Bank Networks and Acquisitions

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Abstract: Does the pre-deal geographic overlap of the branches of two banks affect the probability that they merge, post-announcement stock returns, and post-merger performance? We compile information on U.S. bank acquisitions from 1984 through 2016, construct several measures of network overlap, and design and implement a new identification strategy. We find that greater pre-deal network overlap (1) increases the likelihood that two banks merge, (2) boosts the cumulative abnormal returns of the acquirer, target, and combined banks, and (3) reduces employment, boosts revenues, reduces the number of branches, improves loan quality, and expedites executive turnover.

JEL Classification: G34; G21; G28

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1. Introduction

Mergers and acquisitions have reduced the number of U.S. banks by 60% since the mid-1980s, spurring research into the causes and consequences of bank mergers. Researchers examine whether and the conditions under which bank mergers create value (e.g., James and Weir, 1987; Houston and Ryngaert, 1994, 1997; DeLong, 2001, 2003; Houston, James and Ryngaert, 2001), enhance operating performance (e.g., Cornett and Tehranian, 1992; Boyd and Runkle, 1993; Akhavein, Berger and Humphrey, 1997; Calomiris, 1999; Cornett, McNutt and Tehranian, 2006; Hughes and Mester, 2013), reduce competition (e.g., Focarelli and Panetta, 2003; Erel, 2011), and reflect and satisfy the empire-building incentives of executives at the expense of shareholders (e.g., Brook, Hendershott and Lee, 1998; Bliss and Rosen, 2001; Hughes, Lang, Mester, Moon and Pagano, 2003; Laeven and Levine, 2007; Goetz, Laeven and Levine, 2013). Yet, several basic questions about the relationship between branch networks and the incidence and ramifications of bank mergers remain unaddressed or unresolved.

In this paper, we examine how the geographic overlap between the branches of two bank holding companies (BHCs) influences (1) the likelihood that they merge, (2) the stock price reaction to an announced merger, and (3) post-merger performance. Existing research offers differing perspectives on the impact of overlap on the likelihood and effects of mergers as suggested by the literature cited above. First, more overlap implies greater opportunities for merging banks to economize on costs by eliminating redundant staff and branches, boosting valuations and profits. Second, greater pre-deal overlap tends to imply more post-deal market power, increasing revenues, profits, and valuations. Third, greater pre-deal overlap can mitigate adverse governance effects associated with mergers. Research shows that geographic expansion (low overlap) impedes the effective governance of banks (e.g., Goetz, Laeven and Levine, 2013 and the references therein). From this perspective, mergers involving banks with greater geographic overlap will create more efficiently managed banks than otherwise similar mergers with less overlap. In contrast, other research emphasizes that greater pre-deal overlap can reduce the likelihood of mergers and hurt post-deal performance and valuations. To the extent that empire-building incentives motivate managers, they might support geographically expansive mergers even if such mergers harm shareholders. Furthermore, high-overlap mergers will tend to limit risk diversification opportunities, potentially boosting the cost of capital, hindering the efficiency of financial intermediation, and impeding the governance of banks relative to low-overlap mergers (e.g., Goetz, Laeven and Levine, 2016; Levine, Lin and Xie, 2018).

We contribute to existing research in several ways. First, we believe that ours is the first study of whether and how the degree of geographic overlap between the branches of two BHCs influences the likelihood that they merge. Second, we contribute to research on how the geographic overlap between the

branches of the acquiring and target BHC influences the stock price reaction to the deal by (a) developing and implementing a new identification strategy to evaluate the impact of network overlap on cumulative abnormal returns (CARs) and (b) materially increasing the sample of bank mergers relative to past studies. Third, we provide new evidence on the potential synergies linking pre-acquisition network overlap and post-deal stock returns. Specifically, we examine the impact of pre-deal overlap on post-deal changes in the costs, market power, and operational performance of both the merged acquirer-target bank and the target bank alone. We believe this is the first paper to provide separate analyses of the impact of overlap on changes in target banks following acquisitions.

To conduct these examinations, we compile a comprehensive dataset on BHC mergers and acquisitions that also includes information on the geographic location of bank branches, stock prices, and other BHC and deal traits. We start our analyses in 1984 due to data limitations on bank mergers and the location of bank branches. We construct several measures of the degree of overlap between the branch networks of the acquirer and target BHCs. These overlap measures focus on the degree to which the BHCs have branches in the same states prior to the acquisition. To measure the CARs of the acquiring, target, and merged BHC, we use the five-day event window around the announcement of the acquisition, i.e., the window from two days before until two days after the announcement. To evaluate how the merged BHC responds to the deal in terms of other performance criteria, we examine changes in both the merged and target bank's (1) costs—including salaries, employment, and number of branches, (2) market power—as captured interest income, interest expenses, net interest margins, and (3) operational performance—as captured by loan quality (insider loans and loan charge-offs and changes in leadership (executives and board members) at the target bank.

We turn first to the question of whether more network overlap between two BHCs increases, decreases, or has no effect on the likelihood that they merge. To identify the impact of overlap on BHC acquisitions—and address potential selection bias due to the nonexperimental assignment of mergers, we use propensity score matching. For each completed deal, we create several counterfactual deals using nearest neighbor matching on bank traits. We then run a probit regression in which the dependent variable equals one for actual deals and zero for the counterfactual deals. The main explanatory variable is a measure of network overlap between the acquirer and target BHCs in the actual and counterfactual deals.

We discover that network overlap is positively associated with the likelihood of a bank merger. This result holds across the different measures of network overlap and when controlling for an array of acquirer and target characteristics, as well as acquirer-target state-pair and deal fixed effects. Furthermore, these results are robust to implementing different propensity score matching criteria. Moreover, the estimated effects are nontrivial. The estimates indicate that a one standard deviation increase in overlap is

associated with 3% - 6% increase in the probability of a merger, depending on the specific proxy of network overlap.

We next turn to the question of whether the overlap between merging BHCs influences the CARs of the acquiring, target, and combined BHC. We begin by using OLS and controlling for an array of acquirer, target, and deal characteristics, as well as year and acquirer-target state-pair fixed effects. We find that pre-announcement network overlap is positively associated with the post-announcement CARs of the acquiring, target, and combined BHCs.

There are, however, identification concerns with the OLS estimates. Consider first potential biases arising from endogenous selection into the sample of merging banks, i.e., nonrandom assignment. If the factors accounting for selection are related to bank performance, this could lead to biased estimates of the impact of overlap on CARs. To address this concern, we use a Heckman selection model and find that (a) the OLS and Heckman model yield very similar parameters estimates on the overlap measures and (b) inverse mills ratio enter insignificantly, suggesting that sample selection is not biasing the OLS estimates. Second, there might be standard endogeneity bias. For example, more capable executives might seek local targets with greater overlap and manage the merged bank more effectively. Under these conditions, the OLS estimates of the relationship between post-merger performance and network overlap will be biased upward. We address this identification concern by constructing an instrumental variable (IV) of overlap.

To more precisely identify the impact of overlap on CARs, we develop an IV of network overlap that exploits two time-varying exogenous influences on whether a BHC acquires a BHC headquartered in each of the other states. The first source of variation is interstate bank deregulation. For most of the 20th century, BHCs headquartered in one state were prohibited from acquiring BHCs in other states. In 1982, individual U.S. states started removing these restrictions. Not only did states start the process of interstate bank deregulation in different years, they also followed different dynamic paths, as states signed bilateral and multilateral agreements. The Riegle-Neal Act effectively eliminated regulatory prohibitions on interstate BHC acquisitions in 1995.[1] During the pre-1995 period, therefore, interstate bank regulations defined whether BHCs headquartered in one state could acquire banks in other states (i.e., whether those states are "accessible"). This allows us to compute the potential network overlap between BHCs headquartered in each pair of states in each year.

The second source of variation is geography: the distance between each BHC headquarters and other states. As discussed below, BHCs are more likely to acquire geographically close BHCs (e.g., Goetz, Laeven and Levine, 2013). Thus, the geographic location of the acquiring BHC provides information on

[1] An extensive body of research indicates that interstate bank deregulation does not reflect the level, growth rate, or distribution of state income (e.g., Jayaratne and Strahan, 1996, Kroszner and Strahan, 1999, Morgan, Rime and Strahan, 2004, and Beck, Levine and Levkov, 2010) or banking system profitability, valuations, and risk (Goetz, Laeven and Levine, 2013, 2016; Jiang, Levine and Lin, 2016).

the likelihood that it acquires a target in each accessible state. We then weight the potential overlap values between the acquiring BHC and each accessible state by the likelihood that it purchases a target in that state, where these likelihood weights are based on geographic distance. Finally, we aggregate these weighted potential overlap values to create the instrumental variable for the actual overlap of the acquiring BHC. Since BHCs headquartered within one state differ in their distances to other states, our instrument differentiates among BHCs headquartered within the same state and year, so that it is measured at the BHC-year level. It is worth emphasizing that this BHC-specific instrumental variable depends only on the geographic location of the acquiring BHC in a deal and interstate bank regulations; the instrument does not depend on the actual target or other features of the acquiring BHC.

The IV analyses indicate both that greater network overlap materially boosts the CARs of the acquirer, target, and merged BHC and that the estimated impact is greater than that from the OLS regressions. In the IV analyses, the endogenous regressor is one of the pre-deal network overlap measures. The analyses continue to control for acquirer, target, deal characteristics, and fixed effects for year and the acquirer's state. We find that the deregulation-gravity instrument explains actual network overlap, entering with an F-statistic of over ten in all of the specifications for acquirer, target, and combined CARs and for all of the measures of pre-deal network overlap. The coefficient estimates indicate that the impact of overlap is economically large. Consider two otherwise identical mergers, where the high-overlap merger has one standard deviation larger pre-deal overlap. The IV estimates imply that the high-overlap merger will have combined CAR that is almost 18 percentage points higher than the low-overlap merger. As noted above, the differences between the OLS and IV estimates could be explained by omitted variables that are positively correlated with pre-merger overlap and negatively correlated with post-merger performance that bias the OLS estimates toward zero. For example, less effective executives might have a propensity to seek local targets.

We next use our identification strategy to evaluate specific mechanisms through which network overlap might affect CARs. First, if greater network overlap offers expanded opportunities for the combined BHC to economize on labor costs and redundant branches, then more overlap should lead to greater post-merger cuts in staff, total salary expenditures, and branches. Second, if greater network overlap creates a combined bank with more market power, then more overlap should trigger larger increases of net interest margins following mergers. Third, if network overlap boosts CARs by offering enhanced opportunities to improve operations, policies, and replace inefficient or redundant executives and board members, then more overlap should lead to greater post-merger replacement of executives and board members and more substantive improvements in loan quality. We examine changes at the combined BHC and the target during the year following the acquisition. Typically, it is impossible to examine post-merger changes in target firms because the target firm's balance sheet is consolidated into

the combined firms, though see Erel, Jang, and Weisbach's (2015) study of nonfinancial European acquisitions. For our examination of bank acquisitions, we exploit the Chicago Fed's BHC database, which includes information on a subset of target BHCs following mergers.

We discover that pre-acquisition network overlap (1) reduces employment, salary expenditures, and the number of branches, (2) boosts revenues by increasing net interest margins, (3) triggers more rapid replacement of executives and board members at target banks, and (4) lowers insider lending and loan charge-offs. We also show that pre-deal overlap is positively associated with post-deal ROA but is unrelated to overall lending. As with the CAR analyses, these analyses hold when using OLS, the Heckman selection model, and the IV strategy described above. These findings are consistent with the views that network overlap creates greater opportunities for cutting costs, augmenting revenues, and improving loan quality, which help account for the positive impact of overlap on announcement returns.

Our work relates to several strands of research. First, an extensive body of work examines whether empire-building motivates bank acquisitions (e.g., Gorton and Rosen, 1995; Brook, Hendershott and Lee, 1998; Ryan, 1999; Bliss and Rosen, 2001; Hughes, Lang, Mester, Moon and Pagano, 2003; Laeven and Levine, 2007; Goetz, Laeven and Levine, 2013). Although empire-building might be a powerful driver of some bank acquisitions, we show that the degree of pre-deal network overlap exerts a powerful influence on post-deal value creation, cost cutting, revenue generation, and loan quality. This suggests heterogeneity in the degree to which value-destroying empire-building shapes the likelihood and consequences of bank acquisitions.

Second, our work contributes to research on whether there is a diversification discount or premium. Berger and Ofek (1995) and Lang and Stulz (1994) stress that firms that diversify beyond their core competencies destroy value, while Hubbard and Palia (1999), Stein (1997), and others stress that diversification lowers risks and creates shareholder value. A related line of research explores the advantages and disadvantages of focus versus diversification (e.g., Winton, 1999, Gorton and Winton, 2004, and Acharya, Hasan, and Saunders, 2006). We show that the degree of pre-acquisitions overlap—the degree to which a merger will intensify geographic focus—boosts shareholder value.

Third, our work relates to work on whether bank mergers benefit consumers. For example, Sapienza (2002) shows that mergers tend to increase the prices that banks charge on loans and confirms the findings in Berger et al (1998) that mergers reduce the flow of credit to smaller firms. Focarelli and Panetta (2003) also find that mergers tend to harm consumer in the short-run by increasing lending rates, but emphasize that mergers generally trigger long-run efficiency improvements that benefit consumers. Erel (2011) find that mergers both increase market power and facilitate cost cutting with countervailing effects on consumers. We differentiate among mergers by the degree of pre-deal geographic overlap and focus on assessing the impact of overlap on (1) the probability that banks merge, (2) the stock market's

reaction to an announced merger, and (3) post-merger performance. Although our focus is on the bank, not on assessing consumer welfare, we do show that higher-overlap mergers facilitate cost cutting, increase lending rates, and boost profits without expanding lending.

Finally, our work contributes to recent research on the geography of finance. As discussed, we find that the pre-deal geographic overlap of the branches of two banks boosts the closing of bank branches, but we do not examine the ramifications of those closings. Nguyen (2018) shows that bank branch closings during the 2000s reduced the ability of local firms to access credit.

The remainder of the paper is organized as follows. Section 2 described the data and variable construction. Section 3 examines whether the degree of pre-acquisition network overlap influences the likelihood that two banks merge, while Section 4 evaluates the CARs of the acquirer, target, and merged BHCs around the announcement date. Section 5 examines the potential sources of synergies by evaluating post-merger change in total salary expenditures, number of employees, average salaries, net interest margins, interest income, loan quality, insider lending, the turnover of executives and board members. Section 6 concludes.

2. Data and Variable Construction

To assess how the pre-merger geographic overlap of BHC branches shapes the likelihood of a merger, the cumulative abnormal returns associated with a merger, and the post-merger performance of BHCs, we use data on BHC mergers and acquisitions, the geographic overlap of BHC branches, stock prices, and an assortment of bank-level and deal-level characteristics. To create the dataset used in our analyses, we merge several data sources. In this section, we describe the sample, data sources, and key variables. Table 1 gives variable definitions and Table 2 provides summary statistics.

2.1. Sample of BHC mergers & acquisitions

Thomson Reuters Securities Data Company (SDC) provides data on BHC mergers and acquisitions (M&As). We begin in 1984 because that is when it becomes feasible to match BHCs in these datasets effectively. For the OLS regressions, we use data on bank mergers and acquisitions through 2016. For the instrumental variable (IV) analyses, we conduct the analyses through 1995 because the instruments are based on the relaxation of interstate banking restrictions that occurred over the period from 1982 through 1995. Congress passed the Riegle-Neal Act at the close of 1994, and this act effectively ended most restrictions on the interstate establishment of bank subsidiaries by the end of 1995.

Our sample includes completed deals in which the acquirer and target are US-based, the acquirer is publicly traded, the SDC categorizes the deal as "Merger," "Acquisition," "Acquisition of Assets," or "Acquisition of Majority Interest," the value of the deal is both above $1 million (in 2000 US dollars) and above 1% of the acquirer's market value, and the deal results in the acquirer holding more than 50% of

the target. We exclude deals in which the acquirer's initial stake in the target already exceeded 50%. This yields 2808 completed M&A deals from SDC.

We then match these data from the SDC on M&A deals with data from the Federal Deposit Insurance Corporation (FDIC) and the Center for Research in Security Prices (CRSP). The FDIC provides data on the geographic location of BHC branches as well as income and balance sheet information. CRSP provides data on stock prices. After dropping deals that cannot be matched across the three datasets or that are missing data on branch locations.[2]

2.2. Network overlap measures

We create several measures of the degree to which the branch networks of the acquirer and target BHCs overlap geographically using the following two-step process. First, for each BHC in each year, we construct one unweighted and two weighted 51-element vectors to measure the geographic distribution of its branches. In the unweighted vector, each element is one or zero depending on whether the BHC has a branch in each state and the District of Columbia (DC) or not. In the "number" weighted 51-element vector, each element is zero or the number of branches in each state and the DC. In the "deposit" weighted vector, each element is zero or the total deposits of branches in each state and the DC.

Second, we construct seven proxies of the branch network overlap of the acquirer and target BHCs in each deal. *Overlap* equals the number of non-zero elements in the intersection of the two BHCs' unweighted vectors of branches divided by the total number of non-zero elements in the union of the two BHCs' unweighted vectors. For example, if *u*=[1,0,1,0] and *v*=[1,1,0,0], then $u \cap v = [1,0,0,0]$, $u \cup v = [1,1,1,0]$, and therefore *Overlap* = 1/3.

Correlation Coefficient equals the correlation coefficient of the unweighted vectors of branches of the two merging banks. More formally, the *Correlation Coefficient* is defined as

$$\rho_{u,v} = \frac{\sum_{i=1}^{n}(u_i - \bar{u})(v_i - \bar{v})}{\sqrt{\sum_{i=1}^{n}(u_i - \bar{u})^2}\sqrt{\sum_{i=1}^{n}(v_i - \bar{v})^2}}.$$

For example, if u=[1,0,1,0] and v=[1,1,0,0], *Correlation Coefficient* is 0. It is worth noting that *Correlation Coefficient* takes on values between -1 and 1. We construct two similarly constructed proxies based on the weighted vectors. In particular, *Correlation Coefficient (Weighted by Branch Number)* uses

[2] There are challenges to matching banks in the SDC, FDIC, and CRSP due to spelling mistakes, abbreviations, BHCs in different states sharing the same name, and the datasets not using the same identifying code. The SDC contains the BHC's name and, for many BHCs, it's CUSIP (which uniquely identifies the securities of BHCs). We use (a) the CRSP-RSSD linking table provided by the Federal Reserve Bank of New York (where the RSSD is a unique identifier assigned to institutions by the Federal Reserve and CRSP contains the CUSIP, which we use to link the BHC with its stock price data) and (b) the Federal Reserve Bank of Chicago's dataset on bank mergers with related RSSDs, which provides additional data discussed below. After completing the matching, we have data on 2249 completed deals, though, as we detail below, there are missing data on some key variables.

the 51-element vector in which each element is zero or the number of branches in each state and the DC and *Correlation Coefficient (Weighted by Branch Deposit)* uses the 51-element vector in which each element is zero or the total deposits held in the bank's branches in each state and the DC.

Cosine Distance measures overlap using cosine distance based on the unweighted and two weighted vectors of bank branch networks. *Cosine Distance* of vector *u* and *v* is defined as

$$d(u,v) = 1 - \frac{u \cdot v}{||u||_2 ||v||_2}.$$

Thus, *Cosine distance* is a measure of "dissimilarity." It takes on values between 0 and 1, such that $d(u,v) = 0$ when $u = v$, which is when the two vectors are exactly the same and hence there is perfect overlap. In turn, $d(u,v) = 1$, when $u \cdot v = 0$, which is when the two vectors do not overlap at all. For example, if u = [1,0,1,0] and v = [1,1,0,0], then

$$u \cdot v = \sum_i u_i v_i = 1 \times 1 + 0 \times 1 + 1 \times 0 + 0 \times 0 = 1,$$

where u_i and v_i are components of vector *u* and *v*, so that

$$||u||_2 = \sqrt{\sum_i u_i^2} = \sqrt{1^2 + 0^2 + 1^2 + 0^2} = \sqrt{2},$$

$$||v||_2 = \sqrt{\sum_i v_i^2} = \sqrt{1^2 + 1^2 + 0^2 + 0^2} = \sqrt{2}, \text{ and}$$

$$d(u,v) = 1 - \frac{u \cdot v}{||u||_2 ||v||_2} = 1 - \frac{1}{\sqrt{2} \times \sqrt{2}} = \frac{1}{2}.$$

Building on this *Cosine distance* measure, we construct two similarly constructed proxies based on the weighted vectors. In particular, *Cosine distance (Weighted by Branch Number)* uses the vector in which each element is zero or the number of branches and *Cosine distance (Weighted by Branch Deposit)* uses the vector in which each element is zero or the total deposits held in the bank's branches.

We address two questions concerning these overlap measures. First, do they provide information beyond the distance between the acquirer and target? We examine the correlation between the overlap measures and four measures of distance: (1) distance between the acquirer's and target's headquarters, (2) mean of the distances between the acquirer's headquarters and the target's branches, (3) mean of the distances from the target's headquarters and the acquirer's branches, and (4) mean of the distances between the acquirer's and target's headquarters and the acquirer's and target's branches. Of the 28 correlations, the maximum is 0.22. Also, when conducting the analyses for the subsample of mergers in which distance is above the sample median, the results reported below hold and yield similar coefficient estimates to those reported below. Second, are the results driven by large, national banks? During the sample period, few banks have branches in many states. Only 1.15% of the deals involved an acquirer-

target pair with branches in over 20 states. When we exclude deals involving those banks, all of the results reported below hold. Furthermore, when we exclude large banks (banks with total assets in the top-fourth of the sample), all of the results hold. For brevity, we do not report these robustness tests, but they are available upon request.

2.3. CARs

We examine cumulative abnormal returns (*CARs*) for the acquirer, target, and combined entity over the five-day window from two days before until two days after the announcement day of the acquisition. Setting the announcement day as day 0, the CAR window is therefore indicated as (-2, +2). Following Brown and Warner (1985), we define abnormal returns by using the difference between actual and projected returns. To compute projected returns, we (1) regress the BHC's daily return on the returns on the CRSP value-weighted market portfolio over the 200-day period from the 210th trading day through the 11th trading day before the announcement date of each deal and (2) use the estimated parameters to compute the projected returns during the 5-day event window (-2, +2). The CAR for the combined entity is calculated as the market value-weighted average of the CARs for the acquirer and target banks. The results reported below are robust to using (a) an 11-day CAR window (-5, +5) or (b) using the three- or four-factor asset pricing model to compute abnormal returns.

To compute the acquirer, target and combined CARs, we use security prices from CRSP. After excluding deals in which the acquirer is missing key data in CRSP, there are 1,971 deals. When excluding deals in which the target is missing key data in CRSP, there are 1,118 observations. Finally, after excluding deals in which either the acquirer or target is missing relevant CRSP data, there are 999 deals. The missing data on the stock prices of target banks primarily arises because many targets were not publicly traded at the time of the announcement.

Additional acquirer, target, and deal characteristics

We control for several acquirer, target, and deal characteristics using data from the SDC, CRSP, Compustat and Bloomberg. From CRSP, *Acquirer Runup* equals the percentage change in the acquirer's stock price over the period from 200 days before the announcement until 11 days before the announcement. From the SDC, *Attitude dummy* equals one if the deal is "friendly" (i.e., the target did not resist or receive an unsolicited offer, as defined by the SDC) and zero otherwise; *Cash deal dummy* equals one if the acquisition is 100% in cash and zero otherwise; *Deal size adjusted by assets* equals the value of the acquisition divided by the total assets of the acquiring BHC; *Dummy (acquirer acquired other targets in past 3 yrs.)* equals one if the acquirer acquired another target bank within the last three years; *Number of offers target received* equals the number of acquisition offers that a target received within the last three years, *Percentage of shares acquired* equals the percentage of share of the target purchased by the acquiring BHC; *Stock deal dummy* equals one if the acquisition is 100% in stock and zero otherwise; and,

Target public dummy equals one if the target BHC is publicly traded and zero otherwise. From Compustat, *Acquirer total assets* equals the total assets of the acquiring bank; *Acquirer profitability* equals the acquirer's return on assets; and *Acquirer target assets ratio* equals the ratio of the total assets of the acquirer to the total assets of the target. From Bloomberg, *Acquirer Tobin's Q* equals the ratio of the market to the book value of assets.

After excluding observations with missing data of *acquirer run-up (-200, -11), acquirer profitability, acquirer Tobin's Q, deal size adjusted by asset, cash deal dummy, stock deal dummy, attitude dummy, target public dummy, percentage of shares acquired, or acquirer total assets,* there are 1,849 observations with acquirer CARs, 986 with target CAR, and 956 with combined CARs. When we additionally control for *Acquirer target assets ratio, Dummy (acquirer acquired other targets in past 3 yrs.),* and *Number of offers target received,* we are left with 1225 observations with acquirer CARs, 659 with target CARs, and 635 with combined CARs (e.g., Table 4). The main reason of the drop in the number of observations is missing data on target banks.

We also assemble data on the pre- and post-merger values of total salary, average salary, number of employees, total loans, insider loans, net charge-offs, interest income ratio, interest expense ratio, net interest margin, and return on assets for the acquirer and target BHCs from the Chicago Federal Reserve Bank. In the pre-merger period, we obtain separate data for the acquirer and target. In the post-merger period, we obtain data on the combined acquirer-target and in some cases we can also obtain separate data on the target bank. After omitting BHCs with incomplete data, there are 765 acquirers and 592 targets for which we have data in the pre-and post-merger period. These data provide a unique opportunity to examine the post-merger performance of target BHCs. For each target BHC in a completed deal, we obtain its quarterly information from three years before the announced merger to three years after the announcement. We exclude observations in the year of the announcement.

3. Does Geographic Overlap Make BHCs More Likely to Merge?

In this section, we examine whether the likelihood that one BHC acquires another is increasing in the degree to which the two BHCs have branch networks that overlap geographically. To identify the impact of network overlap on BHC acquisitions, we build on Gompers, Mukharlyamov, and Xuan (2016) and use propensity score matching (PSM) to create pseudo-deals. Specifically, we examine actual deals and pseudo-deals, where the counterfactual banks in pseudo deals are matched to actual deals using nearest neighbor based on eleven bank traits: total assets, the leverage ratio (total liabilities divided by total assets), the interest income ratio (interest income divided by interest-bearing assets), net income, return on assets (ROA), total loans to employee number ratio (loans divided by number of employees), deposits to assets ratio, loan growth rate, small business loans proxy ratio (small business obligations

divided by total loans), and real estate loans ratio (loans secured by real estate—excluding nonfarm, nonresidential properties—divided by total loans). The goal is to find counterfactual acquirer banks that are most similar to the real acquirer and counterfactual target banks that are most similar to the real target.[3]

We employ the following matching strategy. For each completed (real) deal, we create ten pseudo deals. In these pseudo deals, either the acquirer or the target is "real" and the other bank is "matched" from the PSM procedure. Thus, the actual acquirer is matched with five distinct pseudo targets and the actual target is matched with five distinct pseudo acquirers and we call these "Real-Matched Pseudo Deals." The following illustrates this matching strategy:

Real Acquirer	Real Target
Matched Acquirer 1	Real Target
Matched Acquirer 2	Real Target
Matched Acquirer 3	Real Target
Matched Acquirer 4	Real Target
Matched Acquirer 5	Real Target
Real Acquirer	Matched Target 1
Real Acquirer	Matched Target 2
Real Acquirer	Matched Target 3
Real Acquirer	Matched Target 4
Real Acquirer	Matched Target 5

As shown in Online Appendix Table OA1, there is great similarity between the actual acquirers and targets and their match counterparts on the ten bank traits.

We then estimate the following probit regressions using these Real-Matched pseudo deals:

$$Complete_d = \alpha + \beta_1 Network\ Overlap_d + \beta_2 X_d + \theta_d + \varepsilon_{d,} \quad (1)$$

where the dependent variable, $Complete_d$, is a dummy that equals one for actual acquisition deals (d) and zero for the pseudo matched pairs of the acquirer and target associated with deal d. $Network\ Overlap_d$ represents one of the seven measures of geographic overlap between the actual or pseudo acquirer and target of deal d defined above. X_d is a set of acquirer and target characteristics in the year before the announcement of the deal: *Acquirer Total Assets, Acquirer Interest Income Ratio, Acquirer Net Income, Acquirer ROA, Acquirer Leverage Ratio* and the corresponding five variables for the targets. θ_d is a set of fixed effects: (1) *Dummy (acquirer acquired other target in past 3 years)* that equals one if the

[3] The results are robust to using different bank traits. For example, the results hold when using a parsimonious set of traits: the leverage ratio, the interest income ratio, net income, and ROA. Furthermore, we use the term "small business loans proxy ratio," because the numerator equals loans to small businesses that are transferred with recourse, as there are no other variables in the dataset that that directly measure lending to small businesses. The results, however, are robust to using an alternative indicator, loans of $1 million or less.

acquiring bank acquired *another* target in the last three years, (2) *Deal Fixed Effects* that equals one for the actual deal and the pseudo-deals associated with the actual deal and zero otherwise, so that there is a separate deal fixed effect for each group of pseudo-pairs and its corresponding actual deal, and (3) *Acquirer State*Target State Fixed Effects*, so that there is a separate dummy variable for each state-pair that equals one if the deal involves BHCs headquartered in those two states and zero otherwise.[4] Standard errors are clustered at the deal-level. The results also hold when clustering at the acquirer-state level. In Table 3, we report the marginal effects of the explanatory variables.

As shown in Table 3, more network overlap is associated with a higher probability that two BHCs merge. This result is statistically significant for each of the network overlap measures. The estimated effects are also economically material. Consider, for example, a one standard deviation increase in *Overlap* (0.389) and a one standard deviation in *Correlation Coefficient* (0.367) and the corresponding estimated regression coefficients in columns (1) and (2) respectively. These estimates indicate that a one standard deviation increase in network overlap as measured by *Overlap* is associated with a 2.7% (0.027=0.389*0.07) increase in the probability that the two BHCs merge, while a one standard deviation increase in network overlap as measured by *Correlation Coefficient* is associated with a 5.5% (0.055=0.367*0.15) increase in the probability that the two BHCs merge.

The finding that network overlap is positively associated with the probability that two BHCs merge is robust to additional tests. First, we use two additional matching strategies when implementing the PSM. In the first additional strategy, we create five pseudo deals for each real deal, where the five pseudo deals involve matching pseudo targets and pseudo acquirers. In these pseudo deals, neither the acquirer nor the target is from the completed real deal; both are "matched" to the actual acquire or target using the propensity score procedure. The goal of this Matched-Matched strategy is to create pseudo acquirer-target deals that are similar to the actual deal except in terms of the degree of network overlap and then assess whether network overlap helps account the decision of two BHCs to merge. In creating the pseudo-deals, we do not select pseudo-acquirers or pseudo-targets that were involved in an M&A during the three years prior to the relevant deal. As shown in Online Appendix Table OA3 Panel A, all of the results hold using the Matched-Matched strategy. In the second additional matching strategy, we compute 35 pseudo deals for each completed real deal. These include the ten Real-Matched pseudo deals and the 25 additional Matched-Matched pseudo deals, where each of the five pseudo-acquirers is separately linked with each of the five pseudo-targets. As shown in Online Appendix Table OA4 Panel A, all of the results hold using his combined matching strategy.

[4] All of the results throughout this paper are robust to using *Acquirer State* and *Target State* fixed effects instead of *Acquirer State*Target State Fixed Effects.*

Second, the results are robust to conducting the analyses at the MSA-level (Metropolitan Statistical Area level) rather than at the state-level. In particular, when constructing the network overlap measures at the state level, we used a one-zero vector of whether a BHC has branches in each US state and the District of Columbia or not. For the MSA-level overlap indicators, we instead we use a one-zero vector of whether each BHC has branches in each MSA or not. From this vector, we construct MSA-level network overlap measures for each merger. Online Appendix Tables OA2, OA3 and OA4 show that the results hold using these MSA-level measures.[5]

These findings indicate that the likelihood of one BHC acquiring a target is increasing in the degree to which they have overlapping branch networks. Holding other features of the BHCs constant, network overlap is apparently viewed as a positive feature by those making merger decisions within the BHCs. However, this does not necessarily imply that conditional on an acquisition that greater network overlap boosts the returns to and profitability of the merged BHC. We now turn to this question.

4. Network Overlap and CARs

In this section, we evaluate whether network overlap shapes the CARs of the acquirer, target, and merged BHCs. In the first subsection, we use OLS and control for an array of acquirer, target, and deal characteristics. The second subsection employs a Heckman selection model to address concerns about nonrandom sorting into the sample of merging banks. In the next subsections, we describe and use a gravity-deregulation instrumental variable to address identification concerns.

4.1 OLS

To assess the relationship between pre-merger network overlap and the stock price reaction to the deal, we begin with the following linear regression:

$$CAR_d = \alpha + \alpha + \beta_1 Network\ Overlap_d + \beta_2 X_d + \theta_d + \varepsilon_{d,} \quad (2)$$

where CAR_d is the acquirer, target, or combined 5-day CAR(-2, +2) around the announcement date of deal *d*, which has one acquirer and one target. As defined above, $Network\ Overlap_d$ is one of the measures of pre-merger network overlap for deal *d*. As in the Masulis, Wang and Xie (2007) study of CARs following M&As, we control for the following characteristics (X_d): *Acquirer Runup*, *Acquirer net income*, *Acquirer Tobin's Q*, *Deal size adjusted by acquirer assets*, *Acquirer total assets*, *Percentage of shares acquired*, and a series of four dummy variables that provide information about the deal: *Cash deal dummy*, *Stock deal dummy*, *Attitude dummy*, *and Target public dummy*. Furthermore, since the

[5] We also combined this PSM approach with the IV strategy described below and obtain similar results.

announcement CARs might depend on the relative sizes of the acquiring and target banks and on the overall activity levels of the acquiring and target banks in the merger market, we control for (a) the pre-merger ratio of acquirer assets to target assets (*Acquirer target assets ratio*), (b) an indicator variable that equals one if the acquirer bank in this deal had acquired another target in the last three years (*Dummy (acquirer acquired other targets in past 3 yrs.*), and (c) the number of offers that the target bank has received in the year of the merger announcement (*Number of offers target received*).[6] As represented by θ_d, we include year fixed effects and acquirer-target state-pair effects, so that there is a separate dummy variable for each state-pair that equals one if the deal involves banks headquartered in those two states and zero otherwise. Standard errors are clustered at the acquirer level since several BHCs engage in multiple acquisitions.[7]

As shown in Panel A of Table 4, pre-announcement overlap is positively and significantly associated with the post-announcement CARs of the acquirer, target, and combined BHCs and the estimated impact is economically large. The dependent variable is *Acquirer CAR* in columns 1-3, *Target CAR* in columns 4-6, and *Combined CAR* in columns 7-9. For each of these dependent variables, we provide three regression results, where the key explanatory variable is *Overlap, Correlation Coefficient,* or *Cosine distance* respectively. The results hold across all specifications. When interpreting the signs on the estimated coefficients, recall that larger values of *Overlap* and *Correlation Coefficient* signify greater pre-deal overlap, while larger values of *Cosine Distance* indicate less overlap. The estimates are economically substantive. Consider two otherwise identical mergers, where the high-overlap merger has a one standard deviation larger pre-deal overlap as measured by the *Correlation Coefficient* (0.367) than the low-overlap merger. The Panel A estimates indicate that the high-overlap merger will have a *Combined CAR* that is 4.39 (=11.96*0.367) percentage points higher than the low-overlap merger. This is large, as the sample mean and standard deviation of *Combined CAR* are 11.82% and 18.47% respectively.

These results are robust to several checks. First, the results hold across all the weighted network overlap measures discussed above, i.e., when weighting the *Correlation Coefficient* and *Cosine Distance* measures by the number of branches or the deposits in those branches (Online Appendix Table OA7). Second, the results hold when using the network overlap measures computed at the MSA-level (Online Appendix Table OA8). Third, the results are robust to eliminating national banks. The Office of the Comptroller of the Currency granted national banks greater latitude with respect to interstate acquisitions. When removing these banks from the sample, the results hold (Online Appendix Table OA10 and OA14). Fourth, we obtain similar results when conducting the analyses over the 1984-1995 period. Since we

[6] Conducting the analyses without these three additional controls increases the sample size from 1,225 to 1,849 and all of the results hold (Online Appendix Table OA5).
[7] The results are robust to clustering at the acquirer-state level.

conduct our IV analyses over the 1984-1995 period because of the nature of the instrumental variables, it is valuable to confirm that the OLS results hold over this period (Online Appendix Table OA6).

4.2 Heckman selection model

Since biases may arise from nonrandom assignment into the sample of merging banks, we repeat the analyses using a Heckman selection model. For the first stage, we conduct the analyses at the state-state-year level, where the dependent variable is a dummy variable that equals one if there is a bank in the acquirer state acquiring a bank in the target state in the given year and zero otherwise. Besides conditioning on year, acquirer state, and target state fixed effects, the explanatory variables in the first stage include: (a) a dummy variable that equals one if banks headquartered in the acquirer's state are allowed to acquire banks in the target state, (b) the distance between the acquirer state and the target state, (c) the gross state products per capita of the acquirer and target states, (d) the gross state products of the acquirer and target states, and (e) the growth rates of the gross state products of each state. Most of these explanatory variables enter significantly in the first stage (Online Appendix Table OA9).

As shown in Panel B of Table 4, the Heckman correction results are fully consistent with the OLS results. In the Heckman correction analyses, the branch network overlap measures enter statistically significantly and enter with very similar coefficient estimates to those obtained from the OLS regressions. Also, note that Heckman's lambda enters insignificantly, suggesting that nonrandom assignment is not biasing the estimated impact of overlap on CARs.

4.3. Instrument variables

Although the OLS regressions condition on many factors and the Heckman selection model addresses potential biases created by nonrandom assignment, there might be omitted variables that are correlated with both pre-merger overlap and post-merger performance, which would bias the OLS estimates.

To obtain more accurate estimates of the impact of overlap on post-merger CARs, we develop an instrumental variable for network overlap that exploits two exogenous sources of influence on the potential overlap between an acquiring BHC and banks headquartered in each of the other states. The two sources of variation are (1) time-varying, state-pair specific variation in regulatory restrictions on whether banks in one state can acquire banks in another state and (2) the geographic distance between each BHC's headquarters and every other state.[8] We compute for each BHC in each year the potential degree of overlap from that BHC making an acquisition, where potential overlap is computed as the regulatory overlap in "accessible states" (states where the BHC can legally make an acquisition based on interstate

[8] The instrument does not depend on the location of the actual target; it depends only on interstate banking regulations and the distance between the deal's acquiring BHC and other states.

bank regulations) between a BHC's state and the accessible states of its potential targets while weighting accessible states by the inverse of the geographic distance between that BHC and the corresponding potential targets' states. Intuitively, if there is higher overlap between an acquirer's accessible states and potential targets' accessible states, then the actual overlap of a realized deal involving this acquirer will tend to be higher. By identifying only that component of potential overlap associated with regulations and geography, our instrumental variable strategy reduces concerns that omitted factors bias the estimated impact of overlap on CARs. In the remainder of this subsection, we describe the two key building blocks of the instrument and the construction of the instrument.

4.3.1. Building blocks

To construct an instrumental variable for the pre-merger network of two merging BHCs, we consider only the acquiring BHC and use two building blocks. The first building block is the process of interstate bank deregulation. For most of the 20th century, states prohibited interstate banking, i.e., each state prohibited banks from other states from establishing subsidiaries and branches within its geographic borders. Starting in 1982, individual states began a process of removing these restrictions.[9] States started interstate bank deregulation in different years and followed different paths of deregulation over time. Some states unilaterally opened their borders to out-of-state banks, while others signed a sequence of bilateral and multilateral reciprocal agreements with other states. Other states started the process of interstate bank deregulation in different years and followed different dynamic processes of deregulating with other states until the Riegle-Neal Act effectively ended prohibitions on interstate banking by the end of 1995, though some restrictions on interstate branching remained.

Interstate bank regulations, therefore, determine whether two BHCs headquartered in different states can, in year *t*, acquire and operate banks in the same states, i.e., regulations determine the potential degree of network overlap. For example, interstate bank regulations determine whether BHC *b1* with its headquarters in state *i* and BHC *b2* with its headquarters in state *j* can legally own subsidiary banks in states *i*, *j*, and every other state *k* in year *t*. In this way, interstate bank regulations define the potential network overlap between BHCs headquartered in each pair of states in each year. While, interstate bank regulations determine potential overlap at the state-pair-year level, they do not distinguish among banks within states.

The second building block of the instrumental variable is geography. Specifically, as a second source of exogenous variation in the likely pre-deal overlap of an acquiring bank, we compute the distance between each BHC's headquarters and the states into which it can legally acquire targets, i.e.,

[9] Specifically, Maine passed legislation in 1978 permitting out-of-state acquisitions on a national reciprocal basis. Since no states reciprocated until 1982, this deregulation process was in fact stalled until 1982, when Alaska and New York passed laws similar to Maine's.

"accessible states." This building block is based on the gravity model of investment that when applied to banking, predicts that the costs of acquiring and managing targets increase with distance. Thus, the geographic location of the acquiring BHC provides information on the likelihood that it acquires banks in each accessible state.[10]

From the two building blocks, we weight the potential overlap values between the acquiring BHC and each of its accessible states that emerge from interstate bank regulations by the likelihood that it purchases a target in that state, where these likelihood weights are based on the second building block: geography. We then aggregate these weighted potential overlap values to form the instrumental variable for the actual overlap of the acquiring BHC. As stressed, this instrument depends only on interstate bank regulations and the geographic location of the acquiring BHC. Since BHCs headquartered within one state differ in their distances to other states, our instrument differentiates among BHCs headquartered within the same state and year.

4.3.2. Construction of the instrument and validity

We now provide a step-by-step description of the construction of the instrumental variables. For brevity in describing the construction of the instruments, we refer to "overlap" rather than separately discussing each measure. First, for each completed deal, we identify all states in which the acquiring BHC could have legally made an acquisition in the year when the deal was announced. We call these "accessible states" and include the BHC's home state as an accessible state.[11]

Second, we find each accessible state's accessible states and calculate the degree of overlap between the acquirer's accessible states and each of the states that those accessible states can enter based on interstate bank regulations. For example, if the acquirer's state *i* can access three other states (besides its home state *i*) in year *t* when the acquisition is announced—states *k*, *l*, and *m*, we compute (a) the overlap between the states that BHCs headquartered in state *i* can access and the states that BHCs headquartered in state *k* can enter in year *t* and call this O_{ikt}, (b) the overlap between the states that BHCs headquartered in state *i* can access and the states that BHCs headquartered in state *l* can enter in year *t* and call this O_{ilt}, and (c) the overlap between the states that BHCs headquartered in state *i* can access and the states that BHCs headquartered in state *m* can enter in year *t* and call this O_{imt}. This yields four overlap values, one for each of the acquirer's non-home accessible states and one for the acquirer's own state (O_{iit}), where $O_{iit} = 1$ in all *t*.

Third, we weight each of these overlap values by an index that is inversely related to the geographic distance between the acquirer's headquarters and the corresponding accessible state.

[10] Goetz, Laeven, and Levine (2013) and Nguyen (2017) show that this holds for banks. Economists stress the impact of distance on investment, e.g., Marshall (1890), Helpman (1984), Helpman, Melitz, and Rubinstein (2008).
[11] All results hold when excluding the acquiring bank's state as an accessible state when constructing the instrument.

Continuing the example from above, for an acquiring BHC *b* (headquartered in state *i*) in year *t*, we weight each of the overlap measures O_{ijt} (where *j = i, k, l, m*) by distance-weights ($w_{b(i)jt}$) that are inversely related to the distance between BHC *b* and each accessible state *j*, where $\sum_j w_{b(i)jt} = 1$. We define the construction of the distance-weights below.

Fourth, we sum these distance-weighted overlap values for each acquiring BHC and use this as the instrumental variable for acquiring BHC *b* in year *t*. Thus, the instrument for BHC *b* (headquartered in state *i*) in year *t* equals:

$$\sum_j O_{ijt} w_{b(i)jt},$$

where the summation is done across *j*—BHC *b*'s accessible states in *t*. The instrument reflects both the state-specific process of interstate bank deregulation (as reflected in O_{ijt}) and the geographic location of each BHC's headquarters relative to potential targets at time *t* (as captured by $w_{b(i)jt}$).

To construct the distance-weights, we begin by calculating the geographic distance between the acquirer's headquarters and each of the acquirer's accessible states. We employ three different measures of this distance and show that the results are robust. Specifically, we use the distance from the acquirer's headquarters to either the accessible state's (1) city with the most BHCs, (2) city with the most people, or (3) closest border. For the distance between the acquirer's headquarters and its own state, we use the average distance between the acquirer's headquarters and the three cities with the most BHCs within the acquirer's state for each of the three different distance measures. Thus, for BHC *b* (headquartered in state *i*), let $d_{b(i)j}$ represent its distance to each accessible state *j* (using one of the three distance measures), where $d_{b(i)i}$ is the average distance between BHC *b*'s headquarters and the three most "banked" cities in state *i*. Based on these distances, we compute corresponding distance-weights $w_{b(i)jt}$ for each accessible state as follows. For the case (infrequent in our sample) when the BHC can only make acquisitions within its home state, $w_{b(i)it} = 1$. For other cases where the number of accessible states, *n*, is greater than one, the distance-weight for acquiring BHC *b* (headquartered in *i*) and accessible state *j* in year *t* is:

$$w_{b(i)jt} = \frac{1}{n-1}\left[1 - \frac{d_{b(i)j}}{\sum_j d_{b(i)j}}\right].$$

As noted above, $w_{b(i)jt}$ is then used to construct the instrument for BHC *b*'s overlap in year *t*, i.e., $\sum_j O_{ijt} w_{b(i)jt}$, where $\sum_j w_{b(i)jt} = 1$.[12]

[12] Note: (1) Online Appendix Instrument Construction Example provides a concrete example of constructing the instrument; (2) the IV results hold when using an instrument that does weight by the geographic location of the acquiring BHC within its home state (Online Appendix Table OA11); and (3) there are no cases in our sample where BHC *b* announces the acquisition of an out-of-state bank and BHC *b*'s home state prohibits intrastate acquisitions.

For this deregulation-gravity variable to be a valid instrument, it must both satisfy the exclusion restriction and explain differences in actual network overlap. With respect to exclusion—and as argued above, the instrument is based on integrating two plausibly exogenous sources of variation in the network overlap of an acquiring BHC: interstate bank deregulation and the location of the acquiring BHC's headquarters. With respect to instrument power, Panel B of Table 5 shows that they explain differences in actual network overlap. In the first stage regressions, the instrument enters positively and significantly when the dependent variable is the actual pre-merger network overlap. Moreover, the F-statistic on the null hypotheses that the instrument does not explain actual overlap is greater than 10, suggesting that we do not have a weak instrument problem (Stock and Watson, 2007).

4.4. Instrument variable results

Using these gravity-deregulation instrumental variables, Table 5 presents an assessment of the impact of network overlap on post-deal CARs. We examine three measures of network overlap, *Overlap*, *Correlation Coefficient*, and *Cosine Distance*, while using their corresponding instrumental variables. We present the results using the instruments based on the distance from each acquiring bank to each accessible state's city with the most people. In the Online Appendix (Table OA12 and Table OA13), we show that the results hold when using instruments based on the distance between the acquiring bank and either the city in each accessible state with the most banks or the border of the accessible states. Standard errors are clustered at acquirer BHC level. As noted earlier, all of the results hold when clustering at the acquirer-state level. The regressions control for the same variables used in the OLS analyses.

As shown, the instrumental variable results indicate that pre-merger overlap exerts a statistically significant, robust, and economically large impact on acquirer, target, and combined CARs. *Overlap*, *Correlation Coefficient*, and *Cosine Distance* enter significantly in all specifications. With respect to the estimated impact of geographic overlap on stock returns, again consider two otherwise identical mergers, where the high-overlap merger has one standard deviation larger pre-deal overlap as measured by the *Correlation Coefficient* (0.367). The Table 5 estimates indicate that the high-overlap merger will have a *Combined CAR* that is 17.75 (=48.37*0.367) percentage points higher than the low-overlap merger, which is almost four times larger than the estimates from the OLS regressions in Table 4.

The much larger estimates from the instrumental variables regressions are consistent with the view that omitted variables—that are positively correlated with network overlap and negatively correlated with post-merger performance—bias the OLS estimates toward zero. For example, less capable managers, more risk-averse managers, and more entrenched managers might each have a tendency to search for local targets and to generate less robust post-merger performance, which biases the OLS estimates of the impact of overlap on CARs toward zero. These findings advertise the importance of using instrumental

variables to address identification concerns and thereby obtain sharper estimates of the impact of network overlap on the stock price reaction to the announcement of BHC mergers.

5. Sources of Synergy

5.1 Framework

This section empirically explores several potential channels through which pre-announcement network overlap can boost post-announcement CARs. First, greater overlap can enhance opportunities for the merged bank to cut costs by eliminating redundant staff and branches, with positive repercussions on valuations. Second, with greater overlap, the merged bank will tend to have greater local market power, allowing the bank to boost revenues, profits, and valuations. Third, the relationship between overlap and agency frictions might also help account for the positive relationship between pre-announcement overlap and post-announcement CARs. Specifically, past research finds that bank acquisitions that materially expand the geographic boundaries of the merged bank (lower overlap acquisitions) tend to intensify agency problems and put downward pressure on valuations because of the difficulties in effectively governing distant subsidiaries and branches. Accordingly, higher overlap acquisitions will suffer less from these agency frictions, creating comparatively better opportunities for boosting performance.[13] This framework also suggests that the impact of geographic overlap on costs and revenues will depend on the functional overlap of—the similarity of the financial services provided by— the merging banks. For example, if two banks with high geographic overlap also provide the same banking service, this increases the opportunities for eliminating redundancies associated with providing that service and exploiting market power over the local provision of that service. We evaluate these hypotheses below.

This view of how pre-deal overlap boosts post-deal profits does not necessarily imply that overlap improves welfare. Indeed, to the extent that overlap facilitates the exploitation of market power, the merged bank might charge higher prices for the same services. Although this paper focuses on assessing the impact of overlap on CARs, profits, cost cutting, revenue generation, and operational efficiency, we contribute to discussions about the impact of bank consolidation on consumers by examining bank loans, net interest margins, and interest income.

Empirically, we proceed as follows. We examine both the combined acquirer-target and the target BHC. To construct data on the pre-merger "combined" acquirer-target BHC, we consolidate readily available information on the pre-merger acquirer and pre-merger target. The post-merger data on the

[13] To address questions about how long it takes for the impact of overlap on BHC performance to emerge and whether these effects endure, we investigated the dynamics of overlap on post-merger performance and report these results in Online Appendix Table OA15. As shown, the effects materialize quickly (within the first year) and endure for at least the next two years (i.e., through at least the 12th quarter after the merger announcements).

acquirer-target BHC is available from the reports filed with the Federal Reserve. Thus, there is complete information on changes in key BHC characteristics for the combined acquirer-target bank. For the target, there are comprehensive data during the pre-merger period because it was a standalone BHC. Not all merged banks, however, provide separate data on the target following the merger. Thus our comparisons and of pre- and post-deal targets uses the subset of targets with data.[14]

We again employ three statistical methods: OLS, Heckman correction model, and instrumental variables. As shown above, there is no evidence that nonrandom assignment influences the CAR findings. In this section, we confirm that the Heckman selection results are consistent with the OLS findings when examining the relationships between pre-acquisition overlap and post-merger costs, market power, and operational performance. Similarly, the IV findings (using the same strategy as in the CAR analyses) confirm the OLS results on costs, market power, and operational performance. We report the OLS results because (a) the sample size drops materially from the CAR analyses due to data limitations on the mechanisms, (b) this drop is exacerbated when using the additional variables employed in the first stages of the Heckman correction and instrumental variable models, and (c) the results hold using these other methods as shown in Online Appendix Tables OA15-OA20.

5.2 Preliminaries

We begin by examining the relationship between pre-acquisition overlap and the pre- to post-merger change in (a) the on assets (*Change in ROA*) and (b) lending (*Growth in total loans*). While the results on CARs suggest that equity markets expect profits to rise by more following higher overlap mergers, we evaluate whether this indeed holds. We also examine the impact of overlap on loans. Although theory suggests that overlap will tend to boost profits, cost cutting, and revenues, the impact on the lending is ambiguous.

As shown in Table 6, pre-deal network overlap is positively associated with post-deal ROA but not with lending. The finding that overlap boosts ROA is consistent with the view that the market correctly anticipates this relationship, as reflected in CAR findings above. Second, the finding on the growth rate in loans suggests that mergers with greater overlap do not improve consumer welfare by boosting lending.

5.3 Cost reductions: labor costs and branches

As noted, one mechanism through which network overlap could boost valuations is by providing greater cost cutting opportunities. Thus, we evaluate the relationship between network overlap and changes in total salary expenditures (*Change of log(Total Salary)*), salary expenditures per employee

[14] Although there are potential biases from nonrandom selection of targets, the sample of combined acquirer-target banks does not suffer from this concern and the results on acquirer-targets are consistent with those on targets.

(*Change of log (Average Salary)*), and the number of employees (*Change of log(Employee Number)*) following acquisitions.

Consistent with the view that pre-deal network overlap facilitates post-deal cost cutting, the Table 7 results indicate that total salary expenditures and the number of employees fall more after mergers with greater pre-acquisition overlap. There is no relationship, however, between pre-deal overlap and changes in the average salary of employees after the acquisition. That is, the larger cut in total salary expenditures following larger overlap mergers is accounted for by reductions in the number of employees.

To assess the economic magnitude of the estimated effects, we conduct the following calculations. We compare a high-overlap merger with an otherwise similar low-overlap merger, where the high-overlap merger has one standard deviation greater overlap (*Correlation Coefficient*) than the low-overlap merger, i.e., *Correlation Coefficient* is 0.367 greater. We then computed the difference in the estimated change in the target's expenditures on salary relative to the net income of the average target bank in our sample ($2.69 million). The Table 7 estimates indicate that log(*Total Salary*) will be about 0.14 (=0.367*0.3855) smaller in the target with higher pre-deal overlap than in target with low pre-deal overlap. Using the average salary expenditures at target banks as a benchmark ($3.56 million), the estimates indicate a merger involving high overlap will induce a $0.47 million greater reduction salary expenditures by the target than an equivalent merger involving low pre-deal overlap 0.47 (=3.56*(exp(0.14)-1), which is 17% (=0.47/2.69) of the net income of the average target bank.

We next evaluate whether pre-deal network overlap facilitates post-deal cost cutting through the closure of bank branches. To conduct this examination, we use deal-level data on both combined acquirer-target BHCs and targets alone, computing the growth rate in the number of branches from one year before until one year after the announced acquisition.

As shown in Table 8, the number of branches falls more when the merger involves banks with greater pre-acquisition network overlap. This result holds when examining the combined acquirer-target BHCs or when only examining the target banks. Furthermore, the estimated effects are economically large. Again, compare a merger that has one standard deviation greater *Correlation Coefficient* (0.367) than an otherwise equivalent merger. The estimates indicate that the growth of the number of branches will be 3.6% (=0.367*0.097) smaller in the merged BHC with greater pre-acquisition network overlap than in the low-overlap merger.[15]

[15] To shed additional empirical light on the impact of pre-merger network overlap on post-merger lending conditions, we examined the degree to which mergers influence counties through their overlapping branch networks and then evaluated the resultant effect on county lending conditions. To measure the degree to which mergers influence counties through their overlapping branch networks, we computed for each county-year observation *# Overlapping Merger*, which equals the number of bank mergers in which each of the merging banks has at least one branch in the county in the year of the merger. For example, if two banks merge in year *t* and only one of the banks has a branch

5.4 Market power

To evaluate the post-deal exploitation of market power, we examine the (1) net interest margin (*Net Interest Margin*), (2) the ratio of interest income to interest-bearing assets (*Interest Income Ratio*), and (3) the ratio of interest expense to interest-bearing deposits (*Interest Expense Ratio*). Thus, using the same specifications as in Tables 6-8, we test whether *Net Interest Margin*, *Interest Income Ratio*, and *Interest Expense Ratio* respond differently to mergers involving banks with greater pre-acquisition network overlap.

Consistent with the view that more pre-deal network overlap implies greater post-deal market power, the results in Table 9 indicate that pre-deal network overlap boosts *Net Interest Margin* and *Interest Income Ratio* and the estimated impact is economically large. That is, interest margins and income grow more when bank mergers involve banks with greater pre-acquisition network overlap. When combined with the earlier findings on profits, our results indicate that greater overlap boosts post-merger profits, interest margins, and interest income without increasing lending.

In terms of economic magnitudes, we perform the same comparisons as above when examining expenditures on salary, where we now examine the estimated impact of overlap on net interest income as a share of bank profits. As shown in Table 9, Panel A, column 5, targets in high-overlap mergers experience a 0.4% larger increase in the *Net Interest Margin* than in low-overlap mergers (=0.367*1.09%). Using the average value of interest-bearing assets among target banks ($173 million), this implies that net interest income of targets in high-overlap mergers will increase by $0.69 million (=173*0.004) more than targets in low-overlap mergers. This extra boost in net interest income is about 25% (=0.69/2.69) of the average net income of target banks. Comparing the extra reductions in salaried expenditures and the additional boost in net interest income associated high-overlap vs. low-overlap mergers, the boost in net interest income is much higher as a proportion of profits: 25% as compared to 17%.

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in a county, then *# Overlapping Merger* equals zero for that county in year *t*; if two banks merge and both banks have at least one branch in a county, then *# Overlapping Merger* equals one for that county.

We discovered that counties with more overlapping mergers—those with greater *# Overlapping Merger*—tend to experience (a) a drop in the value of small business loans, (b) a drop in branch openings by banks not engaged in M&As, (c) an increase in branch closings by banks not engaged in M&As, and (d) a drop in net branches by banks not engaged in M&As. We find no effect of *# Overlapping Merger* on total deposits or the Herfindahl index of deposits across branches. These results are consistent with this section's findings: While mergers involving greater overlap boost revenue generation, cost cutting, and profits at the merging banks, we do not find that mergers improve local lending conditions. These results are reported in Online Appendix Table 21.

5.5 Operational and governance performance: Loan quality and leadership changes

We next turn to the governance and lending quality of the merged bank. To the extent that mergers involving BHCs with more widely dispersed branches create combined BHCs that are more difficult to govern, this could harm lending quality and the ability of the merged bank to make leadership changes. By avoiding the adverse effects of low-overlap mergers, therefore, greater pre-deal overlap might foster comparatively strong post-merger performance. To shed some empirical light on this potential mechanism, we examine two indicators of loan quality and one measure of leadership turnover at the target bank: (1) the ratio of insider loans (loans to directors and c-suite executives) to total loans and leases (*Insider Loans/Total Loans*), (2) the proportion of loan charge-offs to total loans (*Net Charge-offs/Total Loans*), and (3) the percentages of directors or executives at the target BHC who are replaced during the year following the deal.

As reported in Table 10, greater pre-deal network overlap is associated with a drop in both *Insider Loans/Total Loans* and *Net Charge-offs/Total Loans*. These findings hold for both the combined acquirer-target and for the target bank alone. The findings are consistent with the view that pre-deal network overlap spurs post-deal efficiency. The estimated economic effects are also large. To illustrate the economic effects, again compare a merger that has one standard deviation greater *Correlation Coefficient* (0.367) than an otherwise equivalent merger. The coefficient estimate on *Correlation Coefficient* in Table 10 indicates that the *Insider Loan Ratio* will drop by 0.24% (=0.367*0.0065) more in the target of the merged BHC with greater pre-acquisition network overlap than in the low-overlap merger.

We next assess whether a higher percentage of target BHCs board members and executives are replaced during the year after an acquisition when the BHCs have a greater pre-deal overlap. For each deal, we find the target BHC's list of directors and executives one year before the merger announcement by merging data from the SDC and BoardEx. We then check whether these directors and executives work for the target one year after the merger. If they are not working at the target BHC, we check if they are board members or executives at the combined acquirer-target BHC. If the directors and executives of the target before the merger work at the combined acquirer-target BHC after the merger, then we do not consider them "replaced." In this way, we measure whether each director and executive in the target BHC is replaced after the merger. We calculate the percentages of target board directors and executives that are replaced and use that percentage as the dependent variable in our regressions.

As shown in Table 11, we find that pre-deal network overlap is positively and significantly associated with the post-deal replacement of board members and executives at the target BHC. Whether examining *Overlap*, *Correlation Coefficient*, or *Cosine Distance*, we find that these proxies of pre-acquisition network overlap enter statistically significantly when assessing either the percentage of

directors (columns 1-3) or executives (columns 4-6) who are replaced following acquisitions.[16] Moreover, the estimated relationship is economically significant. As reported in column (5), high-overlap mergers (those with a one standard deviation above the mean values of *Correlation Coefficient*) are associated with 15.3% (0.153 = 0.367*0.418) greater proportion of target executive replacements within one year of the merger than the average target, where on average 40% of target executives are replaced.

5.6 Pre-deal overlap, post-deal performance, and other features of the merging banks

As discussed above, the view that pre-announcement network boosts post-announcement CARs by facilitating cost reductions and revenue generation also suggests that the impact of overlap will depend positively on the degree to which banks provide similar services. To measure similarity, we compare the banks' ratios of loans to total assets. Specifically, the similarity measure is: $SIM_d = -|AcqLoanRatio_d - TarLoanRatio_d|$, where $AcqLoanRatio_d$ ($TarLoanRatio_d$) is the pre-deal loan-to-assets ratio of the acquirer (target) in deal *d*. We divide the full sample into two subsamples: the high-similarity subsample includes deals have SIM_d above the median, and the low-similarity subsample is defined analogously.

We then re-estimate all of the regressions reported above on CARs and the potential channels through which pre-deal overlap shapes post-merger performance except that we separately conduct the regressions on the high- and low-similarity subsamples. Thus, Table 12 provides 46 regressions: two for each of the dependent variables in Tables 6-11. For brevity, we only provide the results for one overlap measure (*Correlation Coefficient*), though the results are similar when using the other measures.

As shown in Table 12, the results support the view that the impact of pre-deal overlap on CARs, cost reductions, and revenue generation is greater when the merging banks have similar mixtures of assets. We find that in the sample of mergers with more similar loan to asset ratios, the associated between overlap and both cost cutting and revenue generation is greater than in the sample of less similar mergers. These results confirm that pre-deal network overlap shapes post-deal cost cutting, revenue generation, and operational performance and post-announcement CARs in theoretically predictable ways.

6. Conclusion

Does the geographic overlap of the branches of two BHCs influence the likelihood that they merge and post-merger value creation and synergies? To address these questions, we compiled data on U.S. bank acquisitions since 1984, constructed an array of measures of pre-deal network overlap, and designed and implemented a new identification strategy for assessing the impact of pre-merger network overlap on post-merger CARs. Moreover, to shed empirical light on the mechanisms underlying stock price reactions

[16] The results also hold when examining the percentage of directors or executives at the target who are replaced from one year before the merger (instead of using the year of the merger) until one year after the merger.

to announced BHC mergers, we examined how pre-deal network overlap shapes post-merger costs, revenues, executive turnover, and loan quality.

We discover the following. First, pre-deal network overlap increases the probability that two BHCs merge. Second, pre-deal network overlap materially boosts the CARs of the acquirer, target, and combined banks. Third, pre-acquisition network overlap (1) lowers post-acquisition employment, salary expenditures, and number of branches, (2) boosts post-acquisition ROAs, interest margins, and interest income, (3) reduces insider lending and net loan charge-offs, and (4) boosts the proportion of directors and executives replaced at targets. The results are consistent with the view that bank mergers with greater network overlap offer expanded opportunities for both cost cutting and revenue generation.

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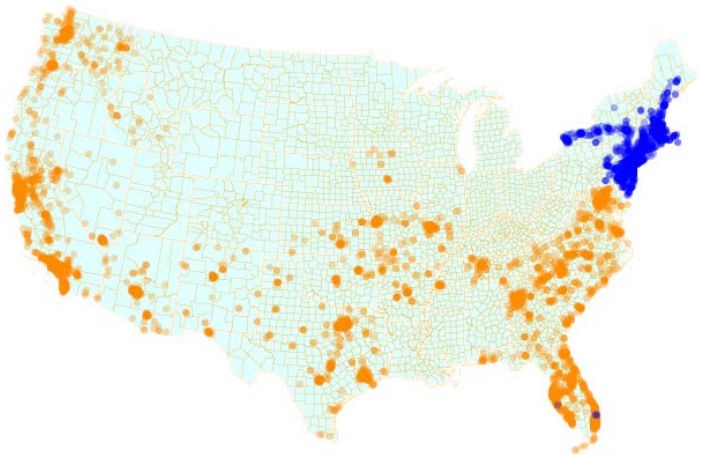
Figure 1: The Geographic Overlap of Subsidiaries before an Acquisition: Two Examples

Acquirer (Orange) and Target (Blue) Bank Branches' Geographic Distribution

Panel A: Bank of America (Headquartered in North Carolina) Acquires FleetBoston Financial (Massachusetts), Announced in 2003



Panel B: Financial (Alabama) Acquires AmSouth Bancorp (Alabama), Announced in 2006

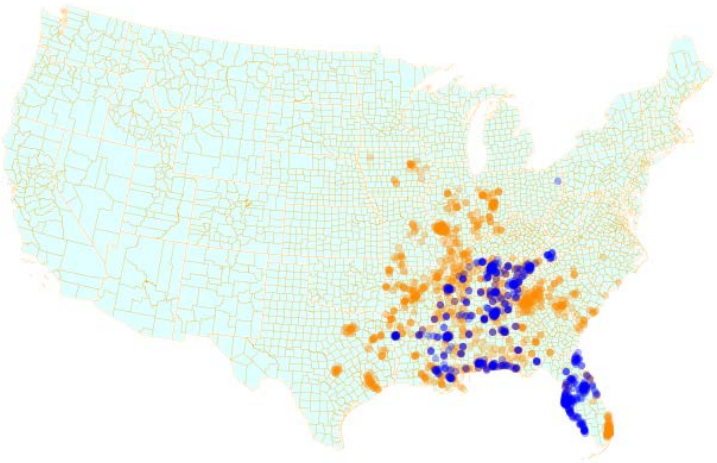


Table 1 Variable Definitions	
Dependent Variables	
Average salary	Average salary that a target bank pays an employee in a quarter, in thousand dollars, i.e., Total salary/Employee number. In thousand USD.
Cumulative abnormal return (CAR)	5-day CAR during the window (-2, +2), where day 0 is the announcement date of the acquisition. We define abnormal returns by using the difference between actual and projected returns, where we estimate projected returns as follows: (1) regress the BHC's daily return on the returns on the CRSP value-weighted market portfolio over the 200-day period from the 210th trading day through the 11th trading day before the announcement date of each deal and collect the estimated coefficients and (2) use the estimated coefficients to compute the projected returns during the 5-day event window (-2, +2).
Employee number	Number of employees that a target bank hires in a quarter.
Insider loan ratio	Value of insider loans divided by the value of total loans and leases. In percent.
Interest income ratio	Interest income divided by interest-bearing assets. In percent.
Interest expense ratio	Interest expense divided by interest-bearing deposits. In percent.
Net charge-off ratio	The difference between the charge-offs on loans and leases and recoveries on loans and leases divided by the total value of loans and leases. In percent.
Net interest margin	Net interest income divided by interest-bearing deposits. In percent.
Post-merger growth of bank branches	(Post-merger branch number - pre-merger branch number)/pre-merger branch number
Proportion of target banks' board directors replaced during the year after the acquisition	The number of board directors who were in the target bank one year before the merger announcement but who were not in the target banks on the first year after the announcement, divided by the total number of board directors who were in the target banks on the year of merger announcement.
Proportion of target banks' executives replaced during the year after the acquisition	The number of executives who were in the target bank one year before the merger announcement but who were not in the target banks on the first year after the announcement, divided by the total number of executives who were in the target banks on the year of merger announcement.
ROA	Return on assets. Calculated as net income divided by total assets.
Total loans	A bank's total loan volume.
Total salary	Total salary and employee benefits that a target bank pays all the employees in a quarter, in thousand dollars. In thousand USD.
Inputs of Overlap Measures	
Unweighted vector (state-level)	For each BHC in each year, we construct an unweighted 51-element vector to measure the geographic distribution of its subsidiaries (and a separate unweighted vector for branches). Each element is one or zero depending on whether the BHC has a subsidiary (branch) in each state and the District of Columbia or not.
Weighted vector (state-level)	For each BHC in each year, we construct a weighted 51-element vector to measure the geographic distribution of its subsidiaries (and a separate weighted vector for branches). Each element is zero or the number of subsidiaries (branches) in each state and the District of Columbia.

Overlap Measures	
Overlap	The number of non-zero elements in the intersection of the two BHCs' unweighted vectors of subsidiaries divided by the total number of non-zero elements in the union of the two BHCs' vectors. For example, if *u*=[1,0,1,0] and *v*=[1,1,0,0], then $u \cap v = [1,0,0,0]$ and $u \cup v = [1,1,1,0]$, therefore Overlap = 1/3 = 33.33%. Denoted in percentage.
In the following definitions, u and v are two 1-dimentional vectors	
Correlation coefficient	Pearson's correlation coefficient of two banks' unweighted vectors, defined as $$\rho_{u,v} = \frac{\sum_{i=1}^{n}(u_i - \bar{u})(v_i - \bar{v})}{\sqrt{\sum_{i=1}^{n}(u_i - \bar{u})^2}\sqrt{\sum_{i=1}^{n}(v_i - \bar{v})^2}}$$
Cosine distance	Measures overlap using the cosine distance based on unweighted vectors of bank subsidiary networks: $$d(u,v) = 1 - \frac{u \cdot v}{\|\|u\|\|_2 \|\|v\|\|_2}\ d(u,v) = 0$$ when $u = v$, meaning that the two vectors are the same. $d(u,v) = 1$ when $u \cdot v = 0$, meaning that the two vectors are very dissimilar.
Control Variables and Other Variables	
Acquirer deposit to assets ratio	Acquirer banks' total deposit divided by total assets.
Acquirer leverage ratio	Acquirer banks' total liabilities divided by acquirer total assets. Calculated from data in call reports.
Acquirer net income	Acquirer banks' net income in million USD. Obtained from call reports.
Acquirer profitability	Acquirer bank's return on assets. Obtained from Compustat.
Acquirer real estate loans ratio	Acquirer banks' loans secured by real estate minus real estate loans secured by nonfarm nonresidential properties divided by total loans
Acquirer run-up (-200, -11)	The percentage change in the acquirer's stock price over the period from 200 days before the announcement until 11 days before the announcement. Data are from CRSP.
Acquirer small business loans ratio	Acquirer banks' small business loans divided by total loans.
Acquirer target assets ratio	Acquirer total assets/target total assets
Acquirer Tobin's Q	The ratio of the market to the book value of assets. Obtained from Bloomberg.
Acquirer total assets	Acquirer banks' total assets. Obtained from Compustat. In million USD.
Acquirer total loans to employee number ratio	Acquirer banks' total loans divided by total number of employees.
Attitude dummy	Equals one if the deal is friendly and zero otherwise, where "friendly" means the target bank did not resist or face an unsolicited offer as determined by the SDC. Obtained from Thomson Reuters SDC.

Cash deal dummy	Equals one if the acquisition is 100% in cash and zero otherwise. Obtained from Thomson Reuters SDC.
Deal size adjusted by acquirer asset	The value of the acquisition divided by the total assets of the acquiring BHC. Deal size is obtained from Thomson Reuters SDC.
Dummy(quarters 1-4 after deal)	Dummy variable that equals one for quarter 1 through 4 following a merger and zero otherwise in deal-quarter sample analysis.
Dummy(quarters 5-12 after deal)	Dummy variable that equals one for quarter 5 through 12 following a merger and zero otherwise in deal-quarter sample analysis.
Dummy (acquirer acquired other targets in past 3 yrs)	Equals one if the acquirer acquired other target banks within the past 3 years of the merger announcement. Calculated from data in Thomson Reuters SDC.
Number of offers target received	Number of acquisition offers that a target bank receives in a given year. Calculated from data in Thomson Reuters SDC.
Percentage of shares acquired	Percentage of shares acquired by the acquiring BHC. Obtained from Thomson Reuters SDC.
Stock deal dummy	Equals one if the acquisition is 100% in stock and zero otherwise. Obtained from Thomson Reuters SDC.
Target deposit to assets ratio	Target banks' total deposit divided by total assets.
Target leverage ratio	Target banks' total liabilities divided by target total assets. Calculated from data in call reports.
Target net income	Target banks' net income. Obtained from call reports.
Target profitability	Target bank's return on assets. Obtained from Compustat.
Target public dummy	Equals one if the target bank is public. Obtained from Thomson Reuters SDC.
Target real estate loans ratio	Target banks' loans secured by real estate minus real estate loans secured by nonfarm nonresidential properties divided by total loans.
Target small business loans ratio	Target banks' small business loans divided by total loans.
Target total assets	Target banks' total assets. Obtained from Compustat. In million USD.
Target total loans to employee number ratio	Target banks' total loans divided by total number of employees.

Table 2 Summary Statistics

Dependent Variables

	Obs	Mean	Std. Dev	Min	25%	Median	75%	Max
Cumulative abnormal return (CAR)								
Acquirer CAR (-2,+2) in %	1,849	-0.296	4.784	-49.683	-2.415	-0.293	1.692	39.096
Target CAR (-2,+2) in %	986	11.817	18.471	-58.248	0.016	3.508	20.493	118.039
Combined CAR (-2,+2) in %	956	10.911	18.710	-65.130	-0.577	4.889	18.411	123.125
Percentage change of total loans								
Target bank	622	0.509	1.383	-0.790	-0.208	0.109	0.678	6.963
Acquirer + target	1005	0.228	0.221	-0.037	0.083	0.165	0.320	1.003
Change of ROA								
Target bank	426	-0.001	0.006	-0.033	-0.003	0.000	0.002	0.030
Acquirer + target	1075	0.000	0.004	-0.033	-0.001	0.000	0.002	0.015
Change of log(total salary)								
Target bank	566	0.204	0.503	-1.708	-0.137	0.171	0.472	1.509
Acquirer + target	704	0.310	0.318	-2.134	0.137	0.286	0.477	1.482
Change of log(average salary)								
Target bank	566	0.176	0.491	-1.849	-0.166	0.187	0.512	1.667
Acquirer + target	704	0.159	0.138	-0.850	0.093	0.154	0.223	1.095
Change of log(employee number)								
Target bank	566	0.027	0.188	-1.070	-0.066	-0.001	0.087	1.104
Acquirer + target	704	0.151	0.288	-2.277	0.000	0.119	0.307	1.293
Post-merger growth of bank branches								
Target bank	1,530	-0.078	0.294	-1	0	0	0	0.500
Acquirer + target	1,757	0.049	0.311	-0.659	0	0	0	1
Change of net interest margin								
Target bank	539	0.003	0.037	-0.049	-0.009	0.002	0.014	0.820
Acquirer + target	548	0.003	0.012	-0.208	-0.002	0.001	0.004	0.040
Change of interest income ratio								
Target bank	539	0.010	0.209	-0.081	-0.019	-0.002	0.019	4.904
Acquirer + target	548	0.001	0.020	-0.318	-0.008	0.000	0.006	0.113
Change of interest expense ratio								
Target bank	539	0.001	0.065	-0.047	-0.012	-0.003	0.007	1.581
Acquirer + target	548	-0.002	0.012	-0.109	-0.008	0.000	0.005	0.073
Change of insider loan ratio								
Target bank	500	0.000	0.012	-0.057	-0.005	0.000	0.002	0.080
Acquirer + target	714	-0.018	0.023	-0.111	-0.032	-0.016	-0.003	0.124
Change of net charge-off ratio								
Target bank	540	0.000	0.004	-0.020	-0.001	0.000	0.001	0.027
Acquirer + target	663	-0.003	0.006	-0.048	-0.004	-0.001	0.000	0.034
Proportion of target banks' board directors that are replaced during the year after the acquisition	523	0.394	0.462	0	0	0	1	1
Proportion of target banks' executives that are replaced during the year after the acquisition	493	0.402	0.463	0	0	0.071	1	1

	Obs	Mean	Std. Dev	Min	25%	Median	75%	Max
Key Independent Variables								
Overlap	1,913	0.490	0.389	0	0.167	0.333	1	1
Correlation Coefficient	1,913	0.587	0.367	-0.312	0.379	0.567	1	1
Correlation Coefficient (weighted by branch number)	1,913	0.583	0.445	-0.218	0.072	0.867	1	1
Correlation Coefficient (weighted by branch deposit)	1,913	0.580	0.452	-0.178	0.053	0.908	1	1
Cosine Distance	1,913	0.397	0.352	0	0	0.423	0.592	1
Cosine Distance (weighted by branch number)	1,913	0.405	0.432	0	0	0.132	0.898	1
Cosine Distance (weighted by branch deposit)	1,913	0.409	0.440	0	0	0.092	0.920	1
Control Variables								
Acquirer profitability	1,913	0.023	0.117	-0.084	0.009	0.011	0.013	0.155
Acquirer run-up (-200,-11)	1,913	0.014	0.154	-1.274	-0.001	0.010	0.020	4.856
Acquirer target assets ratio	1,225	53.325	478.856	0.110	4.360	10.868	31.686	19836
Acquirer Tobin's Q	1,913	1.107	0.556	0.014	1.030	1.066	1.120	17.225
Acquirer total assets	1,913	18602.6	72835.3	58	1325.3	3864.7	11998	1502157
Attitude dummy	1,913	0.994	0.076	0	1	1	1	1
Cash deal dummy	1,913	0.162	0.369	0	0	0	0	1
Deal size adjusted by acquirer asset	1,913	0.029	0.059	0.0000119	0.005	0.013	0.033	1.856
Dummy (acquirer acquired other targets in past 3 yrs)	1,913	0.618	0.486	0	0	1	1	1
Number of offers target received	1,913	1.086	0.311	1	1	1	1	4
Percentage of shares acquired	1,913	99.772	2.920	34.600	100	100	100	100
Stock deal dummy	1,913	0.541	0.498	0	0	1	1	1
Target public dummy	1,913	0.487	0.500	0	0	0	1	1

Table 3: Overlap and Mergers with Real-Matched Pseudo Bank Pairs

This table uses the 1984-2016 sample and provides probit regression results of the relationship between the geographic overlap of the branches of two banks and whether they merge. Each observation is a potential deal between an acquirer and target bank. The dependent variable, Deal Completed, is an indicator variable that equals one if the two banks merge and zero otherwise. For each completed (real) deal, we also include up to ten pseudo deals, where for each real acquirer we include matched pairings with up to five pseudo targets and where for each real target we include matched pairings with five pseudo acquirers. For these pseudo deals, Deal Completed equals zero. To create pseudo acquirers and targets, we use propensity score matching based on the total assets, the leverage ratio, the interest income ratio, net income, return on assets, total loans to employee number ratio, deposit to assets ratio, loan growth rate, real estate loans ratio, consumer loans ratio. To measure the geographic overlap of the branches of real and matched pseudo deals, we use Overlap, Correlation Coefficient, Correlation Coefficient weighted by the number of branches in a state, Correlation Coefficient weighted by the deposits of all branches in a state, Cosine Distance, Cosine Distance weighted by the number of branches in a state, and Cosine Distance weighted by the deposits of all branches in a state. Each regression controls for Deal fixed effects, where there is a separate deal fixed effect for each set of a completed deal and the corresponding ten pseudo deals, such that the fixed effects equal one for those 11 deals and zero for all other completed and pseudo deals. Each regression also includes: Acquirer Total Assets, Acquirer Interest Income Ratio, Acquirer Net Income, Acquirer ROA, Acquirer Leverage Ratio, Acquirer Total Loans to Employee Number Ratio, Acquirer Small Business Loans Ratio, Acquirer Deposit to Assets Ratio, Acquirer Real Estate Loans Ratio, Acquirer Loan Growth Rate, the corresponding ten variables for the targets, and a dummy variable that equals one if the acquiring bank acquired another target in the last three years. We also control for Acquirer Bank State*Target Bank State fixed effects. The Table 1 provides variable definitions. Standard errors are clustered at the deal level. Robust z-statistics are in parentheses. *, **, *** indicate significance at 10%, 5% and 1% respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Acquirer-Target Bank Pairing: Complete Deals with Control Sample, Probit Model						
	Dependent Variable: Deal Completed						
Overlap	0.07***						
	(15.31)						
Correlation Coefficient		0.15***					
		(24.76)					
Correlation Coefficient (Weighted by Branch Number)			0.16***				
			(18.47)				
Correlation Coefficient (Weighted by Branch Deposit)				0.16***			
				(17.09)			
Cosine Distance					-0.15***		
					(-24.27)		
Cosine Distance (Weighted by Branch Number)						-0.17***	
						(-18.42)	
Cosine Distance (Weighted by Branch Deposit)							-0.17***
							(-17.14)
Acquirer and Target Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dummy (acquirer acquired other targets in past 3 yrs)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Deal Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer State*Target State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	14,924	14,924	14,924	14,924	14,924	14,924	14,924

Table 4: Overlap and Acquirer, Target, and Combined CARs

This table uses the 1984-2016 sample and presents OLS regression results of the relationship between the geographic overlap of the branches of two banks and the CARs of the acquirer, target, and combined bank following the acquisition. The dependent variable is the acquirer, target, or combined 5-day CAR (-2, +2). The explanatory variable of interest is one of three measures of the geographic overlap of the branches of the acquiring and target banks: Overlap, Correlation Coefficient, or Cosine Distance. Regressions in all panels include: Acquirer run-up (-200, -11), Acquirer Net Income, Acquirer Tobin's Q, Deal size adjusted by Acquirer Assets, Cash deal dummy, Stock Deal dummy, Attitude dummy, Target public dummy, Percentage of shares acquired, Acquirer Total Assets, Acquirer/Target Assets Ratio, a dummy for whether the acquiring banks acquired another target during the last three years, and number of offers that the target received, Year fixed effects, and Acquirer Bank State*Target Bank State fixed effects. Panel B includes a Heckman's Lambda. Standard errors are clustered at the bank level. Robust t-statistics are in parentheses. *, **, *** indicate significance at 10%, 5% and 1% respectively.

Panel A: OLS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Acquirer CAR (-2,+2) in %			Target CAR (-2,+2) in %			Combined CAR (-2,+2) in %		
Overlap	2.24***			8.35*			9.74**		
	(2.85)			(1.86)			(2.03)		
Correlation Coefficient		2.44**			10.78**			11.96**	
		(2.54)			(2.16)			(2.27)	
Cosine Distance			-2.52***			-12.23**			-13.66**
			(-2.60)			(-2.26)			(-2.35)
Controls, Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,225	1,225	1,225	659	659	659	635	635	635
R-squared	0.254	0.254	0.254	0.492	0.494	0.496	0.484	0.486	0.489

Panel B: Heckman Correction

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Acquirer CAR (-2,+2) in %			Target CAR (-2,+2) in %			Combined CAR (-2,+2) in %		
Overlap	2.45***			8.99**			8.80*		
	(2.99)			(2.10)			(1.93)		
Correlation Coefficient		2.48**			11.55**			11.11**	
		(2.51)			(2.51)			(2.23)	
Cosine Distance			-2.63***			-13.18***			-12.93**
			(-2.64)			(-2.63)			(-2.34)
Heckman's lambda	-0.32	-0.35	-0.35	-0.61	-0.68	-0.77	-1.15	-1.20	-1.30
	(-1.41)	(-1.52)	(-1.54)	(-0.47)	(-0.52)	(-0.59)	(-0.80)	(-0.83)	(-0.92)
Controls, Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,225	1,225	1,225	659	659	659	635	635	635
R-squared	0.256	0.254	0.255	0.519	0.522	0.525	0.502	0.505	0.508

Table 5: Overlap and Acquirer, Target, and Combined CARs: Instrumental Variables

Panel A uses the 1984-1995 sample and presents instrumental variable regression results of the relationship between the geographic overlap of the branches of two banks and the CARs of the acquirer, target, and combined bank following the acquisition. The dependent variable is the acquirer, target, or combined 5-day CAR (-2, +2). The explanatory variable of interest is one of three measures of the geographic overlap of the branches of the acquiring and target banks: Overlap, Correlation Coefficient, or Cosine Distance. The corresponding instruments are Weighted Overlap of States that Allowed Entry, Weighted Correlation Coefficient of States that Allowed Entry, and Weighted Cosine Distance of States that Allowed Entry, respectively, where the weights relate to the distance between the headquarters of the acquiring banks and each accessible state's most populated city. Each regression also includes: Acquirer run-up (-200, -11), Acquirer Net Income, Acquirer Tobin's Q, Deal size adjusted by Acquirer Assets, Cash deal dummy, Stock Deal dummy, Attitude dummy, Target public dummy, Percentage of shares acquired, Acquirer Total Assets, acquirer target assets ratio, dummy (acquirer acquired other targets in past 3 yrs), number of offers target received, Year fixed effects, and Acquirer Bank State*Target Bank State fixed effects. Panel B reports the corresponding first-stage regression results. Table 1 provides variable definitions. Standard errors are clustered at the bank level. Robust t-statistics (first stage) and z-statistics (second stage) are in parentheses. *, **, *** indicate significance at 10%, 5% and 1% levels respectively.

Panel A: Second Stage	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent Variables:	Acquirer CAR (-2,+2) in %			Target CAR (-2,+2) in %			Combined CAR (-2,+2) in %		
Overlap	30.69*			49.48***			57.60***		
	(1.79)			(4.25)			(5.22)		
Correlation Coefficient		20.65*			43.10***			48.37***	
		(1.89)			(5.78)			(8.32)	
Cosine Distance			-25.15**			-39.71***			-48.79***
			(-2.30)			(-6.24)			(-9.00)
Acquirer Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Deal Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer State*Target State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	474	474	474	133	133	133	128	128	128
F-test of Instruments' Joint Significance	13.87	12.32	16.31	11.68	12.22	11.02	17.02	14.35	16.06
Excluded Instruments:									
Weighted Overlap of States that Allowed Entry	Yes			Yes			Yes		
Weighted Correlation Coeff of States that Allowed Entry		Yes			Yes			Yes	
Weighted Cosine Distance of States that Allowed Entry			Yes			Yes			Yes
Panel B: First Stage									
Weighted Overlap of States that Allowed Entry	0.72***			0.63**			0.74**		
	(3.55)			(2.24)			(2.14)		
Weighted Correlation Coeff of States that Allowed Entry		0.81***			1.09***			1.41***	
		(3.32)			(2.77)			(3.12)	
Weighted Cosine Distance of States that Allowed Entry			0.83***			1.08**			1.29**
			(3.48)			(2.29)			(2.37)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer State*Target State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	474	474	474	133	133	133	128	128	128

Table 6: Overlap and Post-merger Change of Loan Volume and Profitability

This table uses the 1984-2016 sample and presents OLS regression results of the relationship between the geographic overlap of the branches of two banks and the total loan volume and return on assets of either the combined acquirer-target bank or the target bank following the acquisition. The dependent variable is the total loan volume (Panel A), or return on assets (Panel B). The explanatory variable of interest is one of three measures of the geographic overlap of the branches of the acquiring and target banks: Overlap, Correlation Coefficient, or Cosine Distance. Each regression also includes: Acquirer run-up (-200, -11), Acquirer Net Income, Acquirer Tobin's Q, Deal size adjusted by Acquirer Assets, Cash deal dummy, Stock Deal dummy, Attitude dummy, Target public dummy, Percentage of shares acquired, Acquirer Total Assets, acquirer target assets ratio, dummy (acquirer acquired other targets in past 3 yrs), number of offers target received, Year fixed effects, Acquirer Bank State*Target Bank State fixed effects. Table 1 provides variable definitions. Standard errors are clustered at acquirer bank (Columns 1-3 in both panels) or target bank (Columns 4-6 in both panels). Robust t-statistics are in parentheses. *, **, *** indicate significance at 10%, 5% and 1% respectively.

Panel A	(1)	(2)	(3)	(4)	(5)	(6)
	Percentage Change of Total Loans					
	Acquirer + Target			Target Bank		
Overlap	0.0346			3.7975		
	(0.6330)			(0.9001)		
Correlation Coefficient		0.0040			3.6837	
		(0.0624)			(0.8500)	
Cosine Distance			-0.0011			-3.9630
			(-0.0177)			(-0.8661)
Controls, Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,005	1,005	1,005	622	622	622
R-squared	0.547	0.548	0.548	0.577	0.575	0.575

Panel B	(1)	(2)	(3)	(4)	(5)	(6)
	Change of ROA					
	Acquirer + Target			Target Bank		
Overlap	0.0009*			0.0033**		
	(1.7882)			(2.0296)		
Correlation Coefficient		0.0011**			0.0034**	
		(2.1743)			(2.0322)	
Cosine Distance			-0.0012**			-0.0035**
			(-2.2095)			(-2.0600)
Controls, Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,075	1,075	1,075	426	426	426
R-squared	0.329	0.329	0.329	0.161	0.161	0.161

Table 7: Overlap and Growth of Total Salary, Average Salary, and Number of Employees

This table uses the 1984-2016 sample and presents OLS regression results of the relationship between the geographic overlap of the branches of two banks and the total salary expenditures, average salary per employee, and number of employees of either the combined acquirer-target bank or the target bank following the acquisition. The dependent variable is the growth rate of total salary expenditures (Panel A), the growth rate of the average salary per employee (Panel B), or the growth rate of the number of employees (Panel C). The explanatory variable of interest is one of three measures of the geographic overlap of the branches of the acquiring and target banks: Overlap, Correlation Coefficient, or Cosine Distance. Each regression also includes: Acquirer run-up (-200, -11), Acquirer Net Income, Acquirer Tobin's Q, Deal size adjusted by Acquirer Assets, Cash deal dummy, Stock Deal dummy, Attitude dummy, Target public dummy, Percentage of shares acquired, Acquirer Total Assets, acquirer target assets ratio, dummy (acquirer acquired other targets in past 3 yrs), number of offers target received, Year fixed effects, Acquirer Bank State*Target Bank State fixed effects. Table 1 provides variable definitions. Standard errors are clustered at acquirer bank (Columns 1-3, 7-9, 13-15) or target bank (Columns 4-6, 10-12, 16-18). Robust t-statistics are in parentheses. *, **, *** indicate significance at 10%, 5% and 1% respectively.

Panel A	(1)	(2)	(3)	(4)	(5)	(6)
	Change of log(Total Salary)					
	Acquirer + Target			Target Bank		
Overlap	-0.1150*			-0.3533*		
	(-1.8357)			(-1.9372)		
Correlation Coefficient		-0.1430**			-0.3855**	
		(-2.0238)			(-2.0438)	
Cosine Distance			0.1562**			0.3964**
			(2.1459)			(2.0193)
Controls, Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	704	704	704	566	566	566
R-squared	0.679	0.680	0.681	0.520	0.519	0.519

Panel B	(7)	(8)	(9)	(10)	(11)	(12)
	Change of log(Average Salary)					
	Acquirer + Target			Target Bank		
Overlap	-0.0020			0.0070		
	(-0.0577)			(0.0504)		
Correlation Coefficient		0.0100			0.0825	
		(0.2925)			(0.5847)	
Cosine Distance			-0.0110			-0.0816
			(-0.3091)			(-0.5573)
Controls, Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	704	704	704	566	566	566
R-squared	0.483	0.484	0.484	0.397	0.398	0.398

Panel C	(13)	(14)	(15)	(16)	(17)	(18)
	Change of log(Employee Number)					
	Acquirer + Target			Target Bank		
Overlap	-0.0933*			-0.0973*		
	(-1.6682)			(-1.7093)		
Correlation Coefficient		-0.1303**			-0.1328**	
		(-2.1721)			(-2.1445)	
Cosine Distance			0.1419**			0.1376**
			(2.2984)			(2.1288)
Controls, Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	704	704	704	566	566	566
R-squared	0.699	0.701	0.702	0.544	0.548	0.548

Table 8: Overlap and Post-merger Growth of Bank Branches

This table uses the 1984-2016 sample and presents the OLS regression results with fixed effects. The deals are from 1984 to 2016. Each observation is a merger deal. The dependent variable is the growth rate in the number of branches from the pre- to the post-merger period for either the combination of the acquirer and target banks or the target bank alone. Post-merger growth of bank branches = (Post-merger branch number - pre-merger branch number)/pre-merger branch number. The explanatory variable of interest is one of three measures of the geographic overlap of the branches of the acquiring and target banks: Overlap, Correlation Coefficient, or Cosine Distance. They are defined in Variable Definition. Acquirer control variables include acquirer run-up, acquirer profitability and acquirer Tobin's Q. Deal control variables are included in all regressions, including cash deal dummy, stock deal dummy, attitude dummy, target public dummy, percentage of shares acquired. Year dummies and Acquirer Bank State*Target Bank State fixed effects are included in all regressions. Standard errors are clustered at acquirer/target bank level. Robust t-statistics are in parentheses. *, **, *** indicate significance at 1%, 5% and 10%.

	(1)	(2)	(3)	(4)	(5)	(6)
	Post-merger growth of bank branches					
	Acquirer + Target			Target Bank		
Overlap	-0.0720			-0.0618*		
	(-1.5656)			(-1.7744)		
Correlation Coefficient		-0.0970**			-0.0801**	
		(-2.0042)			(-2.0286)	
Cosine Distance			0.0971*			0.0761*
			(1.9636)			(1.8701)
Controls, Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,757	1,757	1,757	1,530	1,530	1,530
R-squared	0.282	0.284	0.283	0.253	0.255	0.254

Table 9: Overlap and Change in Net Interest Margins, Interest Income Ratio, and Interest Expense Ratio

This table uses the 1984-2016 sample and presents the OLS regression results with fixed effects. The deals are from 1984 to 2016. Each observation is the difference between an acquirer or a target bank's 12 quarters' average net interest margin/interest income ratio/interest expense ratio after the merger and (minus) the bank's 12 quarters' average net interest margin/interest income ratio/interest expense ratio before the merger. The dependent variables are the change of acquirer and target banks' average net interest margin (Panel A), interest income ratio (Panel B) and interest expense ratio (Panel C). The independent variables are the distance measures between acquirer and target bank branch diversification, including Overlap, Correlation Coefficient and Cosine Distance. They are defined in Variable Definition. Deal control variables are included in all regressions, including cash deal dummy, stock deal dummy, attitude dummy, target public dummy, percentage of shares acquired. Year dummies and Acquirer Bank State*Target Bank State fixed effects are included in all regressions. Standard errors are clustered at acquirer bank (Columns 1-3, 7-9, 13-15) or target bank (Columns 4-6, 10-12, 16-18). Robust t-statistics are in parentheses. *, **, *** indicate significance at 1%, 5% and 10%.

Panel A	(1)	(2)	(3)	(4)	(5)	(6)
	Change of Net Interest Margin					
	Acquirer + Target			Target Bank		
Overlap	0.0069***			0.0088*		
	(2.6258)			(1.7561)		
Correlation Coefficient		0.0045**			0.0109**	
		(2.0533)			(2.2386)	
Cosine Distance			-0.0045**			-0.0110**
			(-2.0668)			(-2.1618)
Controls, Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	548	548	548	539	539	539
R-squared	0.646	0.649	0.649	0.996	0.996	0.996

Panel B	(7)	(8)	(9)	(10)	(11)	(12)
	Change of Interest Income Ratio					
	Acquirer + Target			Target Bank		
Overlap	0.0047**			0.0099**		
	(2.0907)			(1.9793)		
Correlation Coefficient		0.0086**			0.0190**	
		(2.0108)			(2.0015)	
Cosine Distance			-0.0087**			-0.0191*
			(-2.0143)			(-1.9144)
Controls, Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	548	548	548	539	539	539
R-squared	0.648	0.652	0.652	0.993	0.993	0.993

Panel C	(13)	(14)	(15)	(16)	(17)	(18)
	Change of Interest Expense Ratio					
	Acquirer + Target			Target Bank		
Overlap	0.0052			-0.0018		
	(1.4104)			(-0.1362)		
Correlation Coefficient		0.0032			0.0006	
		(1.5272)			(0.0441)	
Cosine Distance			-0.0065			-0.0005
			(-1.3443)			(-0.0387)
Controls, Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	548	548	548	539	539	539
R-squared	0.976	0.977	0.977	0.276	0.275	0.275

Table 10: Overlap and Change in Insider Lending and Loan Charge-offs

This table uses the 1984-2016 sample and presents the OLS regression results with fixed effects. The deals are from 1984 to 2016. Each observation is the difference between an acquirer or a target bank's 12 quarters' average insider loan ratio/net charge-off ratio after the merger and (minus) the bank's 12 quarters' average insider loan ratio/net charge-off ratio before the merger. The dependent variables are the change of acquirer and target banks' average insider loan ratio (Panel A) and average net charge-off ratio (Panel B). The independent variables are the distance measures between acquirer and target bank branch diversification, including Overlap, Correlation Coefficient and Cosine Distance. They are defined in Variable Definition. Deal control variables are included in all regressions, including cash deal dummy, stock deal dummy, attitude dummy, target public dummy, percentage of shares acquired. Year dummies and Acquirer Bank State*Target Bank State fixed effects are included in all regressions. Standard errors are clustered at acquirer bank (Columns 1-3, 7-9) or target bank (Columns 4-6, 10-12). Robust t-statistics are in parentheses. *, **, *** indicate significance at 1%, 5% and 10%.

Panel A	(1)	(2)	(3)	(4)	(5)	(6)
	Change of Insider Loan Ratio					
	Acquirer + Target			Target Bank		
Overlap	-0.0086**			-0.0043		
	(-1.9996)			(-1.4946)		
Correlation Coefficient		-0.0101**			-0.0065**	
		(-2.0247)			(-2.2065)	
Cosine Distance			0.0101**			0.0068**
			(1.9816)			(2.2373)
Controls, Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	714	714	714	500	500	500
R-squared	0.605	0.606	0.606	0.608	0.613	0.614

Panel B	(7)	(8)	(9)	(10)	(11)	(12)
	Change of Net Charge-off Ratio					
	Acquirer + Target			Target Bank		
Overlap	-0.0023*			-0.0022**		
	(-1.7267)			(-2.1018)		
Correlation Coefficient		-0.0030**			-0.0027**	
		(-2.1350)			(-2.2901)	
Cosine Distance			0.0034**			0.0027**
			(2.2380)			(2.2667)
Controls, Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	663	663	663	540	540	540
R-squared	0.763	0.765	0.766	0.689	0.690	0.690

Table 11: Overlap and Changes in Board Members and Executives

This table uses the 1984-2016 sample and presents Tobit regression results. The deals are from 1984 to 2016. The dependent variables are percentages of target banks' board directors (model 1-3) and executives (model 4-6) being replaced in one year after acquisition (not in %, for example, 0.2608 = 26.08%). The independent variables are the distance measures between acquirer and target bank branch diversification, including Overlap, Correlation Coefficient and Cosine Distance. Independent variable of Regression 2 and 5 is Correlation Coefficient. Independent variables of Regression 3 and 6 are Cosine Distance. The definitions of the subsidiary diversification measures are detailed in Variable Definition. Deal control variables are included in all regressions, including cash deal dummy, stock deal dummy, attitude dummy, target public dummy, percentage of shares acquired. Year dummies and Acquirer Bank State*Target Bank State fixed effects are included in all regressions. Standard errors are clustered at target bank level. Robust t-statistics are in parentheses. *, **, *** indicate significance at 1%, 5% and 10%.

	(1)	(2)	(3)	(4)	(5)	(6)
	Proportion of Target Banks' Board Directors Being Replaced in One Year After Acquisition			Proportion of Target Banks' Executives Being Replaced in One Year After Acquisition		
	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit
Overlap	0.3296**			0.3909**		
	(2.0865)			(2.3712)		
Correlation Coefficient		0.3591**			0.4183**	
		(2.0180)			(2.2977)	
Cosine Distance			-0.3414*			-0.4057**
			(-1.8738)			(-2.1523)
Controls, Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	523	523	523	493	493	493
Pseudo R-squared	0.575	0.575	0.573	0.611	0.609	0.608

Table 12: Comparing Two Subsamples with Different Similarity

The two panels present the Chow test results for the two subsamples with different similarity. Each row represents a regression, and we present the p-value of the Chow test between the coefficients for each pair of regressions. Deal controls, Year dummies and Acquirer Bank State*Target Bank State fixed effects are included in all regressions. Standard errors are clustered at acquirer or target bank. Robust t-statistics are in parentheses. *, **, *** indicate significance at 1%, 5% and 10%.

	Dependent Variable	Chow test p-value of High-Low difference	Similarity	Correlation Coefficient	t-stats	Controls, Year FE, Acquirer State*Target State FE	Obs	R-squared
CARs								
(1)	Acquirer CAR (-2,+2) in %	0.090*	High	4.6260**	(2.3914)	Yes	539	0.492
(2)			Low	2.5068*	(1.8581)	Yes	539	0.629
(3)	Target CAR (-2,+2) in %	0.017**	High	13.5844***	(2.8260)	Yes	286	0.756
(4)			Low	9.2882*	(1.6859)	Yes	286	0.873
(5)	Combined CAR (-2,+2) in %	0.003***	High	14.1547**	(2.2468)	Yes	272	0.747
(6)			Low	8.6661	(1.5544)	Yes	272	0.881
Total Loans								
(7)	Target Percentage Change of Total Loans	0.865	High	3.2694	(0.3003)	Yes	269	0.655
(8)			Low	3.3268	(0.2292)	Yes	269	0.467
(9)	Acquirer + Target Percentage Change of Total Loans	0.233	High	-0.0741	(-0.5297)	Yes	481	0.791
(10)			Low	0.0286	(0.1237)	Yes	481	0.801
Profitability								
(11)	Target Change of ROA	0.038**	High	0.0074**	(2.5451)	Yes	206	0.857
(12)			Low	0.0011	(1.4528)	Yes	206	0.941
(13)	Acquirer + Target Change of ROA	0.116	High	0.0052*	(1.9461)	Yes	492	0.885
(14)			Low	0.0035**	(2.2685)	Yes	492	0.876
Employment Cost								
(15)	Target Change of log(Total Salary)	0.018**	High	-0.8066**	(-2.2481)	Yes	250	0.679
(16)			Low	-0.3339*	(-1.8648)	Yes	250	0.897
(17)	Target Change of log(Employee Number)	0.038**	High	-0.1786*	(-1.7330)	Yes	250	0.794
(18)			Low	-0.0525	(-1.4565)	Yes	250	0.872
(19)	Acquirer + Target Change of log(Total Salary)	0.108	High	-0.1773***	(-2.7501)	Yes	333	0.768
(20)			Low	-0.1166*	(-1.6864)	Yes	333	0.877
(21)	Acquirer + Target Change of log(Employee Number)	0.084*	High	-0.1704**	(-2.3272)	Yes	333	0.748
(22)			Low	-0.0448**	(-2.1610)	Yes	333	0.828
Number of Branches								
(23)	Target Post-merger growth of bank branches	0.033**	High	-0.1373**	(-2.4754)	Yes	521	0.448
(24)			Low	-0.1081*	(-1.8626)	Yes	521	0.557
(25)	Acquirer + Target Post-merger growth of bank branches	0.034**	High	-0.1345***	(-2.8902)	Yes	752	0.520
(26)			Low	-0.1008**	(-2.3124)	Yes	752	0.660
Market Power								
(27)	Target Change of Net Interest Margin	0.290	High	0.0198**	(2.4951)	Yes	245	0.720
(28)			Low	0.0106**	(2.0158)	Yes	245	0.996
(29)	Target Change of Interest Income Ratio	0.094	High	0.0171**	(2.2445)	Yes	245	0.737
(30)			Low	0.0195**	(2.3742)	Yes	245	0.996
(31)	Acquirer + Target Change of Net Interest Margin	0.315	High	0.0115**	(2.0807)	Yes	248	0.869
(32)			Low	0.0071*	(1.7745)	Yes	248	0.948
(33)	Acquirer + Target Change of Interest Income Ratio	0.323	High	0.0159***	(2.7197)	Yes	248	0.904
(34)			Low	0.0164**	(2.2796)	Yes	248	0.979
Loan Quality								
(35)	Target Change of Insider Loan Ratio	0.208	High	-0.0067**	(-2.2617)	Yes	216	0.791
(36)			Low	-0.0060**	(-2.3484)	Yes	216	0.906
(37)	Target Change of Net Charge-off Ratio	0.382	High	-0.0023	(-1.5506)	Yes	240	0.902
(38)			Low	-0.0017**	(-2.1781)	Yes	240	0.870
(39)	Acquirer + Target Change of Insider Loan Ratio	0.312	High	-0.0114**	(-2.0310)	Yes	309	0.772
(40)			Low	-0.0128*	(-1.9235)	Yes	309	0.830
(41)	Acquirer + Target Change of Net Charge-off Ratio	0.369	High	-0.0043**	(-2.1196)	Yes	290	0.826
(42)			Low	-0.0012**	(-2.4381)	Yes	290	0.894
Executive Turnover								
(43)	Proportion of Target Banks' Board Directors	0.085*	High	0.7635**	(2.3308)	Yes	183	0.914
(44)	Being Replaced in One Year After Acquisition		Low	0.1391	(1.0581)	Yes	183	0.955
(45)	Proportion of Target Banks' Executives Being	0.076*	High	0.8043*	(1.8887)	Yes	172	0.910
(46)	Replaced in One Year After Acquisition		Low	0.1644	(1.0200)	Yes	172	0.957