The Importance of Brick-and-Mortar Bank Office for Lending? Evidence from Small Business and Home Mortgage Lending, 1999-2015 *

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Abstract

This paper studies the effect of bank branch closures on local lending in the Digital Ages. I use the mergers between big banks as an exogenous shock to create a quasi-random experiment. Combining the difference-in-differences and the instrumental variable methods, I find that the closure of each physical branch causes a 20% decrease in the total number and the volume of small business lending, even in the areas with sufficient alternative local branches. It indicates that relationship lending plays an important role in small business loaning due to the informational asymmetries in assessing the creditworthiness of local small firms and the difficulties in translating the soft information into hard information.

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1 Introduction

During the Great Recession, a total loss of 7, 689 bank branches occurred (see Figure 1).[1] A well developed banking network eases access to credit, which benefits the local economy by eliminating poverty and activating the labor markets (Becker 2007; Peek and Rosengren 2000; Ashcraft 2005; Burgess and Pande 2005; Bruhn and Love 2014). However, the innovations in monitoring products, such as credit scoring, and the development of secondary market eased lending from long distance (Berger 2003; Petersen and Rajan 2002). Although the traditional banking networks are still important in a bank's credit allocation decisions (Gilje, Loutskina, and Strahan 2016), whether physical branches are necessary for local communities in access to credit in the Digital Age remains unclear.

Previous studies propose two major functions of physical bank branches in local lending: (1) reducing informational asymmetries through relationship lending; and (2) providing geographic proximity between lenders and borrowers. The presence of physical bank branches smooths the informational friction between lenders and borrowers through relationship lending (Hauswald and Marquez 2006; Petersen and Rajan 1994; Nguyen 2015; Stein 2002; Stiglitz and Weiss 1981; Ergungor 2010). By maintaining long term relationships with local firms, lenders who have offices in the neighborhoods are able to collect soft information from nearby small businesses and use the informational advances in assessing borrower's creditworthiness and risk control (Petersen and Rajan 1994; DeYoung, Glennon, and Nigro 2008; Agarwal and Hauswald 2010). For borrowers, the visits to local branches provide them an opportunity of face-to-face interactions which are essential in building the trust between borrowers and their financial institutions. Geographic distance between lenders and borrowers, another possible obstacle in lending, raises costs in information collection for banks and increases the opportunity costs for borrowers to negotiate for the best offers (Brevoort and

[1] According to the Federal Deposit Insurance Corporation (FDIC) Summary of Deposits (SOD), a total loss of 7, 689 bank branches occurred from 2009 to 2016.

Wolken 2009; Sussman and Zeira 1995).

The wide use of hard information such as the borrower's credit history, reduces informational asymmetries and allows for long-distance small business lending (Petersen and Rajan 2002; Frame, Srinivasan, and Woosley 2001; Berger 2003). The improvements in lending technologies raise the question of whether it is necessary for banks to keep all brick-and-mortar offices.

To answer this question, I examine the massive closures of bank branches occurred in the past decade. While the literature provides many useful insights into the possible impact of changes in banking networks on local lending (Strahan and Weston 1996; Peek and Rosengren 1998; Berger, Saunders, Scalise, and Udell 1998; Brevoort and Wolken 2009; Ergungor 2010; Nguyen 2015), most of the studies focus on the effects of the shifts in the market structure of the banking sector or emphasize the importance of banking accessibility. This study addresses the changes of banking networks at branch level by examining the effect of the shuttering of physical branches. I find that the branch closures have a negative effect on local small business lending in the surrounding neighborhoods, even for the areas with sufficient alternative branches. The finding suggests that soft information still plays an important role in local lending.

This paper extends the literature by examining the role of physical branches in the areas with sufficient alternative credit accessibilities. It indicates the importance of relationship lending in small business loaning and suggests that the informational asymmetries exaggerate the costs of switching financial institutions for small business owners since the soft information stored in the previous borrower-lender relationships could not be properly translated into hard information which could be assessed by the potential alternative lenders.

One major challenge in identifying the effect of branch closures on local lending is

the endogeneity problem: banks tend to close branches in the areas with lower lending activities due to profitability concerns. To create an exogenous variation in branch closures, I follow Nguyen (2015) and use the mergers between big banks as an instrument for the incidence of local branch closures. This assumes that the mergers between big banks, who run business nationwide, are not driven by the local economic conditions in one small area. More specifically, in the areas where both parties of the merger have physical branches, the post merger consolidations and closures of redundant offices are mainly the consequence of cost savings and in pursuit of operational efficiency, instead of profitability concerns. Therefore, by limiting the sample to all county subdivision areas where (1) at least two big banks have offices, and (2) at least one tract exposed to branches from both banks of merger, the qualified mergers become a valid instrument for branch closures because they are not driven by local lending activities but related to branch closures.

Using the mergers as a quasi-random shock on the local bank branching networks, I combine the difference-in-differences and instrumental variable methods to identify the effect of branch closures on local lending. This specification could be considered as a quasi-random experiment as long as (1) all tracts in the sample are homogeneous, and (2) the occurrence of the mergers are not based on local economic conditions. Therefore, the comparisons are between the tracts exposed to merger-induced overlapping branches, which belong to both sides of the qualified mergers, and the tracts exposed to overlapping branches of another two big banks. To save notation, I refer to the former ones as merger-exposed tracts and the latter ones as control tracts.

Hence, the core of this specification lies in definition of "exposure" and "overlapping." I define both of the two concepts based on the geographic proximity instead of the arbitrary census boundary to better fit the purpose of the study. This study focuses on the neighborhoods with sufficient access to banking locally, while most qualified ones are located in

urban areas. Unlike other geographic concepts defined by spatial sizes, the units of study, Census Tracts, are the county subdivision areas defined by the population size, while the spatial dimension of them varies with the density of inhabitants. In urban areas, the size of Census Tracts are often below a half square mile. In these small areas, borrowers' branch choices are not limited by the arbitrary geographic boundaries since two adjacent branches are often arbitrarily separated into two census tracts. Moreover, as shown in Figure A1, big banks tend to allocate their branches along the borders of tracts, such that the merger-induced overlapping branches, like the circled pair in the figure, are commonly belonging to two different tracts. Therefore, I refer to the overlapping branches as the pairs of branches with geographic distance below one mile, regardless of their official census tract designation. Accordingly, "exposure" means that the tracts are within a certain radius from a pair of overlapping branches.[2] Under this specifications, mergers are still independent from local characteristics and related to post-merger branch closures.

I find that branch closures have a negative effect on small business lending, even in the areas with sufficient alternative branches after merger. With one additional branch closure, the total number of small business originations declines by 20%. The negative effect is as strong in the areas with sufficient alternative branches. It suggests that local small business lending still benefits from relationship lending in the Digital Ages. More specifically, the hard information provided by the development of lending technology has not fully captured the borrower-related soft information collected through long term lender-borrower relationships for small business lending.

This paper provides several implications for the innovation of credit scoring methods and the financial regulations. While the redlining and banking deserts issues have drawn the attention from the policymakers, the determinants of local credit supply is more than the accessibility of local branches. The soft information collected through relationships contains

[2]See Apendix A for more discussions on the definition of radius

messages beyond the public accessible knowledges, and should be translated and considered in assessing the creditworthiness of small businesses.

The paper proceeds as follows. In Section 2, I provide the details on the identification strategy. Section 3 lists data and variable definitions. Section 4 discusses the results, and Section 5 concludes the paper.

2 Identification Strategy

In this section, I present the baseline model to examine the impact of branch closures on local lending. After discussing the potential endogeneity problem in the baseline model, I propose a quasi-random experiment as the solution.

The study is conducted at Census Tract by year level. To identify the relationships between branch closures and local lending activities, I begin with the baseline model:

$$Y_{it} = \alpha_i + \gamma_t + \beta Close_{it} + X'_{it}\delta_t + \epsilon_{it} \tag{1}$$

where the observation of analysis varies by Census Tract i and year t; Y_{it} is the total number or volume of the mortgage or small business loan originations; α_i is the tract fixed effects; γ_t is the year fixed effects; $Close_{it}$ is the total number of closed branches; and X_{it} is the tract level demographic and local economic characteristics.[3]

The baseline model violates the exogeneity assumption: banks tend to close more branches in the neighborhoods where fewer loans are originated. To address this issue, I follow the work of Nguyen (2015) and create a quasi-random experiment. I use the mergers

[3]I allow δ_t to vary by time since the tract level demographic data are not fully time-variant. The tract level demographic data are from the U.S. decennial Census 1990, 2000, and 2010

between big banks as exogenous shocks on the local banking networks and examine the effects of the post-merger branch closures on local lending. I improve the design of the experiment to better fit the study of areas with sufficient branches.

The key of this design requires the exogenous shock, the qualified mergers, to: (1) hit the merger-exposed tracts instead of the control tracts randomly, and (2) cause more branch closures in the merger-exposed tracts. Therefore, as a plausible exogenous shock, a qualified merger needs to satisfy the following requirements: (1) Random or Exogenous: the merger-exposed tracts show no significant differences in the pre-merger economic activities or demographic characteristics from the control tracts; (2) Relative: the merger-exposed tracts experience more closures than their control group counterparts in the post-merger years.

The above requirements could be met by setting restrictions on the mergers and by choosing homogeneous control tracts for each set of merger-exposed tracts. I limit the mergers to the ones that: (1) occur between two big banks that have more than $10 billion assets in the pre-merger year; (2) proceed without financial assistance from the FDIC; and (3) have overlapping branches from both banks of the merger.

The restrictions (1) and (2) limit the mergers to the ones that are locally "random," ones that are not driven by local lending activities. Usually, mergers do not randomly occur- they happen for certain reasons: expanding business to new markets, extending business functions, or cost-saving (Kowalik, Davig, Morris, and Regehr 2015). However, for the mergers between two big banks which have branches nationwide, local economic activities of one particular tract or county should not be the major concern. Furthermore, to avoid possible connections between the mergers and local economic conditions, I drop the mergers with financial assistance from the FDIC, since such mergers are usually related to bank failures or unsuccessful business operations in one or more local areas. I leave the mergers occurred during the Great Recession in the sample as long as they did not require the FDIC

assistance. These crisis mergers are not the results of the economic conditions in one location, but take place because of the national downward trend. To examine the effect of branch closures on local lending for the years after the recession, I include the post-recession mergers in the sample.[4]

Restriction (3) ensures that the mergers are related to branch closures. Occurrences of branch closures are not necessary after the merger of two banks. One exception is that the post-merger consolidations could cause the shuttering of overlapping branches-the adjacent offices from both banks of the merger. For banks seeking cost effectiveness, these pairs of overlapping branches become redundant after merger; hence, such branches face higher risks of closure due to cost-saving concerns.

The core of this specification lies in the definition of overlapping. I define it based on the geographic proximity rather than the arbitrary census boundary.[5] Given that this study is conducted in the areas with sufficient local branches, most tracts in the sample are located in urban areas. As the unit of observation in this study,[6] Census Tracts are small county subdivision areas that are defined based on the population size. The spatial dimension of Census Tracts varies with the density of inhabitants. Hence, in urban areas, the geographic sizes of census tracts are usually less than one square mile. As shown in the circled area of Figure A1, two adjacent branches are often separated into different tracts. To take these situations into consideration, I refers to "overlapping" as the pairs of branches with geographic distances below one mile, regardless of whether both branches are located in the same Census Tracts. This modification accommodates the study of urban tracts in a more realistic manner. Consequently, under these three restrictions, the reason of post-merger

[4] As a robustness exercise, I examine the effect of bank branch closures on local lending excluding mergers that took place during the recession and find similar results.

[5] Existing literature, such as Nguyen(2015), defines "overlapping" branches as the pairs of branches located in the same Census Tract. My definition recognizes that borrowers' branch choices are not limited by the arbitrary geographic boundaries

[6] I use Census Tracts as the unit of observation because the local lending information is aggregated at tract level. It is the smallest possible geographic concepts to study.

branch closures is limited to cost-saving.

Accordingly, I define the sample of study, the merger-exposed groups and the control groups, based on geographic proximity. For each merger, I define the merger-exposed groups as the tracts exposed to at least one pair of overlapping branches which belongs to both sides of the mergers in the pre-merger year. Similarly, I consider the control groups as the tracts that are exposed to at least one pair of overlapping branches from another two big banks in the year prior to the merger. As the key of the sample selection, I refers to "expose" as the geographic proximity between tract centers and the overlapping branches. More specifically, I define "expose" as the tracts that have tract centers within a certain distance from the overlapping branches.[7]

Moreover, for each merger, the merger-exposed tracts cluster in the counties where both sides of the mergers have overlapping branching networks. Therefore, I only consider the control tracts that are located in the same county as the merger-exposed tracts. Consequently, the only difference between the merger-exposed and the control tracts is the occurrence of "random" mergers, which cause higher chance of branch closures in the merger-exposed tracts. Hence, consider a county with four big banks: A, B, C and D. In the merger of bank A and bank B: the merger-exposed tracts are the ones exposed to overlapping branches of A and B; while the control tracts are the ones that: (1) are located in the same county; (2) are exposed to "overlapping" branches of A and C, B and C, or C and D; and (3) are not merger-exposed tracts.[8]

Under the above restrictions, the study is conducted under the fixed-effects approach:

$$Y_{it} = \alpha_i + \gamma_t + \beta Close_i \times Post_{it} + X'_{it}\delta_t + \epsilon_{it} \tag{2}$$

[7]The definition of radius and tract center will be further discussed in the Appendix A.
[8]Appendix A1 presents an example of the selection of the merger-exposed and control tracts.

where the observation of analysis varies by Census Tract i and year t; Y_{it}, α_i, γ_t and X_{it} are the same variables as in Equation 1; $Close_i$ is the indicator of post-merger branch closures, $Close_i = 1$ if any branch closed in tract i during the two years after the merger, otherwise, 0; $Post_{it} = 1$ if year t is a post-merger year for tract i, otherwise, 0.

In Equation 2, the coefficient of interest is the coefficient of the interaction term, β. It reports whether the tracts that have branch closures within two years of the merger experience a deeper decline in local lending in the post-merger years. While the post-merger closures in the merger-exposed tracts are mainly the results of the merger-induced consolidations, the branches in the control tracts could be closed for profitability concerns. Therefore, I re-estimate Equation 2 using $Expose_i \times Post_{it}$ as an instrument for $Close_i \times Post_{it}$. The reduced form regression is specified under a difference-in-differences framework:

$$Y_{it} = \alpha_i + \gamma_t + \beta Expose_i \times Post_{it} + X'_{it}\delta_t + \epsilon_{it} \tag{3}$$

where the observation of analysis varies by Census Tract i and year t; Y_{it}, α_i, γ_t and X_{it} are the same variables as in Equation 1; $Expose_i = 1$ if tract i has ever been a merger-exposed tract, otherwise, 0; $Post_{it} = 1$ if year t is a post-merger year for tract i, otherwise, 0.

In the reduced form regression, β is the coefficient of interest. It estimates whether the merger-exposed tracts experience more post-merger decreases in local lending than the control tracts. Combining DID and IV, the regression examines the effect of the merger-induced branch closures on local lending activities. Under the given restrictions, these branch closures are caused by qualified mergers and thus are exogenous from local economic conditions. For both Equation 3 and the IV regression, β are expected to be negative, i f branch closures have negative effect on local lending,

In the following sections, I discuss the data in Section 3 and present the results in Section

4.

3 Data

In this section, I explain the data structure and define the key variables. The sample is based on the Census Tracts of 293 counties, where at least one tract is exposed to the overlapping branches from both banks of the qualified mergers. The 26 qualified mergers, between 2002 and 2012, are listed in Table 1.[9] The criteria of qualified mergers and the selection of merger-exposed/control groups are further discussed in Section 2. Across all tracts in the sample, 1,412 tracts fall in the merger-exposed group while 15,471 are control tracts.

Compiling the data at Census Tract by year level, I constructed a panel for the above sample on an annual frequency from 1999 to 2015. As the unit of observation in this study, Census Tracts are defined based on the population size in a county subdivision area, while the spatial dimension of them varies with the density of inhabitants. The boundaries of Census Tracts remains stable with occasional changes only as substantial changes in population happens.

To analyze the role of bank branches in local lending, the panel includes four parts of data: Bank merger data, bank branch location data, local lending data and other tract level variables. In the remaining parts of Section 3, I discuss the sources, features, and the calculation of these data.

Bank merger data are from the Reports of Structure Changes by Federal Deposit In-

[9] As discussed in Section 2, qualified mergers are the ones that (1) occur between two big banks that have more than $10 billion assets in the pre-merger year; (2) proceed without financial assistance from the FDIC; and (3) have overlapping branches from both banks of the merger.

surance Corporation (FDIC), which list all mergers between 1999 and 2017. As the after merger economic activities data are not available beyond 2016, I limit the mergers to the ones between 2001 and 2012. To further shorten the merger list to the ones between "big" banks, I add the pre-merger bank assets data from the Call Report by FFIEC. In this paper, I use $10 billion as the asset threshold for "big" banks. Any mergers of banks with smaller asset size are dropped.

Bank branch location data are from the Summary of Deposits (SOD) by FDIC. As "overlapping" is defined by geographic proximity, I geocode the physical addresses of all bank branches and calculate the distance between branches using ArcGIS software. Some of the branches are dropped from the sample during this process due to their incomplete addresses on the FDIC profile. The total number of bank branch is calculated from the same dataset, while the number of closed bank branches is calculated from FDIC Reports of Structure Changes.

I use the Census Tract level boundary files from IPUMS National Historical Geographic Information System in mapping and distance calculation. In supplementary, I use Census TIGER/Line maps for Census block group level boundary files. Both files are based on the U.S. decennial Census 1990, 2000, and 2010.

To measure local lending activities, I use the small business lending data reported under the Community Reinvestment Act (CRA) and mortgage application data reported under the Home Mortgage Disclosure Act (HMDA). Both data record the loan related activities at application level, including detailed information of the lender and borrower, geographic location of the related property/business (the Census Tract of the business or property), and other loan related characteristics. All variables are aggregated at tract level. For the measurements of local loan activities, I include the total number of loan originations and the total amount of loan originations for small business lendings and home mortgage loans.

I use the summation of small business lendings and home mortgage lendings to gauge the size of total local lending activities

Most tract level demographic data, which are relatively stable across years, are from the U.S. decennial Census 1990, 2000 and 2010. Local economic characteristics variables are updated annually: median family income information are from FFIEC Median Family Income (MFI) Report; unemployment rate data are from the Local Area Unemployment Statistics (LAUS) by the Bureau of Labor Statistics (BLS); and housing price index(HPI) data are from Federal Housing Finance Agency(FHFA). All dollar values are adjusted to 2015 U.S. dollar.

4 Results

4.1 Mergers and Pre-Merger Comparison

In this section, I discuss the qualified mergers and describe the sample. I begin with the merger list and examine the acquiring and the outgoing banks. After the discussion of the mergers, I compare the pre-merger economic conditions between the merger-exposed and the control groups and present the regression results.

Table 1 lists the twenty-six qualified mergers that (1) occur between two big banks that have more than $10 billion assets in the pre-merger year; (2) proceed without financial assistance from the FDIC; and (3) have overlapping branches from both banks of the merger. Table 2 summarizes the assets size and branch distribution of the acquiring and the outgoing banks for all listed mergers. As summarized in Panel A of Table 2, both sides of the mergers are considered "big" banks by asset size. Before the merger occurs, the median asset size of the acquiring banks is 132 billion dollars while the median outgoing banks' asset size is 32

billion dollars[10]. Panel B shows that both the acquiring and outgoing banks run businesses nationwide. A median acquiring bank has branches in 106 counties, and a typical outgoing bank owns branches in 58 counties. Therefore, as expected, the qualified mergers are between big banks, and are not likely driven by the economic conditions of one particular area.

To check the baseline balance of the sample, I compare the pre-merger demographic and economic characteristics between the merger-exposed and the control tracts in Table 3 by estimating:

$$Variable_i = \alpha + \gamma_t + \gamma_c + \beta Expose_i + \epsilon_i \tag{4}$$

where $Variable_i$ is the demographic/economic characteristics in tract i at the pre-merger year; γ_t is the year fixed effects; γ_c is the county fixed effects; $Expose_i = 1$ if tract i has ever been a merger-exposed tract, otherwise, 0.

In Equation 4, β is the coefficient of interest. It captures the differences between the merger-exposed and control groups after controlling for year fixed effect and county fixed effect. Column 1 of Table 3 provides the estimates of β, while Column 2 presents the summary statistics of the control tracts in the pre-merger year. As shown in Column 1, the merger-exposed tracts are similar to the control tracts in both demographic and economic aspects before the mergers occur. The only difference lies in the total number of bank branches, which indicates that the merger-exposed groups are more branched than the control groups.

To further examine the differences between the merger-exposed and the control groups, I re-estimate Equation 4 using the average changes and growth rates in branching networks, economic conditions and local credit supply for the two-year pre-merger period as dependent variables. Table 4 presents the comparison of the pre-trend between both groups. Column 1 shows no significant difference in the changes of local economic activities, branching networks, or local credit supply between the merger-exposed and the control tracts. Although the

[10]in 2015 dollars.

merger-exposed tracts have more branches on average, they are not more likely to experience branch closures nor losses in the total number of branches than their counterparts. More importantly, the pre-merger economic conditions are similar in local lending for both group, which confirms the assumption that the baseline sample is balanced.

4.2 Effect of Mergers on Branch Closure

This section discusses the effect of mergers on branch closures. I compare the pattern in branch closures between both sides of the mergers for the pre- and post-merger years and present the estimate results.

To examine the variations in the intensity of branch closures, I use three different measurements: the "close/no close" indicator for the shutterings of full service branches,[11] the closure ratio,[12] and the total number of closed full service branches. To observe the variations in branch networks, I estimate a year-by-year difference-in-differences model and present the results in Figure 2 as the event study plots.

$$Close_{it} = \alpha_i + \gamma_t + \sum_{n=-13}^{13} \beta_n (Treatever_i \times Time_n) + X_{it}\delta_t + \epsilon_{6it} \tag{5}$$

where $Close_{it}$ refers to the three measures for branch closures; $Time_n = 1$ if year t is n years from merger, otherwise, 0.

In Equation 5, β_ns are the coefficients of interest. β_ns should not be significantly different from zero in pre-merger years, if the merger-exposed groups are not more likely to be exposed to branch closures than the control groups; while β_ns are expected to be positive in the post-merger years, if mergers cause more branch closures.

[11] Based on FDIC, "Full service branches" refer to "Full service brick and mortar office" and "Full service retail offce". $Indicator = 1$ if tract i is exposed to one or more closures of full-service branch in year t.

[12] $Close\ Ratio = \frac{\#\ of\ Closed\ Full\ Service\ Branches}{\#\ of\ Total\ Branches} \times 100\%$

Figure 2 presents the plot of coefficient β_n's 95% confidence interval for the 12-year period around merger.[13] β_ns represent the difference in branch closures between the merger-exposed and control groups n years since merger.The upper panel presents the results using the branch closures indicator as the dependent variable; the middle panel plots the estimates using the branch closure ratio as the dependent variable; and the lower panel is the result of using the total number of closed branches as the dependent variable.

Figure 2 shows clear patterns of positive changes in branch closures for the merger-exposed tracts comparing to the control ones. All three measures yield similar results: the merger-exposed groups are no more likely to experience branch closures in the years before mergers, while branch closures occur more often in the merger-exposed areas as the merger becomes effective (from year $t = 0$). The effect lasts for two years before disappearing. Over the two years after the merger, the merger-exposed tracts experience approximately one more branch closure than their control counterparts.

4.3 Effect of Branch Closure on Local Lending Activities

As shown in Section 4.2, mergers cause more branch closures in the merger-exposed tracts. In this section, I will examine whether areas exposed to more branch closures will have a decline in local lending. To observe the effect of branch closures, I begin with comparing the trend in local lending between the merger-exposed and control tracts.

This study focuses on two types of local lending: small business loans which rely more heavily on lender-borrower relationships and home mortgage loans which have a well developed secondary market and depend less on soft information. I use two sets of variables to measure the size of the loans in one neighborhood: the total number of loan originations and

[13] All β_ns are comparable to the β_n of pre-merger year, β_0, which is omitted from the regression. The sample is balanced from $t = -2$ to $t = 4$.

the total volume of loans. To examine the variations in local lending, I estimate Equation 5 using the measures of loans as the dependent variables and plot the results in Figure 3 and 4.

Figure 3 shows the differences in the total number of loan originations between the merger-exposed and control tracts for the 14-year period around the merger. It displays a decline pattern in small business lending as the mergers occur in the merger-exposed tracts, while home mortgage loans are not much affected. Figure 4 shows similar patterns for the volume of loan originations. The decline trend indicates that the merger-exposed tracts start to have less small business loan originations than the control tracts since the mergers affect the market; and the gap between the two groups keeps increasing until six years after the occurrence of the mergers. The decreases in local lending coincide with the increases in the number of closed branches which suggests a negative relationship between branch closures and small business loans.

To understand whether the decrease in lending is caused by branch closures, I estimate Equation 2 and present the coefficient of interest β in Table 6.

The top panel of Table 6 provides the results of the basic model which does not control for tract level characteristics. The bottom panel of Table 6 lists the results after controlling for the tract level characteristics: Columns 1 and 3 present the effect of branch closures on the number of loan originations, while Columns 2 and 4 list the impact on the volume of loans.[14]

To further eliminate the potential endogeneity problem, I use the exposure to mergers as an instrument of branch closures and estimate the reduced form regression as shown in Equation 3. The results are presented in Table 7.

[14]All dollar values are in 2016 dollars. Unit of measurement is thousands of U.S. Dollars.

The internal validity of the Difference-in-Difference estimation is based on the assumption of "parallel" trend. The merger-exposed and the control tracts should have similar or parallel trends in branch networks, local lending and other economic conditions in the pre-merger years. To take the potential violation of the parallel trend assumption into consideration, I control for the county-specific time trend.

$$Y_{it} = \alpha_i + \gamma_t + \theta D_{ce} \times Trend_{it} + \beta Expose_i \times Post_{it} + X'_{it}\delta_t + \epsilon_{it} \tag{6}$$

where the observation of analysis varies by Census Tract i and year t; Y_{it}, α_i, γ_t, $Post_{it}$, $Expose_i$ and X_{it} are the same as in Equation 3; $Trend_{it}$ is a continuous variable that counts the number of years from the merger; D_{ce} is the county by group dummies, in each county, D_{ce} has two values, one for the merger-exposed group and the other for the control group.

The results are presented in Table 8. By controlling for potential county-by-group specific time trend, parallel trend assumption is not strictly required. As shown in Panel B, The results of the difference-in-differences estimate shows a negative relationship between branch closures and local lending for both small business but the mergers did not equally affect home mortgage loans.

Ultimately, combining the DID with IV, I re-estimate Equations 2 and 6 using $Treat_i \times Post_{it}$ as an instrument for $Close_{it} \times Post_{it}$. I present the results of the two-stage IV estimations in Table 9. Given that the mergers between big banks cause approximately one additional branch closure, for each branch closure, the total number of small business loan originations declines by 26, which is approximately 20% of the total originations for an average control tract in the merger effective year. Similarly, the volume of small business lending decreases by 20% after each branch closure. However, the home mortgage lending is not much affected. The results are consistent with Nguyen(2015)'s findings.

A potential explanation for the different results in small business lending and home mortgage lending is that the former one relies more on relationship lending than the latter one. To further explore the impact of branch closures on local lending, I perform a robustness check on a sub-sample and present the results in the following section.

4.4 Robustness

In this section, I examine the effect of branch closures on local lending in the neighborhoods without significant loss in banking accessibilities. I limit the samples to the tracts that have at least two full-service branches in the post-merger years. Therefore, after the merger occurred, small business owners still have sufficient access to banking locally.

I re-estimate Equation 2, 3 and 6, and present the results in Table 10 through Table 13. The tables show similar results as using the full sample. As shown in Table 13, both the total number and the volume of small business loan originations decline by approximately 20% in the post merger years.

This section provides the evidence based on the over-branched areas where sufficient alternative branches are available after the branch closures. It indicates that accessibility to physical branches is not the only determinant factor in small business lending. Soft information, collected through the long-term borrower-lender relationships, plays a more important role for small business owners to get funded. A plausible explanation is that the informational asymmetries in small business lending exaggerate the costs of switching financial institutions since the soft information stored in the previous borrower-lender relationships could not be properly translated into hard information which could be assessed by the potential alternative lenders.

5 Conclusion

This study finds a negative effect of branch closures on small business lending in the Digital Ages. I use mergers between big banks to create exogenous variations in branch closures and examine the effects on local lending. For each branch closure, small business loaning declines by 20% in the surrounding areas, regardless of whether the closed branch is located in the same Census Tract. The results hold for the areas with sufficient alternative sources of banking locally.

This paper suggests that improvements in technology and credit score models have not provided enough hard information to replace the soft information in local lending, especially for the loans which rely on lender-borrower relationships.

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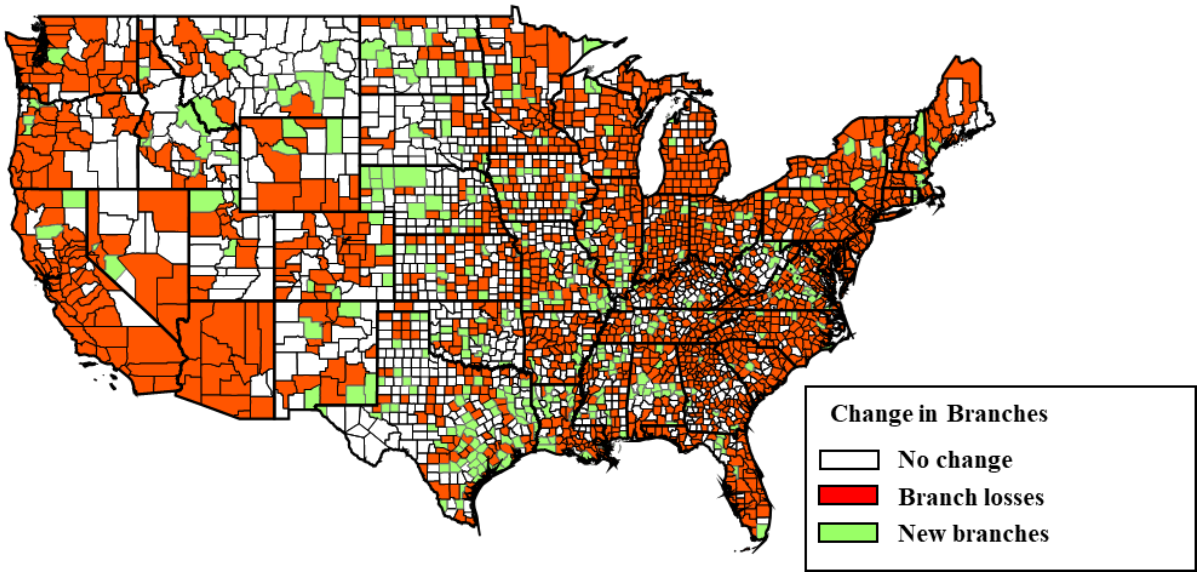
Figure 1: Branch Gain/Loss in U.S. Counties (2009-2016)



Source: FDIC SOD.

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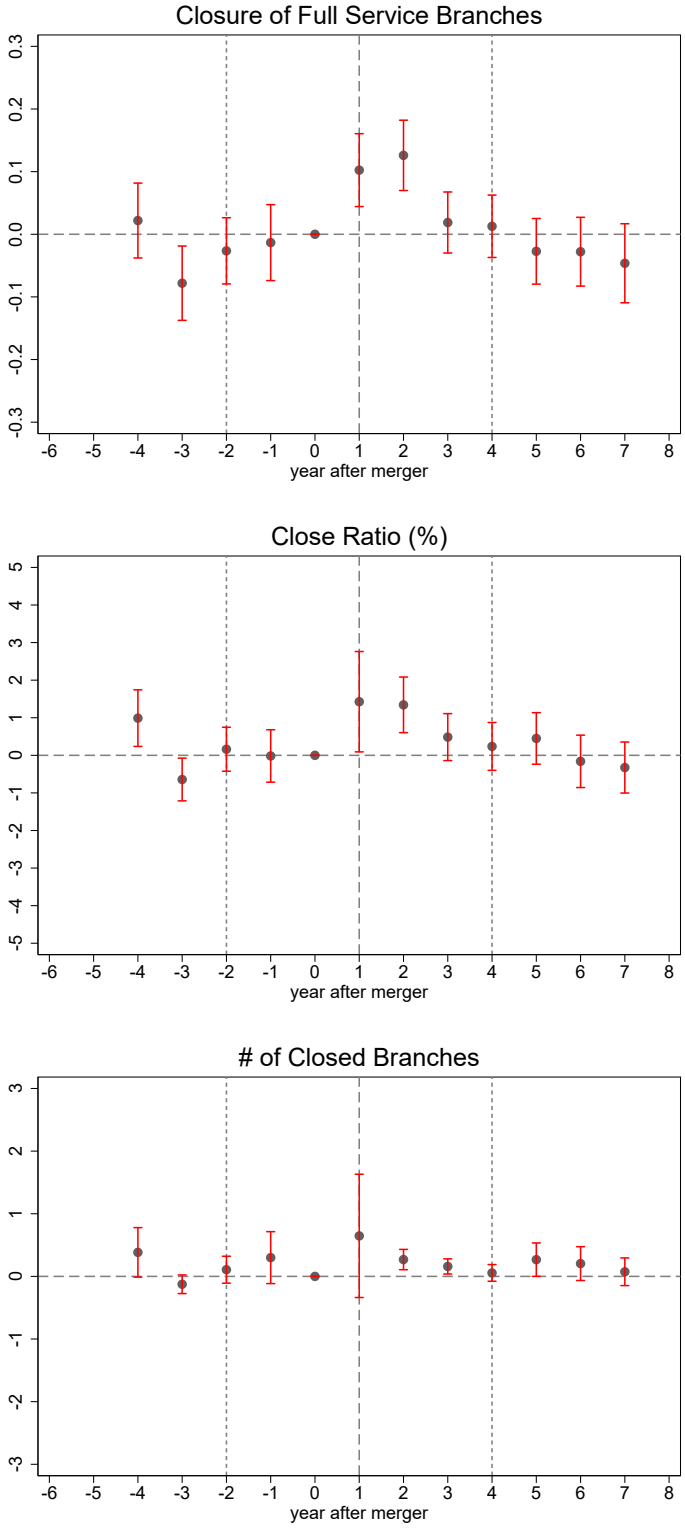
Table 1: Qualified Merger List

Year*	Acquiring Institution	Outgoing Institution
2002	Bank of the West	United California Bank
2002	Firstar Bank	U.S. Bank National Association
2002	Citibank	European American Bank
2002	Michigan National Bank	Standard Federal Bank
2002	First Union National Bank	Wachovia Bank
2003	Manufacturers & Traders Trust Co.	Allfirst Bank
2003	Bank One	Amer. Nat. B&T Co. of Chicago
2005	SunTrust Bank	National Bank of Commerce
2005	Bank of America	Fleet National Bank
2005	National City Bank	The Provident Bank
2005	Regions Bank	Union Planters Bank
2005	North Fork Bank	Greenpoint Bank
2005	Chase Manhattan Bank	Bank One
2005	Wachovia Bank	SouthTrust Bank
2006	TD Bank	Hudson United Bank
2007	Regions Bank	AmSouth Bank
2008	Bank of America	United States Trust Company
2008	The Huntington National Bank	Sky Bank
2008	TD Bank	Commerce Bank
2010	Bank of America	Merrill Lynch
2010	Wells Fargo Bank	Wachovia Bank
2010	Capital One	Chevy Chase Bank
2010	PNC Bank	National City Bank
2011	TD Bank	Carolina First Bank
2012	PNC Bank	RBC Bank (USA)
2012	Harris National Association	M&I Marshall & Ilsley Bank

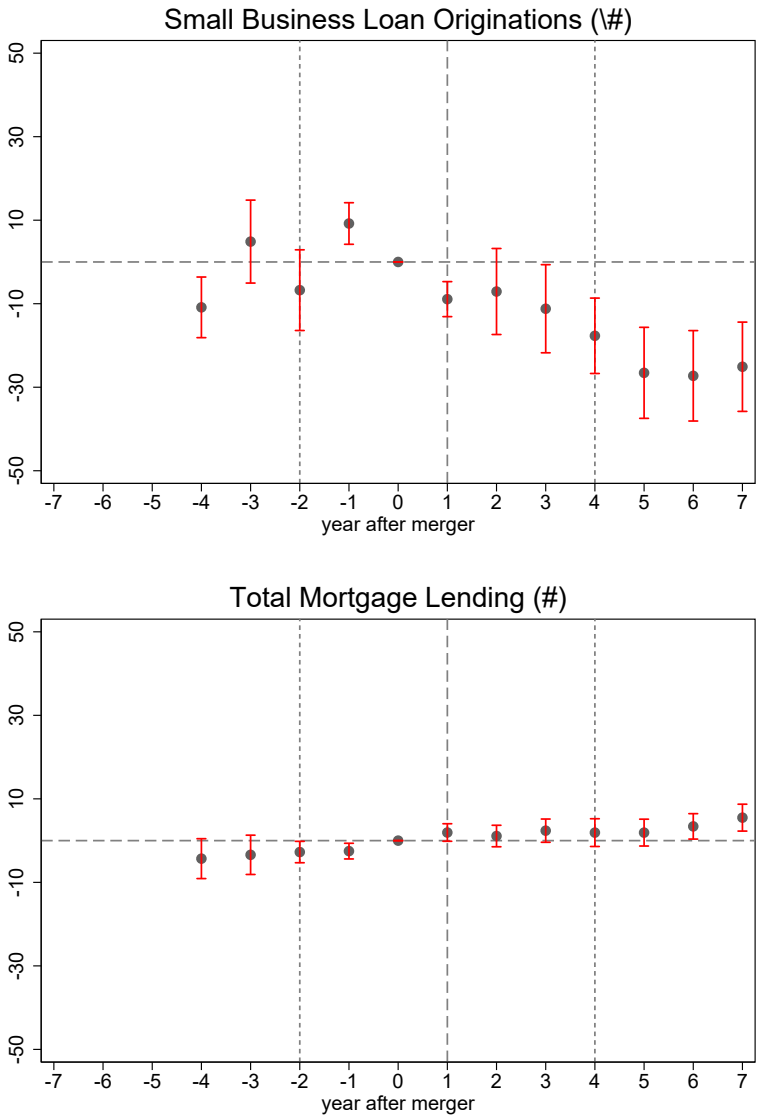
Source: FDIC. This table lists the qualified mergers and their effective year. See Section 4 for details about the qualifications. *Year indicates the effective year of the merger.

Figure 2: Merger and Branking Network



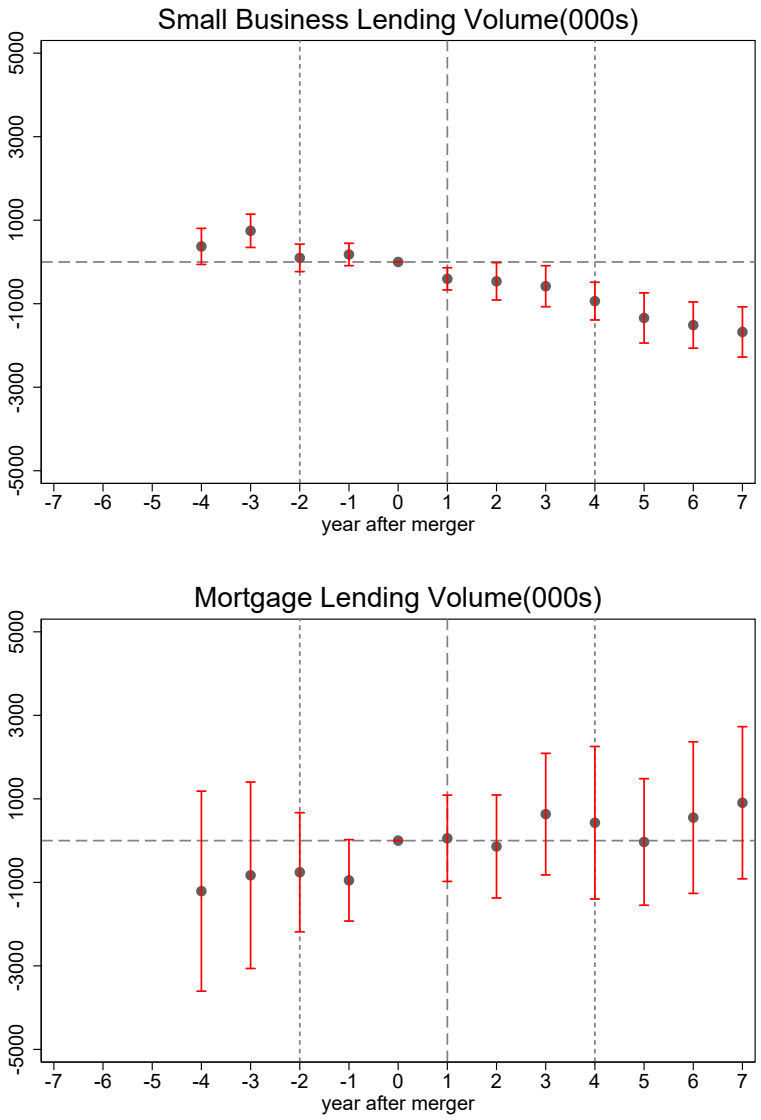
Source: FDIC. All specifications include the full set of year fixed effects, tract fixed effects and tract level characteristics, including: population, housing price index, unemployment rate, median rent, median house value, minority fraction, median family income. All demographic variables are calculated based on Census 1990, 2000, and 2010. All median income, HPI and unemployment variables are the values in year t.

Figure 3: Merger and Local Lending Activities



Source: FFIEC CRA and HMDA. All specifications include the full set of year fixed effects, tract fixed effects and tract level characteristics, including: population, housing price index, unemployment rate, median rent, median house value, minority fraction, median family income. All demographic variables are calculated based on Census 1990, 2000, and 2010. All median income, HPI and unemployment variables are the values in year t. .

Figure 4: Merger and Local Lending Activities



Source: FFIEC CRA and HMDA. All specifications include the full set of year fixed effects, tract fixed effects and tract level characteristics, including: population, housing price index, unemployment rate, median rent, median house value, minority fraction, median family income. All demographic variables are calculated based on Census 1990, 2000, and 2010. All median income, HPI and unemployment variables are the values in year t.

Table 2: Qualified Merger List

	Acquiring Institution	Outgoing Institution
	Panel A. Pre-Merger Assets (Billion 2015 Dollars)	
Median	132	32
Min	17	11
Max	1,620	626
	Panel B. Pre-Merger Total Number of Branched Counties	
Median	106	58
Min	18	6
Max	727	454
Obs.	26	26

Source: FDIC. This table provides the summary statistics of the acquiring banks and the outgoing banks for the qualified mergers. See Section 4 for details about the qualifications.

Table 3: Summary Statistis for Treatment and Control Tracts

	Treat-Control	Control Mean
Total Population	-123.3	4241.1
	(88.04)	
Minority(%)	-1.445	36.63
	(1.177)	
Tract/MSA Median Income (%)	0.868	102.4
	(2.020)	
MSA Median Income (000s)	-0.183	79.80
	(0.206)	
Median Rent (000s)	0.00631	1.056
	(0.0140)	
Housing Price Index	67.68	2346.9
	(57.74)	
Total Number of Branches	11.84***	10.71
	(2.346)	
N	1,412	15,471
SE Clustered at County Level:	Yes	

Source: FFIEC and Census 2000. All demographic variables are calculated based on Census 1990, 2000, and 2010. Median income and HPI are the values of pre-merger year. All dollar values are adjusted to 2015 U.S. dollars.

Table 4: Pre-Merger Trend: Treatment and Control Tracts

	Treat-Control	Control Mean
Change in County Unemployment Rate(%)	-0.0204	0.781
	(0.0227)	
Growth in Total Number of Branches(%)	-7.327	6.477
	(6.518)	
Change in Total Branch Closures(#)	-0.0389	0.0221
	(0.226)	
Growth in Total SML Originations(%)	-0.199	14.38
	(1.035)	
Growth in Total Mortgage Originations(%)	34.06	3.101
	(24.52)	
Growth in Housing Price Index(%)	0.0410	2.015
	(0.229)	
N	1,412	15,471
SE Clustered at County Level:	Yes	

Source: FFIEC, FDIC and FHFA. All variables are the average growth rates/change over the three years before merger.

Table 5: The Effects of Branches Closures on Local Lending: Baseline

	(1)	(2)	(3)	(4)
	Small Business Loan		Home Mortgage Lending	
	Originations(#)	Dollar(000s)	Originations(#)	Dollar(000s)
β	–0.25	47.97***	0.22	–130.36
	(0.40)	(18.06)	(0.28)	(85.96)
Adj. R squared	0.32	0.12	0.23	0.16
Observations	286,177	286,177	286,177	286,177
Merger Year Control Mean	112.83	4,654.40	182.19	21,545.77

Sources: FFIEC CRA, HMDA; FHFA; FDIC; and Census. All regression are based on the full sample of the study. All specifications include the full set of year fixed effects, tract fixed effects and tract level characteristics, including: population, housing price index, unemployment rate, median rent, median house value, minority fraction, median family income. All demographic variables are calculated based on Census 1990, 2000, and 2010. All median income, HPI and unemployment variables are the values in year t. Meger Year Control Mean is the mean value of the control groups at the merger effective year. Standard errors are clustered at tract level and are in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table 6: The Effects of Branches Closures on Local Lending: Fixed Effects Model

	(1)	(2)	(3)	(4)
	Small Business Loan		Home Mortgage Lending	
	Originations(#)	Dollar(000s)	Originations(#)	Dollar(000s)
	Panel A. Basic Model			
β	–8.27***	–553.20***	1.16	296.78
	(1.25)	(58.43)	(0.73)	(220.03)
Adj. R squared	0.30	0.12	0.19	0.14
Observations	286,177	286,177	286,177	286,177
	Panel B. Adding Tract Level Characteristics			
β	–6.89***	–517.69***	0.80	404.28**
	(1.21)	(57.62)	(0.66)	(205.46)
Adj. R squared	0.32	0.13	0.23	0.16
Observations	286,177	286,177	286,177	286,177
Merger Year Control Mean	112.83	4,654.40	182.19	21,545.77

Sources: FFIEC CRA, HMDA; FHFA; FDIC; and Census. All regression are based on the full sample of the study. All specifications include the full set of year fixed effects and tract fixed effects. In addition, bottom panel are controlled for tract level characteristics, including: population, housing price index, unemployment rate, median rent, median house value, minority fraction, median family income. All demographic variables are calculated based on Census 1990, 2000, and 2010. All median income, HPI and unemployment variables are the values in year t. Meger Year Control Mean is the mean value of the control groups at the merger effective year. Standard errors are clustered at tract level and are in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table 7: The Effects of Branches Closures on Local Lending: Difference-in-Differences

	(1)	(2)	(3)	(4)
	Small Business Loan		Home Mortgage Lending	
	Originations(#)	Dollar(000s)	Originations(#)	Dollar(000s)
	Panel A. Basic Model			
β	–16.32***	–1668.25***	6.72***	1390.93***
	(2.67)	(172.02)	(1.19)	(351.35)
Adj. R squared	0.30	0.12	0.19	0.14
Observations	286,177	286,177	286,177	286,177
	Panel B. Adding Tract Level Characteristics			
β	–14.75***	–1608.57***	6.26***	1685.06***
	(2.66)	(170.53)	(1.07)	(334.18)
Adj. R squared	0.32	0.13	0.23	0.16
Observations	286,177	286,177	286,177	286,177
Merger Year Control Mean	112.83	4,654.40	182.19	21,545.77

Sources: FFIEC CRA, HMDA; FHFA; FDIC; and Census. All regression are based on the full sample of the study. All specifications include the full set of year fixed effects and tract fixed effects. In addition, bottom panel are controlled for tract level characteristics, including: population, housing price index, unemployment rate, median rent, median house value, minority fraction, median family income. All demographic variables are calculated based on Census 1990, 2000, and 2010. All median income, HPI and unemployment variables are the values in year t. Meger Year Control Mean is the mean value of the control groups at the merger effective year. Standard errors are clustered at tract level and are in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table 8: The Effects of Branches Closures on Local Lending: Difference-in-Differences with County-by-Group Specific Trends

	(1)	(2)	(3)	(4)
	Small Business Loan		Home Mortgage Lending	
	Originations(#)	Dollar(000s)	Originations(#)	Dollar(000s)
	Panel A. Basic Model			
β	–20.61***	–640.38***	3.38*	42.50
	(5.40)	(193.36)	(1.92)	(655.93)
Adj. R squared	0.31	0.16	0.23	0.16
Observations	286,177	286,177	286,177	286,177
	Panel B. Adding Tract Level Characteristics			
β	–16.70***	–546.31***	3.56*	1206.62*
	(5.28)	(192.22)	(1.89)	(640.44)
Adj. R squared	0.33	0.16	0.25	0.19
Observations	286,177	286,177	286,177	286,177
Merger Year Control Mean	112.83	4,654.40	182.19	21,545.77

Sources: FFIEC CRA, HMDA; FHFA; FDIC; and Census. All regression are based on the full sample of the study. All specifications include the full set of year fixed effects, tract fixed effects and a county-by-group specific time trend. In addition, bottom panel are controlled for tract level characteristics, including: population, housing price index, unemployment rate, median rent, median house value, minority fraction, median family income. All demographic variables are calculated based on Census 1990, 2000, and 2010. All median income, HPI and unemployment variables are the values in year t. Meger Year Control Mean is the mean value of the control groups at the merger effective year. Standard errors are clustered at tract level and are in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table 9: The Effects of Branches Closures on Local Lending: Instrumental Variable

	(1)	(2)	(3)	(4)
	Small Business Loan		Home Mortgage Lending	
	Originations(#)	Dollar(000s)	Originations(#)	Dollar(000s)
	Panel A. Basic Model			
β	–34.06***	–3713.59***	14.45***	3890.16***
	(6.25)	(401.29)	(2.52)	(786.68)
First-Stage F-statistics	4755.13			
Prob> F	0.0000			
Observations	286,177	286,177	286,177	286,177
	Panel B. Adding County-by-Group Specific Trend			
β	–25.94***	–848.62***	5.54*	1874.33*
	(8.21)	(298.60)	(2.94)	(997.08)
First-Stage F-statistics	280.40			
Prob>F	0.0000			
Observations	286,177	286,177	286,177	286,177
Merger Year Control Mean	112.83	4,654.40	182.19	21,545.77

Sources: FFIEC CRA, HMDA; FHFA; FDIC; and Census. All regression are based on the full sample of the study. All specifications include the full set of year fixed effects, tract fixed effects and a county-by-group specific time trend. In addition, bottom panel are controlled for tract level characteristics, including: population, housing price index, unemployment rate, median rent, median house value, minority fraction, median family income. All demographic variables are calculated based on Census 1990, 2000, and 2010. All median income, HPI and unemployment variables are the values in year t. Meger Year Control Mean is the mean value of the control groups at the merger effective year. Standard errors are clustered at tract level and are in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table 10: The Effects of Branches Closures on Local Lending: Fixed Effects Model (Subsample)

	(1)	(2)	(3)	(4)
	Small Business Loan		Home Mortgage Lending	
	Originations(#)	Dollar(000s)	Originations(#)	Dollar(000s)
	Panel A. Basic Model			
β	–8.01***	–543.37***	1.11	344.78
	(1.33)	(61.89)	(0.69)	(216.27)
Adj. R squared	0.31	0.12	0.23	0.16
Observations	257,992	257,992	257,992	257,992
	Panel B. Adding Tract Level Characteristics			
β	–6.58***	–497.92***	1.31**	572.58***
	(1.29)	(61.16)	(0.61)	(198.08)
Adj. R squared	0.33	0.13	0.27	0.18
Observations	257,992	257,992	257,992	257,992
Merger Year Control Mean	112.83	4,654.40	182.19	21,545.77

Sources: FFIEC CRA, HMDA; FHFA; FDIC; and Census. All regression are based on the subsample of the study. All specifications include the full set of year fixed effects, tract fixed effects and a county-by-group specific time trend. In addition, bottom panel are controlled for tract level characteristics, including: population, housing price index, unemployment rate, median rent, median house value, minority fraction, median family income. All demographic variables are calculated based on Census 1990, 2000, and 2010. All median income, HPI and unemployment variables are the values in year t. Meger Year Control Mean is the mean value of the control groups at the merger effective year. Standard errors are clustered at tract level and are in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table 11: The Effects of Branches Closures on Local Lending: Difference-in-Differences (Subsample)

	(1)	(2)	(3)	(4)
	Small Business Loan		Home Mortgage Lending	
	Originations(#)	Dollar(000s)	Originations(#)	Dollar(000s)
	Panel A. Basic Model			
β	–15.36***	–1645.10***	5.89***	1245.21***
	(2.78)	(178.31)	(1.20)	(356.90)
Adj. R squared	0.31	0.12	0.23	0.16
Observations	257,992	257,992	257,992	257,992
	Panel B. Adding Tract Level Characteristics			
β	–13.74***	–1570.04***	6.37***	1738.30***
	(2.77)	(176.76)	(1.06)	(336.61)
Adj. R squared	0.33	0.13	0.27	0.18
Observations	257,992	257,992	257,992	257,992
Merger Year Control Mean	112.83	4,654.40	182.19	21,545.77

Sources: FFIEC CRA, HMDA; FHFA; FDIC; and Census. All regression are based on the subsample of the study. All specifications include the full set of year fixed effects and tract fixed effects . In addition, bottom panel are controlled for tract level characteristics, including: population, housing price index, unemployment rate, median rent, median house value, minority fraction, median family income. All demographic variables are calculated based on Census 1990, 2000, and 2010. All median income, HPI and unemployment variables are the values in year t. Meger Year Control Mean is the mean value of the control groups at the merger effective year. Standard errors are clustered at tract level and are in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table 12: The Effects of Branches Closures on Local Lending: Difference-in-Differences with County-by-Group Specific Trends (Subsample)

	(1)	(2)	(3)	(4)
	Small Business Loan		Home Mortgage Lending	
	Originations(#)	Dollar(000s)	Originations(#)	Dollar(000s)
	Panel A. Basic Model			
β	–21.04***	–651.63***	2.81	–90.04
	(5.64)	(202.21)	(1.97)	(678.78)
Adj. R squared	0.32	0.16	0.29	0.19
Observations	257,992	257,992	257,992	257,992
	Panel B. Adding Tract Level Characteristics			
β	–16.91***	–549.85***	2.88	1005.41
	(5.50)	(200.91)	(1.94)	(662.34)
Adj. R squared	0.34	0.16	0.31	0.22
Observations	257,992	257,992	257,992	257,992
Merger Year Control Mean	112.83	4,654.40	182.19	21,545.77

Sources: FFIEC CRA, HMDA; FHFA; FDIC; and Census. All regression are based on the subsample of the study. All specifications include the full set of year fixed effects, tract fixed effects and a county-by-group specific time trend. In addition, bottom panel are controlled for tract level characteristics, including: population, housing price index, unemployment rate, median rent, median house value, minority fraction, median family income. All demographic variables are calculated based on Census 1990, 2000, and 2010. All median income, HPI and unemployment variables are the values in year t. Meger Year Control Mean is the mean value of the control groups at the merger effective year. Standard errors are clustered at tract level and are in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table 13: The Effects of Branches Closures on Local Lending: Instrumental Variable (Subsample)

	(1)	(2)	(3)	(4)
	Small Business Loan		Home Mortgage Lending	
	Originations(#)	Dollar(000s)	Originations(#)	Dollar(000s)
	Panel A. Basic Model			
β	–31.76***	–3628.60***	14.73***	4017.48***
	(6.48)	(415.93)	(2.51)	(794.00)
First-Stage F-statistics	4516.15			
Prob> F	0.0000			
Observations	257,992	257,992	257,992	257,992
	Panel B. Adding County-by-Group Specific Trend			
β	–25.77***	–838.21***	4.40	1532.66
	(8.40)	(306.30)	(2.96)	(1011.60)
First-Stage F-statistics	271.37			
Prob>F	0.0000			
Observations	257,992	257,992	257,992	257,992
Merger Year Control Mean	112.83	4,654.40	182.19	21,545.77

Sources: FFIEC CRA, HMDA; FHFA; FDIC; and Census. All regression are based on the subsample of the study. All specifications include the full set of year fixed effects, tract fixed effects and a county-by-group specific time trend. In addition, bottom panel are controlled for tract level characteristics, including: population, housing price index, unemployment rate, median rent, median house value, minority fraction, median family income. All demographic variables are calculated based on Census 1990, 2000, and 2010. All median income, HPI and unemployment variables are the values in year t. Meger Year Control Mean is the mean value of the control groups at the merger effective year. Standard errors are clustered at tract level and are in parentheses. ***p<0.01, **p<0.05, *p<0.1

A Selection of Treatment and Control Groups

As discussed in Section 2, I define the merger-exposed groups of each merger as the tracts exposed to "overlapping" branches from both sides of the merger. "Expose" means that the "overlapping" branches are within a certain radius from the tract center[15] in the pre-merger year. The definition of "overlapping" is explained in the following parts of this section. Treatment tracts usually cluster in the counties where both sides of the mergers have "overlapping" branches. Hence, I limit the control tracts to the untreated tracts located in the same county of the merger-exposed tracts.

To select the homogeneous tracts of the treatment tracts, I restrict the control tracts to the ones exposed to "overlapping" branches of another two "big" banks. Consequently, the only difference between the treatment and the control tracts is the occurrence of "random" mergers, which cause higher chances of branch closures in the treatment tracts.

Figure A1 presents a sets of merger-exposed[16] and control[17] tracts in the merger between SunTrust Bank and National Bank of Commerce. The green triangle refers to branches of the acquiring bank, SunTrust Bank; the red triangle represents branches of the outgoing bank, National Bank of Commerce; and the blue circles are the branches of all other big banks[18]. The map shows that the banks tend to allocate their branches along the border of each tract. Obviously, it is not likely that people living in the neighbor tracts will skip these branches because of the arbitrary border line. Moreover, some adjacent branches, such as the ones in the black circle, are separated into different tracts. Therefore, I define "overlapping" based on geographic proximity instead of the arbitrary tract boundaries to take the above situation into consideration.

[15] The tract centers are calculated based on the geographic centroids and population size of the blocks in this tract.
[16] Red areas
[17] Black areas
[18] "Big" banks are the banks with asset size larger than 10 billion dollars.

The black circle in Figure A1 is a pair of overlapping branches which are located in different tracts. As shown in the detailed map in the upper right corner of the figure, these two branches are separated by the tract boundary, the black solid line, but are located less than 1 mile away from each other. If "overlapping" is defined as the branches located in the same tract, the "overlapping" ones like this pair will be ignored.

The map in the upper left corner illustrates the selection of merger-exposed tracts. The black dot is the center of the tract, which is the population-weighted mid-point of the centroids of all blocks in this tract. The circle refers to all areas within R radius[19] from the tract center. In this example, both overlapping branches are within the circle, so that this tract is assigned to the merger-exposed group. Using similar methods, I define the control tracts, the black shaded areas in the map, as the tracts with overlapping branches, from any other two big banks[20], within R radius.

The tract center is calculated based on the population size and the coordinates of the block centroid[21]. For example, if a tract has three blocks, the tract center will be the mid point of the three blocks' centroids, while the weights in calculating the mid point is the population size of each block. The radius, R, is calculated from the area of the tract. $R = (\frac{Tract\ Area}{\pi})^{1/2} + 1$. I try different specifications for R in the robustness test, while all of them yield similar results.

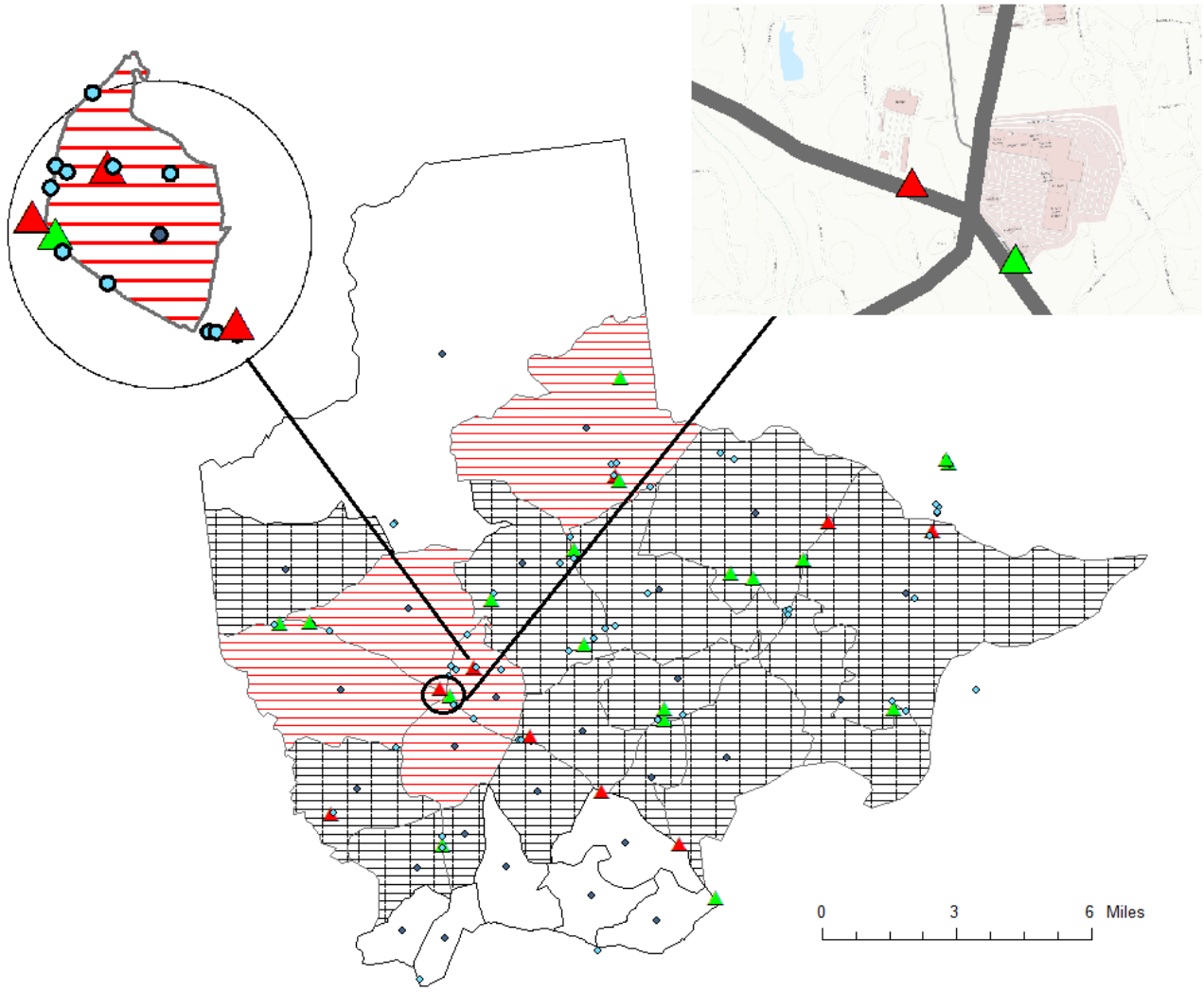
As shown in Figure A1, the above specification yield the sample of the merger-exposed and control groups.

[19] R is calculated based on the size of the tract.

[20] In this example, the two banks could be (1) two big banks other than SunTrust Bank and National Bank of Commerce; (2) SunTrust Bank and a big bank other than National Bank of Commerce; or(3) National Bank of Commerce and a big bank other than SunTrust Bank.

[21] Blocks are the Census Tract subdivision areas.

Figure A1: Example: Treatment and Control Tracts 1 - Fulton County, GA (2004)



Source: FDIC and Census. The map shows an example of merger-exposed and control tracts for the merger between SunTrust Bank and National Bank of Commerce using part of the tracts in Fulton County, GA. I will present more detailed map in the circled area and one of the merger-exposed tract.