Federal Reserve Bank of Philadelphia

Working Papers
Research Department

WP 19-36
September 2019
https://doi.org/10.21799/frbp.wp.2019.36

The Community Reinvestment Act (CRA) and Bank Branching Patterns

Lei Ding
Federal Reserve Bank of Philadelphia

Carolina K. Reid
University of California, Berkeley

COMMUNITY DEVELOPMENT AND REGIONAL OUTREACH

ISSN: 1962-5361

The Community Reinvestment Act (CRA) and Bank Branching Patterns

September 10, 2019

Lei Ding,* Federal Reserve Bank of Philadelphia

Carolina K. Reid, University of California, Berkeley

Abstract

This paper examines the relationship between the Community Reinvestment Act (CRA) and bank branching patterns, measured by the risk of branch closure and the net loss of branches at the neighborhood level, in the aftermath of Great Recession. Between 2009 and 2017, there was a larger decline in the number of bank branches in lower-income neighborhoods than in more affluent ones, raising concerns about access to mainstream financial services. However, once we control for supply and demand factors that influence bank branching decisions, we find generally consistent evidence that the CRA is associated with a lower risk of branch closure, and the effects are stronger for neighborhoods with fewer branches, for larger banks, and for major metro areas. The CRA also reduces the risk of net bank losses in lower-income neighborhoods. The evidence from our analysis is consistent with the notion that the CRA helps banks meet the credit needs of underserved communities and populations by ensuring the continued presence of brick-and-mortar branches.

Keywords: Banking industry, Community Reinvestment Act, Branch, Regulation

JEL classification: G21; G34; L10

* Please direct questions and comments to Lei Ding at lei.ding@phil.frb.org. The authors thank Anna E. Tranfaglia for her excellent research support. The views expressed in this paper are those of the authors and do not necessarily reflect the views of the Federal Reserve Bank of Philadelphia or the Federal Reserve System.

The Community Reinvestment Act (CRA) and Bank Branching Patterns

Lei Ding and Carolina K. Reid

1. Introduction

The U.S. bank branch network has shrunk significantly since the Great Recession. A number of factors are likely contributing to the losses in bank branches, including the lingering effects of the recession, the consolidation of the banking industry, and the rise of online and mobile banking (leading to decreased demand for physical branch services). The recent decline in bank branches, however, has raised concerns regarding its impact on access to financial services, especially considering that lower-income neighborhoods have seen a larger loss in branches than higher-income neighborhoods. There are concerns about the financial well-being of these communities, since research has shown that access to retail bank branches improves access to credit, especially to small business loans, and that the presence of local retail branches is more important in low-income neighborhoods, where information asymmetries may be larger. Branch closures may also contribute to the creation of "banking deserts" — neighborhoods with inadequate or no mainstream financial services — restricting access to credit and potentially increasing the use of payday lenders or other higher-cost financial service providers.

The importance of bank branches — and the services they provide — lies at the very heart of the Community Reinvestment Act (CRA). Enacted in 1977, the CRA requires depository institutions to meet the credit needs of their local communities, including low- and moderate-income (LMI) households and neighborhoods, consistent with safe and sound banking practices. Early advocates of the CRA argued that local bank branches were critical for community financial health and that institutions had an obligation to provide financial services (particularly mortgages) to residents in the surrounding neighborhoods. The original intent has been embodied in how banks are evaluated for CRA compliance: Regulators look at a bank's "assessment areas" — defined by where a bank has its branches or other physical presence — to gauge whether the bank is meeting the credit needs of the communities in which it does business.[1] The CRA also explicitly recognizes the importance of bank branches and financial services as part of the "service" test of the CRA examination, which primarily examines the geographic distribution of large banks' branches, as well as the record of opening and closing bank branches, particularly those that serve lower-income communities.

The shift toward online and mobile banking, however, has raised the question of whether the focus on bank branches as part of the CRA is warranted. If the Main Street model of banking is over, are bank branches and assessment areas still relevant? The Advance Notice of Proposed Rule-Making issued by the Office of the Comptroller of the Currency (2018) poses this question, asking whether banks should be allowed to extend their CRA activities to include a broader geographic scope. Many others, on the other hand, argue strongly for the importance of a bank presence in lower-income and rural communities. Despite the importance of branches to both the intent and implementation of the CRA, however, no studies (to the best of our knowledge) have focused explicitly on the relationship between the CRA and bank branch openings and closures.

This study seeks to fill that gap by examining the relationship between the CRA and bank branching, measured by the risk of branch closure and the change in the number of active branches in CRA-eligible neighborhoods during the post-Great Recession period (2009–2018). Specifically, we employ a regression discontinuity design to assess how branch openings and closures vary in neighborhoods just above and below the CRA eligibility threshold, controlling for a wide range of other factors that may also influence a bank's branching decisions. We focus our analysis on the traditional brick-and-mortar branches of banks and thrifts (financial institutions that are subject to the CRA) and limit the analysis to metropolitan areas, which are generally the focus of CRA exams.

We find that while there is a larger decline in the number of bank branches in lower-income neighborhoods than in more affluent ones, this difference can largely be explained by differences

[1] Assessment areas are officially defined as "one or more [metropolitan statistical areas] . . . or one or more contiguous political subdivisions, such as counties, cities, or towns" that include the census tracts "in which the bank has its main office, its branches, and its deposit-taking ATMs, as well as the surrounding [census tracts] in which the bank has originated or purchased a substantial portion of its loans."

in banking industry factors (e.g., bank failures) and neighborhood-level demographic and economic conditions. Once we control for those factors, we find that CRA-eligible neighborhoods — defined as LMI neighborhoods with a median family income (MFI) of 80 percent or less of the area median family income (AMFI) — are associated with a lower risk of branch closures. Results suggest that in LMI neighborhoods, the CRA reduces the risk that a branch closes by over 8 percent. In addition, we find that the CRA reduces the net loss of bank branches in LMI neighborhoods by over 11 percent. Importantly, we find that this effect is larger in neighborhoods with fewer bank branches, suggesting that the CRA prevents low-income neighborhoods from becoming banking deserts. Since bank branches are still the primary vehicle for accessing a variety of financial services for many LMI households and small business owners, the evidence from our analysis is consistent with the notion that the CRA helps banks meet the credit needs of underserved communities and populations by ensuring the continued presence of brick-and-mortar branches.

This paper is organized as follows: Section 2 provides background information about bank branch closures and the CRA. Section 3 describes the data and methodology in more detail. Section 4 presents the empirical results. Section 5 concludes the paper and discusses policy implications.

2. Background and Literature

While the recent wave of bank branch closures has been relatively dramatic, the total number of bank branches is still relatively high in historical terms. Furthermore, many banks are still investing in new retail outlets. Earlier descriptive analyses suggest that lower-income communities and rural areas are more susceptible to becoming so-called banking deserts (Morgan, Pinkovskiy, and Yang, 2016; NCRC, 2017). The lack of access created by these deserts could cause high transaction costs for basic financial services, particularly when alternative financial service providers such as check cashers and payday lenders fill the financial services gap.

Research suggests that the presence of a bank branch may be particularly important in overcoming credit barriers in low-income communities. Economic research has hypothesized two major functions of physical bank branches: (1) reducing informational asymmetries through relationship lending; and (2) providing geographic proximity between lenders and borrowers (Lang and Nakamura, 1993; Avery et al., 1999; Sumit, et al., 2010; Sumit and Hauswald, 2010; Nguyen, 2019). For banks, interpersonal interactions with customers allow them to gather so-called soft information on a customer, which is not easily captured by the criteria used in lenders' automated underwriting models. Soft information may also include knowledge about local economic conditions or trends, particularly nuanced differences across neighborhoods within a city. Soft information that comes from a bank's local presence could improve lenders' ability to identify creditworthy lower-income borrowers or small business owners who would otherwise be denied credit. In lower-income areas where customers are more likely to have lower credit score or thin credit files, informational frictions may make credit prohibitively expensive or outright rationed (Ergungor, 2010). For borrowers, local branches provide opportunities for personal interactions with loan officers, which are essential in building the trust between borrowers and their financial institutions. Geographic distance between lenders and borrowers, however, raises these information costs. Research suggests that in neighborhoods without a local lender, the "market" for loans can fail; that is, some creditworthy borrowers may not be able to access a loan even if they travel to the next bank branch farther away (Brevoort and Hannan, 2006; Ergungor, 2010).

Empirical studies, especially in research that examines the role of bank branches on small business lending, provide support for this theory. Based on data from 1999 to 2012, Nguyen (2019) finds that bank branch closings leads to a persistent decline in local small business lending: Annual originations fall almost 10 percent after a branch closing and remain depressed for up to six years. The effects are highly localized, dissipating within six miles, and are especially severe during the financial crisis. The decline in lending also has a sizable impact on the local economy, causing about a 2 percentage point decrease in employment growth rates. In another study, Brevoort and Hannan (2006) report that distance operates as a deterrent to small business lending, even within areas traditionally defined as local markets, and that distance is more of a deterrent for small banks than for larger organizations. The importance of local branches for small businesses is more pronounced likely because small business lending is more labor-intensive and dependent on soft information than other types of lending. Bank branch closings thus could have a negative effect on small business lending because a bank may lose its ability to gain more knowledge of the banking habits and savings behavior of small business owners via interactions at the branch level with bank personnel and deposit activity.

In contrast with small business lending, Nguyen finds that the effects of branch closures on mortgage lending are generally small and statistically insignificant (Nguyen, 2019). However, other studies have posited that a local branch presence may similarly have a salutary effect on mortgage lending practices. For example, Ergungor (2010) finds a positive relationship between banks' branch presence in low-income neighborhoods and mortgage originations, and both Ergungor (2010) and Reid and Laderman (2011) have documented a negative relationship between the presence of a branch and the incidence of subprime lending.

Although more research is needed to understand the role of local branches — particularly with the rise of fintech lenders and online banking — the existing studies suggest that the presence of a branch matters and that the branch's presence may be more important in communities that have greater information asymmetries between banks and borrowers (Barr, 2005).

Bank Branching and the CRA

Congress enacted the CRA in 1977 to address concerns about redlining and to ensure that banks were adequately serving the credit and other banking needs of their local communities, with an emphasis on geographic areas. The law requires federal bank agencies to assess banks' records in meeting the credit and banking needs in the "communities" in which banks are located. Although the original statute leaves the definition of "community" intentionally vague, the 1995 revisions to the CRA established that banks have an affirmative obligation to address the credit, investment, and service needs of areas in which they have bank branches. Since then, CRA examinations primarily assess banks' performance in lending, investments, and services in banks' assessment areas, generally the metropolitan statistical area (MSA) or county where a bank has branches and takes deposits.[2]

The CRA could influence bank branching patterns in several — perhaps contradictory — ways. On the one hand, the CRA encourages banks to maintain branches in LMI neighborhoods in order to ensure a positive rating. The CRA service test explicitly evaluates the distribution of bank branches across neighborhoods of different income levels, and regulators place particular emphasis on the institution's record of opening and closing branches in LMI neighborhoods. In addition, the presence of local branches could provide knowledge about local community development initiatives that could satisfy the bank's lending and investment requirements. On the other hand, the more restrictive requirements on branch exits may prevent lenders from opening any new branches in these neighborhoods in the first place. Opening a branch in a new MSA could also expand a bank's assessment area for CRA purposes; this regulatory cost could have a further dampening effect on branch openings. Banks may also have business reasons to close banks in LMI neighborhoods despite the CRA: LMI neighborhoods were hit harder by the foreclosure crisis and the subsequent recession, thereby reducing their demand for banking services. In addition, when banks exit certain lines of business, such as FHA lending or small business lending, the need for a local branch may be reduced. Because CRA activities need to be consistent with safe and sound banking practices, regulators will not downgrade a bank if it can show that a branch closing can be justified for business reasons.

To date, very little empirical work has focused on the CRA's role in shaping branch closings — in fact, except a few informative descriptive studies (e.g., Morgan et al., 2016), we were unable to identify any studies that explicitly examine the CRA's impact on bank branching in a multivariate framework. Instead, the majority of existing studies on the effectiveness of the CRA have focused on bank lending activities (Getter, 2015). Studies on the link between the CRA and mortgage lending activity generally suggest that the CRA has expanded access to credit in LMI communities, but the magnitude of the increase and the mechanisms of the impact of CRA are

[2] The CRA is facing major reform, and proposals to use banks' market presence, in addition to the physical presence, to determine their assessment areas are under consideration (Office of the Comptroller of the Currency, 2018).

far from conclusive (Belsky, Schill, and Yezer, 2001; Avery, Bostic, and Canner, 2005; Gabriel and Rosenthal, 2009). Two recent studies, Ding and Nakamura (2017) and Ringo (2017), employ difference-in-differences approaches and use changes in the definitions of MSAs and metropolitan divisions (MDs) as the exogenous shock. These studies find positive CRA effects on home mortgage lending, with the effects being greater among lower-income tracts. Earlier studies have been less sanguine about the CRA's effects. For example, Dahl, Evanoff, and Spivey (2002) find that banking institutions that had their CRA ratings downgraded did not significantly alter their lending behaviors, suggesting that the CRA does not influence banks' decisions through the exam and rating process.

A few studies have examined the CRA's effects on small business lending. Bostic and Lee (2017) find that the number and dollar amount of small business loans were greater among CRA-eligible tracts during 1996–2002 and 2012–2014, while small business lending lagged in those tracts between 2003 and 2011. Ding, Lee, and Bostic (2018) provide new evidence on the effectiveness of the CRA on small business lending by focusing on a sample of neighborhoods with changed CRA eligibility status across the country because of an exogenous policy shock in 2013. They provide evidence that the CRA promotes small business lending, especially in terms of number of loan originations, in lower-income neighborhoods. They also find that losing CRA eligibility status had a relatively larger effect on small business lending activities compared with newly gaining CRA eligibility.

In this study, we use a standard regression discontinuity design (RDD) model, which has often been used to evaluate the CRA's effectiveness on home mortgage lending (Avery and Brevoort, 2015; Bhutta, 2011; Gabriel and Rosenthal, 2008) and small business lending (Bostic and Lee, 2017). We contribute to this literature by focusing on bank branching outcomes: (1) the risk of bank branch closure and (2) the net loss of bank branches at the neighborhood level. In the following section, we describe our data and empirical approach.

3. Data and Empirical Approach

Data

This analysis uses a unique panel data set on retail branch dynamics in the United States. The Federal Deposit Insurance Corporation (FDIC) collects bank branch data through its Summary of Deposits (SOD). The SOD data provide a snapshot of the nation's bank branches on June 30 of every year. For example, the 2017 SOD data capture any changes to the branch network that occurred from July 1, 2016, until June 30, 2017. The raw SOD data available on the FDIC site, however, lack a unique identifier for individual branches, making it difficult to track the same branch over time. Partly for this reason, we access the SOD data through Savings N Loan's (SNL) Branch Analytics tool (S&P Global Market Intelligence, the SOD for simplification), which cleaned and geocoded the data to allow us to track individual branches over time.[3] Several studies have used this data set, instead of the raw SOD data, such as Tranfaglia (2018).

We construct a comprehensive panel data of bank branches by pooling the annual SOD data for the 2009–2018 period and observing the status (active, closure, or new opening) of each individual branch from June 1, 2009 through June 30, 2018. This allows us to observe the status (active, closure, or new opening) for each individual branch that was active from June 1, 2009 through June 30, 2017. We apply the following decision rules to determine the status of bank branches in each individual year: A branch is considered a new opening in a given year if it first appears in the branch panel data and a closure if it does not appear in subsequent years. For instance, if a branch is present in year t but disappears in year $t+1$ and the years afterward, we consider this branch as being closed between year t and year $t+1$; in cases in which a branch is not present in year t (and the years before year t) but appears in year $t+1$, we consider this branch as a new opening between year t and year $t+1$.[4]

We use these panel data to construct neighborhood-specific measures of bank presence, exit, entry, and net flow by identifying all active branches, branch openings, and branch closings in a particular neighborhood in a given year. Bank branches were geographically classified using the

[3] According to SNL, the SOD data have been cleaned and verified in several ways: (1) SNL created a unique identifier for each individual branch that can be used to track the same branch over time; (2) SNL investigated and updated missing, incomplete, or erroneous addresses and regeocoded the location of all branches; and (3) SNL validated and updated the branch openings, closings, and merger and acquisition activities. As a result, there were generally no observation gaps and only a few hundred duplicates, and we have used our judgement to keep just the unique records in our final sample.

[4] The SNL SOD data provide branch closing and opening dates for most but not all branches. Thus, relying on these closing or opening dates may miss a small number of branches.

2000 census tracts (2009–2011) or the 2010 census tracts (2012–2017) corresponding to their branch addresses. Census tracts are designed to be economically and demographically homogenous geographies and serve as the immediate surrounding neighborhood of a bank branch. Census tracts are used as the primary geographical unit for aggregation, largely because communities as defined in the CRA are at the tract level.

We then merge these bank branch panel data with several other data sets. First, we merge the SOD data with the CRA data provided by the Federal Financial Institutions Examination Council (FFIEC) to identify whether a branch is located in a CRA-eligible tract in a given year. LMI tracts, also referred to *CRA-eligible* tracts,[5] are defined as those with an MFI below 80 percent of the MFI for the surrounding area (MSA, MD, or state nonmetro area).[6] It is important to note that the LMI status of a census tract may change over time, either because the neighborhood undergoes socioeconomic or boundary changes or because the AMFI changes.[7] For example, the LMI status of a neighborhood with an improved median income may move up from moderate-income (50–80 percent of AMFI) to middle-income (80–120 percent), while the status of a neighborhood with a drop in income may move down from middle-income to moderate-income when new census data are used to determine the LMI status of a neighborhood. Fortunately, our panel data approach allows us to capture the time-varying nature of CRA eligibility, which is a significant improvement from earlier cross-sectional regressions. We designate the LMI status of a tract based on 2000 census data for the 2009–2011 period, 2006–2010 American Community Survey (ACS) data for the 2012–2016 period, and 2011–2015 ACS data for 2017, consistent with regulatory guidance.

Second, we merge in additional census and ACS data to construct neighborhood-level controls that may influence the demand for banking services. We linearly interpolate the data for a wide

[5] We use the term *CRA-eligible tract* as shorthand only to mean that the tract is an LMI tract. This does not necessarily mean that none of the lending to a CRA-ineligible neighborhood qualifies for CRA credit. For example, lending to LMI borrowers in middle- or upper-income neighborhoods is still eligible for CRA credit, and revitalization or stabilization activities in distressed or underserved nonmetropolitan middle-income geographies are eligible to receive CRA consideration under the community development definition.
[6] The FFIEC estimates area MFIs (AMFI) for MSAs, MDs, and nonmetropolitan portions of each state.
[7] Because the LMI status of a tract is a relative measure compared with the larger area, the CRA eligibility of a tract can also change if the AMFI changes. The OMB published a new set of MSA/MD definitions in 2013 as part of its comprehensive review of statistical area standards and definitions after the 2010 census, which had a significant impact on the CRA eligibility of tracts (Ding et al., 2018). See more details at www.ffiec.gov/cra/OMB_MSA.htm.

array of neighborhood characteristics using the 2000 census data, the 2006–2010 ACS five-year estimates, and the 2011–2015 ACS five-year estimates. Third, to account for differences in commercial activity in a tract, we obtain the number of business establishments from the ZIP Code Business Patterns database from 2009 to 2016, linearly extrapolating the data for 2017. As the data set is reported at the ZIP code level, we convert the data into census tracts using the number of businesses as weights. Last, we download the list of failed banks during the study period from the Failed Bank List published by the FDIC and the information related to mergers and acquisitions (M&A) from the SNL database (SNL M&A).[8] The SNL M&A data include merger completion dates, the type of merger, and the firms involved in the merger, which we merge into our panel data set using the bank identifier that is available in both the SNL SOD data and the M&A data.

After constructing the panel data, we limit the sample in the following ways. First, we exclude all credit union branches from our analysis because credit unions are not subject to the CRA. Second, we focus only on traditional brick-and-mortar branches that provide full banking services, instead of limited service, in-store branches, or other branch types, as brick-and-mortar branches are believed to be more effective than other branch types in addressing the information problem in LMI neighborhoods. Third, we limit our analysis to branches and neighborhoods in MSAs, and we exclude small census tracts (those with populations of less than 100) as well as tracts with missing data. Fourth, we exclude tracts that do not have any branches at the beginning of the study period (2009). While this may lead to an underestimation of recently opened branches in new neighborhoods, it also reduces the risk that our results will be clouded by the high numbers of exclusively residential neighborhoods. Finally, we exclude banks that have only one branch in the branch-level regressions, because the likelihood of closure is essentially zero for these banks, unless they fail or are merged with another bank.

Empirical Approach

[8] www.fdic.gov/bank/individual/failed/banklist.html.

We use a standard regression discontinuity design (RDD) model to examine the role of the CRA in neighborhood bank branching decisions. One of the key features of the CRA is that the threshold for eligibility is clear: To be a CRA-eligible neighborhood, the MFI in a tract must be less than 80 percent of the AMFI. Given this regulatory framework, neighborhoods with median incomes slightly below and above the CRA threshold are theoretically quite similar, except for their CRA designation. This similarity enables us to view any discontinuities in outcomes at the threshold as the effects of the CRA.

We first investigate the effect of the CRA on banks' decisions to close a branch in a given year using the model specification, and the null hypothesis that we are testing is the CRA has no effect on bank branch closing:

$$Y_{ij,t+1}^{t} = \alpha + \beta_1 * LMI_i^t + \beta_2 * X_{i,t+1}^t + \beta_3 * M\&A_{j,t+1}^t + \beta_4 * BRANCH_{ij}^t + MSA_i + YEAR_t + \varepsilon_{ij,t+1}^t \qquad (1)$$

where *Y* is the outcome of bank branch *i* of lender *j* from year *t* to year *t+1* (equal to 1 if it is closed during that period). The primary variable of interest, *LMI*, is an indicator that is equal to 1 if the branch is located is a LMI neighborhood in year *t* and 0 otherwise. *X* is a vector of market and demographic characteristics at the tract level that are likely associated with the demand for services provided by bank branches. *M&A* includes two measures of bank consolidation: bank failures and bank mergers/acquisitions. *BRANCH* includes a measure of deposits at the branch level as an indicator for its financial viability (on a one-year lag), as well as the size of the lender measured by the total number of bank branches (categorical).[9] The model also includes MSA and yearly fixed effects to control for any market- or year-specific unobserved heterogeneity. Standard errors are clustered at the MSA level. In all our models, we test three tract-level samples that vary in terms of the bandwidths around the 80 percent CRA eligibility threshold (all tracts, tracts that fall within 50–100 percent of AMFI, tracts that fall within 70–90 percent of AMFI, and tracts that fall within 75–85 percent of AMFI).

[9] We also tried measuring bank size by the level of assets of the institution, and the results are quite consistent. Lenders are classified as "intermediate small institutions," "small institutions," and "large institutions," which are each subject to different levels of CRA examinations.

In addition to assessing the CRA's effect on a bank's decision to close a particular branch, we also examine its effect on the net flow of bank branches at the neighborhood level. From the perspective of ensuring that low-income households and neighborhoods have access to mainstream financial services, one branch out of many branches in a neighborhood closing may be less important than the closure of the last branch in the community, which could lead the neighborhood to become a banking desert. We investigate the relationship between the CRA and changes in bank branching at the tract level using a model that can be written as:

$$Y_{i,t+1}^{t} = \alpha + \beta_1 * LMI_i^t + \beta_2 * X_{i,t+1}^t + \beta_3 * M\&A_{i,t+1}^t + MSA_i + YEAR_t + \varepsilon_{i,t+1}^t \qquad (2)$$

where *Y* is the outcome variable for tract *i* from year *t* to year *t+1*. We examine three interrelated outcomes: (1) the net loss in the number of branches per 10,000 residents, (2) the number of branch closures per 10,000 residents, and (3) the number of new openings per 10,000 residents.[10] Similar to Avery et al. (1999), we use the per capita measures as the dependent variable to account for variation in population across census tracts. The primary variable of interest, the *LMI* status of a neighborhood, and other neighborhood level controls are the same as those in the branch level model. The model also includes MSA and yearly fixed effects.

Conceptually, there are two primary reasons a bank may consider closing a branch: a lack of demand for banking services and/or an oversupply of branches or competition within the banking network. To account for demand factors, we control for a set of neighborhood demographic characteristics that are likely associated with the demand for banking services, including the tract's total population (in log), total housing units (in log), homeownership rate, vacancy rate, share of high-income (>$75,000) households, share of college-educated adults, poverty rate, unemployment rate, median age, median rent (in log), and median property value (in log). To account for the demand for banking services from businesses, we control for the number of establishments per capita, which also allows us to distinguish between tracts with different levels of commercial activity.

[10] These three outcomes are interdependent, since the net loss is equal to the number of closures minus the number of new openings in the same year.

On the supply side, we need to account for the consolidation in the industry, which resulted from either mergers of previously independent institutions or the failure of commercial banks and thrifts, since the financial crisis. After consolidation, a bank may seek to reduce expenses by closing branches in areas with oversupply of services or in locations with significant overlap in trade areas. In our branch-level model, we control for whether the parent institutions failed or underwent a merger or acquisition during a given year, as well as the distances from the branch to the next nearest branch by the same lender or by any lender. Because the raw branch deposit amount may have different importance for banks of different asset sizes, we constructed a ratio (b/B)/(1/N) to measure its financial viability (in log since the raw ratio has a long tail), where *b* is deposits at the branch, *B* is the institution's total deposits, and *N* is number of branches. In the tract-level model, we control for the share of branches experiencing bank failures or mergers and acquisitions from year *t* to year *t+1*, instead of a control at the lender level. We also include the initial number of bank branches (per capita) and the one-year lag of the amount of total deposits (per capita) in the tract to help account for changes in the number of branches due to a lagged response in previously overbanked or underbanked areas.

4. Empirical Results

We begin by presenting results from descriptive analysis of our sample. Confirming other studies, the data show that the number of bank branches operated by federally insured banks and thrifts (not including credit unions) dropped from 88,022 in 2009 to 79,872 in 2018 — a decline of 9.3 percent (Figure 1). Lower-income neighborhoods were hit the hardest: LMI tracts saw a decline in the number of bank branches of 11.1 percent, compared with a decline of 8.7 percent in non-LMI tracts. At the aggregate level, LMI neighborhoods accounted for about 28.7 percent of net losses in the number of bank branches since 2009, even though they accounted for only 24.0 percent of the total number of branches (Figure 2). The larger net losses in the number of bank branches, however, may reflect a larger decline in population and profitable business opportunities in lower-income neighborhoods, particularly after the recession.

However, when we focus on neighborhoods just below and above the CRA eligibility threshold of 80 percent of AMFI — those that fall between 70 and 90 percent of AMFI — we find that the net closure rate in LMI neighborhoods was actually slightly lower (10.9 percent) than in non-LMI neighborhoods (11.4 percent) (Figure 2). The descriptive statistics in Figure 3 suggest that LMI neighborhoods experienced a similar level of decline in the number of bank branches before 2013 but a smaller decline afterward than more affluent tracts within the 70–90 percent of income range. This suggests that the CRA may have an impact, at least for neighborhoods in this narrower income range, on bank branching decisions. The question is whether this effect remains after controlling for other factors that might influence the decision to open or close a branch.

Table 1 presents the sample data at the tract level, distinguishing between all LMI and non-LMI tracts in the first panel and narrowing the tracts to those that fall between 70 and 80 percent of AMFI and between 80 and 90 percent of AMFI (the latter of which are not CRA eligible). On average, LMI tracts have fewer branches than non-LMI tracts (2.2 branches per tract compared with 2.5). When adjusted for population size, however, LMI tracts have a larger average number of branches, likely because LMI tracts tend to be in more central city and commercial areas. Over this period, LMI tracts saw smaller numbers of bank branches closing, but non-LMI tracts saw more branch openings. However, after adjusting for population, LMI tracts saw a larger number of bank closures and net branch losses. Not surprisingly, when we limit the sample to tracts between 70 and 90 percent of AMI, the differences in bank branching between LMI and non-LMI tracts shrink considerably.

Table 2 presents similar descriptive statistics for the branch panel. Overall, there are minimal differences in the rate of individual bank branch openings and closures across LMI and non-LMI neighborhoods. Approximately 2.3 percent of bank branches in our sample closed each year between 2009 and 2017, while approximately 1.2 percent of branches in non-LMI and 0.9 percent of branches in LMI neighborhoods were new openings.

Regression Discontinuity Analysis

Our first model explores the relationship between a branch being located in a LMI census tract and the likelihood that it closes.[11] Table 3 summarizes the results of the CRA's effects from four linear probability regressions using the branch panel data, based on four different neighborhood income bands. The outcome is the probability of being closed in a given year for a branch that was still active at the beginning of that year. The results provide consistent evidence that locating a branch in an LMI tract is associated with a lower risk of closure during the study period. The magnitude of the CRA's effect ranges from an average reduction of 0.21 percentage point in the probability of closure (or 9.2 percent of the annual closure rate of 2.3 percent) for branches in tracts within the income range of 70–90 percent to a decrease of 0.32 percentage point (or 14.2 percent of the annual closure rate) when using a narrower neighborhood income range of 75–85 percent. The full model results, which are presented in Appendix A, also suggest that market-level factors are an important determinant of whether a bank branch closes: Branches with higher levels of total deposits and that are farther from other branches are less likely to close, while branches of banks that have failed or that have undergone a merger or acquisition are more likely to close.

The closure of a single branch in a community with a concentration of bank branches may not be as worrisome for the financial access of existing residents. Of concern to policymakers are communities that have no bank branches and the closure of the last branch in a poor community, which can lead to suboptimal financial choices (e.g., the use of alternative financial providers like payday lenders) for existing residents and businesses. Moving away from a branch-level analysis to the neighborhood scale allows us to examine whether the CRA has an impact on bank branching decisions in an LMI tract at the aggregate level.

Table 4 summarizes the results of the CRA's effects from the linear regressions on the net loss of branches in the tract (Panel A), the number of branch closures (Panel B), and the number of new openings (Panel C), all adjusted for population. As with the bank branch model, we run the model for different samples: all tracts, tracts within 50–100 percent of AMFI, tracts within 70–90

[11] Note that if a bank closes a branch but then moves it across the street, it would still be coded as a closed branch (and a new opening).

percent of AMFI, and tracts within 75–85 percent of AMFI. The full model results for the regressions using the 70–90 percent sample are presented in Appendix B.

The results provide generally consistent evidence that CRA-eligible neighborhoods have lower net losses of bank branches during the study period (although the findings for tracts within 70–90 percent of AMFI are insignificant). The magnitude of the CRA's effects ranges from a reduction in the net losses of branches by 0.011 branches per 10,000 residents per year (about 11.4 percent of the mean) to about 0.016 branches per 10,000 residents per year (17.7 percent of the mean). This can be explained by both the lowered rates of branch closures and the increased rates of new openings: The LMI coefficients from all four regressions for branch closures are all negative, while they are mostly positive for branch openings, although the coefficients are largely insignificant. The lack of significance of the CRA's effects in the tract-level regressions may be partly due to the smaller number of observations as well as the reduced level of variation because of data aggregation. The magnitude of the CRA's effects on branch closures from the tract-level regressions, nevertheless, is quite similar to that from the branch-level regression (6.9–11.5 percent of the average from the tract-level regression versus 9.2–14.2 percent from the branch-level regression).

Overall, these models suggest that the likelihood of branch closures, as well as the net loss of branches, is lower in LMI neighborhoods than in non-LMI neighborhoods. The reduced loss in bank branches in LMI neighborhoods can largely be explained by the reduced number of bank closures.

Heterogeneity in the CRA's Effects on Bank Branching

While the overall model results suggest that the CRA reduces the risk of branch closure and the net losses of branches in a neighborhood, the CRA's effects may vary over time or play out differently for rural areas or major metropolitan areas. In this section, we explore these questions further, assessing whether the effects of the CRA vary across lenders, neighborhoods, and regions, as well as over different study periods. In these analyses, we focus only on tracts that fall within the 70–90 percent of AMFI range as an illustration (Table 5).

First, we explore whether the CRA reduces the likelihood of a neighborhood becoming a banking desert. LMI census tracts in our study sample on average have 2.2 branches. In tracts with just one or two branches, a single branch closure could have a significant effect on overall access to mainstream financial services compared with a branch closure in a neighborhood with more banks present. We ran regressions for branches in tracts with different numbers of existing branches (categorical: 1, 2–3, or 4+) to test whether the CRA has a larger effect in neighborhoods with fewer branches relative to other neighborhoods. The results demonstrate that the CRA has a significantly larger effect in neighborhoods with only one branch, where the CRA reduces the probability of branch closure by 0.5 percentage point (significant at 0.05 level). In contrast, the effects for tracts with 2–3 branches or 4 and more branches are smaller (and insignificant). This suggests that CRA exams serve their intended purpose: During a bank's CRA exam, regulators pay attention to whether a proposed branch closure in the neighborhood would result in a banking desert and often require banks to provide additional justification to ensure that the closure is warranted on the basis of the bank's safety and soundness.

Second, the results suggest the CRA's effect on branch closure is more significant among large banks and federally chartered banks, compared with small banks or state-chartered banks. As Table 5 shows, the CRA's effect on branch closure is meaningful and significant for large (-0.3 percentage points) and federally-chartered banks (-0.29 percent points), while the effect is statistically insignificant for smaller banks and less significant for state-chartered banks. The large, national banks are subject to greater scrutiny under the CRA, so it is unsurprising to observe a more significant effect among large banks and federally-chartered banks.

Third, we explore whether the CRA has a similar effect in nonmetro areas or rural areas.[12] Rural areas often lack banking services, and in many cases, rural areas fall outside what is known as the banks' "full scope" CRA exams, meaning that banks' activities in rural areas receive less regulatory scrutiny. We explore whether the CRA's effect differs for metro versus rural areas by adding the nonmetro tracts back into the sample and interacting the LMI variable with the metro

[12] There are various definitions of rural areas; here, we consider nonmetro areas as rural areas and use these two terms interchangeably.

dummy. Results suggest that the CRA's effects on branch closures are larger in metro areas (-0.21 percentage point) than in the non-LMI nonmetro tracts (-0.1 percentage point and statistically insignificant). We also explore whether geographic location is associated with different CRA effects by partitioning the sample by region and re-estimating the baseline regression. We find that the CRA has a larger effect (-0.6 percentage point) in the Northeast, but it is statistically insignificant in the three other regions.

Finally, we sought to assess whether there might be differences in the CRA's effects over time. The panel data regressions, which present the average effects of the CRA on bank branching from 2009 to 2018, may conceal changes in the CRA's impacts during a study period that included both the recession and the recovery of financial markets. The descriptive results show that LMI neighborhoods experienced a smaller decline than more affluent tracts after 2013. We thus pool the data into two time periods (pre- and post-2013) and interact the LMI variable with a time dummy to assess whether the CRA's effect differs over time. The results confirm that the CRA's effects are much larger in the post-2013 period, with the CRA's effect being -0.47 percentage point on the risk of branch closure post-2013 and close to zero and insignificant for the pre-2013 period.[13] This finding may be in part explained by the rise in online banking in recent years, which could explain the greater decline in bank branches in higher-income neighborhoods if one assumes that higher-income clients are more likely to bank online. However, our models do control for neighborhood characteristics (such as the share of college-educated residents, the share of high-income residents, and house values) that should help account for socioeconomic differences in online banking usage. While more research is needed, our analysis does suggest a significant CRA effect on bank branching decisions during a period of rapid bank branch closures.

Robustness Check

The decisions to narrow the final study sample, the specification of the regression model, as well as the construction of the outcome and control variables could all influence the findings. In

[13] This trend is generally consistent with Bostic and Lee's (2017) finding of an insignificant impact of the CRA in the small business market during the pre-2012 period and a generally positive effect in the post-2012 period.

addition to the results we present above, we conducted robustness checks to ensure that our modeling assumptions were not driving the results. Overall, the findings reported above hold up well to these robustness checks. For the sake of simplification, we only mention some general patterns from the additional robustness testing.

We have tried samples with different income ranges, such as a narrower range of 77–83 percent or a broader range of 60–100 percent. The results are quite consistent, except the CRA's effects become larger but less significant when smaller samples are used. When we adjust the population threshold (at least 100 residents in the tract) required to be included in the study, either by including more tracts (at least 50 residents in the tract) or excluding more tracts (at least 500 residents), the empirical results are qualitatively consistent. The CRA's effect becomes slightly smaller when neighborhoods with smaller populations are included, but it remains significant.

In terms of the model specification, when we control for only supply side factors or control for both supply and demand side factors but do not include the time dummies and MSA fixed effects, the CRA's effects are generally consistent in terms of the magnitude and significance of the coefficient of the LMI variable: Bank branches in LMI tracts are less likely to be closed, while the CRA's effects on the likelihood of bank openings remain largely insignificant (see Appendix A). In addition, although the outcome in the branch panel regression is a dichotomous variable, we use the linear probability model to facilitate the interpretation of the coefficients. We replicated the analysis using a set of logistic regressions and the results are consistent with the linear model.

We also test whether our relative measure of branch changes (per 10,000 residents) as the dependent variable influences the results. We test whether changing the dependent variable to the absolute number of branch closures and openings makes a difference, and we find that the results of the CRA variable are consistent and become even more significant. As to the lender consolidation variables, we also have tried different lag periods (since it may take time for lenders to adjust their branching decisions after consolidation). When we control for one- or two-year lagged M&A and bank failure variables, the results on the CRA variable remain largely the same. Overall, the generally consistent results from the various robustness checks give us confidence in our main findings.

5. Discussion

The CRA was designed to address concerns that banking institutions were not providing fair access to credit in lower-income and underserved neighborhoods, and it codified the importance of branches in helping residents overcome the financial disincentives and information constraints banks face in serving LMI areas. The banking branch network, however, has been shrinking in recent years, increasing the risk that lower-income neighborhoods will be left with more limited access to mainstream financial services.

Overall, the empirical results suggest that the CRA has motivated banks keep their branches open in LMI communities in the aftermath of the Great Recession; importantly, this effect is larger in neighborhoods with fewer branches. This has implications for contemporary debates about the continued salience of assessment areas, which are based on where bank branches are located. Our results suggest changing the way assessment areas are defined may have unintended consequences for bank branch coverage. Although we cannot assess the precise mechanism that leads to the CRA's effects in these models, it is possible (especially given the results for areas with fewer bank branches) that the CRA exam's focus on areas containing bank branches is an important factor in preventing the spread of banking deserts. This is particularly important, given research that has shown that branch closings may be more disruptive in lower-income communities (Ergungor, 2010). The impact on small businesses is also of particular concern, given the role that small businesses play in generating jobs and economic activity as part of community development initiatives (Nguyen, 2019).

This analysis also suggests avenues for future research. Overall, more research is needed to understand the mechanisms that underlie the salutary effects of local branch presence. As banks increasingly seek ways to reduce costs, it is likely that more of them will substitute technology such as ATMs or online and mobile banking for in-bank interactions. Understanding "what matters" about a branch could help identify alternative approaches to ensuring that technological shifts do not leave lower-income communities and borrowers behind. In addition, future research on the impact of the CRA on bank branches should consider how assessment areas are drawn and whether those areas influence branching behavior. In this paper, we have only examined the effect of CRA eligibility, instead of whether certain tracts fall within one or more banks' specific assessment areas, because of data constraints. Understanding how the distribution of assessment areas influences a bank's decisions regarding the location and opening/closing of branches, as well as exploring whether the CRA provides a disincentive for institutions to open bank branches in new metropolitan areas, would be valuable in evaluating the CRA's benefits and costs. Servon's (2017) ethnography of the payday lending industry also points to the value of more research that explores customers' experiences with financial services from a qualitative perspective.

Overall, the results presented here provide novel evidence on the importance and effects of the CRA, which suggests that the CRA remains an important policy response to provide fair access to credit in underserved communities, despite the disruptions to the financial system introduced by fintech and online and mobile banking.

References

Avery, Robert B. and Kenneth P. Brevoort. 2015. "The Subprime Crisis: Is Government Housing Policy to Blame?" *Review of Economics and Statistics*, 97 (2): 352–63.

Avery, Robert B., Raphael W. Bostic, Paul S. Calem, and Glenn B. Canner. 1999. "Consolidation and Bank Branching Patterns." *Journal of Banking and Finance*, 23 (2-4): 497–532.

Avery, Robert B., Raphael W. Bostic, and Glenn B. Canner. 2005. "Assessing the Necessity and Efficiency of the Community Reinvestment Act." *Housing Policy Debate*, 16 (1): 143–72.

Barr, Michael. 2005. "Credit Where It Counts: The Community Reinvestment Act and Its Critics." *New York University Law Review*, 75 (600): 101–233.

Belsky, Eric S., Michael Schill, and Anthony Yezer. 2001. *The Effect of the Community Reinvestment Act on Bank and Thrift Home Mortgage Lending*. Cambridge, MA: Joint Center for Housing Studies of Harvard University. Available at www.jchs.harvard.edu/research/publications/effect-community-reinvestment-act-bank-and-thrift-home-purchase-mortgage.

Bhutta, Neil. 2011. "The Community Reinvestment Act and Mortgage Lending to Lower Income Borrowers and Neighborhoods." *Journal of Law and Economics*, 54 (4): 953–83.

Bostic, Raphael W. and Hyojung Lee. 2017. "Small Business Lending Under the Community Reinvestment Act." *Cityscape: A Journal of Policy Development and Research*, 19 (2): 63–84.

Brevoort, Kenneth P. and Timothy H. Hannan. 2006. "Commercial Lending and Distance: Evidence from Community Reinvestment Act Data." *Journal of Money, Credit and Banking*, 38 (8): 1991–2012.

Dahl, Drew, Douglas D. Evanoff, and Michael F. Spivey. 2002. "Community Reinvestment Act and Changes in Targeted Lending." *International Regional Science Review*, 25(3): 307–22.

Ding, Lei, Hyojung Lee, and Raphael W. Bostic. 2018. "Effects of the Community Reinvestment Act (CRA) on Small Business Lending." Federal Reserve Bank of Philadelphia Working Paper 18-27.

Ding, Lei and Leonard I. Nakamura. 2017. "Don't Know What You Got Till It's Gone — the Effects of the Community Reinvestment Act (CRA) on Mortgage Lending in the Philadelphia Market." Federal Reserve Bank of Philadelphia Working Paper 17-15.

Ergungor, O. Emre. 2010. "Bank Branch Presence and Access to Credit in Low-to-Moderate-Income Neighborhoods." *Journal of Money, Credit, and Banking*, 42(7): 1321–49.

Gabriel, Stuart A. and Stuart S. Rosenthal. 2009. *Government-Sponsored Enterprises, the Community Reinvestment Act, and Home Ownership in Targeted Underserved Neighborhoods. In Housing Markets and the Economy: Risk, Regulation, and Policy*, Edward L. Glaeser and John M. Quigley eds., pp. 202–32. Cambridge, MA: Lincoln Institute of Land Policy.

Getter, Darryl E. 2015. The Effectiveness of the Community Reinvestment Act. Congressional Research Service.

Lang, William M. and Leonard I. Nakamura. 1993. “A Model of Redlining.” *Journal of Urban Economics*, 33(2): 223–34.

Morgan, Donald, Maxim Pinkovskiy, and Bryan Yang. 2016. “Banking Deserts, Branch Closings, and Soft Information.” Federal Reserve Bank of New York, *Liberty Street Economics*, March 7, 2016.

National Community Reinvestment Coalition (NCRC). 2017. “Bank Branch Closures from 2008-2016: Unequal Impact in America’s Heartland.” Research Memo.

Nguyen, Hoai-Luu Q. 2019. “Are Credit Markets Still Local? Evidence from Bank Branch Closings.” *American Economic Journal: Applied Economics*, 11(1): 1–32.

Office of the Comptroller of the Currency. 2018. “Reforming the Community Reinvestment Act Regulatory Framework.” Federal Register, 83(172): 45053–59.

Reid, Carolina and Elizabeth Laderman. 2011. “Constructive Credit: Revisiting the Performance of Community Reinvestment Act Lending during the Subprime Crisis,” pp. 159–86 in *The American Mortgage System: Rethink, Recover, Rebuild,* Marvin Smith and Susan Wachter, eds. Philadelphia: University of Pennsylvania Press.

Ringo, Daniel. 2017. “Mortgage Lending, Default, and the Community Reinvestment Act,” Available at papers.ssrn.com/sol3/papers.cfm?abstract_id=2585215.

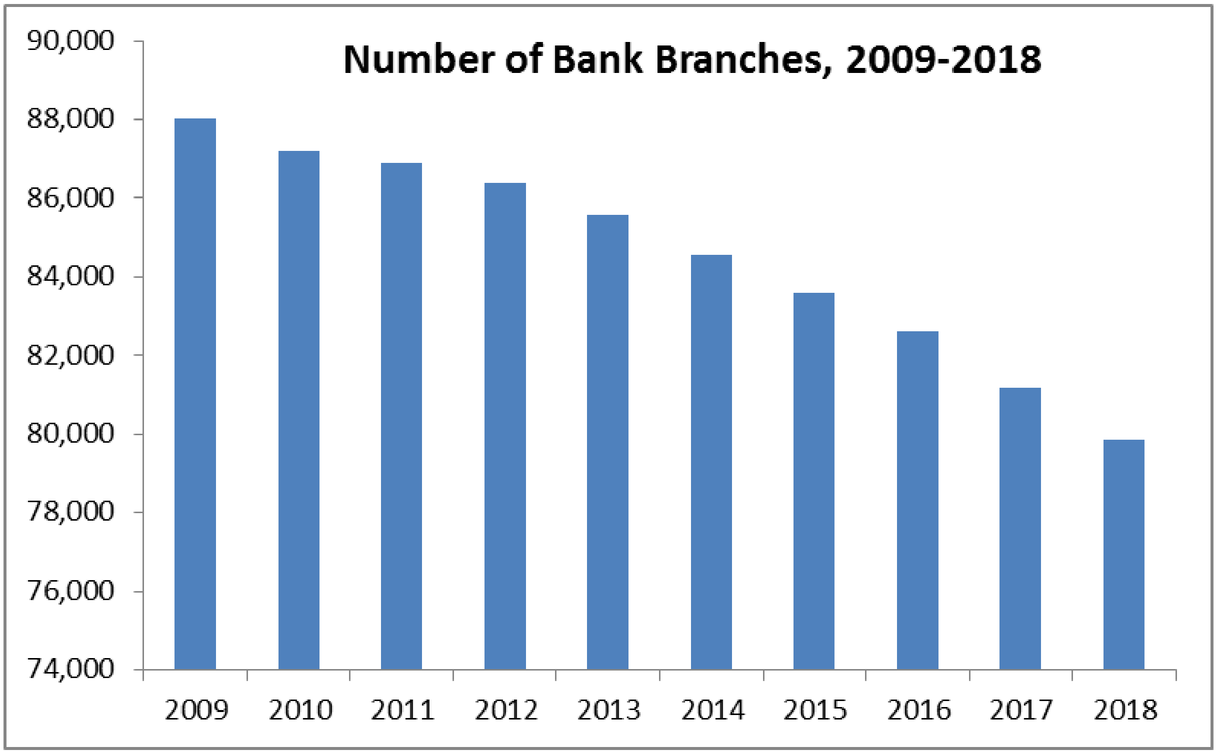
Servon, Lisa J. 2017. *The Unbanking of America: How the New Middle Class Survives*. Houghton Mifflin Harcourt.

Sumit, Agarwal, Souphala Chomsisengphet, Chunlin Liu, and Nicholas S. Souleles. 2010. “Benefits of Relationship Banking: Evidence from Consumer Credit Markets.” Federal Reserve Bank of Chicago Working Paper No. 2010-05.

Sumit, Agarwal and Robert Hauswald. 2010. “Distance and Private Information in Lending.” *Review of Financial Studies,* 23 (7): 2757–88.

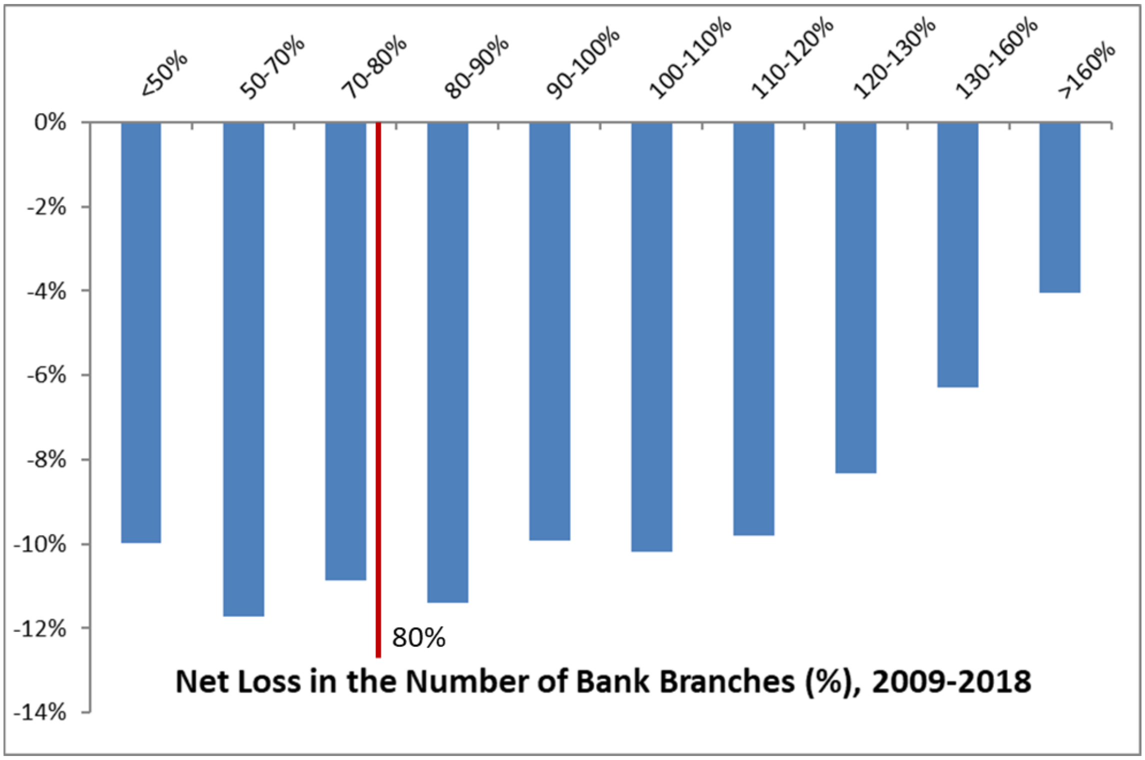
Tranfaglia, Anna. 2018. “Shrinking Networks: A Spatial Analysis of Bank Branch Closures.” Federal Reserve Bank of Philadelphia Working Paper 18-12.

Figure 1. Number of Brank Branches in the U.S., 2009–2018



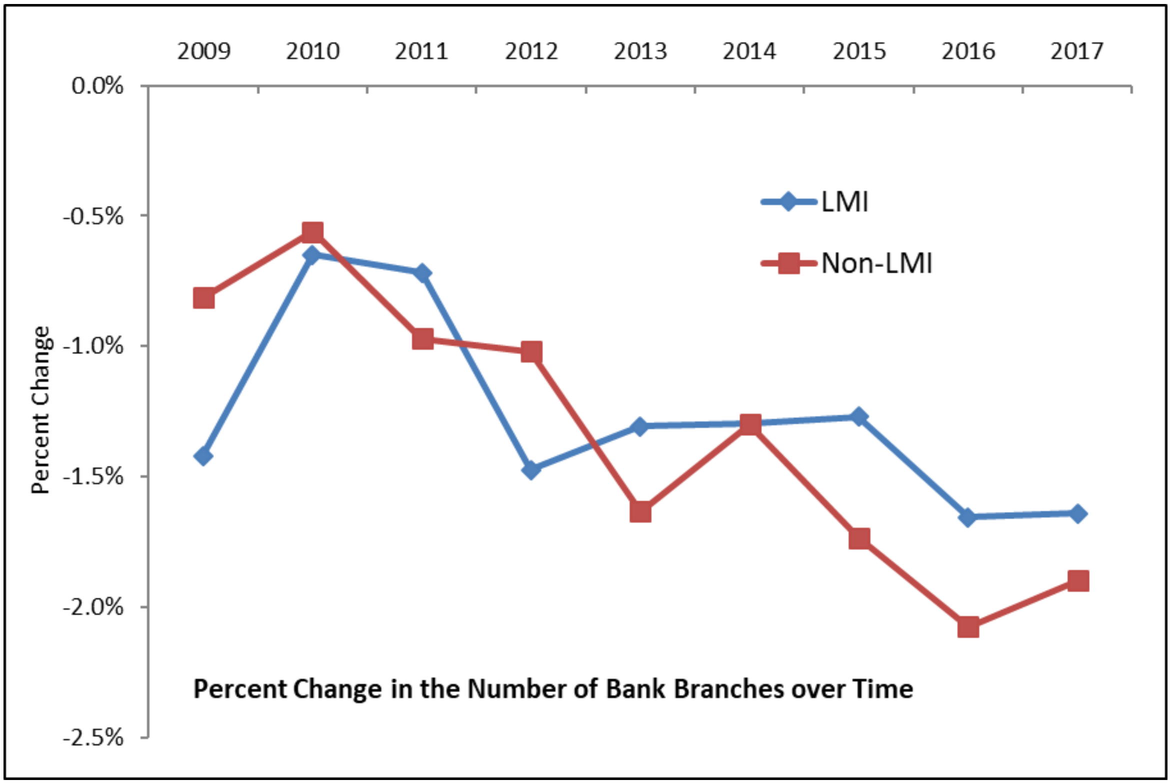
Note: This only includes brick-and-mortar branches operated by federally insured banks and thrift institutions (credit unions are not included) that provide full bank services; credit union branches, branches providing limited service, in-store branches, and other branch types are not included here.
Source: S&P Global Market Intelligence, SNL Branch Analytics

Figure 2. Net Loss of CRA-Covered Bank Branches by Neighborhood Income Ratio (of Area Median), U.S., 2009–2018



Note: This chart is based only on the neighborhood income ratio in 2012 to prevent complications from the changed composition of the sample over time; this only includes brick-and-mortar branches operated by federally insured banks and thrift institutions (credit unions are not included) that provide full bank services; branches providing limited service, in-store branches, and other branch types are not included here.
Source: S&P Global Market Intelligence, SNL Branch Analytics, and FFIEC Census data

Figure 3. Annual Percent Loss in the Number of Bank Branches Over Time (Tracts with Income Between 70 and 90% of Area Median)



Note: This chart is based only on the neighborhood income ratio in 2012 to prevent complications from the changed composition of the sample over time; this only includes brick-and-mortar branches operated by federally insured banks and thrift institutions (credit unions are not included) that provide full bank services; branches providing limited service, in-store branches, and other branch types are not included here.
Source: S&P Global Market Intelligence, SNL Branch Analytics, and FFIEC Census data

Table 1. Summary Statistics of the LMI and Non-LMI Tracts, 2009–2017

	All Tracts				Tracts at 70–90% of AMFI			
	Non-LMI		LMI		Non-LMI		LMI	
	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.
Net branch closures	0.032	0.284	0.036	0.263	0.038	0.266	0.035	0.257
No. of closures	0.058	0.246	0.053	0.236	0.055	0.240	0.051	0.232
No. of new openings	0.026	0.168	0.018	0.140	0.017	0.134	0.017	0.134
No. of branches	2.454	2.195	2.208	2.168	2.249	1.894	2.225	1.941
Net branch closures (per 10,000)	0.078	0.905	0.111	1.148	0.095	0.775	0.092	0.753
No. of closures (per 10,000)	0.136	0.820	0.169	0.991	0.137	0.690	0.134	0.688
No. of openings (per 10,000)	0.058	0.547	0.057	0.695	0.041	0.394	0.042	0.380
No. of branches (per 10,000)	5.630	10.258	6.751	14.753	5.526	6.579	5.748	7.582
% Failed	0.564	5.779	0.498	5.855	0.632	6.236	0.568	6.193
% M&A	0.328	4.402	0.270	4.198	0.345	4.594	0.280	4.283
Lagged total deposits ($1,000)	231,948	2,006,305	261,464	3,360,438	166,115	860,263	250,394	3,999,448
Total population	5,399	3,107	4,398	2,138	4,895	2,610	4,731	2,334
Total housing units	2,297	1,253	1,882	864	2,141	1,074	2,056	945
No. of businesses	150.0	132.8	121.1	118.1	122.7	91.6	123.7	103.6
No. of businesses (per 10,000)	318.7	855.4	320.5	521.7	274.5	287.5	285.7	275.2
Vacancy rate (%)	9.248	8.885	13.439	9.708	11.240	8.824	12.028	9.096
Homeownership rate (%)	68.585	19.130	42.745	20.937	59.809	18.915	52.991	19.340
% College graduates	38.011	19.177	19.672	13.957	24.067	13.301	21.974	13.514
% Unemployment	6.110	4.047	11.086	6.793	7.826	4.628	8.915	5.106
% High income (> $75,000)	44.041	17.428	20.077	12.123	29.306	12.503	24.885	12.052
Poverty rate (%)	10.372	8.160	26.367	13.874	15.877	9.170	19.724	10.380
Median age	40.033	7.054	34.711	7.349	38.245	7.122	36.598	7.299
Median rent ($)	1,140.7	488.6	879.1	281.4	935.6	316.2	910.5	296.4
Median house value ($)	287,256	224,795	174,967	147,933	192,681	139,301	180,381	137,121
N (tract years)	180,778		62,732		26,991		22,054	

Note: This only includes tracts in metro areas with at least one branch and a population over 100 and only covers brick-and-mortar branches operated by federally insured banks and thrift institutions that provide full bank services; branches providing limited service, in-store branches, and other branch types are not included here.
Source: S&P Global Market Intelligence, SNL Branch Analytics and M&A data; FFIEC Census data, the FDIC Failed Bank List, and Census Zip Codes Business Patterns data.

Table 2. Branch Characteristics and Characteristics of the Location (Census Tract) of Branches, Tracts Within 70–90% of AMFI, 2009–2017

	All Branches				Tracts at 70–90% of AMFI			
	Non-LMI		LMI		Non-LMI		LMI	
	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.
Branch closing	0.023	0.150	0.024	0.153	0.024	0.154	0.023	0.150
Branch opening	0.012	0.108	0.010	0.097	0.009	0.095	0.008	0.091
Headquarters branch	0.029	0.167	0.040	0.197	0.039	0.193	0.039	0.194
Failed lender	0.006	0.080	0.005	0.073	0.007	0.084	0.006	0.078
Lender M&A	0.004	0.059	0.003	0.053	0.004	0.059	0.003	0.053
Deposit ratio (1-year lag, log)	-0.576	0.994	-0.656	1.139	-0.581	0.985	-0.611	1.033
Total population (log)	8.468	0.453	8.274	0.479	8.389	0.428	8.366	0.432
Housing units (log)	7.645	0.428	7.479	0.432	7.591	0.402	7.568	0.406
Businesses (per 10,000)	458.0	1374.9	551.0	1362.3	349.7	394.2	387.1	482.0
Vacancy rate (%)	9.576	9.073	13.276	9.373	11.274	8.828	12.045	8.990
Homeownership rate (%)	65.773	20.331	39.929	21.086	56.862	19.557	50.058	19.733
% College graduates	40.750	19.694	21.984	15.320	25.802	14.227	23.882	14.740
% Unemployment	5.876	3.869	10.629	6.599	7.546	4.461	8.679	4.900
% High income (> $75,000)	44.692	17.646	20.691	12.632	29.367	12.737	25.113	12.424
Poverty rate (%)	10.306	8.215	26.008	13.849	15.959	9.364	19.780	10.552
Median age	40.049	7.260	35.146	7.575	38.296	7.391	36.593	7.459
Median rent (log)	6.985	0.397	6.733	0.327	6.802	0.325	6.776	0.314
Median house value (log)	12.421	0.641	11.894	0.742	12.041	0.597	11.951	0.627
Principal city (%)	39.804	48.949	58.064	49.346	38.138	48.573	46.141	49.851
Distance to nearest branch by same lender (column percent)								
0–1.5 miles	21.29		29.46		21.42		23.41	
1.5–3.0 miles	31.82		33.20		29.91		32.19	
3.0–7.5 miles	30.37		21.48		26.40		24.30	
7.5–15.0 miles	11.29		9.43		14.99		12.50	
>15.0 miles	5.13		6.28		7.15		7.47	
Distance to any other branch (column percent)								
<0.05 miles	14.61		17.60		13.03		14.38	
0.05–0.1 miles	25.11		23.78		23.71		23.13	
0.1–0.25 miles	28.70		28.25		28.43		29.00	
0.25–3 miles	28.44		28.63		30.26		30.32	
>=3 miles	3.13		1.74		4.57		3.16	
Total number of branches								
2–3	3.82		3.25		4.48		3.80	
4–10	11.89		10.37		13.16		11.91	
11–100	23.04		20.48		22.53		21.82	
>100	61.25		65.90		59.83		62.46	
N (branch years)	434,856		135,450		59,579		48,185	

Note: This only includes branches in tracts in metro areas with a population over 100 and only covers brick-and-mortar branches operated by federally insured banks and thrift institutions that provide full bank services; branches providing limited service, in-store branches, and other branch types are not included here.Source: S&P Global Market Intelligence, SNL Branch Analytics and M&A data; FFIEC Census data, FDIC Failed Bank List, and Census Zip Codes Business Patterns data

Table 3. Summary of the CRA's Effects on Risk of Branch Closure Using the Branch Panel, 2009–2017

Tract Income Range (relative to AMFI)	Coef.	Std. Err.	P>t	Sample Size
All tracts	-0.0021	0.0008	0.0120	570,306
[50%,100%) of AMFI	-0.0024	0.0010	0.0140	234,674
[70%, 90%) of AMFI	-0.0021	0.0011	0.0550	107,764
[75%, 85%) of AMFI	-0.0032	0.0015	0.0340	54,293

Note: Coefficients of the LMI variable are from four different linear probabilities of branch closure; control variables include bank failures, mergers and acquisitions, bank deposits, whether the branch is a headquarters, lender size, distance to the nearest branch by the same lender (categorical), and neighborhood demographic characteristics: tract total population (log), total housing units (log), homeownership rate, vacancy rate, share of high-income, share of college educated, poverty rate, unemployment rate, median age, median rent and median property value, yearly and MSA fixed effects. Standard errors have been clustered at the metro level.

Source: S&P Global Market Intelligence, SNL Branch Analytics and M&A data; FFIEC Census data, FDIC Failed Bank List, and Census Zip Codes Business Patterns data.

Table 4. Summary of the CRA's Effects on the Net Closures, Closures, and Opening of Bank Branches Using the Tract Year Panel, 2009–2017

Tract Income Range (relative to AMFI)	A. Net Closures Per 1,000			B. Number of closures Per 1,000			C. Number of Branch Openings Per 1,000			Sample Size
	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t	
All tracts	-0.0140	0.0065	0.0320	-0.0093	0.0069	0.1770	0.0047	0.0038	0.2080	243,510
[50%, 100%)	0.0149	0.0069	0.0300	-0.0101	0.0065	0.1230	0.0048	0.0032	0.1300	107,058
[70%, 90%)	-0.0105	0.0082	0.2010	-0.0114	0.0078	0.1450	-0.0009	0.0036	0.8100	49,045
[75%, 85%)	-0.0163	0.0098	0.0970	-0.0154	0.0094	0.1030	0.0010	0.0042	0.8190	24,698

Note: Coefficients of the LMI variable are from 12 different regression discontinuity models; control variables include the share of bank failures, share of mergers and acquisitions, number and total deposits of bank branches in the tract, and neighborhood demographic characteristics: tract total population (log), total housing units (log), homeownership rate, vacancy rate, share of high-income, share of college educated, poverty rate, unemployment rate, median age, median rent and median property value, yearly and MSA fixed effects. Only tracts in MSAs with at least one branch in 2009 and with a population >100 are included. Standard errors are clustered at the metro level.
Source: S&P Global Market Intelligence, SNL Branch Analytics and M&A data; FFIEC Census data, FDIC Failed Bank List, and Census Zip Codes Business Patterns data.

Table 5. Heterogeneity in the CRA's Effects on Branch Closure Across Markets and Over Time (Tracts Within 70–90% of AMFI)

	Coef.	Std. Err.	P>t	Sample Size
By number of existing branches				
1	-0.0050	0.0024	0.0400	22,351
2–3	-0.0015	0.0017	0.3770	42,074
4+	-0.0012	0.0018	0.4950	43,339
*By metro status**				
Nonmetro	-0.0012	0.0013	0.3660	42,896
Metro	-0.0021	0.0011	0.0550	107,764
*By bank asset**				
Large banks	-0.0030	0.0012	0.0140	88,732
Nonlarge banks	0.0029	0.0021	0.1740	19,032
*By state/federal charter**				
State chartered	0.0063	0.0033	0.0570	9,503
Federally chartered	-0.0029	0.0012	0.0140	98,261
By region				
Northeast	-0.0060	0.0026	0.0230	19,683
Midwest	0.0008	0.0024	0.7470	25,543
South	0.0024	0.0017	0.1640	41,556
West	-0.0009	0.0018	0.6040	20,965
*By MSA size**				
Smaller MSAs	-0.0016	0.0015	0.3180	63,329
Large MSAs (top 25)	-0.0028	0.0016	0.0870	44,435
*By cohort**				
Before 2013	0.0002	0.0015	0.8740	50,705
Post-2013	-0.0047	0.0015	0.0020	57,059

Note: * denotes significant at the 0.05 level for the Chow test of the difference in regression coefficients (not tested for regressions by number of branches and by region); control variables include bank failures, mergers and acquisitions, bank deposits, whether the branch is a headquarters, lender size, distance to the nearest branch by the same lender (categorical), and neighborhood demographic characteristics: tract total population (log), total housing units (log), homeownership rate, vacancy rate, share of high-income, share of college-educated, poverty rate, unemployment rate, median age, median rent and median property value, and yearly and MSA fixed effects. Standard errors have been clustered at the metro level.
Source: S&P Global Market Intelligence, SNL Branch Analytics and M&A data; FFIEC Census data, FDIC Failed Bank List, and Census Zip Codes Business Patterns data.

Appendix A. Full Regression Results of the Linear Probability of Branch Closure Risk

	Full sample									In Tracts at 70– 90% of AMFI								
Closure	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t
LMI	-0.0014	0.0007	0.0460	-0.0024	0.0008	0.0020	-0.0021	0.0008	0.0120	-0.0020	0.0011	0.0630	-0.0023	0.0011	0.0350	-0.0021	0.0011	0.0550
Lender 2–3 branches	-0.0021	0.0018	0.2310	-0.0017	0.0018	0.3410	0.0005	0.0018	0.7980	-0.0017	0.0032	0.5820	-0.0017	0.0032	0.5900	0.0005	0.0033	0.8710
Lender 4–10 branches	0.0009	0.0013	0.4980	0.0012	0.0013	0.3430	0.0029	0.0013	0.0310	-0.0005	0.0019	0.8120	-0.0003	0.0020	0.8900	0.0011	0.0021	0.6200
Lender 11–100 branches	0.0070	0.0012	0.0000	0.0072	0.0012	0.0000	0.0081	0.0013	0.0000	0.0076	0.0018	0.0000	0.0079	0.0018	0.0000	0.0088	0.0019	0.0000
Headquarter branch	-0.0049	0.0012	0.0000	-0.0052	0.0012	0.0000	-0.0047	0.0012	0.0000	-0.0004	0.0020	0.8540	-0.0006	0.0021	0.7630	0.0002	0.0021	0.9280
Deposit ratio (in log)	-0.0133	0.0004	0.0000	-0.0136	0.0005	0.0000	-0.0138	0.0005	0.0000	-0.0158	0.0008	0.0000	-0.0162	0.0009	0.0000	-0.0165	0.0009	0.0000
Failed bank	0.1012	0.0115	0.0000	0.1017	0.0115	0.0000	0.1021	0.0115	0.0000	0.1011	0.0163	0.0000	0.1020	0.0163	0.0000	0.1033	0.0164	0.0000
M&A	0.0588	0.0096	0.0000	0.0584	0.0095	0.0000	0.0582	0.0096	0.0000	0.0527	0.0167	0.0020	0.0524	0.0166	0.0020	0.0521	0.0163	0.0020
Miles to same lender: <1.5	0.0083	0.0051	0.1040	0.0085	0.0052	0.1010	0.0080	0.0053	0.1360	-0.0049	0.0108	0.6520	-0.0050	0.0107	0.6400	-0.0080	0.0113	0.4790
1.5–3.0	-0.0071	0.0052	0.1680	-0.0071	0.0052	0.1750	-0.0085	0.0053	0.1070	-0.0207	0.0107	0.0540	-0.0210	0.0107	0.0490	-0.0245	0.0113	0.0310
3.0–7.5	-0.0084	0.0051	0.0990	-0.0083	0.0051	0.1060	-0.0106	0.0052	0.0420	-0.0221	0.0106	0.0380	-0.0227	0.0106	0.0320	-0.0273	0.0112	0.0150
7.5–15.0	-0.0057	0.0051	0.2670	-0.0055	0.0051	0.2820	-0.0078	0.0052	0.1360	-0.0216	0.0107	0.0450	-0.0217	0.0106	0.0420	-0.0257	0.0113	0.0230
>15.0	0.0008	0.0053	0.8760	0.0004	0.0054	0.9470	-0.0010	0.0055	0.8530	-0.0117	0.0107	0.2740	-0.0125	0.0105	0.2360	-0.0149	0.0112	0.1850
Miles to any branch: 0.05–0.1	-0.0048	0.0010	0.0000	-0.0047	0.0008	0.0000	-0.0051	0.0007	0.0000	-0.0037	0.0020	0.0600	-0.0038	0.0018	0.0290	-0.0040	0.0017	0.0190
0.1–0.25	-0.0048	0.0011	0.0000	-0.0046	0.0009	0.0000	-0.0051	0.0009	0.0000	-0.0036	0.0019	0.0610	-0.0037	0.0017	0.0270	-0.0039	0.0017	0.0210
0.25–3	-0.0010	0.0012	0.3950	-0.0007	0.0010	0.4690	-0.0013	0.0009	0.1560	-0.0003	0.0020	0.8720	-0.0002	0.0018	0.9190	-0.0007	0.0018	0.7000
>=3	0.0028	0.0018	0.1190	0.0026	0.0017	0.1170	0.0033	0.0016	0.0430	0.0041	0.0033	0.2080	0.0042	0.0032	0.1870	0.0065	0.0032	0.0430
Total population (log)				-0.0046	0.0018	0.0110	-0.0033	0.0017	0.0570				-0.0007	0.0043	0.8670	0.0049	0.0048	0.3100
Housing units (log)				0.0033	0.0018	0.0580	0.0018	0.0017	0.2920				0.0002	0.0044	0.9690	-0.0051	0.0049	0.3080
Businesses (per 10,000)				0.0000	0.0000	0.1090	0.0000	0.0000	0.0720				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vacancy rate (%)				0.0001	0.0000	0.0600	0.0001	0.0000	0.1580				0.0001	0.0001	0.4380	0.0001	0.0001	0.3150
Homeownership rate (%)				0.0000	0.0000	0.2740	0.0000	0.0000	0.4360				0.0000	0.0000	0.3110	0.0000	0.0000	0.3410
% College graduates				0.0001	0.0000	0.0020	0.0000	0.0000	0.0430				0.0000	0.0001	0.8690	0.0000	0.0001	0.5520
Unemployment rate (%)				0.0002	0.0001	0.0030	0.0000	0.0001	0.5770				0.0001	0.0001	0.3520	-0.0001	0.0001	0.5010
% High Income (> $75,000)				0.0000	0.0000	0.2090	0.0000	0.0000	0.6600				0.0001	0.0001	0.0240	0.0000	0.0001	0.9730
Poverty rate (%)				0.0000	0.0000	0.1460	0.0000	0.0000	0.5080				0.0000	0.0001	0.6110	-0.0001	0.0001	0.4140
Median age				0.0003	0.0000	0.0000	0.0002	0.0000	0.0010				0.0002	0.0001	0.0760	0.0001	0.0001	0.3430
Median rent (log)				0.0018	0.0009	0.0430	-0.0008	0.0008	0.2790				0.0021	0.0025	0.3930	-0.0016	0.0030	0.5880
Median house value (log)				-0.0042	0.0007	0.0000	-0.0004	0.0009	0.6700				-0.0066	0.0013	0.0000	-0.0026	0.0018	0.1580
Yearly dummy: 2010							-0.0062	0.0012	0.0000							-0.0031	0.0020	0.1260
2011							-0.0034	0.0013	0.0080							-0.0002	0.0020	0.9130
2012							-0.0005	0.0013	0.7100							0.0021	0.0021	0.3190
2013							0.0011	0.0015	0.4430							0.0041	0.0024	0.0910
2014							-0.0002	0.0013	0.8500							0.0027	0.0024	0.2730
2015							0.0001	0.0014	0.9300							0.0045	0.0025	0.0750
2016							0.0070	0.0018	0.0000							0.0088	0.0028	0.0020
2017							0.0070	0.0017	0.0000							0.0077	0.0027	0.0050
MSA dummies	No			No			Yes			No			No			Yes		
R Square	0.0134			0.0140			0.0164			0.0159			0.0168			0.0226		
N	570,306			570,306			570,306			107,764			107,764			107,764		

Note: Standard errors have been clustered at the metro level.

Source: S&P Global Market Intelligence, SNL Branch Analytics and M&A data; FFIEC Census data, FDIC Failed Bank List, and Census Zip Codes Business Patterns data.