	0.016	0.031
1-Herfindahl index of assets across states	6271	0.257	0.200	0.000	0.082	0.219	0.395	0.852
1-Herfindahl index of branch deposits across states	7743	0.295	0.212	0.000	0.120	0.260	0.428	0.919
Capital-asset ratio(lag)	6222	0.080	0.019	0.040	0.066	0.079	0.092	0.182
Return on assets(lag)	6222	0.003	0.002	-0.006	0.002	0.003	0.003	0.007
Total assets(lag)	6222	19.735	33.079	0.122	1.923	5.876	18.868	140.085
Noninterest income	6193	0.728	0.120	0.364	0.640	0.720	0.807	0.970
Market concentration (MSA)	4152	0.374	0.240	0.035	0.196	0.309	0.519	1.000
US/State comovement	2399	0.819	0.433	-0.978	0.957	0.993	0.998	1.000
Accessible states comovement	2439	0.766	0.304	-0.900	0.661	0.914	0.969	1.000
Accessible states comovement-weighted	2439	0.567	0.235	-0.690	0.421	0.676	0.746	0.814

Table 2 Geographic diversification and cost of funds

This table reports the estimated relation between a BHC's cost of funds and its geographic diversity of assets using ordinary least squares (OLS) regressions. 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; The dependent variable in column 2 is *Cost of domestic 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. *1-Herfindahl index of assets across states* equals one minus the sum of squared share of assets held in different states among a BHC's subsidiaries. *Total asset (lag)* is the book value of total assets in billion US dollars at the beginning of a period. *Capital-asset ratio (lag)* is the fraction of bank equity over total assets, measured at the beginning of a period. *Return on assets (lag)* equals net income divided by the book value of total asset, measured at the beginning of a period. *Market concentration (MSA)* is the Herfindahl index of banking asset concentration in a Metropolitan Statistical Area (MSA). We impose a value of one for non-MSA. Although not reported, we include across all columns an *MSA indicator*, that equals one if a BHC is headquartered in an MSA, and zero otherwise. 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%.

Variables	*Total cost of funds*	*Cost of domestic deposits*
	(1)	(2)
1-Herfindahl index of assets across states	0.0441***	0.0481***
	(0.00996)	(0.0103)
Capital-asset ratio(lag)	-1.104***	-0.950***
	(0.0601)	(0.0573)
Return on assets(lag)	-1.586***	-1.969***
	(0.577)	(0.531)
Total assets(lag)	-0.000823***	-0.000580***
	(0.000143)	(0.000158)
Market concentration (MSA)	-0.0186**	-0.0370***
	(0.00760)	(0.00813)
Bank holding company fixed effects	Yes	Yes
State-quarter fixed effects	Yes	Yes
Observations	35,741	35,732
R-squared	0.937	0.945

Table 3 Zero-stage estimation for the gravity model

This table shows the relation between distance, population and BHC asset holdings estimated from ordinary least squares (OLS) regressions. 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:

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

where the dependent variable, $Share_{bijt}$, is the share of assets a BHC *b* headquartered in state *i* holds in its subsidiaries 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*. The corresponding fixed effects are indicated in the table. 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%.

Variables	*Asset share*								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ln(Distance)	-0.134***	-0.137***	-0.137***	-0.192***	-0.192***	-0.215***	-0.267***	-0.386***	-0.382***
	(0.00367)	(0.00346)	(0.00351)	(0.00481)	(0.00485)	(0.00524)	(0.00861)	(0.0250)	(0.0251)
Ln(Population ratio)		-0.0343***	-0.0344***	-0.0237***	-0.0240***	-0.0222***	-0.0697*	-0.158***	
		(0.00257)	(0.00257)	(0.00239)	(0.00238)	(0.00262)	(0.0402)	(0.0297)	
Quarter fixed effects			Yes		Yes	Yes	Yes	Yes	
Home-state fixed effects						Yes	Yes		
Foreign-state fixed effects							Yes		
State-pair fixed effects								Yes	
State-pair-quarter fixed effects									Yes
Estimation model	Fractional logit	Fractional logit	Fractional logit	OLS	OLS	OLS	OLS	OLS	OLS
Observations	1,381,467	1,381,467	1,381,467	1,381,467	1,381,467	1,381,467	1,381,467	1,381,467	1,381,467

Table 4 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; The dependent variable in column 3 is *Cost of domestic 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 assets across state*, defined as one minus the sum of squared share of assets held in different states. The excluded instrument is *1 - Herfindahl index of assets across states (Predicted)*, which is computed as follows: Using the coefficient estimates from the gravity-deregulation model (column 2 in Table 3), we predict the share a BHC holds in a state and year, where we impose that BHCs' projected holdings of assets 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 assets across states (Predicted). Bank controls include *Capital-asset ratio (lag) Return to assets (lag)*, and *Total assets (lag)*, all measured at the beginning of a period. *Market concentration (MSA)* is the Herfindahl index of banking asset concentration in a Metropolitan Statistical Area (MSA). We impose a value of one for non-MSA. Although not reported, we include across all columns an *MSA indicator*, that equals one if a BHC is headquartered in an MSA, and zero otherwise. 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

Variables	*Total cost of funds*	*1-Herfindahl index of assets across states*	*Cost of domestic deposits*	*1-Herfindahl index of assets across states*
	(1)	(2)	(3)	(4)
1-Herfindahl index of assets across states	-1.615***		-1.052***	
	(0.363)		(0.286)	
1 - Herfindahl index of assets across states (predicted)		0.771***		0.779***
		(0.139)		(0.139)
Capital-asset ratio(lag)	-0.799***	0.188***	-0.746***	0.189***
	(0.105)	(0.0320)	(0.0853)	(0.0321)
Return on assets(lag)	-1.095	0.270	-1.655***	0.261
	(0.789)	(0.315)	(0.634)	(0.315)
Total assets(lag)	-0.00238***	-0.000962***	-0.00162***	-0.000971***
	(0.000465)	(0.000187)	(0.000365)	(0.000187)
Market concentration (MSA)	-0.0423***	-0.0138**	-0.0529***	-0.0140**
	(0.0132)	(0.00581)	(0.0112)	(0.00580)
Bank holding company fixed effects	Yes	Yes	Yes	Yes
State-quarter fixed effects	Yes	Yes	Yes	Yes
Observations	35,229	35,229	35,216	35,216
R-squared	0.853		0.914	
F-statistics of Weak IV		30.90		31.49

Panel B: Reduced form

Variables	*Total cost of funds*	*Cost of domestic deposits*
	(1)	(2)
1 - Herfindahl index of assets across states (predicted)	-1.245***	-0.819***
	(0.186)	(0.173)
Capital-asset ratio(lag)	-1.102***	-0.945***
	(0.0601)	(0.0572)
Return on assets(lag)	-1.531***	-1.930***
	(0.580)	(0.532)
Total assets(lag)	-0.000821***	-0.000597***
	(0.000144)	(0.000159)
Market concentration (MSA)	-0.0200***	-0.0382***
	(0.00763)	(0.00814)
Bank holding company fixed effects	Yes	Yes
State-quarter fixed effects	Yes	Yes
Observations	35,229	35,216
R-squared	0.936	0.944

Table 5 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 columns 1 – 3. Using the same empirical methods as in Table 4, column 1 reports the results using the sample period from 1986 through 1997, before the full implementation of the Riegle-Neal Act; column 2 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 3 reports the results using the Herfindahl index of branch deposits across states to measure bank diversification. The dependent variable in column 4 is *Cost of uninsured funds*, equals to Interest expenses on uninsured funds divided by the uninsured interest-bearing liabilities at the beginning of a period. Appendix Table A4 shows the results are robust to the other cost measure, *Cost of domestic deposits*. *BHC controls* include the same set of controls as in Table 4, namely *Capital-asset ratio (lag)*, *Return to assets (lag)*, and *Total assets (lag)*, *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%.

Variables	*Total cost of funds*	*Total cost of funds*	*Total cost of funds*	*Cost of uninsured funds*
	Before the full implementation of the Riegle-Neal Act	Product mixes	Diversification using branch deposits	Uninsured funds
	(1)	(2)	(3)	(4)
1-Herfindahl index of assets across states	-1.694***	-1.566***		-1.592***
	(0.490)	(0.332)		(0.605)
Noninterest income		0.157***		
		(0.0186)		
1-Herfindahl index of branch deposits across states			-0.550***	
			(0.132)	
BHC controls	Yes	Yes	Yes	Yes
Bank holding company fixed effects	Yes	Yes	Yes	Yes
State-quarter fixed effects	Yes	Yes	Yes	Yes
Observations	19,073	33,869	32,511	34,906
R-squared	0.802	0.862	0.925	0.617
F-statistics of Weak IV	19.90	35.24	50.01	32.44

Table 6 Geographic diversification and cost of funds: Economic comovement

This table reports the second-stage regression results from 2SLS analyses (Panel A) and reduced form regression results (Panel B) that are similar to the specification in Table 4, while differentiating the effects of geographic diversity on banks' funding costs based on the correlation between a BHC's home state and foreign states. The dependent variable is *Total cost of funds* across columns, defined as the logarithm ratio of Total interest expenses to Interest-bearing liability at the beginning of a period. The endogenous variable is *1 - Herfindahl index of assets across state*, defined as one minus the sum of squared share of assets held in different states. The excluded instrument is *1 - Herfindahl index of assets across states (Predicted)*, which is computed using the same gravity-deregulation model as described in Table 4. We construct three measures for the economic comovement between a BHC's home state and the rest of the economy. First, *US/State comovement* equals the correlation between a BHC's home state's coincident index and the US coincident index. 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 pairwise correlations using the monthly values of the coincident index over the previous 12 quarters. Second, *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*. Third, *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 that accounts for the geographic proximity. Bank controls include *Capital-asset ratio (lag) Return to assets (lag)*, and *Total assets (lag)*, all measured at the beginning of a period. *Market concentration (MSA)* is the Herfindahl index of banking asset concentration in a Metropolitan Statistical Area (MSA). We impose a value of one for non-MSA. Although not reported, we include across all columns an *MSA indicator*, that equals one if a BHC is headquartered in an MSA, and zero otherwise. 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: Second-stage results

Variables	*Total cost of funds*		
	(1)	(2)	(3)
1-Herfindahl index of assets across states	-2.356***	-3.895***	-4.310***
	(0.579)	(1.030)	(1.135)
US/State comovement (1-Herfindahl index of assets across states)*	0.790**		
	(0.316)		
Accessible states comovement (1-Herfindahl index of assets across states)*		2.136***	
		(0.647)	
Accessible states comovement-weighted (1-Herfindahl index of assets across states)*			3.205***
			(0.931)
BHC controls	Yes	Yes	Yes
Bank holding company fixed effects	Yes	Yes	Yes
State-quarter fixed effects	Yes	Yes	Yes
Observations	35,063	35,229	35,229
R-squared	0.833	0.753	0.728
F-statistics of Weak IV	12.82	9.187	8.815

Panel B: Reduced form

Variables	*Total cost of funds*		
	(1)	(2)	(3)
1-Herfindahl index of assets across states(predicted)	-1.350***	-1.627***	-1.741***
	(0.196)	(0.213)	(0.224)
US/State comovement (1-Herfindahl index of assets across states(predicted))*	0.159**		
	(0.0778)		
Accessible states comovement (1-Herfindahl index of assets across states(predicted))*		0.500***	
		(0.128)	
Accessible states comovement-weighted (1-Herfindahl index of assets across states(predicted))*			0.819***
			(0.193)
BHC controls	Yes	Yes	Yes
Bank holding company fixed effects	Yes	Yes	Yes
State-quarter fixed effects	Yes	Yes	Yes
Observations	35,063	35,229	35,229
R-squared	0.936	0.936	0.936

Table 7 Geographic diversification and cost of funds: Information environment

This table reports the second-stage regression results from 2SLS analyses (Panel A) and reduced form regression results (Panel B) that are similar to the specification in Table 4, while splitting the sample based on a BHC's information environment, measured by (a) the frequency of 8-K filings, (b) the size (cumulative length) of 8-K filings, and (c) the number of exhibits in these filings. The dependent variable is *Total cost of funds* across columns, defined as the logarithm ratio of Total interest expenses to Interest-bearing liability at the beginning of a period. The endogenous variable is *1 - Herfindahl index of assets across state*, defined as one minus the sum of squared share of assets held in different states. The excluded instrument is *1 - Herfindahl index of assets across states (Predicted)*, which is computed using the same gravity-deregulation model as described in Table 4. We consider three measures of a BHC's information environment: (a) *8-K frequency* equals the total number of 8-K filings. For each BHC, we use its sample averaged value of *8-K frequency*. Then we divide the sample into high/low transparency groups based on whether a BHC's *8-K frequency* is above/low the sample median; (b) *8-K size* equals the number of characteristics in 8-K filings; and (c) *8-K exhibits* equals the number of exhibits in these 8-K filings. We define high/low transparency groups using *8-K size* and *8-K exhibits* in a similar fashion. Bank controls include *Capital-asset ratio (lag) Return to assets (lag)*, and *Total assets (lag)*, all measured at the beginning of a period. *Market concentration (MSA)* is the Herfindahl index of banking asset concentration in a Metropolitan Statistical Area (MSA). We impose a value of one for non-MSA. Although not reported, we include across all columns an *MSA indicator*, that equals one if a BHC is headquartered in an MSA, and zero otherwise. 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: Second-stage results

Variables	*Total cost of funds*					
	8-K frequency		*8-K size*		*8-K exhibits*	
	High	Low	High	Low	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)
1-Herfindahl index of assets across states	-1.420***	0.238	-1.786***	2.054	-1.396***	1.377
	(0.456)	(0.490)	(0.614)	(1.516)	(0.329)	(0.844)
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	20,718	13,573	21,040	13,430	20,634	13,608
R-squared	0.863	0.946	0.810	0.912	0.855	0.927
F-statistics of Weak IV	16.98	12.03	11.11	3.570	29.67	10.27

Panel B: Reduced form

Variables	*Total cost of funds*					
	8-K frequency		*8-K size*		*8-K exhibits*	
	High	Low	High	Low	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)
1 - Herfindahl index of assets across states (predicted)	-1.756***	-0.126	-1.387***	-0.485*	-1.655***	-0.526*
	(0.386)	(0.260)	(0.281)	(0.266)	(0.290)	(0.280)
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	20,718	13,573	21,040	13,430	20,634	13,608
R-squared	0.934	0.947	0.931	0.956	0.932	0.954

Appendix

Table A1 Variable definition and sources

Variable	Definition	Sources
Total cost of funds	Logarithm of the ratio of Total interest expenses to Interest-bearing liability at the beginning of a period.	Calculated by authors, FR-Y9C
Cost of domestic deposits	Logarithm of Interest expenses on domestic deposits divided by Interest-bearing domestic deposits at the beginning of a period.	Calculated by authors, FR-Y9C
Cost of uninsured funds	Logarithm of Interest expenses on uninsured funds divided by the uninsured interest-bearing liabilities at the beginning of a period.	Calculated by authors, FR-Y9C, FDIC
1-Herfindahl index of assets across states	BHC diversification measure, defined as one minus the sum of squared share of assets held in different states via bank subsidiaries.	Calculated by authors, FR-Y9C, Call reports
1-Herfindahl index of branch deposits across states	Alternative BHC diversification measure, equal to one minus the sum of squared share of deposits held in different states via branches.	Calculated by authors, FR-Y9C, Call reports, Summary of Deposits (SOD)
Total assets (lag)	Book value of total assets in billion US dollars, measured at the beginning of a period.	Calculated by authors, FR-Y9C
Capital-asset ratio (lag)	The fraction of bank equity over total assets, measured at the beginning of a period.	Calculated by authors, FR-Y9C
Return on assets (lag)	Net income divided by the book value of total assets, measured at the beginning of a period.	Calculated by authors, FR-Y9C
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.	Calculated by authors, FR-Y9C, Call reports, U.S. Census Bureau
Noninterest income	One minus the absolute difference between net interest income and total noninterest income divided by the total operating income.	Calculated by authors, FR-Y9C
8-K frequency	The total number of 8-K filings for a BHC in a quarter. For each BHC, we use its average value during the sample period, and then divide the sample into high/low 8-K-frequency groups based on the sample median value.	SEC Analytics
8-K size	The cumulative length of 8-K filings for a BHC in a quarter. For each BHC, we use its average value during the sample period, and then divide the sample into high/low 8-K-size groups based on the sample median value.	SEC Analytics
8-K exhibits	The number of exhibits in 8-K filings for a BHC in a quarter. For each BHC, we use	SEC Analytics

	its average value during the sample period, and then divide the sample into high/low 8-K-exhibits groups based on the sample median value.	
US/State comovement	The correlation between individual state's coincident index and the US nationwide coincident index. 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 12 quarters. A higher value of *US/State comovement* indicates a higher correlation between a state and the rest of the US.	Calculated by authors, Federal Reserve Bank of Philadelphia
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 12 quarters. A higher value indicates a larger correlation between a state and its accessible states.	Calculated by authors, Federal Reserve Bank of Philadelphia
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 divided by the distance between the two states. More formally, $\sum_j \frac{Corr_{i,j} * RGSP_j / Distance_{i,j}}{\sum_j RGSP_j}$, where j denotes all the accessible states that allow state i to enter at time t.	Calculated by authors, Federal Reserve Bank of Philadelphia, Bureau of Economic Analysis

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 4 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

Variables	*Total cost of funds*	*1-Herfindahl index of assets across states*	*Cost of domestic deposits*	*1-Herfindahl index of assets across states*
	(1)	(2)	(3)	(4)
1-Herfindahl index of assets across states	-2.038***		-1.406***	
	(0.495)		(0.385)	
1 - Herfindahl index of assets across states (predicted)		0.614***		0.620***
		(0.119)		(0.119)
Bank holding company fixed effects	Yes	Yes	Yes	Yes
State-quarter fixed effects	Yes	Yes	Yes	Yes
Observations	36,107	36,107	36,093	36,093
R-squared	0.803		0.891	
F-statistics of Weak IV		26.68		27.24

Panel B: Reduced form

Variables	*Total cost of funds*	*Cost of domestic deposits*
	(1)	(2)
1 - Herfindahl index of assets across states (predicted)	-1.252***	-0.872***
	(0.181)	(0.168)
Bank holding company fixed effects	Yes	Yes
State-quarter fixed effects	Yes	Yes
Observations	36,107	36,093
R-squared	0.935	0.944

Table A3 Geographic diversification and cost of funds: Instrumental variable based only on distance

This table reports the Instrumental variable test results that are similar to Table 4 in the main text, except that the instruments are predicted only using geographic distance, not population. The dependent variables and explanatory variables have the same meaning as in the previous table. 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

Variables	*Total cost of funds*		*Cost of domestic deposits*	
	(1)	(2)	(3)	(4)
1-Herfindahl index of assets across states	-3.126***	-2.360***	-2.092***	-1.460***
	(0.867)	(0.589)	(0.618)	(0.421)
BHC controls	No	Yes	No	Yes
Bank holding company fixed effects	Yes	Yes	Yes	Yes
State-quarter fixed effects	Yes	Yes	Yes	Yes
Observations	36,107	35,229	36,093	35,216
R-squared	0.630	0.762	0.829	0.888
F-statistics of Weak IV	17.60	21.45	17.83	21.73

Panel B: Reduced form

Variables	*Total cost of funds*		*Cost of domestic deposits*	
	(1)	(2)	(3)	(4)
1 - Herfindahl index of assets across states (predicted Distance only)	-1.453***	-1.422***	-0.979***	-0.886***
	(0.186)	(0.190)	(0.173)	(0.181)
BHC controls	No	Yes	No	Yes
Bank holding company fixed effects	Yes	Yes	Yes	Yes
State-quarter fixed effects	Yes	Yes	Yes	Yes
Observations	36,107	35,229	36,093	35,216
R-squared	0.935	0.936	0.944	0.944

Table A4 Geographic diversification and cost of funds: Robustness tests (the alternative cost measure)

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 *Cost of domestic deposits* in columns 1 – 3. Using the same empirical methods as in Table 4, column 1 reports the results using the sample period from 1986 through 1997, before the full implementation of the Riegle-Neal Act; column 2 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 3 reports the results using the Herfindahl index of branch deposits across states to measure bank diversification. *BHC controls* include the same set of controls as in Table 4, namely *Capital-asset ratio (lag)*, *Return to assets (lag)*, and *Total assets (lag)*, *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%.

Variables	*Cost of domestic deposits*		
	Before the full implementation of the Riegle-Neal Act	Product mixes	Diversification using branch deposits
	(1)	(2)	(3)
1-Herfindahl index of assets across states	-1.684***	-1.151***	
	(0.471)	(0.281)	
Noninterest income		0.0592***	
		(0.0161)	
1-Herfindahl index of branch deposits across states			-0.481***
			(0.128)
BHC controls	Yes	Yes	Yes
Bank holding company fixed effects	Yes	Yes	Yes
State-quarter fixed effects	Yes	Yes	Yes
Observations	19,061	33,856	32,508
R-squared	0.811	0.913	0.937
F-statistics of Weak IV	20.37	35.85	50

Table A5 Geographic diversification and cost of funds: Economic comovement (the alternative cost measure)

This table reports the second-stage regression results from 2SLS analysis (Panel A) and reduced form regression results (Panel B) that are similar to the specification in Table 4, while differentiating the effects of geographic diversity on banks' funding costs based on the correlation between a BHC's home state and foreign states. The dependent variable is *Cost of domestic deposits* in columns 1 – 3. The endogenous variable is *1 - Herfindahl index of assets across state*, defined as one minus the sum of squared share of assets held in different states. The excluded instrument is *1 - Herfindahl index of assets across states (Predicted)*, which is computed using the same gravity-deregulation model as described in Table 4. We construct three measures for the economic comovement between a BHC's home state and the rest of the economy. First, *US/State comovement* equals the correlation between a BHC's home state's coincident index and the US coincident index. 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 pairwise correlations using the monthly values of the coincident index over the previous 12 quarters. Second, *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*. Third, *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 that accounts for the geographic proximity. Bank controls include *Capital-asset ratio (lag) Return to assets (lag)*, and *Total assets (lag)*, all measured at the beginning of a period. *Market concentration (MSA)* is the Herfindahl index of banking asset concentration in a Metropolitan Statistical Area (MSA). We impose a value of one for non-MSA. Although not reported, we include across all columns an *MSA indicator*, that equals one if a BHC is headquartered in an MSA, and zero otherwise. 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: Second-stage results

Variables	*Cost of domestic deposits*		
	(1)	(2)	(3)
1-Herfindahl index of assets across states	-2.121***	-3.527***	-3.877***
	(0.507)	(0.849)	(0.933)
*US/State comovement** *(1-Herfindahl index of assets across states)*	1.130***		
	(0.295)		
*Accessible states comovement** *(1-Herfindahl index of assets across states)*		2.326***	
		(0.533)	
*Accessible states comovement-weighted** *(1-Herfindahl index of assets across states)*			3.369***
			(0.766)
BHC controls	Yes	Yes	Yes
Bank holding company fixed effects	Yes	Yes	Yes
State-quarter fixed effects	Yes	Yes	Yes
Observations	35,050	35,216	35,216
R-squared	0.889	0.839	0.825
F-statistics of Weak IV	13.13	9.443	9.053

Panel B: Reduced form

Variables	*Cost of domestic deposits*		
	(1)	(2)	(3)
1-Herfindahl index of assets across states(predicted)	-1.099***	-1.410***	-1.525***
	(0.183)	(0.199)	(0.209)
*US/State comovement** *(1-Herfindahl index of assets across states(predicted))*	0.380***		
	(0.0756)		
*Accessible states comovement** *(1-Herfindahl index of assets across states(predicted))*		0.774***	
		(0.128)	
*Accessible states comovement-weighted** *(1-Herfindahl index of assets across states(predicted))*			1.166***
			(0.191)
BHC controls	Yes	Yes	Yes
Bank holding company fixed effects	Yes	Yes	Yes
State-quarter fixed effects	Yes	Yes	Yes
Observations	35,050	35,216	35,216
R-squared	0.944	0.945	0.945

Table A6 Geographic diversification and cost of funds: Information environment (the alternative cost measure)

This table reports the second-stage regression results from 2SLS analyses (Panel A) and reduced form regression results (Panel B) that are similar to the specification in Table 4, while splitting the sample based on a BHC's information environment, measured by (a) the frequency of 8-K filings, (b) the size (cumulative length) of 8-K filings, and (c) the number of exhibits in these filings. The dependent variable is *Cost of domestic deposits* in columns 1 – 6. The endogenous variable is 1-Herfindahl index of assets across state, defined as one minus the sum of squared share of assets held in different states. The excluded instrument is 1 - Herfindahl index of assets across states (Predicted), which is computed using the same gravity-deregulation model as described in Table 4. We consider three measures of a BHC's information environment: (a) *8-K frequency* equals the total number of 8-K filings. For each BHC, we use its sample averaged value of *8-K frequency*. Then we divide the sample into high/low transparency groups based on whether a BHC's *8-K frequency* is above/low the sample median; (b) *8-K size* equals the number of characteristics in 8-K filings; and (c) *8-K exhibits* equals the number of exhibits in these 8-K filings. We define high/low transparency groups using *8-K size* and *8-K exhibits* in a similar fashion. Bank controls include *Capital-asset ratio (lag) Return to assets (lag)*, and *Total assets (lag)*, all measured at the beginning of a period. *Market concentration (MSA)* is the Herfindahl index of banking asset concentration in a Metropolitan Statistical Area (MSA). We impose a value of one for non-MSA. Although not reported, we include across all columns an *MSA indicator*, that equals one if a BHC is headquartered in an MSA, and zero otherwise. 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: Second-stage results

Variables	*Cost of domestic deposits*					
	8-K frequency		*8-K size*		*8-K exhibits*	
	High	Low	High	Low	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)
1-Herfindahl index of assets across states	-0.818**	0.131	-1.329***	0.988	-1.030***	0.581
	(0.329)	(0.505)	(0.477)	(1.208)	(0.258)	(0.782)
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	20,713	13,573	21,035	13,430	20,629	13,608
R-squared	0.922	0.954	0.884	0.956	0.905	0.956
F-statistics of Weak IV	17.62	12.03	11.49	3.570	30.26	10.27

Panel B: Reduced form

Variables	*Cost of domestic deposits*					
	8-K frequency		*8-K size*		*8-K exhibits*	
	High	Low	High	Low	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)
1 - Herfindahl index of assets across states (predicted)	-1.031***	-0.0694	-1.051***	-0.233	-1.235***	-0.222
	(0.352)	(0.269)	(0.249)	(0.276)	(0.241)	(0.296)
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	20,713	13,573	21,035	13,430	20,629	13,608
R-squared	0.942	0.954	0.940	0.964	0.940	0.960