Do Closing Minority Depository Institutions Affect Credit in Their Communities

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Abstract

I investigate the role of urban community banks, Minority Depository Institutions (MDIs) in promoting credit access in underserved, diverse urban neighborhoods. I construct a panel dataset, employ an event-study design and treat MDI and non-MDI branch closures within census tracts as interventions. The effects are largely minimal, with a few notable exceptions: 1) Asian MDI branch closures lower mortgage originations within the Asian community, 2) Hispanic MDI branch closures lower small business loan (SBL) originations to small firms, while, 3) non-MDI branch closures lower mortgage originations within Black communities served by Black MDIs. Surprisingly, non-MDI branch closures precede an increase in total SBL originations. Using lender-level Herfindahl–Hirschman index, I show branch closures do not lead to more concentrated lending markets, rather encourage entry of non-local and non-bank lenders. The results highlight the evolving and decreasing role of physical bank branches and relationship banking in an increasingly digital banking landscape.

JEL Classification Codes: G20, G21 , L10

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1 Introduction

Minority Depository Institutions (MDIs) are US banks owned and operated primarily by minorities and established to serve minority borrowers that historically had limited access to credit (Government Accountability Office, 2006). The Federal Deposit Insurance Corporation (FDIC) defines MDIs as banks with at least 51% minority ownership or with a majority of the board of directors of minority origin and serving mostly minority-populated areas. The Office of the Comptroller (OCC) also designates any national bank or federal savings association as an MDI given the institution already serves the credit needs of communities consisting of minority borrowers (OCC, 2021).[1] In late nineteenth century, urban minority communities, primarily Blacks set up banks with minority ownership to address credit constraints in segregated urban neighborhoods. These institutions were affiliated with Black churches and Black fraternities. Since their inception, Black-owned banks faced difficulty with sound loan underwriting. This is because they often faced pressures to make risky loans based off their affiliations to their parent churches or communities, causing many of them to fail Baradaran (2017). In spite of the obstacles, new Black-owned banks continued to form. The first Asian-owned and the first Hispanic-owned banks formed in the nineteen-sixties.

Empirical studies provide conflicting evidence regarding the impact of MDIs on lending to minority borrowers. Dahl (1996) examines lending patterns of 34 commercial banks during alternate periods of minority and non-minority ownership in the nineteen eighties and nineties. He shows loan growth is slower when banks are owned by minorities than by non-minorities. In contrast, Eberley et al. (2019) find MDIs originate a larger share of their mortgages and SBLs to borrowers who live in Low-Moderate Income (LMI) census tracts and to minority borrowers than non-MDI community banks.[2,3] Despite the mixed

[1]The OCC can consider a mutual institution as an MDI if women comprise a majority of the board of directors and hold a significant percentage of senior management positions.

[2]Qualitative information from the Government Accountability Office report shows MDIs often provide financial literary services and serve customers who prefer to do banking in person rather than through other less costly alternatives such as mobile phones or internet, resulting in higher operating costs.

[3]LMI census tracts are identifiable when a census tract's median family income is less than 80% relative to either a metropolitan statistical area (MSA) or a metropolitan divisions (MD) or a statewide non-

evidence, recent research shows MDIs serve their customers more broadly through their in-depth knowledge of the communities they serve. Berger et al. (2022) find that borrowers and lenders sharing minority characteristics reduce informational asymmetries via tacit understandings and mutual trust leading to better lending practices in minority communities. Hurtado and Sakong (2023) show borrowers applying for mortgages in banks whose owners are of the same minority group are nine percentage points more likely to be approved than otherwise identical borrowers in non-minority banks and they are six times more likely to be approved in case of a minority loan officer. Similarly, Toussaint-Comeau et al. (2020), who study MDI failures during the Great Recession, show small businesses in primarily Black census tracts faced significant frictions in obtaining credit as a result of the failures, leading to cumulative declines in aggregate small business lending in Black neighborhoods that lasted up to 3 years.

I study change in credit access due to bank branch closures within census tracts served by MDIs. To conduct the analysis, I construct a panel dataset spanning from 2011 to 2021 from publicly available sources. Using an event-study design, where branch closures are considered interventions, I examine whether the closure of MDI branches reduces access to credit in their local markets measured by mortgage originations and SBL originations within the community sharing the same minority identity as the MDI owners. I also estimate how mortgage originations and SBL originations vary due to non-MDI branch closures in the same local markets. This design lets me disentangle the impact of the closure of a generic bank (non-MDI) branch versus a mission-oriented bank (or MDI) branch.

The number of MDI branch offices fell more than non-MDI branch offices in the aftermath of the Great Recession.[4] Branches closed due to office closures, mergers and failures of MDIs during this time period. However, MDI branch closures were more pronounced primarily for two reasons. First, many failed MDIs were located in zip codes with a higher fraction of

metropolitan area's median family income (Minneapolis FRB, 2025).

[4]In my sample of 1085 census tracts, from 2011 to 2021, the number of MDI branches fell by 30 percent, while the number of non-MDI branches fell by 9 percent.

subprime borrowers (Mian and Sufi, 2009; Justiniano et al., 2016) and therefore, experienced higher default rates. Second, MDIs have limited ability to raise capital and high operating costs making them more vulnerable to financial shocks (Eberley et al., 2019).[5] Surviving MDIs benefited from closer relationship with their communities, with those specializing in serving low-income communities less likely to fail (Babajanova, 2022).

My analysis reveals four key findings regarding the differing impacts of MDI and non-MDI branch closures on credit accessibility. I find when Asian-owned bank branches close, mortgage originations decrease only within the Asian community by 18-26 percent; when Hispanic-owned bank branches close, SBL originations to firms less than $1 million in assets fall within the immediate community by 13 percent; while, when non-MDI branches close mortgage originations to the Black community decrease by 33-40 percent in the tracts that are served by Black MDIs. Contrary to common expectations, non-MDI bank branch closures precede an increase in SBL originations (of less than $1 million in volume) by 25-30 percent. Using a pooled regression, I show MDI closures generally have a contractionary effect on credit access among the minority population sharing identity with the MDI owners whereas non-MDI closures primarily have an expansionary effect on credit.

I further analyze the causes behind MDI and non-MDI branch closures and whether the closures lead to more concentrated lending markets. I find most MDI and non-MDI branch closures are simple branch closures and not a result of mergers or failures among parent banks. In my sample, MDIs with assets sizes between $1 and $10 billion close branches in greater proportions. Conversely, medium and large-sized non-MDIs, those with assets between $10 and $50 billion, close branches more aggressively. This finding implies branch closures impact relatively small and medium-sized MDIs and relatively larger non-MDIs. Using lender-level Herfindahl–Hirschman index (HHI) from the mortgage origination data, I show branch closures do not lead to more concentrated lending markets, rather encourage

[5]MDIs have high noninterest expenses relative to interest and noninterest income (efficiency ratio) and higher overhead expenses relative to average assets when compared to other financial institutions of similar asset sizes.

entry of "non-local" or "non-bank" lenders, implying sustained demand for credit in these markets.

This paper relates broadly to research studying the causal effect of bank branch closures on credit accessibility within census tracts (Nguyen, 2019; Toussaint-Comeau et al., 2020). It draws upon recent literature on the proliferation of online banking followed by a reduction of bank branches. Calzada et al. (2022) and Koont (2024) highlight how banks reduce branches in markets after introducing online applications for iOS and Android devices. Similarly, Jiang et al. (2024) use county-level data and show banks with low branch reliance are more likely to close their branches due to 3G internet penetration when compared to banks with higher branch reliance. I find entry of "non-local" or "non-bank" mortgage lenders in majority of census tracts that experience MDI branch closures. This finding underscores similar findings on the expansion of fintech firms and non-banks in the mortgage lending market post Great Recession, as substitutes of traditional banks (Buchak et al., 2018; Fuster et al., 2018; Corbae et al., 2023).

The findings also provide supporting evidence to recent research that study the interaction between bank presence and SBL originations. Salvo (2021) studies the 30 largest Metropolitan Statistical Areas (MSAs) with over 2 million population and show large "non-local" banks dominate the market for SBLs. These banks originate business credit cards that account for the majority of the SBL originations, dominating the SBL market.[6] Both Gopal and Schnabl (2022) and Cornelli et al. (2024) show post Great Recession, fintech lenders increasingly replace traditional banks (especially community banks) in supplying SBLs. Furthermore, Minton et al. (2024) show a decrease in community bank branches, due to mergers among local community banks, positively impacts community investment through SBL originations. Additionally, I provide a mechanism for this phenomenon by drawing on research on the effect of increasing deposit concentration (due to branch closures) on SBL

[6]Banks have a minimum loan size below which credit evaluation is completely automated. For small local banks the threshold is $10,000, whereas for larger banks the threshold is much higher at $60,000 leading these banks to make a larger quantity of small-sized loans.

originations (Drechsler et al., 2021; Li et al., 2023).

I also highlight the heterogeneous effects of branch closures on SBL originations and mortgage originations. I find Hispanic MDI branch closures lead to a decrease in SBL originations to very small firms, those with assets less than 1$ million. Notably, over 80% of small businesses owned by Hispanics can be categorized as very small firms, with assets less than $1 million Federal Reserve Banks (2021). Similarly, I find closures of Asian MDI branches reduces total mortgages among the Asian community by about 20 percent, a result supported by Hurtado and Sakong (2023) who study the failure of an Asian MDI in New York city and show Asian borrowers in the most exposed census tracts experienced declines in mortgage approvals in the range of 20 to 40 percent. These findings imply when Asian or Hispanic MDI branches close, language barriers may impact credit accessibility within their most immediate communities.

This paper also advances the extensive literature on the impact of community banks within their local communities and the role internet banking, fintechs and non-banks play to fill the credit gap left by decreasing bank branches and makes three contributions. This is the first paper to look at the impact of the closure of MDI branches on mortgage originations within communities sharing the same minority identity as the MDI owners. Since I can obtain mortgage originations information by racial composition and by census tracts, I can study the effect of branch closure of an MDI, that was, as an example, designated as a Black depository institution, on mortgage originations to the Black community within that census tract. Second, I study the effect of branch closure of an MDI on SBL originations in the immediate community. Third, I evaluate what happens to credit accessibility within these racially diverse communities when a non-MDI bank branch closes in the local market.

2 Financial Inclusion of Minority Communities

Historically, urban minority communities in the US struggled accessing credit for mortgages and SBLs. This phenomenon can be partially attributed to the Home Owner's Loan Corporation (HOLC), the Federal Housing Administration (FHA) and the Federal Home

Loan Bank Board (FHLBB) established in 1930s (Baradaran, 2017; Winling and Michney, 2021). These institutions were designed by the federal government to facilitate refinancing and insuring nonfarm residential mortgages after the Great Depression. In the late 1930s, HOLC created color-coded maps that evaluated neighborhoods in more than 200 cities and exacerbated mortgage lending activity in predominantly minority neighborhoods (Jackson, 1985).[7] Even before the HOLC maps, the FHA restricted the geographic scope of their mortgage activity and did not insure mortgages in primarily minority populated areas (Fishback et al., 2024). Because the maps also served as a dominant source of information for private lenders, homeowners in lower graded neighborhoods, primarily Blacks, also faced significantly higher private credit costs (Hiller and Knowles, 2002). The HOLC maps lowered home ownership rates, house values and rents and exacerbated racial segregation in the US in the following decades (Aaronson et al., 2021). "Redlining" also adversely impacted SBL originations within primarily minority populated urban areas (Bates et al., 2022) and its ramifications persists to the present day. Bates and Robb (2015) find firms with Black, Hispanic or Asian American owners still experience "unmet credit needs".

Minority-owned banks, especially Black-owned banks, have previously filled this credit gap (Toussaint-Comeau et al., 2020; Baradaran, 2017). Minorities consist of about 38 percent of the US population and operate 19 percent of all businesses in the US. However, the proportion of MDIs is modest and stands at 2.8 percent (Barth and Xu, 2020). In spite of their small numbers, Black-owned banks are more likely to locate near historically "redlined" neighborhoods compared to other MDIs and non-MDIs (Razzak, 2025). Since MDIs are mission oriented, it is crucial to understand how their closures impact the immediate and long-term credit outcomes of the communities sharing minority identity with the MDI owners. Table 1 shows all MDI institutions and their corresponding branches in existence in 2021.

[7] Urban neighborhoods coded green (designated as A) were considered "new, homogeneous, and in demand as residential locations.", while areas coded blue (designated as B) were termed "reached their peak", but desirable. Finally, areas coded yellow (designated as C) were termed as "definitely declining" and those coded red (designated as D), the lowest rating, were considered as the most undesirable.

3 Conceptual Framework

Two concepts inform my approach to understanding the effect of MDI closures: the supply of bank branches and the role of relationship banking in providing access to credit. Between 2011 and 2021, the number of MDI institutions decreased from 180 to 143. In the studied tracts, the number of MDI branches decreased from 1411 to 934. This decreases in the number of bank branches likely affected the time to travel to a branch and relationship banking with minority borrowers in the local markets.

3.1 Supply of bank branches

Bank branch closures decrease the number of available branches, leaving fewer bank branches to serve a customer base, assuming the remaining branches do not expand credit to offset the decline in the number of suppliers. The median census tract that lost an MDI branch had two bank branches rather than three, the median census tract that still had an operating MDI branch. One way the disappearance of a bank branch may influence access to credit is by increasing the physical distance between a potential borrower and a bank branch. Herpfer et al. (2022) study the impact of distance to bank branches on lending and show that lower travel time increases the likelihood of initiating a new banking relationship and lowers transaction costs. Nguyen (2019) show that bank branch closings causes a persistent decline in local small business lending. If MDIs play a prominent role in providing credit within their immediate communities, the closure of an MDI branch, even in the presence of other bank branches, may increase the cost of obtaining credit in unforeseen ways; for example, households or small business owners may need to invest more time looking for credit.

3.2 Relationship banking

Relationship banking's role in supplying credit have been widely studied. Peterson and Rajan (1994) show maintaining long term relationships to creditors increases the availability of financing for small business and to a lesser extent reduces the price of credit. Cole (1998) finds a potential lender is more likely to extend credit to a firm if they share a pre-existing

relationship, however the length of this relationship is not important. Bodenhorn (2003), analyzing historical data from nineteenth century, shows firms that maintained long term relationship with lending banks could access credit at lower costs, required fewer personal guarantees and had a greater possibility of their loan terms being renegotiated during a financial crisis and subsequent recession. Avery and Samolyk (2004) and Minton et al. (2024) study bank consolidation in recent decades and find consolidation activity involving big banks is related to lower loan growth, whereas community bank consolidations and a greater concentration of community banks lead to higher loan growth. Nguyen and Barth (2020), using data from 2003-2016 show community banks still provide 30 percent more small business funding than non-community banks.

Small businesses primarily owned and operated by minorities may also be more reliant on relationship banking. Henderson et al. (2015) study credit score discrimination among small business owners and examine the degree to which availability of business credit lines is influenced by racial and gender-related factors, beyond would-be borrowers' credit scores. They find that Whites are more favorably treated when it comes to access to credit lines than are Blacks, Hispanics, and Asians with the same firm characteristics, owner characteristics, and credit scores. Barth and Xu (2020) show the population in areas with any Black-owned banks is over three times more likely to be Black than in the nation on average and more than five times the national average in areas where those banks hold more than 20 percent of deposits, revealing that Black-owned banks do locate near Black communities.

3.3 Role of online banking, non-banks and fintech

As banking and lending activities shift online, credit accessibility may not be heavily reliant on the presence of physical branches and relation banking while the proliferation of Android and iOS applications introduced by banks may replace branch-based banking. Koont (2024) show that after adopting digital platforms, banks increasingly operate branchlessly in their surrounding markets. Digitalization decreases local and national market concentration by allowing more banks to operate in markets where they physically do not have a branch.

This phenomenon is also observed by Jiang et al. (2024) who find that due to the staggered distribution of 3G mobile networks, banks lend to a greater geographic area and at the same time reduce branch presence in markets adept at adopting newer technologies.

When banks start lending branchlessly, credit history of individuals and businesses become more prominent in deciding who has access to this credit available through online channels. Buchak et al. (2018) show fintech lenders serve more creditworthy borrowers compared to traditional banks and charge a premium when providing their services leading to more convenience rather than cost savings for borrowers. As digitization decreases bank branch concentration, it forces banks to rely more on hard information, such as credit histories of individuals and businesses in making loan decisions. This may cause the evolution of small business loans to small firms (less than $1 million in assets), which is more reliant on relationship banking, to diverge from the evolution of total small business loans provided to comparatively larger firms. Similarly, digitization may affect mortgage originations within some communities more than others, especially if they face language barriers when accessing information online.

3.4 Role of MDI branches

The role MDI branch closures play in these diversified markets is not immediately clear. If the fall in the number of branches impact available credit supply to the immediate communities evenly, we can expect the quantity of credit to decrease across all communities. On the other hand, if the influence of relationship banking dominate and MDIs do end up integrating within their communities and play a prominent role in the supply of credit, then the loss of an MDI branch in a census tract would result in a decrease of mortgage originations or SBL originations among some communities more than others. A third outcome could be that the closure of these bank branches do not significantly impact credit outcomes within any of the communities in their local markets because mortgage originations and sbl originations are not impacted by branch presence or relationship banking anymore and one can obtain a mortgage or a business loan without having to physically step inside a bank.

4 Data

I construct a panel dataset by combining publicly available datasets such as the Summary of Deposits (SoDs), Call Reports, Home Mortgage Disclosure Act (HMDA) Mortgage Originations, National Archives, Community Reinvestment Act (CRA) SBL Originations and 5-year American Community Survey (ACS). This results in a dataset of all census tracts where an MDI branch is present in the year 2011, a total of 1085 tracts.[8] All dollars values are converted to the 2021 dollar value using the Consumer Price Index (CPI) from the US Bureau of Labor Statistics (2021) website. In order to capture the effect of branch closures in the community sharing minority identity with the MDI owners, I divide the sample into four sets of tracts: tracts with at least one MDI, tracts with Black MDIs, tracts with Hispanic MDIs and tracts with Asian MDIs, respectively. Figure 2 shows the percentage of MDI and non-MDI branch closures over time in the four sets of tracts. It is apparent Black-owned banks were disproportionately impacted by the branch closures.

4.1 Summary of Deposits and Call Reports

I obtain information on banks from the Call Reports on the Federal Financial Institutions Examination Council (FFIEC) website and bank branches from the SoDs on the FDIC website respectively. The SoDs contain information on every operating bank branch in the US, including street addresses, zip codes, geolocation data and individual branch deposits, published at the end of June of every year. Initially I collect the CERT numbers (a unique identification number for each institution assigned by the FDIC) of MDIs from 2011 until 2021. Using the CERT numbers, I collect all zip codes where an MDI or any other bank branch are present between the years 2011 and 2021. The SoD data does not contain the census tract or census block where the branches are located so I use the "pygris" package in Python to geolocate latitude and longitude information of each branch to their corresponding

[8] Originally I have 1090 tracts but I exclude the most extreme outlier census tract and census tracts with populations fewer than 100, resulting in 1085 census tracts.

census tracts based on the 2010 Census.[9] Figure 1 shows how the number of MDI branches varies in the US counties under study between 2011 and 2021.

I collect merger and failure information from the FFIEC website and match Call Report data with the SOD data. Figure 3 (a) shows the proportion of branches that close as a result of mergers, failures or simple branch closures. About 80 percent MDI branch closures and 60 percent non-MDI branch closures are simple branch closures without the parent banks merging or failing. Figure 3 (b) shows the proportion of branch closures by asset sizes of parent banks. Over 85 percent of MDI branch closures have parent banks less than $10 billion in assets. However, MDIs with assets sizes between $1 and $10 billion close branches in greater proportions. Conversely, 62 percent of non-MDI branch closures have parent banks more than $10 billion in assets and medium sized banks (assets between $10 and $50 billion) close branches more aggressively. This finding demonstrates branch closures impacted relatively small and medium-sized MDIs and relatively larger non-MDIs. Figure 3 (c) shows MDIs and non-MDIs close branches in both LMI and non-LMI tracts in equal proportions.

I calculate deposit level HHI from the deposit shares of each bank branch at the census tract level to account for deposit market concentration. A deposit HHI of 10,000 means the presence of a monopoly within a market whereas a deposit HHI close to zero denotes perfect competition.[10] Bank branch characteristics are provided in Appendix A. I also account for all bank branches within the neighboring tracts of each census tract under study and calculate the average deposit HHI from the deposit shares of branches within the neighboring tracts.[11] Although some tracts lose the only bank branch operating within the respective tracts, I still observe neighboring tracts with bank branches.

[9]Many branch locations have missing latitude and longitude data. In case of missing latitude and longitude information, I use the API from OpenStreetMaps to obtain latitude and longitude information from street addresses of each branch.

[10]Since 10,000 is an upper bound, a census tract that eventually lose all bank branches also receive a HHI of 10,000 in the data.

[11]I obtain the neighboring tracts by matching the census tracts under study to the data provided by Spatial Strucures in the Social Sciences, Brown University (2023)'s website.

4.2 HMDA Mortgage Originations

The HMDA data contain information on individual mortgage applications by census tract, race, income and other characteristics and whether the application is approved or denied. Outcome variable characteristics are provided in Appendix B. Figure B1 show the distribution of total mortgage originations by race in all the census tracts under study. As expected, the data are mostly skewed to the right with a few extreme outliers. The Black community has the lowest value of total mortgage originations, with over 800 of the tracts giving out less than $5 million. Loans to the Hispanic community were the second lowest with a over 600 of the tracts giving out total mortgages of less than $5 million per tract to Hispanics. Table B1 provides summary statistics on mortgage originations.

4.3 CRA SBL Originations

The CRA data are available by tract only and do not contain specific information on the race of the applicants or other characteristics. CRA defines small firms as those with assets of less than $1 million dollars and lists total small business loans to small firms as a separate category. Figure B2 show distribution of total SBL originations and SBL to small firms in the census tracts in 2011. Tables B2 provides summary statistics on SBL originations.

4.4 American Community Survey

I collect census tract characteristics from the 5-year ACS website. Census tract characteristics are provided in Appendix C. Table C1, Panel A and Panel B show MDIs locate in markets that have a high percentage of the population sharing minority identity with the MDI owners. For example, Black MDIs were located in census tracts with 70% Black population on average. Similarly, Hispanic MDIs were located in census tracts with 52% Hispanic population on average and Asian MDIs were located in census tracts with 32% Asian population on average.

5 Empirical Analysis

I use census tracts as the primary local markets, an approach adopted by other papers studying the local impact of bank branches (Nguyen, 2019; Toussaint-Comeau et al., 2020; Avramidis et al., 2021; Calzada et al., 2022). This is because most MDIs tend to locate in large counties such as the Los Angeles county, Miami-Dade county and Cook county, to name a few. Hence, analyzing the data at the county level abstracts away from the local impact that these institutions have in their immediate communities. I use two different treatments in this study. First, I consider "treated" tracts as those that encountered at least one MDI branch closure with the number of non-MDI branches in the tracts remaining constant. I drop tracts where the number of non-MDI branches decrease along with MDIs, resulting in 1035 census tracts. Second, I designate "treated" tracts as those tracts that lose at least one non-MDI branch with the number of MDI branches in those tracts remaining constant. Again, I drop tracts where the number of MDI branches decrease along with non-MDIs, resulting in 1057 census tracts.

5.1 Estimation Model

If a census tract i loses at least one MDI branch at time t with non-MDI branches remaining constant, I will consider the tract as treated at that time. Similarly, if a census tract loses at least one non-MDI branch at time t with MDI branches remaining constant, I will consider it as treated at that time. The treatment status $g_{i,t}$ is given by

$$g_{i,t} = \begin{cases} 1, & if\ census\ tract\ i\ is\ treated\ in\ period\ t \\ 0, & otherwise. \end{cases} \tag{1}$$

Hence, I consider a census tract treated if two conditions are observed: 1. it loses at least one MDI branch from the previous year and 2. if the total number of non-MDI branches in that tract remain constant. This serves two purpose, first, I can isolate the effect of the bank branch closure only to one or more MDI branches closing. Second, if an MDI merges

with another bank or MDI and the branch just loses its MDI designation but continues to operate without being physically closed, I do not consider the census tract to be a treated tract. However, if an MDI merges either with another bank or an MDI and as a result closes a branch previously operating in the tract, I will consider the tract as treated. A similar approach is taken by Nguyen (2019) who studies credit outcome in census tracts where bank branches close due to mergers.

If an MDI fails and has to close a branch in a particular tract, I consider the tract as treated as long as the above two conditions hold. This allows me to explore what happens to credit access when a branch that was designated an MDI and operated within the local community closes, which may happen either due to bank mergers, bank failures or simply branch closures. The relationship that the MDI branch had with its immediate community will be affected regardless of the reasons behind its closure. The same reasoning is applied when the treated tracts are those that lose at least one non-MDI branch but the number of MDI branches remain constant.

Once a census tract loses an MDI branch or a non-MDI branch, it is considered treated for the remaining period, reflecting the continued loss of connection with its community. I do observe multiple branches closing in a few tracts over the study period however this observation does not contradict the treated status of those tracts. To estimate the Average Treatment on the Treated (ATT), I employ the generalized semi-parametric difference-in-difference (DiD) estimator by Callaway and Sant'Anna (2021). I estimate the outcome of interest using the following specification

$$Y_{i,t} = \alpha_i + \lambda_t + \beta X_{i,t} + \nu_{i,t}. \tag{2}$$

In the above specification, $Y_{i,t}$ is the outcome of interest for census tract i at time t. This can be mortgage originations, SBL originations to small firms or total SBL originations less than \$1 million. α_i and λ_t are census tract and year fixed effects. $X_{i,t}$ is census tract time varying controls, which are population and percent of the racial community sharing the

same minority identity as the owners of the MDI. β are the coefficients of the time-varying covariates. Callaway and Sant'Anna (2021) defines the $ATT(g,t)$ as

$$ATT(g,t) = E[Y_{i,t} - Y_{i,g-1}|G_i = g] - E[Y_{i,t} - Y_{i,g-1}|G_i \in \mathbb{G}_{comp}]. \quad (3)$$

Here $Y_{i,t}$ and $Y_{i,g-1}$ are the outcome variables at times t and $g-1$ respectively where $t \geq g > g-1$.

The $ATT(g,t)$ is the multi-period analog of the result in the two period model showing difference in population means given by $\tau = E[Y_{i,2} - Y_{i,1}|D_i = 1] - E[Y_{i,2} - Y_{i,1}|D_i = 0]$ (Roth et al., 2023). Since equation 3 holds for any comparison group $g^{'} > t$, it also holds if averaged over some set of comparisons groups such that $g^{'} > t$ for all $g \in \mathbb{G}_{comp}$. In essence, the $ATT(g,t)$ is identified by comparing the expected change in outcome for cohort g between periods $g-1$ and t to that for a control group not-yet treated at period t. Replacing the expectations with the sample averages produces the estimated $ATT(g,t)$ below

$$\widehat{ATT}(g,t) = \frac{1}{N_g} \sum_{i:G_i=g} [Y_{i,t} - Y_{i,g-1}|G_i = g] - \frac{1}{N_{\mathbb{G}_{comp}}} \sum_{i:G_i \in \mathbb{G}_{comp}} [Y_{i,t} - Y_{i,g-1}|G_i \in \mathbb{G}_{\mathbb{comp}}]. \quad (4)$$

Callaway and Sant'Anna (2021) consider two options for $\mathbb{G}_{comp}$: (a) the never-treated units ($\mathbb{G}_{comp} = \infty$) and (b) the not-yet-treated units, used in this paper. The $ATT_{g,t}$ estimator is unbiased and consistent when the observations satisfy parallel trends in baseline outcome and display no anticipatory behavior prior to treatment. The data in this paper satisfy both parallel trends and no anticipatory behavior assumptions since banks do not announce in a year in advance when closing a branch.[12] I check the robustness of the results using the interaction weighted estimator of Sun and Abraham (2021) and the saturated OLS regression by Wooldridge (2021). I provide a brief discussion on the estimators in Appendix D.

[12]Treatment effect homogeneity, which requires that each cohort experiences the same path of treatment effects, do not hold in this paper. However, the latter condition is a sufficient but not a necessary condition for the $ATT_{g,t}$ estimator to be unbiased and consistent.

5.2 Isolating the effect of branch closures

In order to isolate the effect of individual branch closures I drop tracts where a non-MDI branch close two years prior to an MDI branch closure and vice versa. This ensures that the number of bank branches in the census tracts does not decrease for at least two years before an MDI or a non-MDI branch close. This enables me to attribute the effect on credit outcomes due to either MDI branches or non-MDI branches closing. The truncated sample provides similar results as the full sample. Appendix E show estimation results from the truncated sample.

5.3 Advantages over traditional Two-way Fixed Effects (TWFE) estimators

The $ATT_{g,t}$ estimator provides more plausible estimates over traditional dynamic Two-way Fixed Effects (TWFE) estimators because it takes into account treatment group heterogeneity and avoid negative weighting of cohorts, which can sometimes be the case in OLS estimations. Moreover, the estimator makes explicit which control groups are being considered. In this paper, the "not yet treated" group serves as the control; these are tracts where the total number of bank branches does not fall between 2012 and 2021. Some branches lose (or gain) MDI designation in these tracts either due to mergers with non-MDIs (or MDIs) or because these branches are purchased by non-MDIs (or MDIs). The standard errors are clustered at the census tract level following the recommendations of Abadie et al. (2023).

6 Results

6.1 Impact on mortgage originations

Table 2 provides estimates on changes in mortgage originations between the treated and the control tracts. The plot estimates in Figure 4 and Figure 5 show the effect of MDI and non-MDI branch closures on mortgage originations by race. The third column of Table 2 shows mortgage originations to the local Asian community decrease between 18-26 percent due to an Asian MDI branch closure. Noticeably, mortgage originations to the local Black community are not impacted by MDI branch closures but rather by non-MDI closures. The

fifth column of Table 2 shows when non-MDI branches close, mortgage originations to Blacks fall by 33-40 percent. Mortgage originations to Hispanics are not impacted by either MDI or non-MDI branch closures. In the next section, I show lender-level concentration actually decreases with branch closures for tracts with Hispanic MDIs, meaning non-banks, fintechs or other credit suppliers fill in the role of physical bank branches.

Figure 10 partially explains the results of Table 2. Here, I plot the number of unique mortgage lenders and the change in the number of bank branches between the treated and the control census tracts. The number of unique mortgage lenders in tracts with Black MDIs, Hispanic MDIs and tracts with any MDI increase with MDI branch closures. Hence MDI closures do not necessarily reduce the number of unique mortgage lenders in their corresponding local markets even after branch closures. Notably, Figure 10 shows the number of unique lenders providing mortgages fall with MDI branch closures in tracts served by Asian MDIs.

Figure 11 also explains the results of Table 2. It demonstrates decreasing mortgage lenders due to non-MDI branch closures in tracts served by Black MDIs. The number of unique mortgage lenders fall along with non-MDI branches in these tracts. As a result, mortgage originations to the local Black community fall when non-MDI branches close in these tracts since online banking or non-banks do not replace the role of the traditional bank branches. Unsurprisingly, Figure 11 shows the number of unique mortgage lenders do not decrease with non-MDI branch closures in tracts with Asian or Hispanic MDIs, implying online banking and non-banks do fill the credit supply gaps in these markets left by closing non-MDI branches.

6.2 Impact on SBL originations to small firms

Table 3, Panel A shows the ATT estimates for SBL originations to small firms for each set of tracts. The plot estimates in Figure 6 and Figure 7 show the effect of MDI and non-MDI branch closures on SBL originations to small firms respectively. The second column of Panel A shows that SBL originations to small firms decrease 13 percent due to MDI branch

closures in tracts served by Hispanic MDIs. However, SBL originations to small firms are not impacted in the other sets of tracts. There are two possible explanations for this result. One, SBL originations data do not account for race and it is quite likely that MDI branch or non-MDI branch closures do not create a dent in the total volume of small business loans to small firms dispersed in the local market. The CRA also requires banks with assets over $1 billion to report business loan commitments and many MDIs have asset sizes of less than a billion dollars and therefore their business lending activity may not show up in the data.

6.3 Impact on SBL originations of less than $1 million

Table 3, Panel B shows the ATT estimates for SBL originations of less than $1 million for each set of tracts. The first four columns of Table 3, Panel B show MDI branch closures do not statistically impact total SBL originations, however, the signs on the estimates are negative. Conversely, the last three columns of Table 3, Panel B show non-MDI branch closures precede an increase in total SBL originations of less than $1 million. The increases are between 25-30 percent in each set of tracts. The plot estimates in Figure 8 and Figure 9 show the effect of MDI and non-MDI branch closures on total SBL originations of less than $1 million respectively. It is apparent from Figure 9 that as non-MDI branches close, SBL originations of less than $1 million increase substantially, although the result is noisy and not significant for tracts with Black MDIs.

6.4 Pooled regression

I apply a pooled regression by matching minority identity of the population within the local market with the MDI type in each type of tracts and combine the four separate samples, tracts with Black MDIs, tracts Hispanic MDIs, tracts with Asian MDIs and tracts with Native MDIs. Table 4 shows results from the pooled regression. These results act as confirmations of the previous results. MDI closures lead to a 17-22% decrease in mortgage originations among the communities sharing the minority identity with the MDI owners. Non-MDI closures lead to an increase in SBL originations, by about 20-30%. Figure 10 shows event-study plots corresponding to these results.

7 Further Evidence and Implications

7.1 Increasing number of lenders

It may be argued that closures of bank branches in their local markets are not exogenous shocks but endogenous decisions of the banks based on their assessment of expected future loans within their local markets. Although, some degree of endogeneity can not be ruled out because banks will indeed close branches that are not profitable, I show that the closure of the branches are not directly related to expected future loans at the census tract level. Figure 11 show as MDI branches close, the number of unique mortgage lenders rises for most sets of tracts. Similarly, Figure 12 show as non-MDI branches closes, the number of unique mortgage lenders at the census-tract level do not fall. Another supporting evidence is observed in Figure 13 and Figure 14. The figures show even though MDI and non-MDI branches physically close down, the number of unique SBL lenders per county actually increase with time.

7.2 Lender-level HHI

I construct lender-level HHI from the mortgage data to show bank branch closures are not a direct consequence of expected future loans at the local market level. I estimate the effect of both MDI and non-MDI branch closures on the change in lender-level HHI. Table 5, Panel A shows estimates of changes in lender-level HHI in census tracts where either MDI branches or non-MDI branches close. If indeed banks close branches based on expected future loans, we would expect the lender-level HHI to increase. In other words, the results would show only a few lenders dominating the local market as more and more bank branches close, with banks correctly predicting future expected loans. In fact, I observe the opposite. As branches close, the lending market do not get more concentrated and the sign on the coefficients are negative. Notably, lender-level HHI decrease significantly for census tracts with Hispanic MDIs, meaning there are more competing lenders even after branch closures. The plot estimates in Figure 15 and Figure 16 confirm lender-level HHI do not increase either

before or after branch closures.

7.3 Deposit level HHI

I construct census tract level deposit HHI to show even though the mortgage lender market does not get concentrated, the deposit market gets concentrated. The plot estimates in Figure 17 and Figure 18 show how deposit HHI changes in the census tracts due to MDI and non-MDI branch closures respectively. The results in Table 5, Panel B show deposit HHI increase due to both kinds of closures; although the increase in deposit level HHI is more prominent when non-MDI branches close, as evident in the last four columns of the table. In each sets of tracts, HHI increases by 20-25 percent when non-MDI branches close. This phenomenon may explain why total SBL originations increase when non-MDI branches close as the remaining branches accumulate a greater proportion of the deposit share leading them to give out a greater quantity of small business loans.

7.4 Possible mechanisms

I posit the credit supplier gap left by the closing of non-MDI branches is picked up by existing branches, online branchless banking and fintechs. This is why, non-MDI branch closures precede an increase in total SBL originations of less than $1 million. I also observe deposit level HHI increasing in each set of treated tracts. The results in this paper support previous research on deposit market power of banks. Drechsler et al. (2021) show a larger deposit core causes banks to earn interest income that is insensitive to fluctuating market interest rates and enables the banks to lend long term at fixed rates. Similarly, Li et al. (2023) show banks with more deposit market power give out longer maturity loans and at the same time charge lower maturity premiums, leading to more loans. It is not immediately clear why total SBL originations remain unaffected due to MDI branch closures even though deposit level HHI also increase in these markets and may be grounds for future research.

8 Conclusion

I study impact on credit accessibility due to branch closures, as demonstrated by mortgage originations issued to different racial communities and SBL originations at the census tract level. I consider two kinds of treatments. First, I consider treated tracts as those where MDI branches close with non-MDI branches remaining constant. Second, I consider treated tracts as those where non-MDI branches close with MDI branches remaining constant. I control for covariates such as population and percent of the community sharing minority identity with the MDI owners.

Closure of MDIs and non-MDIs reveal differential impacts on credit access within different local communities. When MDI branches close, mortgage originations decrease only within the local Asian community. However, when non-MDI branches close, mortgage originations to the local Black community decrease in the tracts served by Black MDIs. In both cases, the number of unique mortgage lenders per census tract fall along with branch closures. However, in other scenarios, MDI and non-MDI branch closures is followed by increases in unique mortgage lenders at the census tract level and unique SBL lenders at the county level.

The findings of Calzada et al. (2022) and Koont (2024) provide circumstantial evidence consistent with these results as they show banks optimize and close branches in census tracts where they have a substantial presence through online banking. Furthermore Jiang et al. (2024) show banks already less reliant on branches are more likely to close more branches. My findings also support Buchak et al. (2018), Fuster et al. (2018) and Corbae et al. (2023) who document non-banks and fintech lenders taking up substantial market share for mortgage originations post Great Recession. Salvo (2023) also confirms the results in this paper and shows decreasing mortgage lender-level HHI over time in the largest metro areas in the US. He shows decreasing concentration in markets for both mortgage loan originations and SBL originations between 2010 and 2019 in the 30 largest MSAs.

The results on SBL originations imply decreasing role of relationship banking. Non-MDI branch closures precede an increase of total SBL originations of sizes less than $1 million. At

the same time, deposit level HHI increases substantially in markets where non-MDI branches close. The results suggest the increase in SBL originations arise due to relatively large non-MDI banks closing their physical branches or merging with other banks in markets that are saturated and possibly supplying SBL through credit cards. Adams et al. (2020) and Salvo (2021) suggest non-local banks issue a large proportion of small business loans through business credit cards because they can quickly approve more of these smaller loans for large-sized small businesses. Furthermore, Gopal and Schnabl (2022) and Cornelli et al. (2024) show post Great Recession fintech firms also replace traditional bank branches in providing SBLs and capture 60% of the market share of small business lending. This explains why with MDI closures, the estimates of SBL originations are negative but do not have statistical power. I also find Hispanic MDI branch closures negatively impact SBL originations to small firms in census tracts served by Hispanic MDIs. Therefore, the presence of physical MDI branches may play a prominent role in supplying small business credit in these local markets.

To conclude, I contrast the varying impacts on credit accessibility due to MDI and non-MDI branch closures, demonstrating that MDI and non-MDI branch closures do not impact all communities similarly. Using a pooled regression, I show MDI branch closures generally have a contractionary effect on credit access among the minority population sharing identity with the MDI owners. Therefore, MDIs may still play a prominent role in supplying credit to customers who may be slower to adapt to technological innovations. Consequently, non-MDI branch closures primarily have an expansionary effect on credit, demonstrating the evolving and decreasing role of physical branches and relationship banking for large-sized non-community banks.

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Table 1: Total number of MDIs and branches operating in 2021

State	Number of MDIs	Number of MDI branches
California	43	337
Texas	37	327
New York	28	120
New Jersey	18	34
Florida	14	85
Georgia	13	39
Oklahoma	11	51
Illinois	11	25
Alabama	6	10
Washington	5	16
Pennsylvania	5	8
Massachusetts	4	13
Maryland	4	10
Nevada	4	7
Virginia	4	7
Hawaii	3	27
North Carolina	2	23
Missouri	2	5
Washington DC	2	5
Michigan	2	4
Wisconsin	2	4
Kansas	2	2
Montana	2	2
Louisiana	1	10
Minnesota	1	7
New Mexico	1	6
Arizona	1	2
South Carolina	1	2
Tennessee	1	2
Colorado	1	1
Iowa	1	1
Kentucky	1	1
Mississippi	1	1
North Dakota	1	1

Table 2: Change in total mortgage loans (in millions of dollars)

	Outcome variable: Total mortgage originations							
		MDI Closures				Non MDI Closures		
	Loans to Blacks	Loans to Hispanics	Loans to Asians	Loans to All	Loans to Blacks	Loans to Hispanics	Loans to Asians	Loans to All
C&S ATT	0.249	0.011	-5.648**	-2.937	-1.420**	0.807	2.668	1.997
	(0.621)	(0.709)	(2.246)	(1.834)	(0.656)	(0.683)	(2.930)	(2.039)
ETWFE ATT	-0.0496	0.380	-4.130*	-3.160	-1.730**	0.194	3.060	1.670
	(0.652)	(0.661)	(2.220)	(1.690)	(0.635)	(0.597)	(1.940)	(1.780)
S&A ATT	0.367	-0.082	-4.051*	-2.598	-1.492**	0.224	3.823*	0.699
	(0.647)	(0.693)	(2.248)	(1.710)	(0.608)	(0.644)	(2.236)	(1.498)
Baseline mean	5.06	8.58	21.14	35.38	4.25	8.69	23.15	41.69
Fixed Effects by:								
Year:	11	11	11	11	11	11	11	11
Census Tracts:	145	470	375	1035	147	473	392	1057
Observations	1,595	5,160	4,125	11,375	1,617	5,203	4,312	11,617
R^2	0.816	0.765	0.779	0.803	0.813	0.766	0.790	0.806
Within R^2	0.082	0.072	0.086	0.089	0.047	0.070	0.060	0.088

Notes: *p<0.1; **p<0.05; ***p<0.01
Standard errors are clustered at the census tract level. Baseline means are in millions.

Table 3: Change in small business loans (in millions of dollars)

	Panel A: SBL to small firms (less than $1 million assets)							
	MDI Closures				Non MDI Closures			
	Blacks tracts	Hispanics tracts	Asians tracts	All tracts	Blacks tracts	Hispanics tracts	Asians tracts	All tracts
C&S ATT	0.018	-0.254**	0.052	-0.083	0.306	0.146	0.098	0.132
	(0.196)	(0.121)	(0.183)	(0.083)	(0.418)	(0.232)	(0.253)	(0.138)
ETWFE ATT	0.194	-0.223*	-0.132	-0.181**	-0.486	0.270	0.370*	0.283**
	(0.202)	(0.190)	(0.171)	(0.092)	(0.354)	(0.197)	(0.202)	(0.126)
S&A ATT	0.051	-0.210*	0.101	-0.082	0.201	0.053	0.204	0.109
	(0.191)	(0.116)	(0.143)	(0.078)	(0.311)	(0.206)	(0.163)	(0.118)
Baseline mean	1.00	1.75	2.69	1.90	4.76	2.81	3.49	3.18
Fixed Effects by:								
Year:	11	11	11	11	11	11	11	11
Census Tracts:	145	470	375	1035	147	473	392	1057
Observations	1,595	5,160	4,125	11,375	1,617	5,203	4,312	11,617
R^2	0.901	0.853	0.892	0.878	0.911	0.859	0.905	0.889
Within R^2	0.041	0.077	0.082	0.059	0.169	0.074	0.083	0.061
	Panel B: Total SBL less than $ 1 millions							
	MDI Closures				Non MDI Closures			
	Blacks tracts	Hispanics tracts	Asians tracts	All tracts	Blacks tracts	Hispanics tracts	Asians tracts	All tracts
C&S ATT	-2.109	-0.162	-0.259	-0.482	4.861	2.129**	3.488**	2.582**
	(1.364)	(0.438)	(1.015)	(0.420)	(3.088)	(0.745)	(1.624)	(0.619)
ETWFE ATT	0.218	-0.670	-1.170	-1.270**	0.804	2.390***	3.730***	2.910***
	(0.725)	(0.526)	(0.994)	(0.513)	(2.000)	(0.642)	(1.180)	(0.614)
S&A ATT	-1.005	-0.363	-0.203	-0.788**	2.637*	1.738**	2.867***	2.159***
	(0.887)	(0.436)	(0.741)	(0.368)	(1.423)	(0.613)	(0.905)	(0.482)
Baseline mean	3.53	5.51	9.45	6.37	18.58	8.89	12.32	10.74
Fixed Effects by:								
Year:	11	11	11	11	11	11	11	11
Census Tracts:	145	470	375	1035	147	473	392	1057
Observations	1,595	5,160	4,125	11,375	1,617	5,203	4,312	11,617
R^2	0.848	0.877	0.896	0.890	0.904	0.886	0.901	0.897
Within R^2	0.054	0.050	0.107	0.060	0.246	0.087	0.130	0.088

Notes: *p<0.1; **p<0.05; ***p<0.01
Standard errors are clustered at the census tract level. Baseline means are in millions.

Table 4: Pooled regression results

	Outcome variables: Total mortgage and SBL originations			
	MDI Closures		Non MDI Closures	
	Total mortgages	Total SBLs	Total mortgages	Total SBLs
C&S ATT	-2.081**	-0.163	1.702	2.202***
	(1.001)	(0.401)	(1.312)	(0.636)
ETWFE ATT	-1.900*	-0.679	1.380	3.150***
	(1.040)	(0.491)	(0.923)	(0.652)
S&A ATT	-2.670**	-0.393	1.211	2.437***
	(1.013)	(0.370)	(0.913)	(0.568)
Baseline mean	12.48	6.85	14.09	10.76
Fixed Effects by:				
Year:	11	11	11	11
Census Tracts:	1034	1034	1034	1034
Observations	11,452	11,452	11,452	11,452
R^2	0.785	0.888	0.786	0.894
Within R^2	0.062	0.072	0.065	0.093

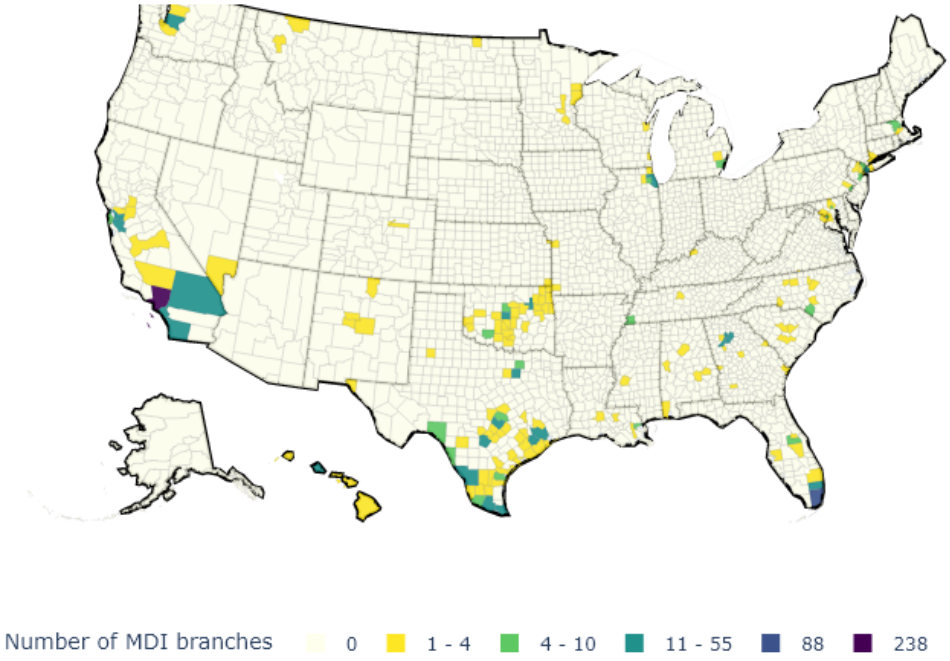
Notes: *p<0.1; **p<0.05; ***p<0.01
Standard errors are clustered at the census tract level. Baseline means are in millions.

Table 5: Change in HHI (in thousands)

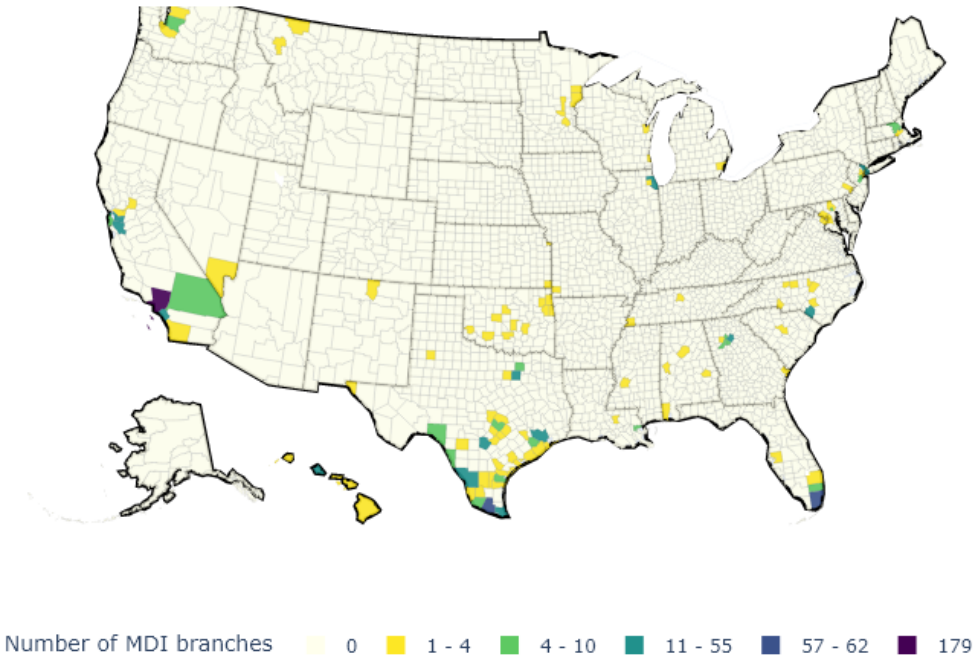
	Panel A: HMDA lender-level HHI							
	MDI Closures				Non MDI Closures			
	Blacks tracts	Hispanics tracts	Asians tracts	All tracts	Blacks tracts	Hispanics Tracts	Asians tracts	All tracts
C&S ATT	0.136	-0.166*	0.065	-0.029	-0.147	-0.007	-0.017	-0.010
	(0.177)	(0.093)	(0.077)	(0.063)	(0.345)	(0.102)	(0.103)	(0.073)
ETWFE ATT	0.038	-0.142*	0.007	-0.056	-0.155	0.086	0.056	0.064
	(0.109)	(0.072)	(0.067)	(0.045)	(0.357)	(0.072)	(0.061)	(0.048)
S&A ATT	0.099	-0.174*	0.072	-0.040	-0.100	-0.013	-0.027	-0.003
	(0.155)	(0.089)	(0.073)	(0.055)	(0.310)	(0.088)	(0.086)	(0.062)
Baseline mean	1.31	0.96	1.05	1.06	1.75	0.99	1.09	1.11
Fixed Effects by:								
Year:	11	11	11	11	11	11	11	11
Census Tracts:	145	470	375	1035	147	473	392	1057
Observations	1,595	5,160	4,125	11,375	1,617	5,203	4,312	11,617
R^2	0.390	0.457	0.595	0.502	0.398	0.450	0.588	0.499
Within R^2	0.070	0.021	0.031	0.009	0.086	0.018	0.031	0.010

	Panel B: Deposit HHI							
	MDI Closure				Non MDI Closure			
	Blacks tracts	Hispanics tracts	Asians tracts	All tracts	Blacks tracts	Hispanics tracts	Asians tracts	All tracts
C&S ATT	0.696**	0.444***	1.120***	0.782***	1.077**	1.234***	1.216***	1.261***
	(0.254)	(0.119)	(0.156)	(0.089)	(0.318)	(0.130)	(0.160)	(0.101)
ETWFE ATT	0.584**	0.240*	1.120***	0.673***	0.943***	1.170***	1.140***	1.180***
	(0.229)	(0.135)	(0.153)	(0.097)	(0.265)	(0.128)	(0.147)	(0.091)
S&A ATT	0.703**	0.440***	1.104***	0.771***	1.158***	1.204***	1.196***	1.231***
	(0.225)	(0.126)	(0.160)	(0.092)	(0.257)	(0.124)	(0.143)	(0.089)
Baseline mean	8.25	6.81	5.56	6.63	5.17	4.97	4.34	4.79
Fixed Effects by:								
Year:	11	11	11	11	11	11	11	11
Census Tracts:	145	470	375	1035	147	473	392	1057
Observations	1,595	5,160	4,125	11,375	1,617	5,203	4,312	11,617
R^2	0.878	0.892	0.887	0.892	0.913	0.900	0.885	0.899
Within R^2	0.043	0.033	0.092	0.044	0.127	0.087	0.154	0.117

Notes: *p<0.1; **p<0.05; ***p<0.01
Standard errors are clustered at the census tract level. Baseline means are in thousands.

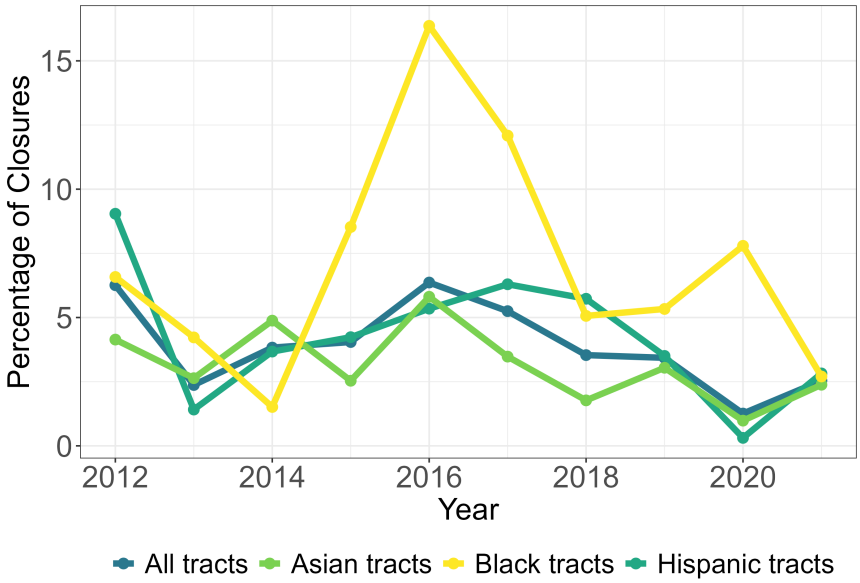


(a) MDI branches in counties under study in 2011

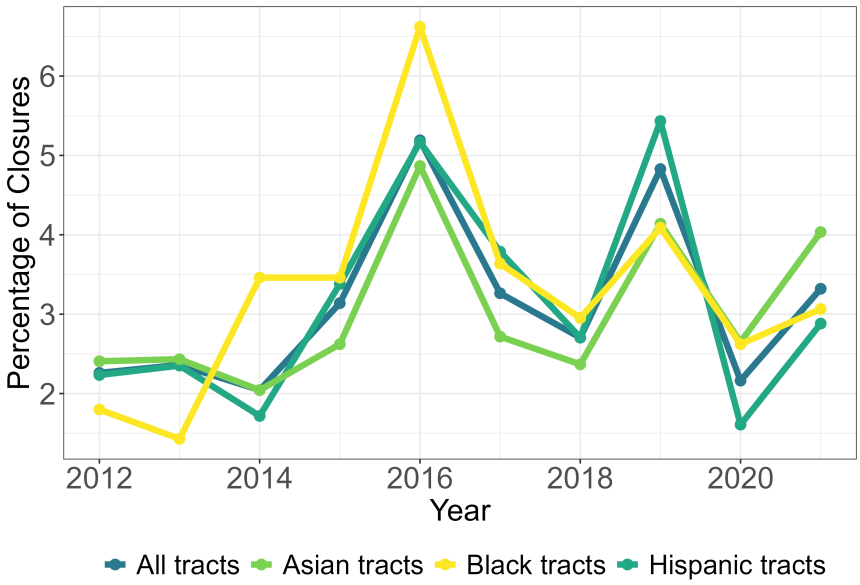


(b) MDI branches in counties under study in 2021

Figure 1: The figure shows how the number of MDI branches changed in the counties under study between 2011 and 2021.

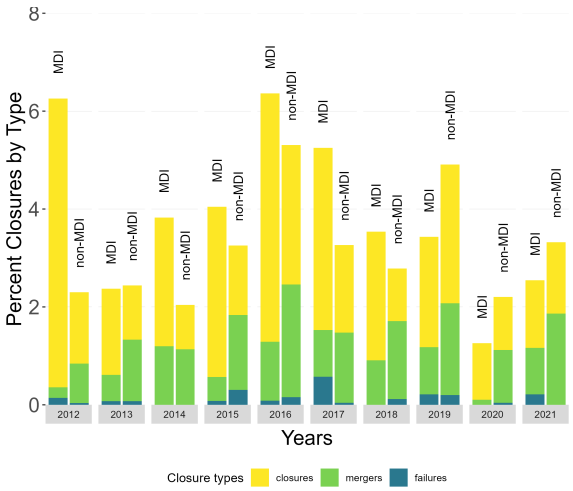


(a) MDI branch closures

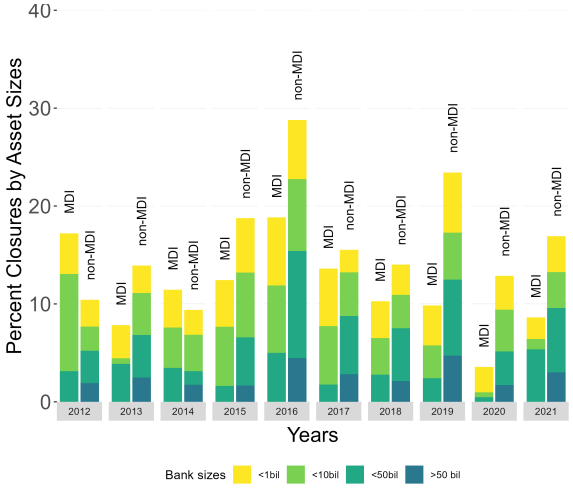


(b) Non-MDI branch closures

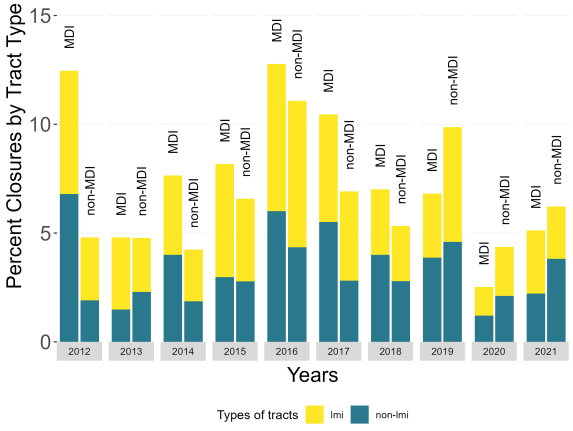
Figure 2: The figure shows branch closures over time



(a) Why branches close in the studied tracts.



(b) Which sized banks tend to close branches in the studied tracts.



(c) Where branches are closing in the studied tracts.

Figure 3: The figure shows reasons for branch closures and asset sizes of parent banks

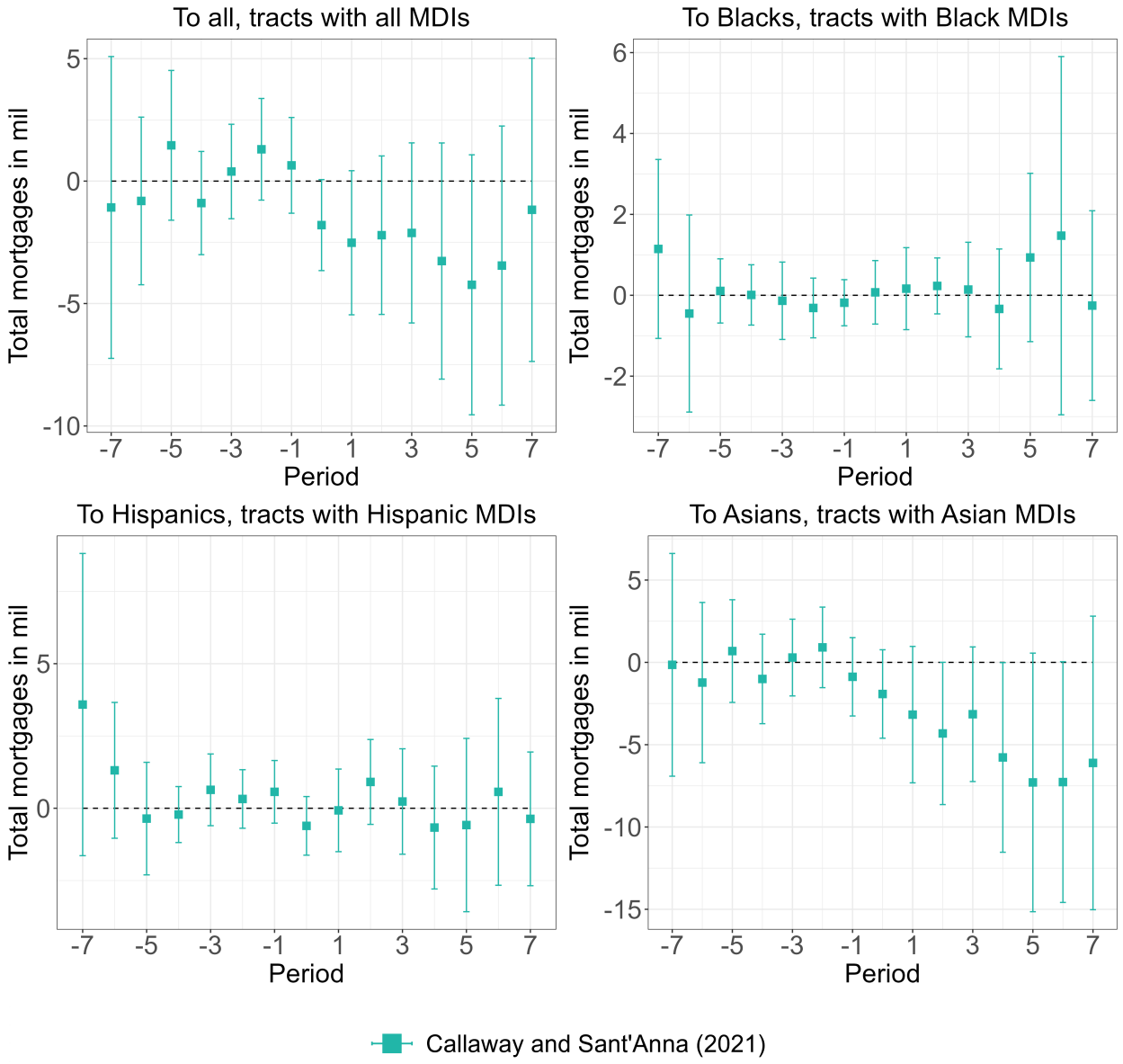


Figure 4: MDI branch closures and total mortgage originations

Notes: The figure shows effect on total mortgage originations due to the closing at least one MDI branch in a census tract seven calendar years before and after the closing.

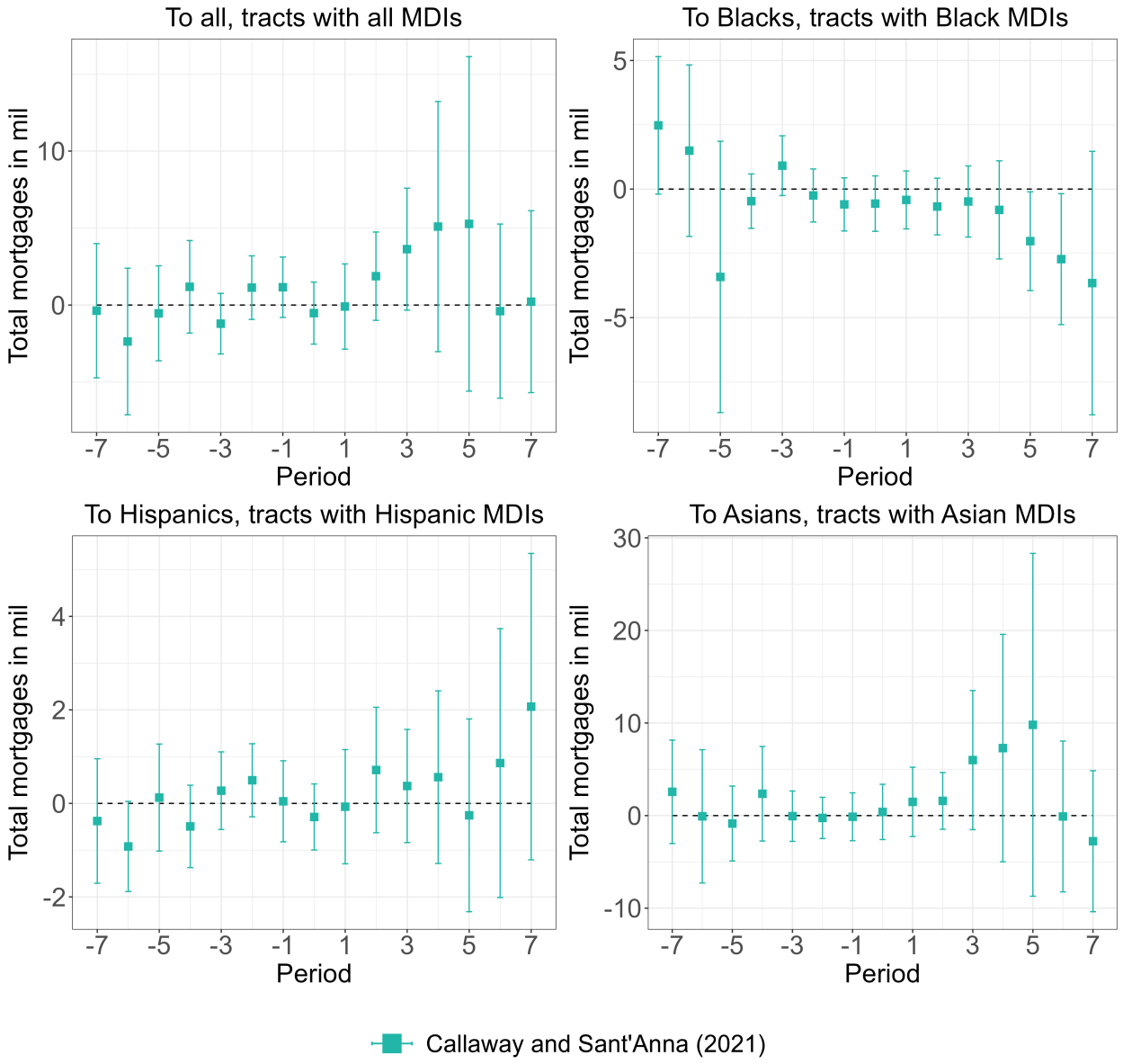


Figure 5: Non-MDI branch closures and total mortgages originations

Notes: The figure shows effect on total mortgage originations due to the closing at least one non-MDI branch in a census tract seven calendar years before and after the closing.

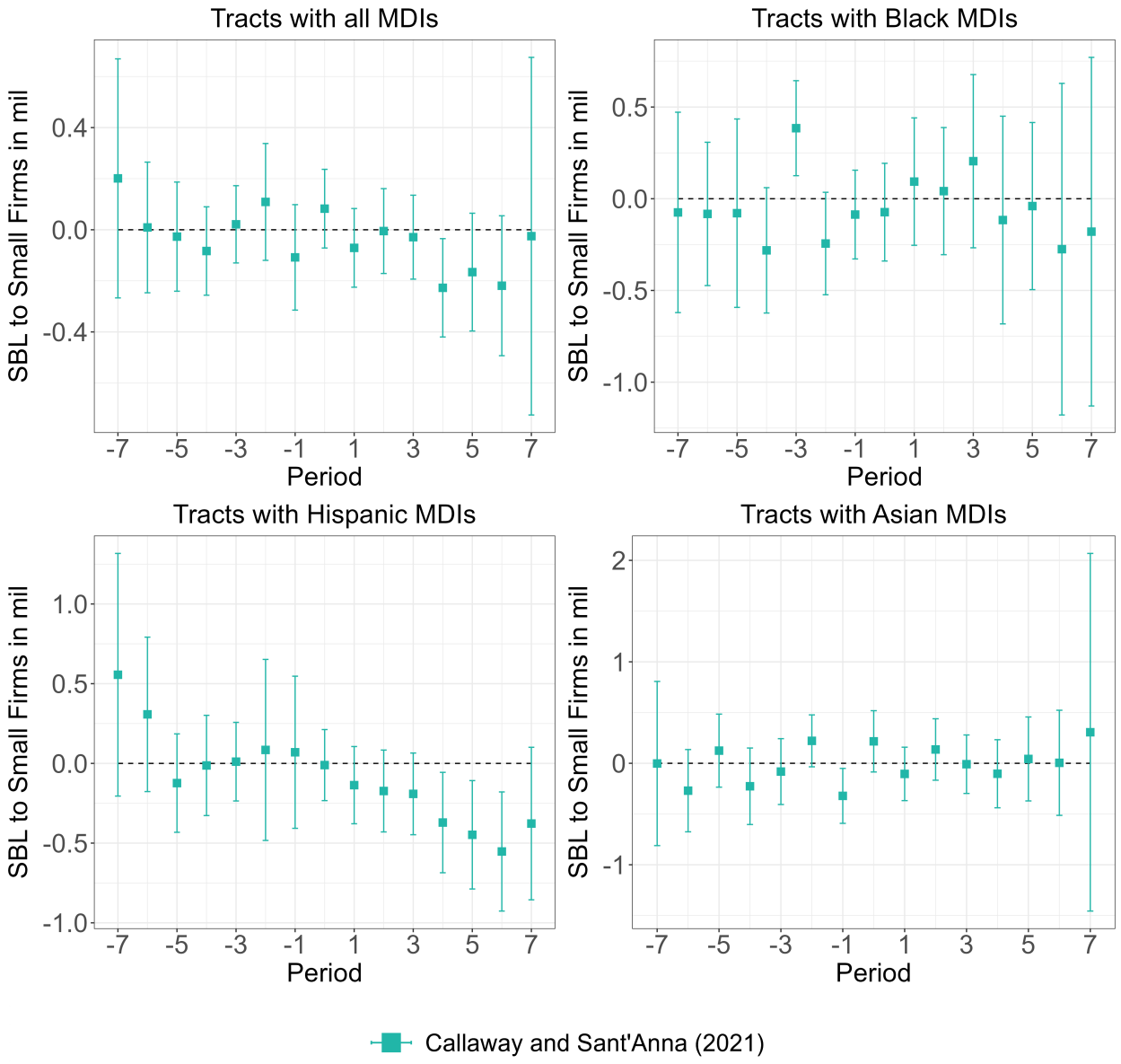


Figure 6: MDI branch closures and SBL originations to small firms

Notes: The figure shows effect on SBL originations to small firms (less than $1 million in assets) due to the closing at least one MDI branch in a census tract seven calendar years before and after the closing.

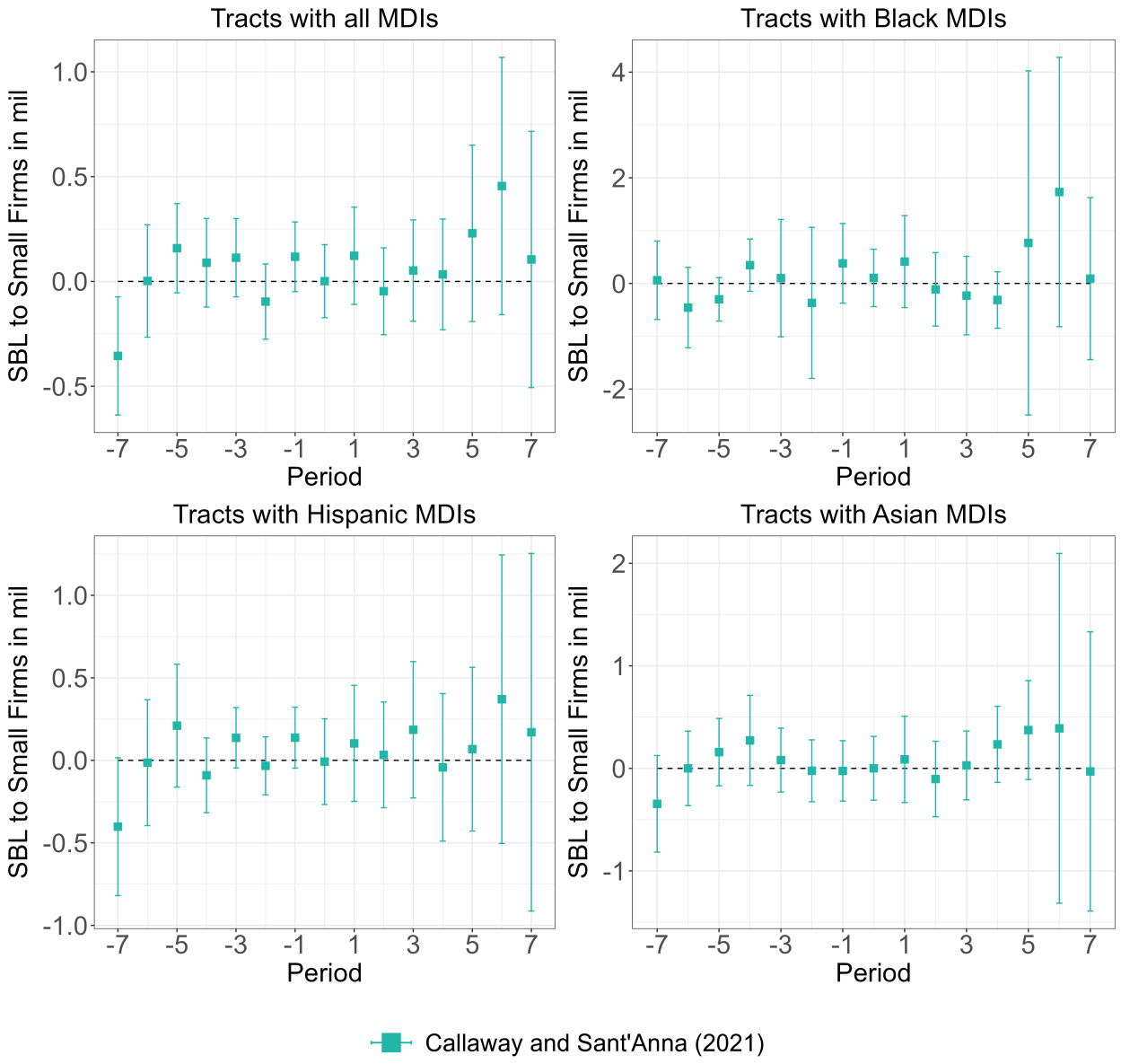


Figure 7: Non-MDI branch closures and small business originations to small firms

Notes: The figure shows effect on SBL originations to small firms (less than $1 million in assets) due to the closing at least one non-MDI branch in a census tract seven calendar years before and after the closing.

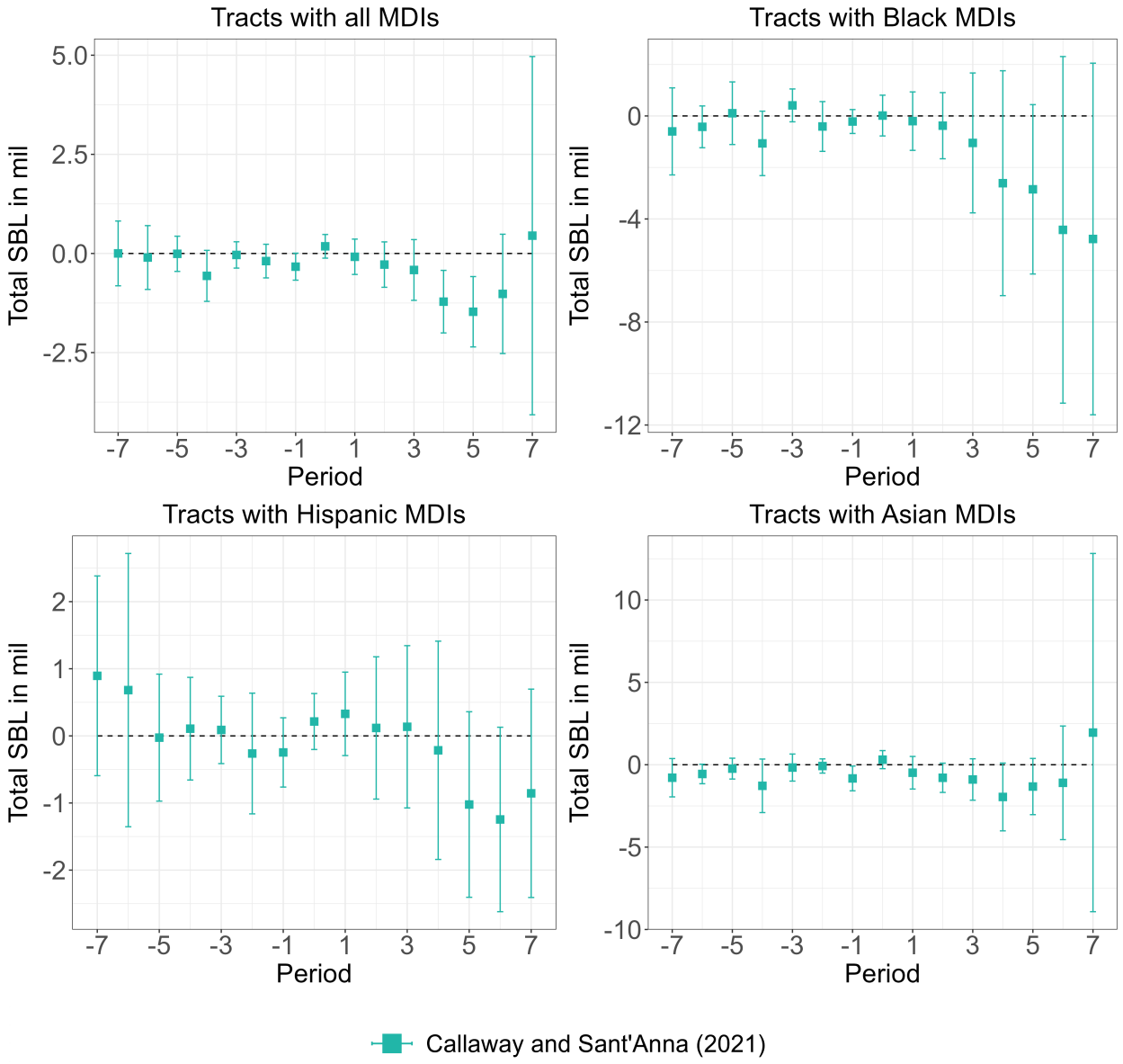


Figure 8: MDI branch closures and total small business originations

Notes: The figure shows effect on total SBL originations of sizes less than $1 million due to the closing at least one MDI branch in a census tract seven calendar years before and after the closing.

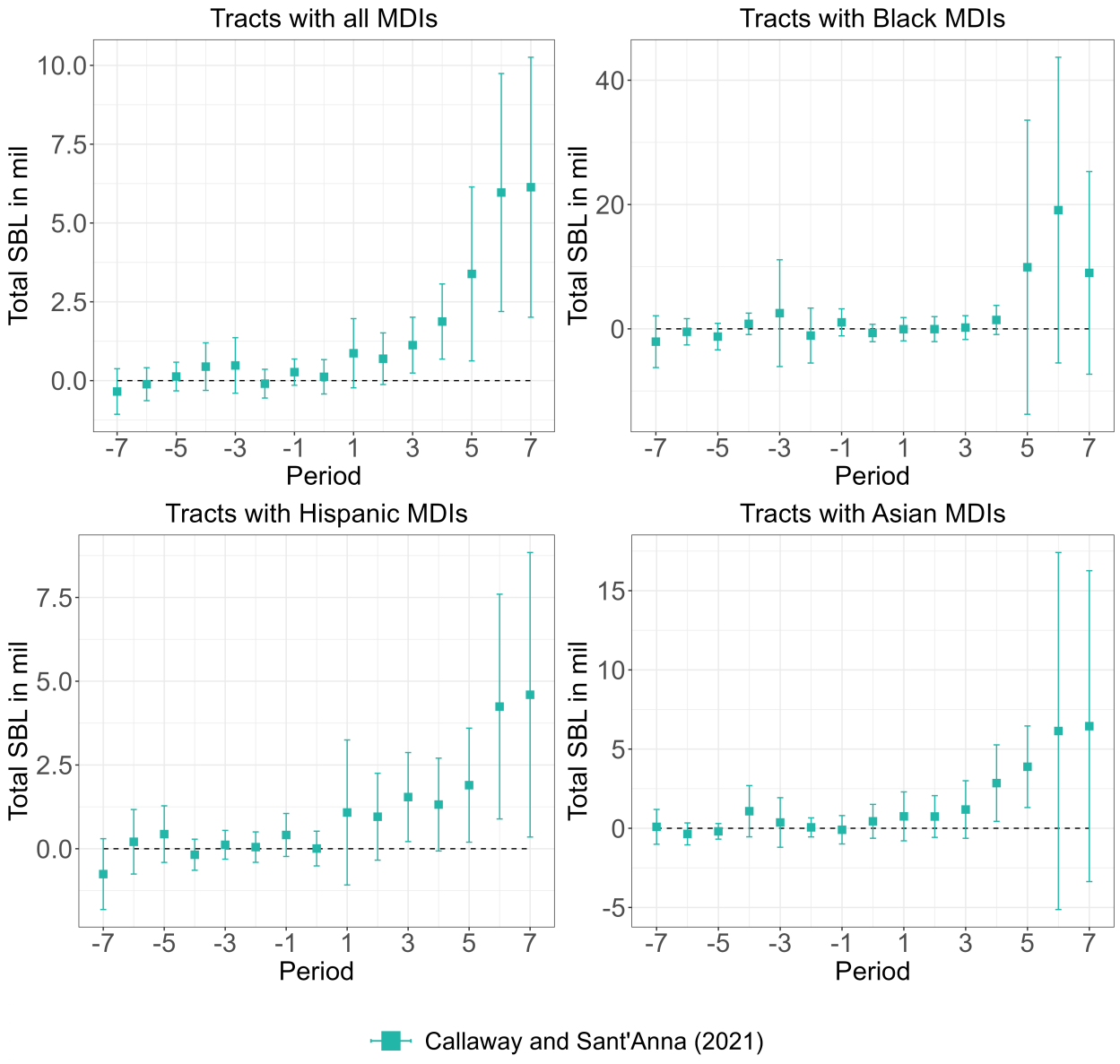
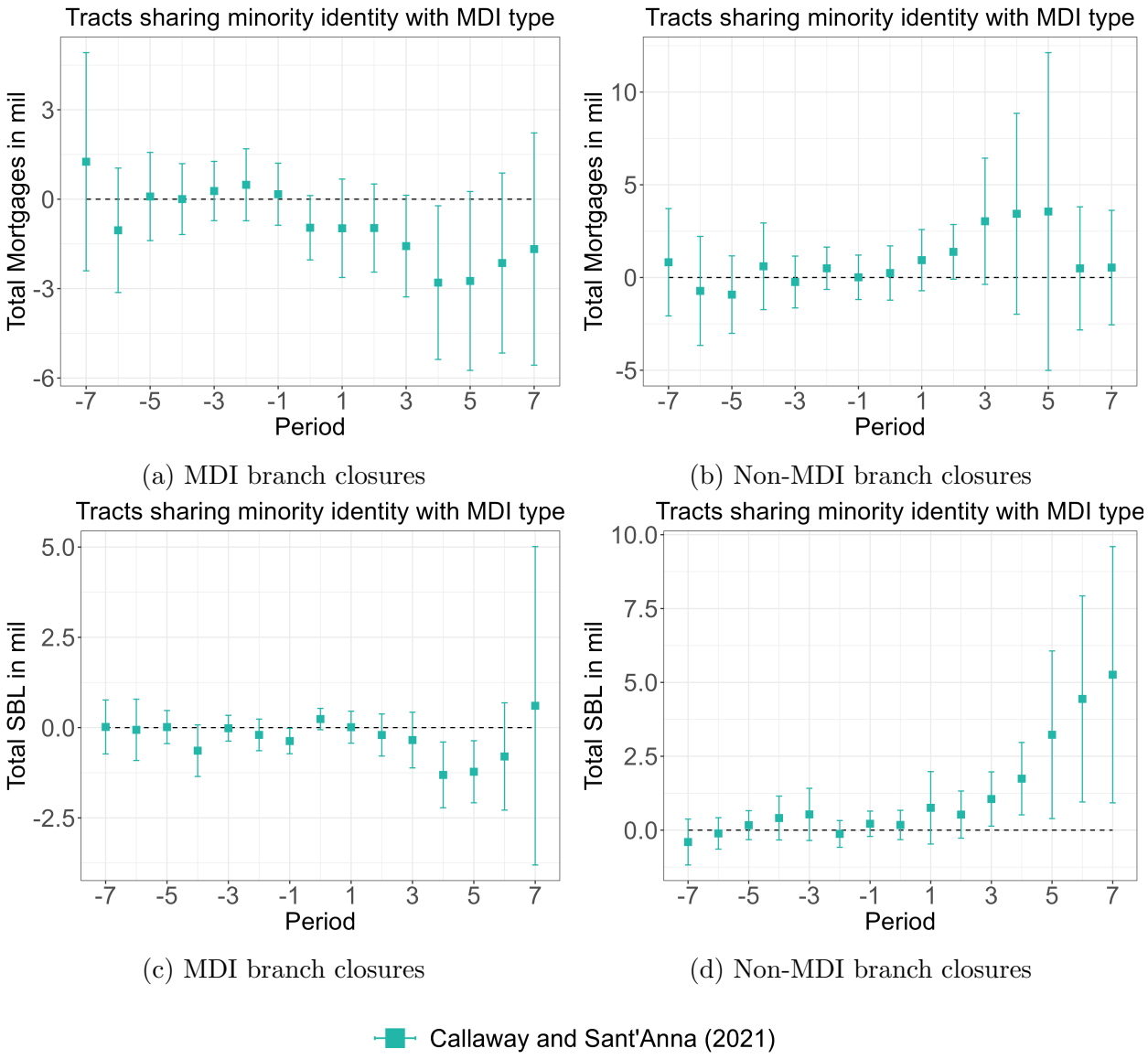


Figure 9: Non-MDI branch closures and total SBL originations

Notes: The figure shows effect on total SBL originations of sizes less than $1 million due to the closing at least one non-MDI branch in a census tract seven calendar years before and after the closing.



(a) MDI branch closures

(b) Non-MDI branch closures

(c) MDI branch closures

(d) Non-MDI branch closures

Figure 10: Pooled regression results.

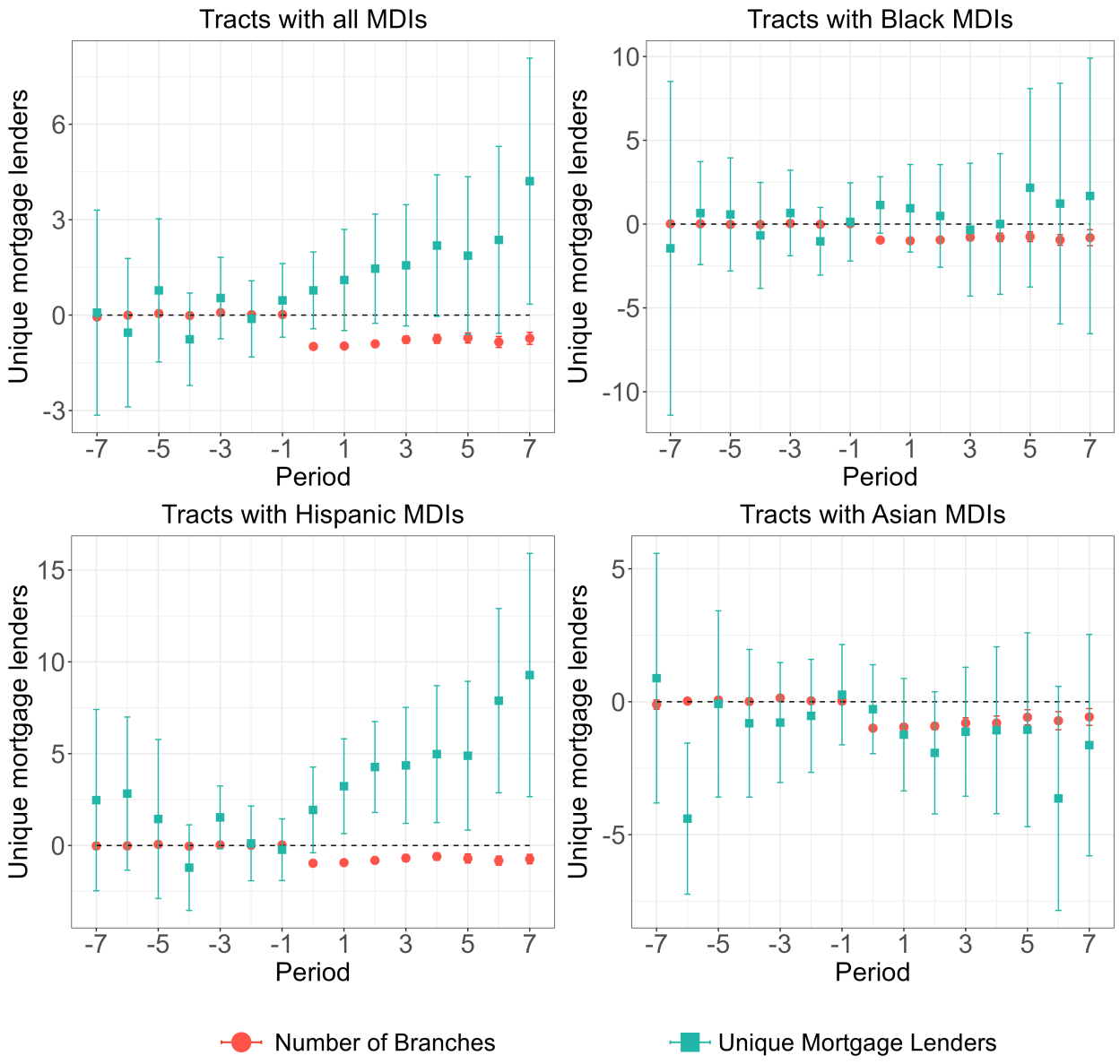


Figure 11: MDI branch closures and unique mortgage lenders

Notes: The plots represent estimates from Callaway and Sant'Anna (2021).

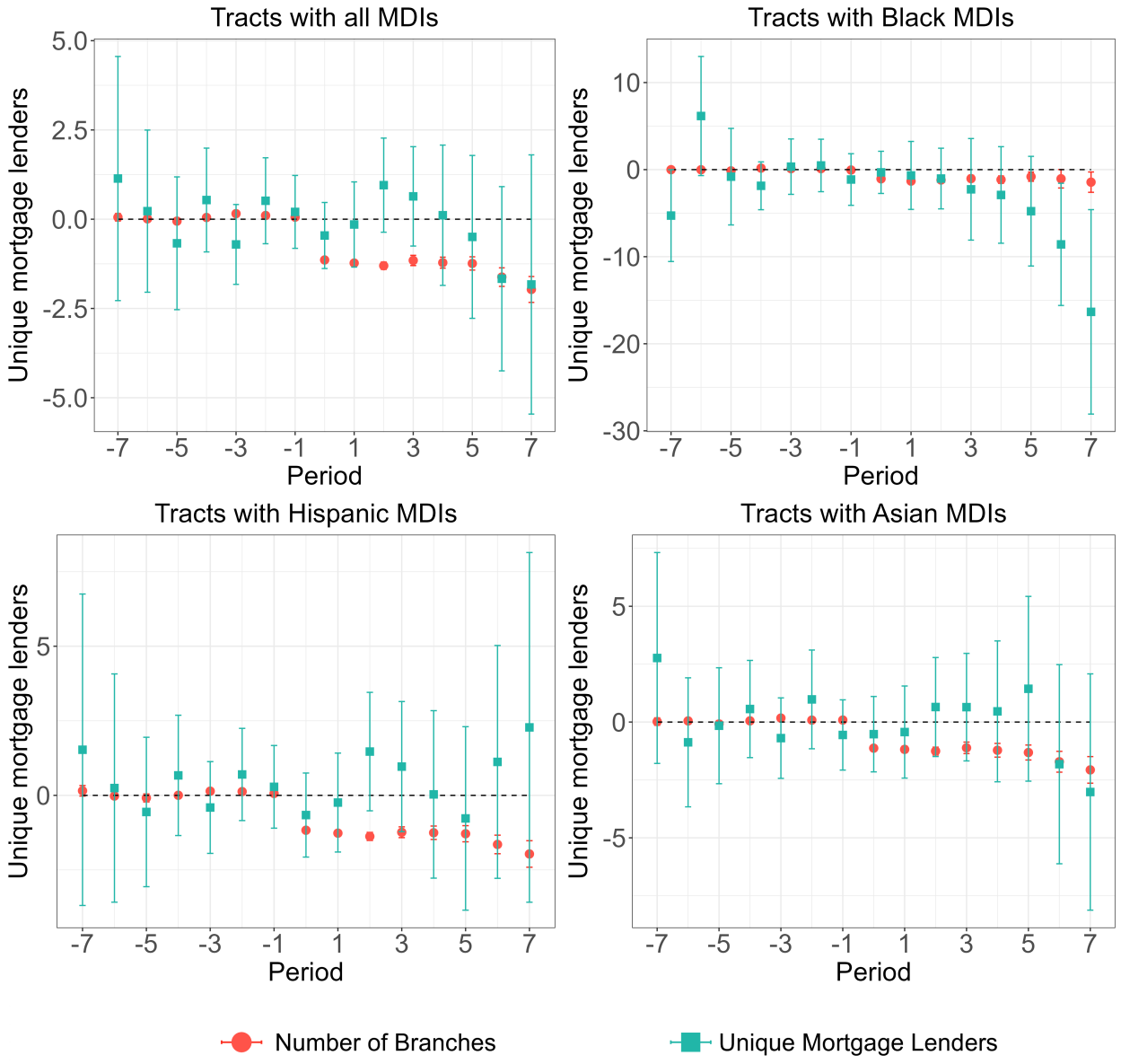


Figure 12: Non-MDI branch closures and unique mortgage lenders

Notes: The plots represent estimates from Callaway and Sant'Anna (2021).

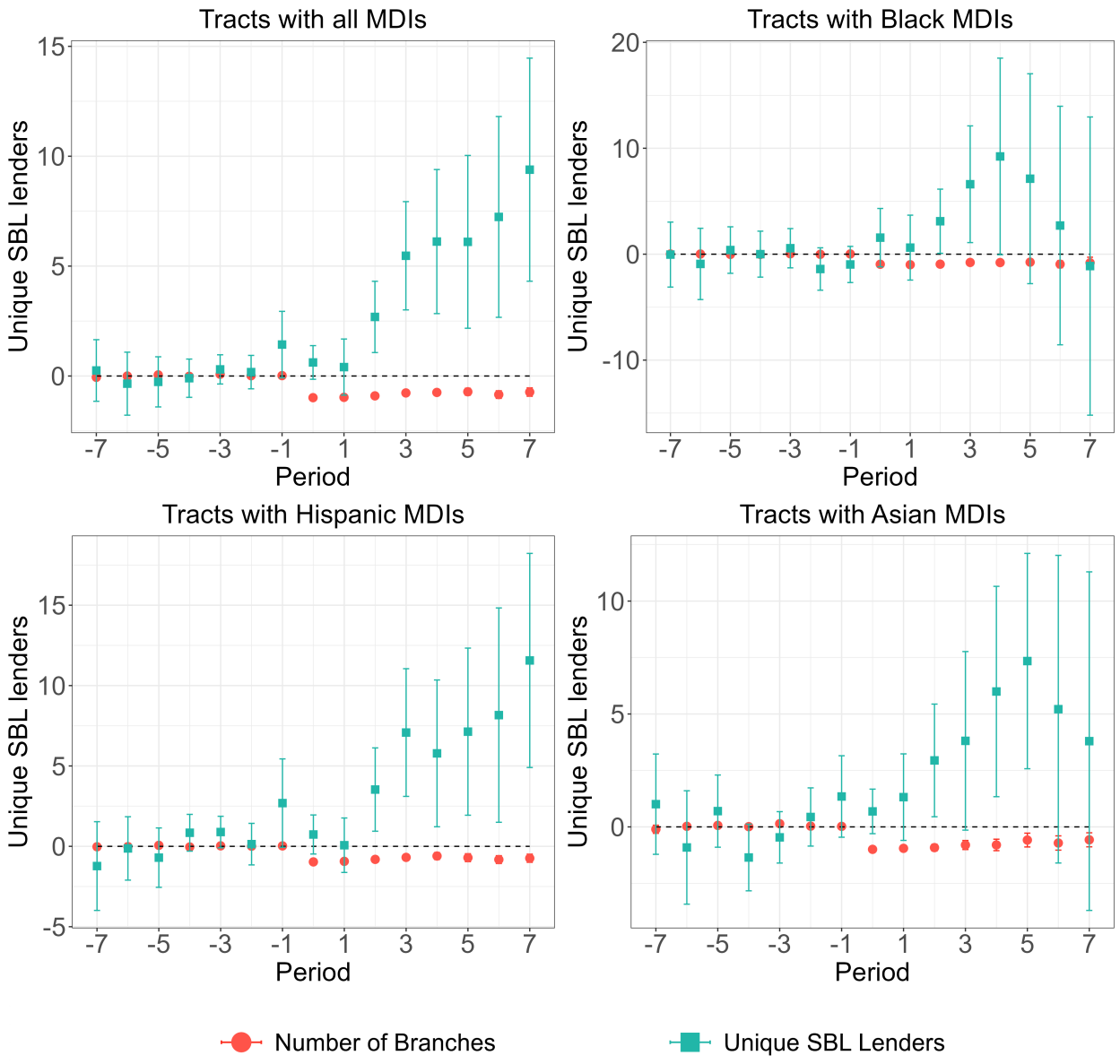


Figure 13: MDI branch closures and unique SBL lenders per county

Notes: The plots represent estimates from Callaway and Sant'Anna (2021).

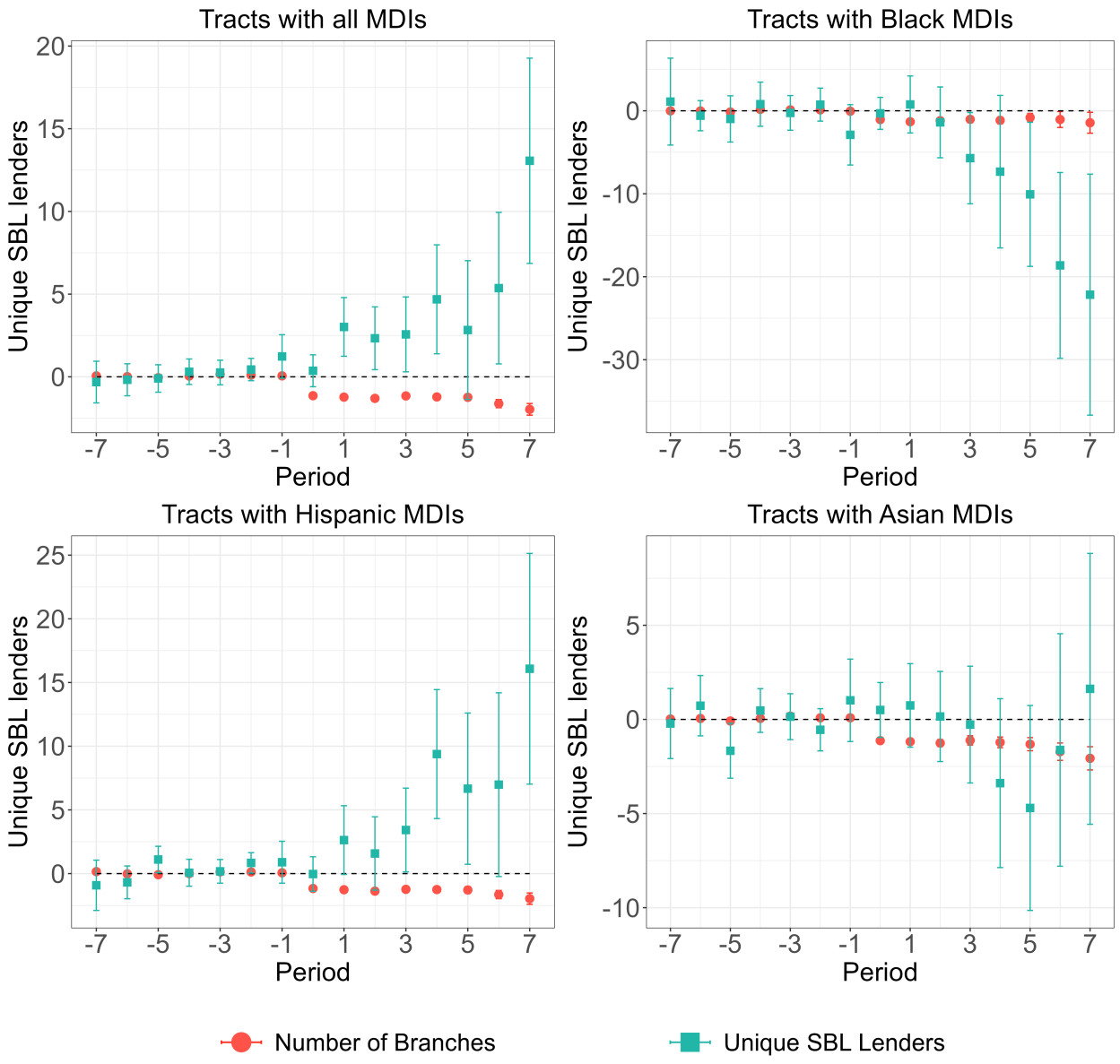


Figure 14: Non-MDI branch closures and unique SBL lenders per county

Notes: The plots represent estimates from Callaway and Sant'Anna (2021).

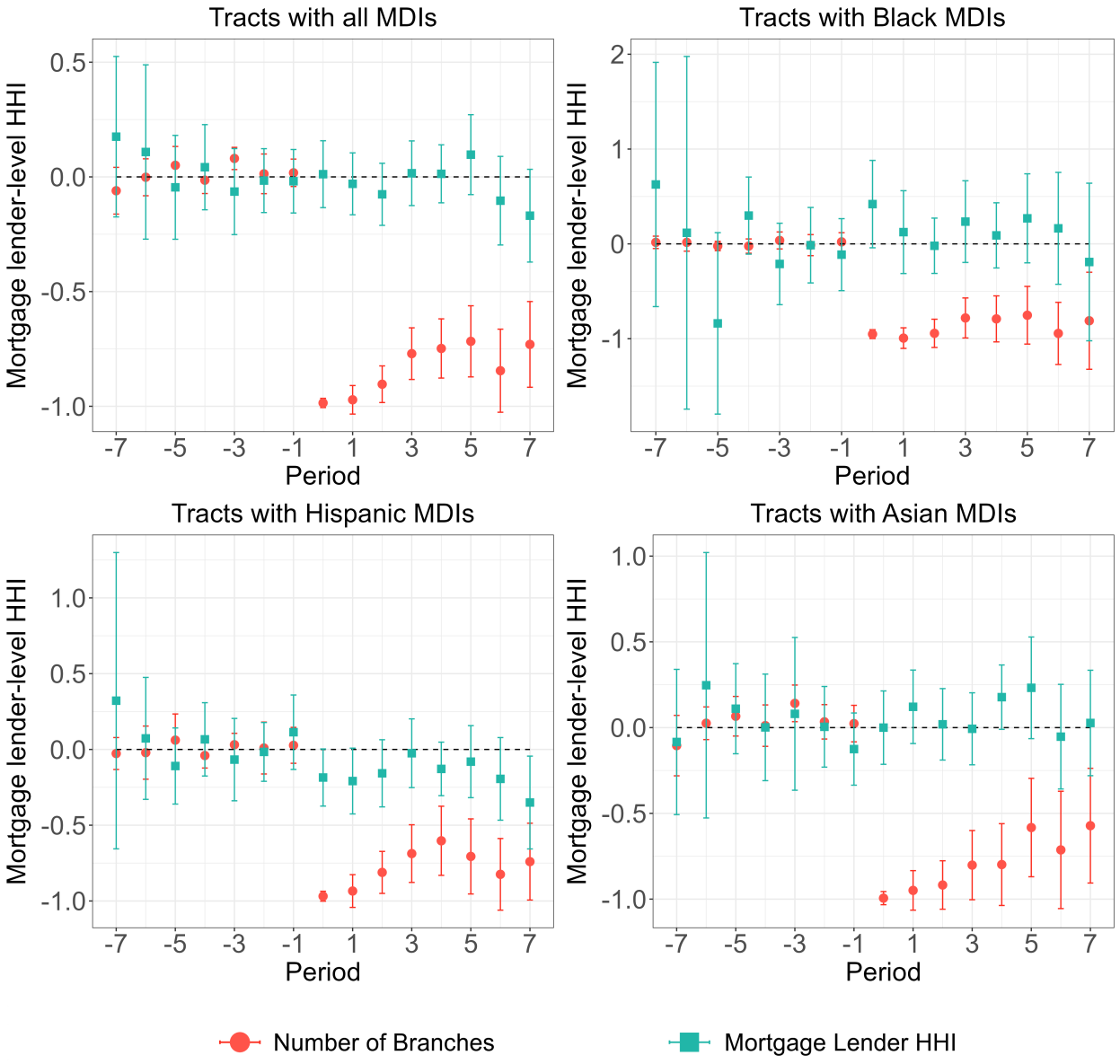


Figure 15: MDI branch closures and mortgage lender-level HHI

Notes: The plots represent estimates from Callaway and Sant'Anna (2021).

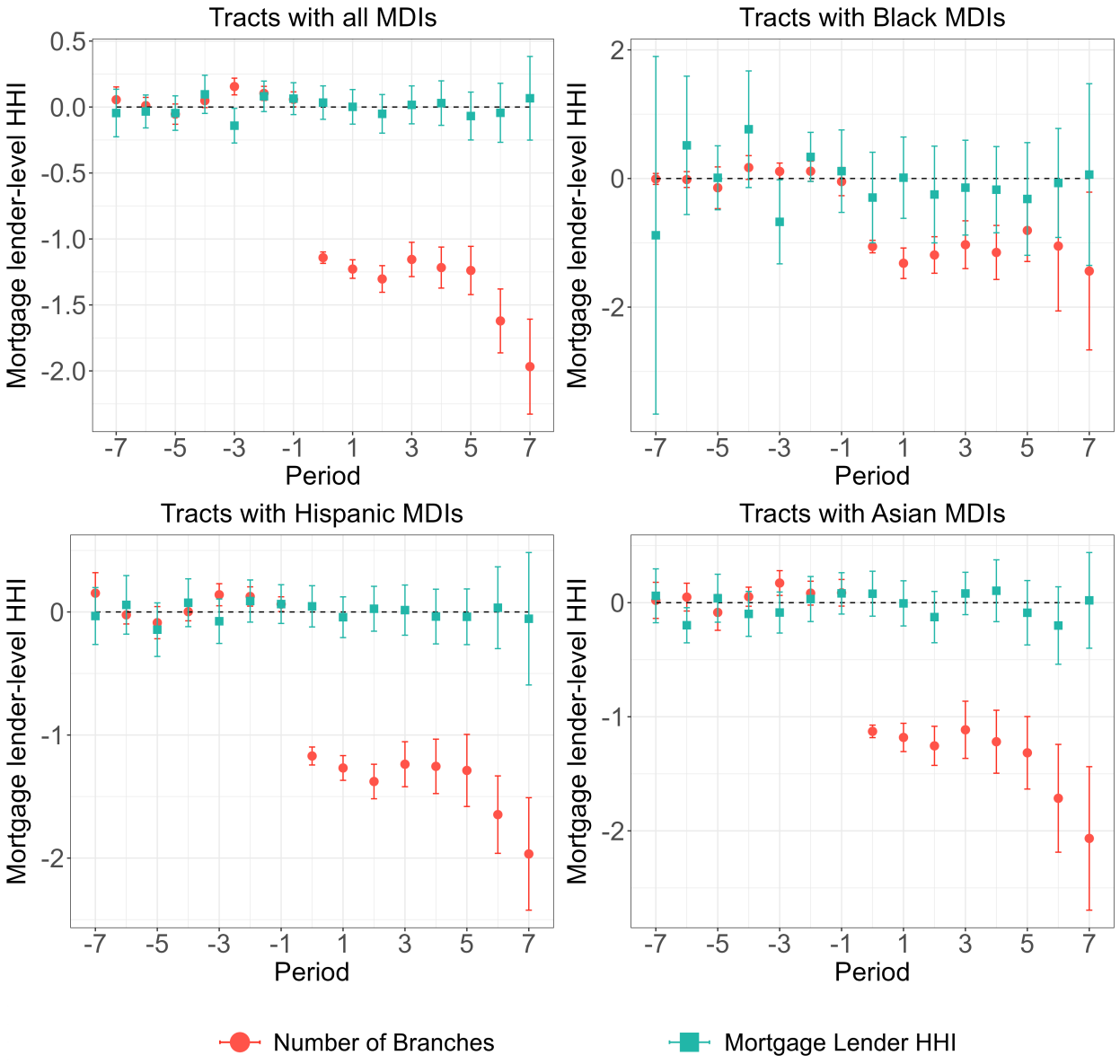


Figure 16: Non-MDI branch closures and mortgage lender-level HHI

Notes: The plots represent estimates from Callaway and Sant'Anna (2021).

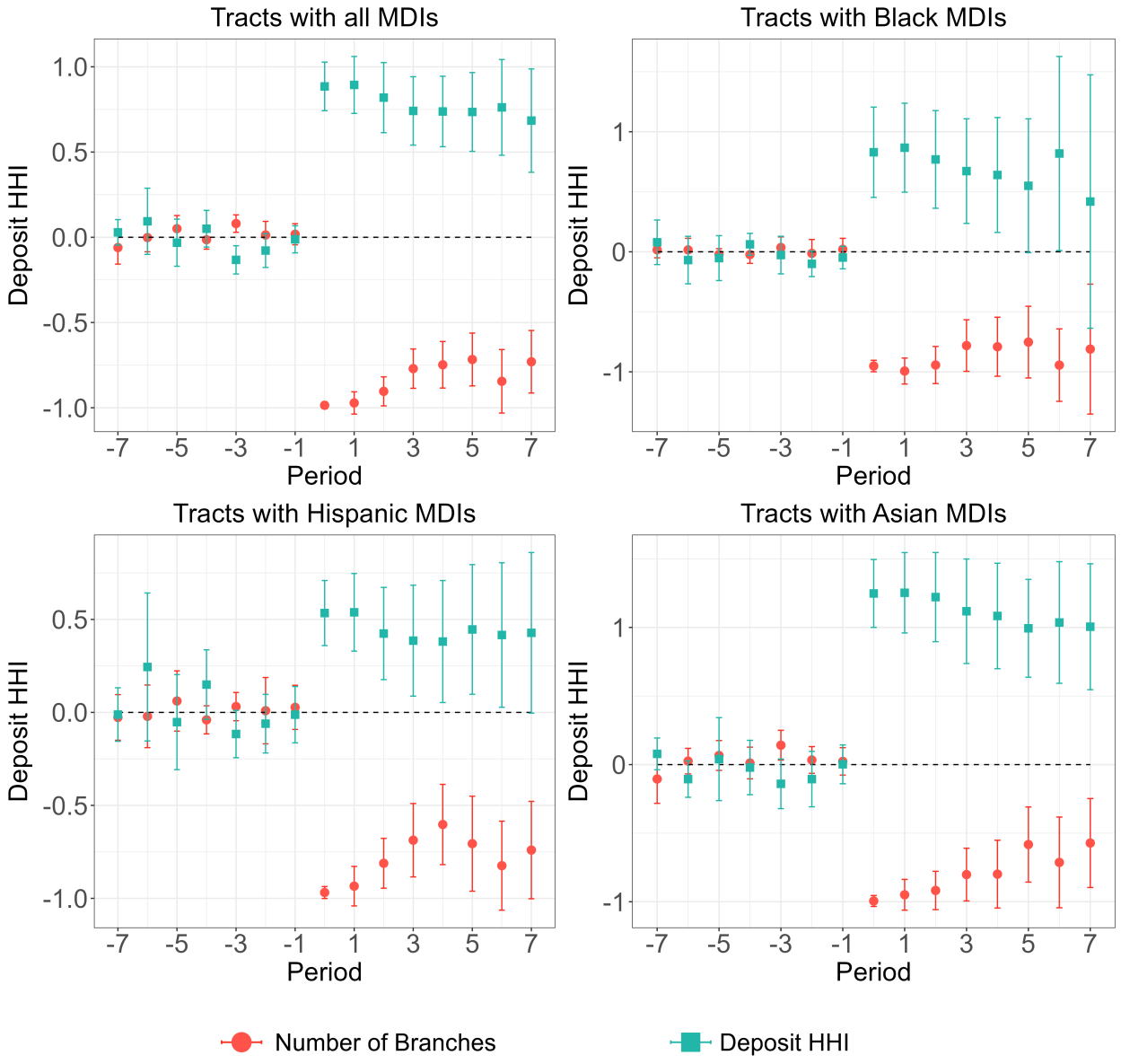


Figure 17: MDI branch closures and deposit HHI

Notes: The plots represent estimates from Callaway and Sant'Anna (2021).

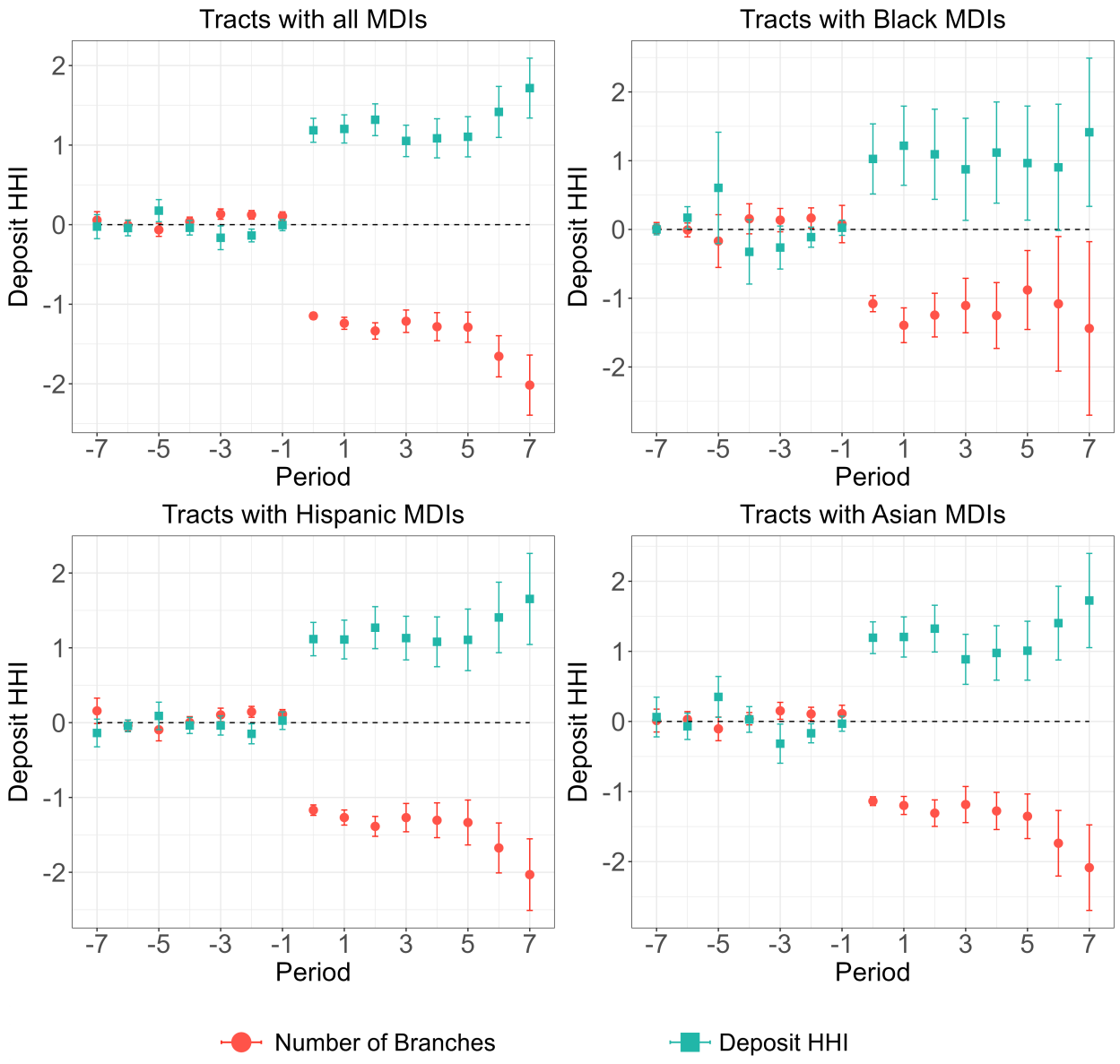


Figure 18: Non-MDI branch closures and deposit HHI

Notes: The plots represent estimates from Callaway and Sant'Anna (2021).

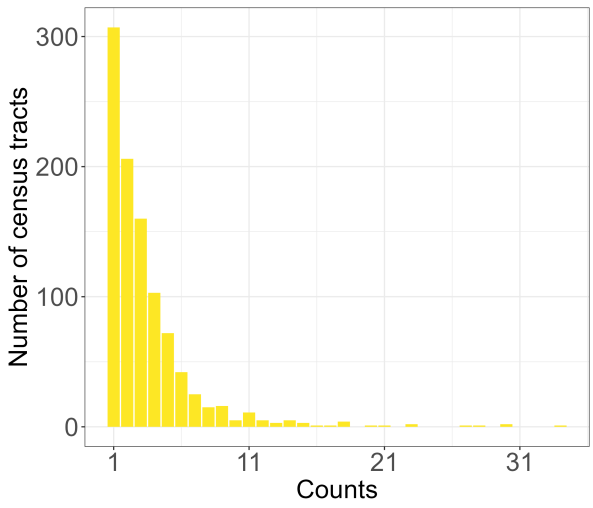
A Appendix: Bank branch characteristics

Summary statistics for bank branches in the census tracts under study in the year 2011. HHI values are in thousands. The standard deviation is in second brackets followed by the median in third brackets. Table A1 provides mean, median and standard deviation of bank branches, along with deposit HHI and lender-level (from the HMDA data) HHI in all the studied census tracts in 2011. In Table A1 Panel A, the "treated" tracts are those that face at least one MDI branch closure while non-MDI branches remain constant. Whereas in Panel B, the "treated" tracts are those that face at least one non-MDI branch closure with the number of MDI branches remaining constant.

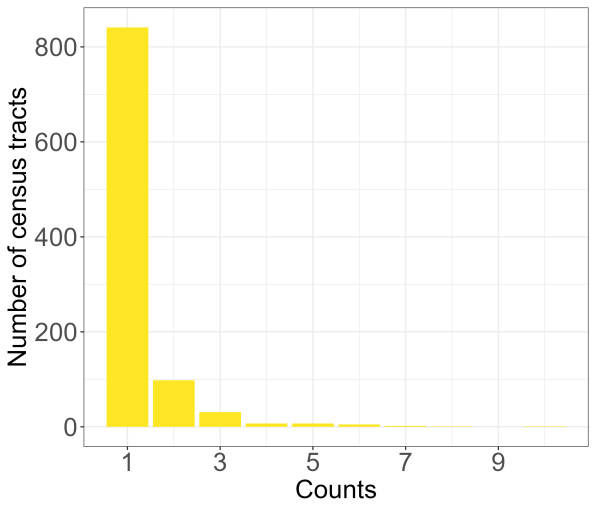
Figure A1 shows the distribution of total bank branches, MDI branches and total branches in neighboring census tracts in 2011. Approximately a third of the census tracts under study has only one branch in 2011 and 80 percent of census tracts has only one MDI branch.

Table A1: Bank branch characteristics in treated and control tracts in the year 2011

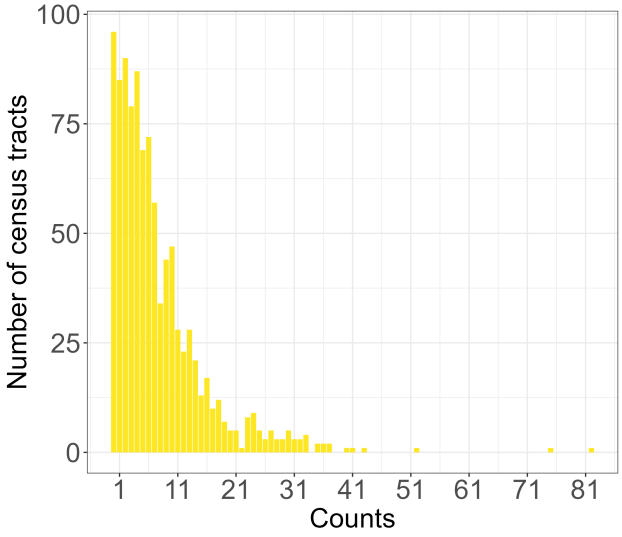
	Panel A: At least one MDI closes with non-MDI constant							
	Not Treated				Treated			
	Blacks tracts	Hispanics tracts	Asians tracts	All tracts	Blacks tracts	Hispanics tracts	Asians tracts	All tracts
Non-MDIs	2.33	2.35	2.49	2.49	1.85	0.80	2.29	1.97
	(3.51)	(4.87)	(3.66)	(3.40)	(2.73)	(1.30)	(3.46)	(2.83)
	[1]	[1]	[2]	[2]	[1]	[0]	[1]	[1]
MDIs	1.18	1.04	1.15	1.36	1.40	1.04	1.25	1.79
	(0.59)	(0.20)	(0.53)	(0.79)	(1.06)	(0.21)	(0.81)	(1.53)
	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]
Deposit HHI	6.21	7.46	6.14	5.51	6.62	8.25	6.81	5.56
	(2.91)	(2.82)	(2.80)	(3.02)	(3.09)	(2.52)	(3.09)	(3.04)
	[5.51]	[8.96]	[5.50]	[4.86]	[6.38]	[10.0]	[6.50]	[5.10]
Lender HHI	1.01	1.23	1.00	0.92	1.06	1.31	0.96	1.05
	(1.02)	(0.99)	(1.05)	(0.89)	(1.16)	(1.51)	(0.85)	(1.30)
	[0.70]	[0.92]	[0.71]	[0.65]	[0.71]	[0.82]	[0.71]	[0.68]
Neighboring tract branches	7.16	3.79	7.75	8.77	8.32	2.82	8.19	11.44
	(6.78)	(4.83)	(6.78)	(8.22)	(9.89)	(2.99)	(9.16)	(11.72)
	[5]	[3]	[6]	[6]	[5]	[2]	[5]	[9]
	Panel B: At least one non-MDI closes with MDI constant							
	Not Treated				Treated			
	Blacks tracts	Hispanics tracts	Asians tracts	All tracts	Blacks tracts	Hispanics tracts	Asians tracts	All tracts
Non-MDIs	0.99	0.45	1.01	1.19	3.99	5.36	3.89	4.06
	(1.42)	(0.87)	(1.43)	(1.65)	(4.98)	(6.32)	(1.43)	(5.42)
	[1]	[0]	[1]	[1]	[3]	[3]	[3]	[3]
MDIs	1.18	1.04	1.08	1.39	1.36	1.07	1.29	1.64
	(0.58)	(0.20)	(0.33)	(0.88)	(0.95)	(0.26)	(0.84)	(1.28)
	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]
Deposit HHI	7.59	8.70	7.74	6.77	4.79	5.17	4.97	4.34
	(2.79)	(2.19)	(2.66)	(3.07)	(2.51)	(2.72)	(2.51)	(2.43)
	[10.0]	[10.0]	[9.94]	[6.45]	[4.27]	[4.42]	[4.47]	[3.75]
Lender HHI	1.11	1.21	0.99	0.88	1.11	1.75	0.99	1.09
	(1.25)	(1.24)	(0.89)	(0.88)	(1.15)	(1.66)	(1.07)	(1.22)
	[0.78]	[0.82]	[0.72]	[0.67]	[0.77]	[1.12]	[0.70]	[0.69]
Neighboring tract branches	6.52	2.92	6.45	9.20	9.41	4.57	9.70	10.99
	(7.60)	(4.01)	(6.68)	(9.61)	(8.814	(4.57)	(8.56)	(10.17)
	[5]	[2]	[2]	[5]	[7]	[3]	[1]	[7]



(a) Total bank branches



(b) MDI branches



(c) Total neighboring tracts branches

Figure A1: Distribution of total bank branches, MDI branches and total neighboring branches per tract over the study period, 2011 until 2021.

B Appendix: Outcome variable characteristics

The first table provide summary statistics for total mortgage loans (in millions) by race from in the census tracts under study in the year 2011. Table B1 provides total mortgage loan summary statistics for "treated" and "not treated" tracts, based on the year 2011. In Table B1 Panel A, the "treated" tracts are those that experience at least one MDI branch closure while the non-MDI branches remain constant. Meanwhile in Panel B, the "treated" tracts are those that encounter at least one non-MDI branch closure with the number of MDI branches remaining constant. The table shows that "treated" and "not treated" tracts have comparable total mortgage originations, total mortgage originations to Whites, Asians, Hispanics and Blacks. However, "treated" tracts on average gave out slightly higher total loans.

Table B2 provides summary statistics for total SBL originations (less than 1 million) and SBL to small firms in the census tracts under study in the year 2011. The standard deviation is in second brackets followed by the median in third brackets. In Panel A, the "treated" tracts are those that undergo at least one MDI branch closure with non-MDI branches remaining constant. Similar to the mortgage originations data, in Panel B, the "treated" tracts are those that face at least one non-MDI branch closure with the number of MDI branches remaining the same.

Table B1: Mortgage originations in treated and control tracts in the year 2011.

	Panel A: At least one MDI closes with non-MDI constant							
		Not Treated				Treated		
	Blacks tracts	Hispanics tracts	Asians tracts	All tracts	Blacks tracts	Hispanics tracts	Asians tracts	All tracts
Total loans	$57.04	$30.49	$42.52	$92.97	$56.06	$28.66	$51.64	$79.93
	(77.72)	(45.71)	(54.68)	(104.13)	(72.38)	(68.67)	(64.80)	(87.86)
	[$28.72]	[$13.30]	[$22.62]	[$60.19]	[$28.56]	[$12.24]	[$26.72]	[$58.28]
Counts of	186	105	177	226	190	103	210	208
loans	(169)	(101)	(165)	(182)	(206)	(97)	(257)	(170)
	[134]	[65]	[123]	[196]	[128]	[71]	[125]	[183]
Loans to	$1.81	$ 8.23	$1.01	$1.37	$2.64	$8.89	$2.38	$1.27
Blacks	(4.18)	(12.01)	(2.45)	(2.37)	(6.39)	(11.79)	(7.89)	(2.24)
	[$0.41]	[$3.07]	[$0.19]	[$0.60]	[$0.60]	[$1.79]	[$0.38]	[$0.46]
Loans to	$6.50	$1.11	$10.14	$4.90	$6.30	$ 1.63	$10.33	$4.10
Hispanics	(10.63)	(2.08)	(13.94)	(5.85)	(9.62)	(3.92)	(12.73)	(4.36)
	[$2.48]	[$0.28]	[$4.52]	[$3.01]	[$2.88]	[$0.19]	[$5.66]	[$2.79]
Loans to	$12.32	$1.53	$2.32	$32.15	$10.50	$1.68	$4.30	$23.31
Aisans	(38.41)	(3.81)	(6.70)	(59.75)	(24.14)	(8.71)	(13.21)	(33.48)
	[$1.05]	[$0.07]	[$0.40]	[$12.58]	[$1.12]	[$0.12]	[$0.58]	[$11.28]

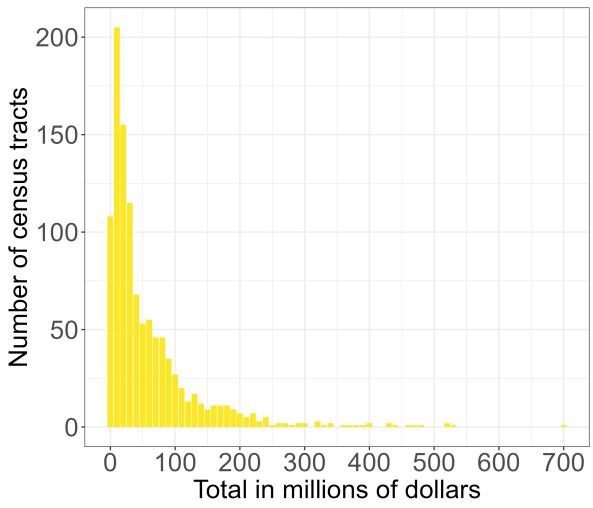
	Panel B: At least one non-MDI closes with MDIs constant							
		Not Treated				Treated		
	Blacks tracts	Hispanics tracts	Asians tracts	All tracts	Blacks tracts	Hispanics tracts	Asians tracts	All tracts
Total loans	$49.36	$26.11	$37.92	$84.53	$68.22	$46.08	$54.70	$91.38
	(69.72)	(57.55)	(49.25)	(96.69)	(83.63)	(79.51)	(66.70)	(98.04)
	[$24.55]	[$12.10]	[$19.74]	[$55.26]	[$41.88]	[$15.66]	[$31.09]	[$61.26]
Counts of	170	101	167	211	208	129	214	219
loans	(164)	(97)	(178)	(166)	(205)	(149)	(228)	(183)
	[121]	[69]	[107]	[182]	[159]	[69]	[152]	[193]
Loans to	$2.27	$6.74	$1.33	$1.18	$1.91	$4.43	$1.74	$1.44
Blacks	(4.92)	(8.50)	(3.30)	(1.87)	(5.20)	(5.69)	(6.51)	(2.59)
	[$0.47]	[$4.06]	[$0.18]	[$0.49]	[$0.49]	[$2.00]	[$0.28]	[$0.51]
Loans to	$5.85	$1.57	$9.76	$4.36	$7.02	$1.32	$10.69	$4.61
Hispanics	(10.02)	(3.52)	(13.69)	(4.59)	(10.38)	(2.70)	(13.34)	(5.88)
	[$2.14]	[$0.19]	[$4.48]	[$2.86]	[$3.12]	[$0.28]	[$5.19]	[$2.65]
Loans to	$10.75	$1.41	$2.39	$29.48	$12.74	$2.77	$3.57	$26.13
Asians	(32.28)	(7.20)	(10.16)	(50.59)	(34.89)	(5.54)	(8.34)	(49.86)
	[$0.67]	[$0.07]	[$0.34]	[$11.80]	[$2.25]	[$0.29]	[$0.66]	[$10.98]

Total mortgage originations are in millions.

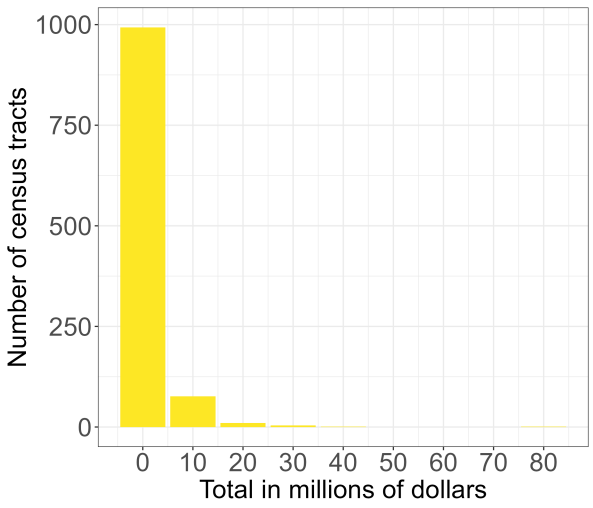
Table B2: SBL originations in treated and control tracts in the year 2011.

	Panel A: At least one MDI closes with non-MDI constant							
	Not Treated				Treated			
	Blacks tracts	Hispanics tracts	Asians tracts	All tracts	Blacks tracts	Hispanics tracts	Asians tracts	All tracts
Total loans	$2.25	$2.26	$2.11	$2.72	$1.90	$1.00	$1.75	$2.68
to Small Firms	(3.81)	(4.27)	(3.70)	(4.06)	(2.59)	(1.56)	(2.15)	(3.54)
	[$1.13]	[$0.55]	[$1.09]	[$1.64]	[$1.06]	[$0.26]	[$1.14]	[$1.61]
Counts to	58	40	53	79	54	21	52	78
Small Firms	(87)	(65)	(82)	(103)	(74)	(30)	(63)	(102)
	[36]	[17]	[35]	[52]	[32]	[13]	[31]	[46]
Total Small	$7.07	$7.72	$6.34	$9.22	$6.37	$3.53	$5.51	$9.45
Business	(14.91)	(15.96)	(14.51)	(16.96)	(13.22)	(6.11)	(8.73)	(19.43)
Loans	[$3.04]	[$1.23]	[$2.99]	[$3.99]	[$2.69]	[$1.15]	[$2.77]	[$3.39]
Count to	137	99	127	191	131	51	123	193
Small	(219)	(176)	(218)	(256)	(201)	(71)	(150)	(286)
Businesses	[80]	[34]	[76]	[123]	[75]	[26]	[72]	[106]
	Panel B: At least one non-MDI closes with MDIs constant							
	Not Treated				Treated			
	Blacks tracts	Hispanics tracts	Asians tracts	All tracts	Blacks tracts	Hispanics tracts	Asians tracts	All tracts
Loans to	$1.49	$0.77	$1.30	$2.23	$3.19	$4.46	$2.81	$3.48
Small Firms	(2.20)	(1.21)	(1.69)	(3.06)	(5.01)	(7.22)	(4.20)	(5.41)
	[$0.85]	[$0.26]	[$0.77]	[$1.25]	[$1.72]	[$1.95]	[$1.56]	[$1.92]
Counts to	42	17	36	70	82	81	73	99
Small Firms	(62)	(24)	(38)	(92)	(116)	(112)	(101)	(137)
	[25]	[11]	[25]	[43]	[49]	[37]	[45]	[61]
Total Small	$4.71	$2.22	$3.72	$7.78	$10.74	$18.57	$8.89	$12.32
Business	(11.15)	(3.87)	(6.12)	(17.59)	(20.77)	(33.06)	(17.16)	(22.16)
Loans	[$2.14]	[$0.94]	[$2.17]	[$2.96]	[$4.36]	[$5.32]	[$3.95]	[$4.82]
Counts to	100	38	85	170	201	217	178	245
Small	(162)	(53)	(89)	(249)	(304)	(349)	(271)	(349)
Businesses	[59]	[22]	[56]	[95]	[115]	[87]	[101]	[138]

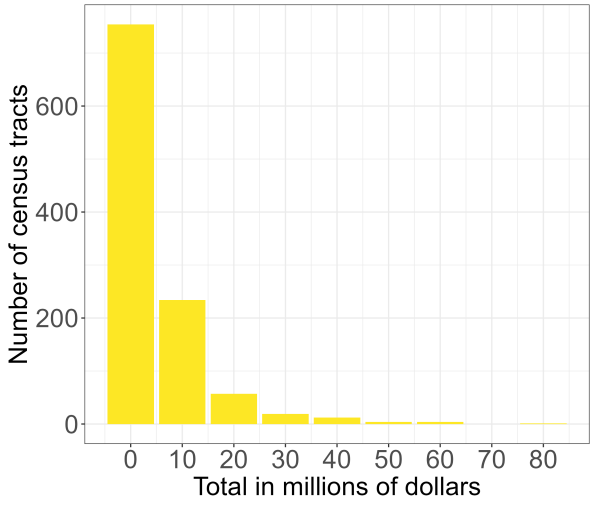
Total SBL originations are in millions.



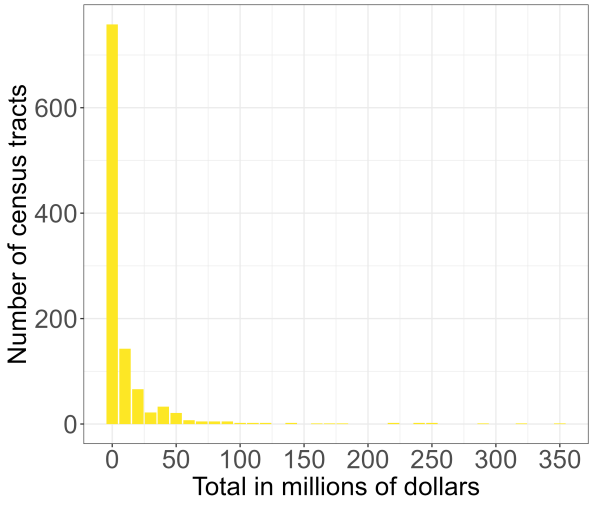
(a) Total Mortgages.



(b) Mortgages to Blacks.



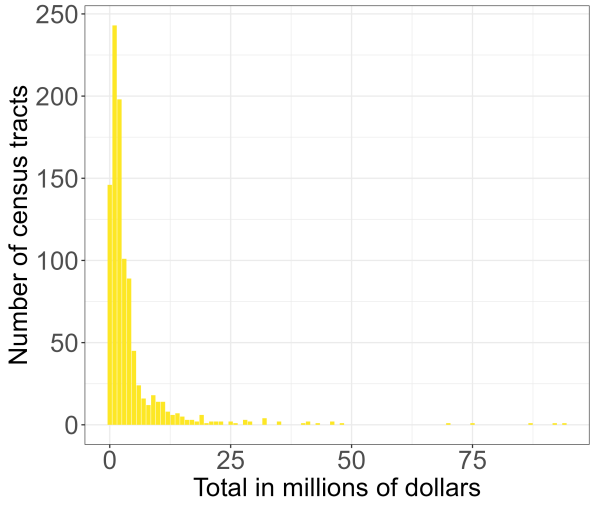
(c) Mortgages to Hispanics.



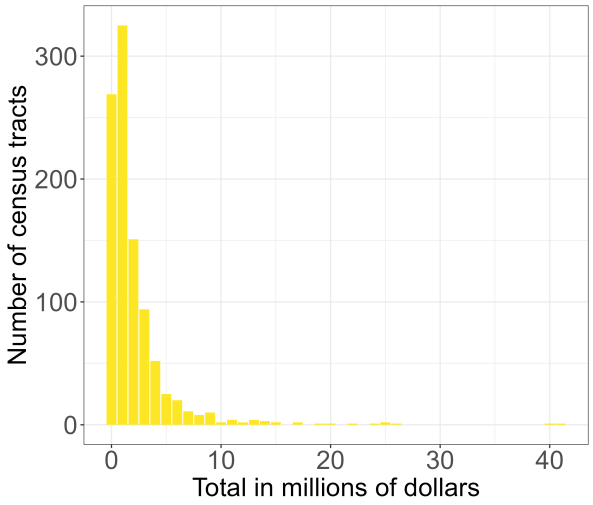
(d) Mortgages to Asians

Figure B1: Distribution of the mortgages in millions of dollar in 2011

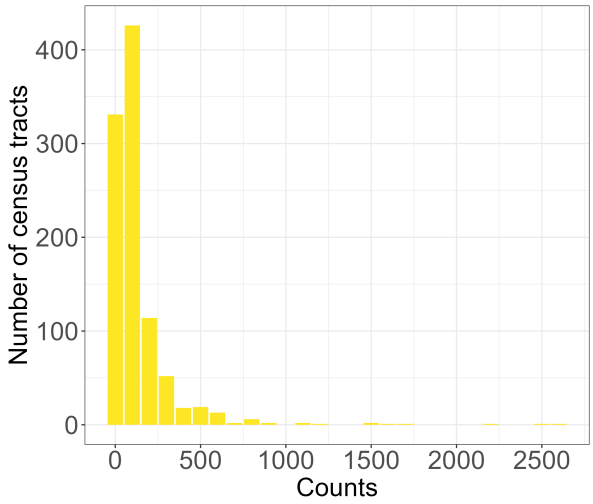
Notes: The left most bar represents loans between 0 and 9 million, while the second left most bar represents loans between 10 to 19 million and so on.



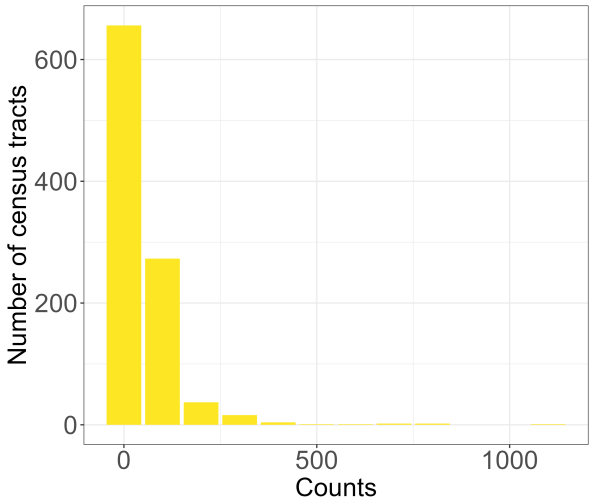
(a) Total small business loans (of sizes less than 1 million dollars.)



(b) Small business loans to small firms (assets less than $1 million).



(c) Number of total small business loans.



(d) Number of small business loans to small firms

Figure B2: Distribution of small business loans in millions of dollars in 2011

Notes: Total loans are in millions of dollars. The left most bar represents loans between 0 and .9 million, while the second left most bar represents loans between 1 and 1.9 million and so on. The count of the loans are in hundreds. Left most bar represents counts between 0 and 99, while the second left most bar represents counts between 100 and 199 and so on.

C Appendix: Census tract characteristics

Census tract level characteristics such as population, percent of different races, percent high school graduated, percent college graduated, percent in labor force, percent of mortgages in owner occupied units, percent of households on SNAP, median rent value, median household income and median home prices are collected from the 5 year American Community Survey (ACS) data. Summary statistics of these demographics within all the tracts under study are provided in Tables C1 and **??** respectively. In Table C1, the "treated" tracts are those that encounter at least one MDI branch closure with non-MDI branches remaining constant. As before, in Table **??** the "treated" tracts are those that experience at least one non-MDI branch closure with the number of MDI branches remaining constant.

Table C1: Summary statistics of demographic variables from all tracts with an MDI present in year 2011.

	Panel A: At least one MDI closes with non-MDIs constant							
		Not Treated				Treated		
	All tracts	Black MDI tracts	Hispanic MDI tracts	Asian MDI tracts	All tracts	Black MDI tracts	Hispanic MDI tracts	Asian MDI tracts
Population	4650	3420	5041	4585	4780	3536	5260	4780
	(2220)	(2101)	(2396)	(1831)	(2452)	(1616)	(2853)	(1937)
Percent Whites	58.43	23.72	74.46	48.33	53.26	21.18	71.68	46.31
	(27.59)	(23.68)	(19.44)	(22.50)	(29.27)	(22.65)	(22.40)	(23.15)
Percent Blacks	15.50	67.50	7.36	7.80	20.08	71.42	9.62	8.70
	(24.32)	(28.40)	(11.27)	(9.76)	(29.57)	(28.09)	(15.72)	(13.47)
Percent Hispanics	34.01	9.17	52.31	23.93	34.55	10.67	52.44	25.76
	(31.80)	(13.89)	(33.35)	(21.12)	(30.13)	(15.43)	(30.88)	(21.48)
Percent Asian	13.45	4.07	4.64	31.49	14.91	3.93	5.82	31.99
	(19.38)	(5.78)	(7.79)	(22.83)	(20.61)	(3.94)	(9.18)	(24.34)
Percent High-School Graduates	24.33	26.71	25.03	20.72	24.69	30.35	24.11	21.95
	(9.50)	(10.14)	(8.92)	(8.94)	(9.16)	(8.61)	(8.93)	(8.53)
Percent College Graduates	18.87	14.90	17.17	23.91	18.91	12.97	18.97	22.47
	(9.50)	(9.16)	(9.76)	(10.61)	(9.16)	(8.63)	(11.67)	(11.08)
Percent in Labor Force	63.47	59.95	63.55	65.42	64.48	59.67	65.35	65.99
	(10.23)	(13.05)	(10.05)	(8.56)	(9.39)	(11.04)	(8.92)	(8.37)
Percent Households on SNAP	13.89	22.41	16.24	7.18	13.98	21.86	15.43	8.22
	(12.32)	(13.31)	(12.76)	(7.44)	(12.17)	(12.37)	(12.21)	(9.20)
Percent Mortgages	65.60	67.55	62.34	70.81	68.24	69.14	67.00	69.80
	(17.72)	(20.35)	(18.61)	(14.33)	(16.60)	(15.82)	(17.82)	(15.25)
Median Rent	$1.38	$0.99	$1.91	$0.96	$0.97	$0.87	$0.96	$1.06
	(10.77)	(0.84)	(15.71)	(0.67)	(0.69)	(0.56)	(0.73)	(0.72)
Median Household Income	$65.07	$47.19	$59.85	$82.16	$64.05	$46.80	$64.70	$72.71
	(34.17)	(26.18)	(29.43)	(37.92)	(31.32)	(22.25)	(29.82)	(34.32)
Median Home Value	$360.40	$314.48	$260.45	$560.22	$366.50	$254.84	$306.65	$513.55
	(283.65)	(255.17)	(213.75)	(294.58)	(267.20)	(215.04)	(231.51)	(282.39)

Median household income, median rent and median home value are in thousands.

Table C1: Summary statistics of demographic variables from all tracts with an MDI present in year 2011.

Panel B: At least one non-MDI closes with MDIs constant

		Not Treated				Treated		
Statistic	All tracts	Black MDI tracts	Hispanic MDI tracts	Asian MDI tracts	All tracts	Black MDI tracts	Hispanic MDI tracts	Asian MDI tracts
Population	4584	3523	5363	4636	4883	4017	5834	4696
	(2061)	(1818)	(2717)	(1705)	(2563)	(2263)	(3731)	(2057)
Percent Whites	53.97	21.41	72.00	47.01	59.07	30.91	74.14	48.35
	(29.32)	(21.73)	(22.96)	(22.25)	(26.57)	(24.39)	(18.32)	(23.49)
Percent Blacks	19.90	69.79	7.97	8.31	13.38	58.71	8.09	7.92
	(29.55)	(27.54)	(13.71)	(11.91)	(20.72)	(30.13)	(11.17)	(10.34)
Percent Hispanics	35.23	12.08	58.06	26.06	32.03	7.31	48.43	22.08
	(31.76)	(16.85)	(31.58)	(20.84)	(29.98)	(9.48)	(32.04)	(21.16)
Percent Asian	13.09	3.99	4.72	32.21	16.11	5.90	6.14	31.62
	(19.82)	(4.28)	(8.25)	(24.01)	(20.92)	(6.65)	(9.70)	(23.70)
Percent High-School Graduates	26.24	27.13	24.75	22.25	21.99	23.48	21.56	19.92
	(9.10)	(9.60)	(9.03)	(8.90)	(9.25)	(11.33)	(9.26)	(8.68)
Percent College Graduates	16.91	13.87	15.45	22.33	21.66	17.90	20.21	24.55
	(10.39)	(8.33)	(9.45)	(11.22)	(10.73)	(9.96)	(10.71)	(10.31)
Percent in Labor Force	63.05	58.29	59.88	65.59	64.96	57.73	62.86	65.90
	(9.20)	(10.91)	(9.81)	(8.06)	(10.45)	(16.34)	(10.34)	(8.66)
Percent Households on SNAP	15.67	25.89	19.50	8.13	11.59	22.15	15.21	7.42
	(12.94)	(14.48)	(13.30)	(9.09)	(10.73)	(14.70)	(12.85)	(7.03)
Percent Mortgages	65.83	63.61	57.67	69.79	67.24	62.72	59.73	70.19
	(17.29)	(17.62)	(18.52)	(14.57)	(17.77	(19.68)	(16.63)	(15.83)
Median rent	$1.37	$0.78	$1.00	$0.95	$1.08	$1.34	$1.06	$1.08
	(11.45)	(0.46)	(5.4)	(0.61)	(0.81)	(1.06)	(0.85)	(0.75)
Median household income	$61.13	$47.61	$62.12	$76.69	$70.49	$57.27	$72.15	$81.10
	(32.11)	(25.85)	(43.02)	(36.76)	(36.53)	(47.93)	(54.23)	(41.64)
Median home value	$346.18	$275.40	$274.48	$538.17	$397.54	$315.94	$309.99	$558.57
	(281.46)	(275.24)	(244.27)	(309.73)	(286.67)	(340.69)	(266.79)	(299.11)

Median household income, median rent and median home value are in thousands.

D Appendix: A brief discussion of interaction-weighted differences-in-differences framework and the Pooled OLS or ETWFE framework

Sun and Abraham (2021) use the following specification

$$Y_{i,t} = \alpha_i + \lambda_t + \beta X_{i,t} + \sum_{l=-K}^{-2} \mu_l D_{i,t}^l + \sum_{l=0}^{L} \mu_l D_{i,t}^l + \nu_{i,t} \tag{D.1}$$

In the above specification, $Y_{i,t}$ is the outcome of interest for unit i at time t. α_i and λ_t are unit and time fixed effects. $X_{i,t}$ are time varying controls and β are the coefficients of the time-varying covariates. $D_{i,t}^l := \mathbb{1}\{t - E_i = l\}$ is an indicator for census tract i being l periods away from initial treatment at calendar time t. E_i is the time for unit i to initially receive a binary absorbing treatment, whether an MDI branch closed or not (or whether a non-MDI branch closed or not). For never-treated census tracts $E_i = \infty$) and I set $D_{i,t}^l = 0$ for all l and all t.

The parameters of interest are the coefficients of $D_{i,t}^l$ which are $\hat{\mu}_l$. Sun and Abraham (2021) define the Cohort-specific Average Treatment effect on the Treated (CATT) l periods from initial treatment as:

$$CATT_{e,l} = E[Y_{i,e+l} - Y_{i,e+l}^{\infty} | E_i = e] \tag{D.2}$$

Here $Y_{i,e+l}^{\infty}$ are the not yet treated units. Each $CATT_{e,l}$ represents the average treatment effect l periods from the initial treatment for the cohort of units first treated at period e. The $CATT_{e,l}$ estimator is unbiased and consistent when the observations satisfy parallel trends in baseline outcome and display no anticipatory behavior prior to treatment.

Wooldridge (2021) considers the two-way FE estimator and show that a simple extension of the Mundlak device reproduces the TWFE estimates. In particular, he shows that adding both unit-specific time series averages and period-specific cross-sectional averages in a POLS regression reproduce the two-way FE estimates. The key terms in the estimator are as follows:

- $Y_{i,t}$ is the outcome of interest for unit i at time t.
- D_{ig} captures staggered treatment entry for unit i at time g.
- X_i are time varying covariates
- fs_t is a dummy variable equal to unity of $s = t$ and zero otherwise
- α is the intercept.
- β_g and $\eta_g$are selection effects and π_s capture heterogeneous trends.
- τ_{gd} are the ATT estimates.

Similar to both Sun and Abraham (2021) and Callaway and Sant'Anna (2021), the estimator is built on three key assumptions:

Assumption CNA (Conditional No Anticipation): For each treatment cohort $g \in \{q, ..., T\}$,

$$E[Y_t(g)|D_q, ..., D_T, X] = E[Y_t(\infty)|D_q, ..., D_T, X]. \tag{D.3}$$

Assumption CPT (Conditional Parallel Trends): For$t \in 2, ..., T$ and time-constant controls X,

$$E[Y_t(\infty) - Y_1(\infty)|D_q, ..., D_T, X] = E[Y_t(\infty)Y_1(\infty) - |X]. \tag{D.4}$$

The above equation implies a conditional PT assumption in levels.
Assumption LIN (Linearity): For treatment cohort indicators D_g and control variables X,

$$E(Y_1|\mathbf{D}, \mathbf{X}) = \alpha + \sum_{g=q}^{T} \beta_g D_g + \mathbf{X}\kappa + \sum_{g=q}^{T} (D_g.\mathbf{X})\zeta_g, \tag{D.5}$$

Following CPT,

$$E[Y_t(\infty)|\mathbf{D}, \mathbf{X}] - E[Y_1(\infty)|\mathbf{D}, \mathbf{X}] = \sum_{s=2}^{T} \gamma_s fs_t + \sum_{s=2}^{T} (fs_t.\mathbf{X})\pi_s. \tag{D.6}$$

Building on the assumptions, Wooldridge (2021) provides the following process to estimate the ATT:

$$\begin{aligned} E(Y_{it}|D_i, X_i) = \alpha + \sum_{g=q}^{T} \beta_g D_{ig} + X_i\kappa + \sum_{g=q}^{T} (D_{ig}.X_{ig})\zeta_g + \sum_{s=2}^{T} \gamma_s fs_t \\ + \sum_{s=2}^{T} (fs_t.X_i)\pi_s + \sum_{g=q}^{T}\sum_{s=q}^{T} (D_{id}fs_t)\tau_{gs} \\ + \sum_{g=q}^{T}\sum_{s=q}^{T} (D_{id}fs_tX_{ig})\rho_{gs} \end{aligned} \tag{D.7}$$

This estimator offers a general and flexible regression approach that identify the treatment effects of interest. The estimator also allows for testing restrictions on treatment effects. Finally, the POLS/ETWFE has exact and asymptotic efficiency properties under the above mentioned assumptions.

E Appendix: Robustness Checks

Robustness checks are carried out using the truncated sample of census tracts. The results are similar to the ones provided in the main body of the paper.

Table E1: Change in total mortgage loans (in millions of dollars)

	Outcome variable: Total mortgage originations							
	MDI Closures				Non MDI Closures			
	Loans to Blacks	Loans to Hispanics	Loans to Asians	Loans to All	Loans to Blacks	Loans to Hispanics	Loans to Asians	Loans to All
C&S ATT	0.257	-0.037	-5.964**	-3.044	-1.520**	0.903	2.991	2.069
	(0.628)	(0.850)	(2.751)	(2.007)	(0.774)	(0.677)	(3.039)	(1.967)
ETWFE ATT	-0.143	0.032	-4.850*	-4.25*	-1.750**	0.750	2.810	2.100
	(0.735)	(0.790)	(2.570)	(2.340)	(0.635)	(0.731)	(2.170)	(1.950)
S&A ATT	0.382	-0.157	-4.382*	-2.768	-1.392*	0.251	3.487	0.518
	(0.664)	(0.722)	(2.394)	(1.811)	(0.688)	(0.609)	(2.305)	(1.580)
Baseline mean	5.06	8.58	21.14	35.38	4.25	8.69	23.15	41.69
Fixed Effects by:								
Year:	11	11	11	11	11	11	11	11
Census Tracts:	141	452	355	996	140	457	379	1020
Observations	1,551	4,972	3,905	10,956	1,540	5,027	4,169	11,220
R^2	0.816	0.765	0.783	0.803	0.813	0.766	0.790	0.806
Within R^2	0.082	0.072	0.045	0.089	0.047	0.070	0.060	0.088

Notes: *p<0.1; **p<0.05; ***p<0.01
Standard errors are clustered at the census tract level. Baseline means are in millions.

Table E2: Change in small business loans (in millions of dollars

	Panel A: SBL to small firms (less than $1 million assets)							
	MDI Closures				Non MDI Closures			
	Blacks tracts	Hispanics tracts	Asians tracts	All tracts	Blacks tracts	Hispanics tracts	Asians tracts	All tracts
C&S ATT	0.006	-0.229*	0.114	-0.013	0.312	0.230	0.172	0.184
	(0.185)	(0.122)	(0.198)	(0.088)	(0.462)	(0.251)	(0.268)	(0.161)
ETWFE ATT	0.202	-0.233*	-0.125	-0.124	-0.174	0.286	0.425	0.312**
	(0.207)	(0.132)	(0.178)	(0.096)	(0.491)	(0.210)	(0.197)	(0.133)
S&A ATT	0.052	-0.231*	0.147	-0.053	0.201	0.095	0.193	0.124
	(0.196)	(0.121)	(0.151)	(0.081)	(0.311)	(0.218)	(0.169)	(0.125)
Baseline mean	1.00	1.75	2.69	1.90	4.76	2.81	3.49	3.18
Fixed Effects by:								
Year:	11	11	11	11	11	11	11	11
Census Tracts:	141	452	355	996	140	457	379	1020
Observations	1,551	4,972	3,905	10,956	1,540	5,027	4,169	11,220
R^2	0.901	0.853	0.892	0.878	0.911	0.859	0.905	0.889
Within R^2	0.041	0.077	0.082	0.059	0.169	0.074	0.083	0.061
	Panel B: Total SBL less than $ 1 millions							
	MDI Closures				Non MDI Closures			
	Blacks tracts	Hispanics tracts	Asians tracts	All tracts	Blacks tracts	Hispanics tracts	Asians tracts	All tracts
C&S ATT	-1.191	-0.200	-0.540	-0.167	4.861	2.444**	3.665**	3.462***
	(0.921)	(0.438)	(1.152)	(0.449)	(3.088)	(0.778)	(1.619)	(0.782)
ETWFE ATT	-0.309	-0.775	-1.410	-0.871*	2.900	2.540***	3.980***	3.080***
	(0.742)	(0.541)	(1.010)	(0.497)	(2.520)	(0.676)	(1.240)	(0.649)
S&A ATT	-1.030	-0.491	-0.350	-0.604	3.030*	1.925***	2.980***	2.274***
	(0.902)	(0.444)	(0.734)	(0.356)	(1.639)	(0.650)	(0.917)	(0.510)
Baseline mean	3.53	5.51	9.45	6.37	18.58	8.89	12.32	10.74
Fixed Effects by:								
Year:	11	11	11	11	11	11	11	11
Census Tracts:	141	452	355	996	140	457	379	1020
Observations	1,551	4,972	3,905	10,956	1,540	5,027	4,169	11,220
R^2	0.848	0.877	0.896	0.890	0.904	0.886	0.901	0.897
Within R^2	0.054	0.050	0.107	0.060	0.246	0.087	0.130	0.088

Notes: *p<0.1; **p<0.05; ***p<0.01
Standard errors are clustered at the census tract level. Baseline means are in millions.

F Appendix: Small sized mortgages

I also examine whether MDI or non-MDI branch closures impact small-sized mortgage originations. For this, I collect median home price data from 2011 until 2021 from the Federal Reserve Bank of St. Louis (FRED) website. I consider small-sized mortgage originations as those below 50 percent of the median US home prices in their corresponding year.[13] The estimation results show minimal negative impact of MDI closures and non-MDI closures on small-sized mortgage originations at the census tract level. The results are provided in Appendix F, Table F1.

Table F1: Change small-sized in mortgage loans (in millions of dollars)

	Panel: Small-sized mortgages							
	MDI Closures				Non MDI Closures			
	Loans to Blacks	Loans to Hispanics	Loans to Asians	Loans to All	Loans to Blacks	Loans to Hispanics	Loans to Asians	Loans to All
C&S ATT	0.126	0.001	-0.035	0.112	-0.122	-0.075	0.056	-0.119
	(0.142)	(0.123)	(0.041)	(0.145)	(0.140)	(0.083)	(0.056)	(0.101)
ETWFE ATT	0.080	0.069	-0.029	0.104	-0.221	-0.188*	0.026	-0.223**
	(0.139)	(0.134)	(0.049)	(0.131)	(0.156)	(0.106)	(0.049)	(0.109)
S&A ATT	0.162	0.030	-0.027	0.242	-0.184	-0.153	0.070	-0.124
	(0.142)	(0.150)	(0.039)	(0.169)	(0.129)	(0.096)	(0.043)	(0.096)
Baseline mean	1.17	1.23	0.38	2.58	1.26	1.42	0.40	2.59
Fixed Effects by:								
Year:	11	11	11	11	11	11	11	11
Census Tracts:	145	470	375	1035	147	473	392	1057
Observations	1,595	5,160	4,125	11,375	1,617	5,203	4,312	11,617
R^2	0.907	0.897	0.693	0.899	0.892	0.896	0.730	0.897
Within R^2	0.145	0.056	0.046	0.062	0.060	0.056	0.052	0.054

Notes: *p<0.1; **p<0.05; ***p<0.01
Standard errors are clustered at the census tract level. Baseline means are in millions.

[13] I do not use a fixed number (for example $100,000 as small mortgages) because median home prices in the US generally rise and a $100,000 mortgage in 2011 is not the same as a $100,000 mortgage in 2021.

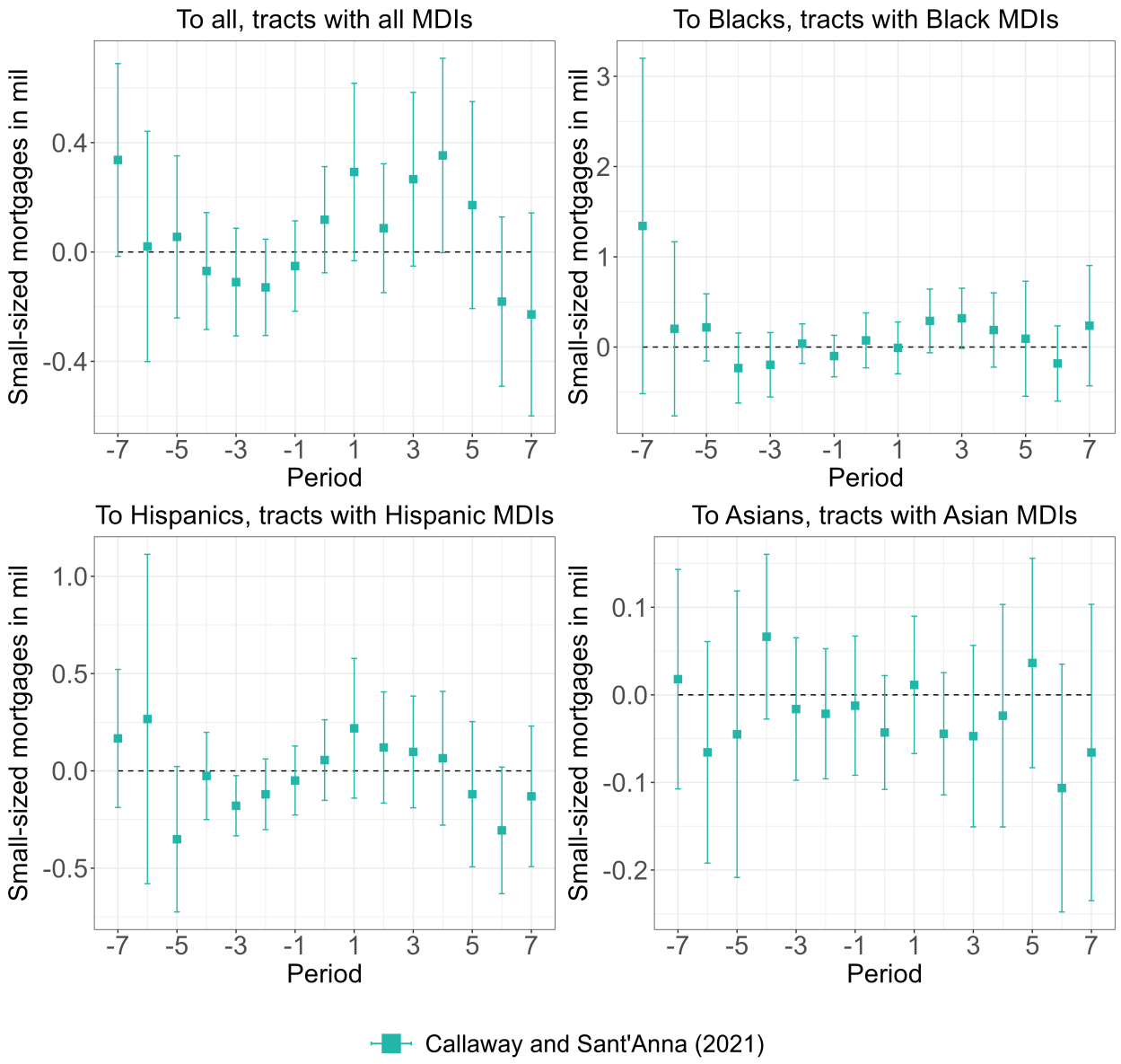


Figure F1: MDI branch closures and small-sized mortgages

Notes: The figure shows effect on small-sized mortgage originations due to the closing at least one MDI branch in a census tract seven calendar years before and after the closing.

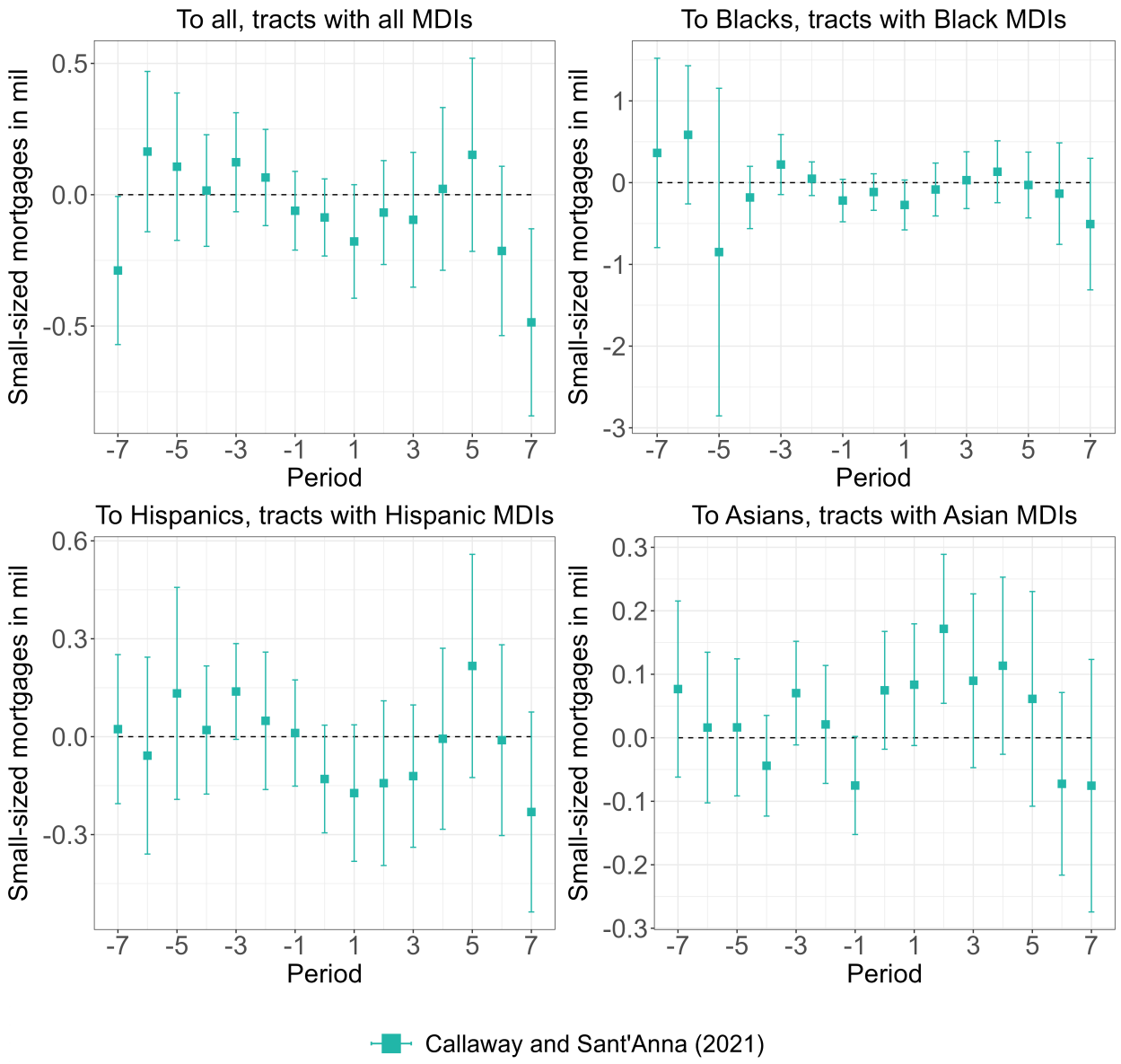


Figure F2: Non-MDI branch closures and small-sized mortgages

Notes: The figure shows effect on small-sized mortgage originations due to the closing at least one non-MDI branch in a census tract seven calendar years before and after the closing.

G Appendix: How the number of MDI branches in the neighboring tracts changes as MDI and non-MDI branches close in the studied tracts

The two figures in this section show plots for change in number of MDIs when MDI branches close with non-MDI branches remain constant (Figure **??**) and when non-MDI branches close with MDI branches remaining constant (Figure **??**). Following an MDI closure, the number of MDIs in neighboring tracts increase by 10 percent, while following an Asian MDI closure, the number of MDIs in neighboring tracts increase by 13 percent.

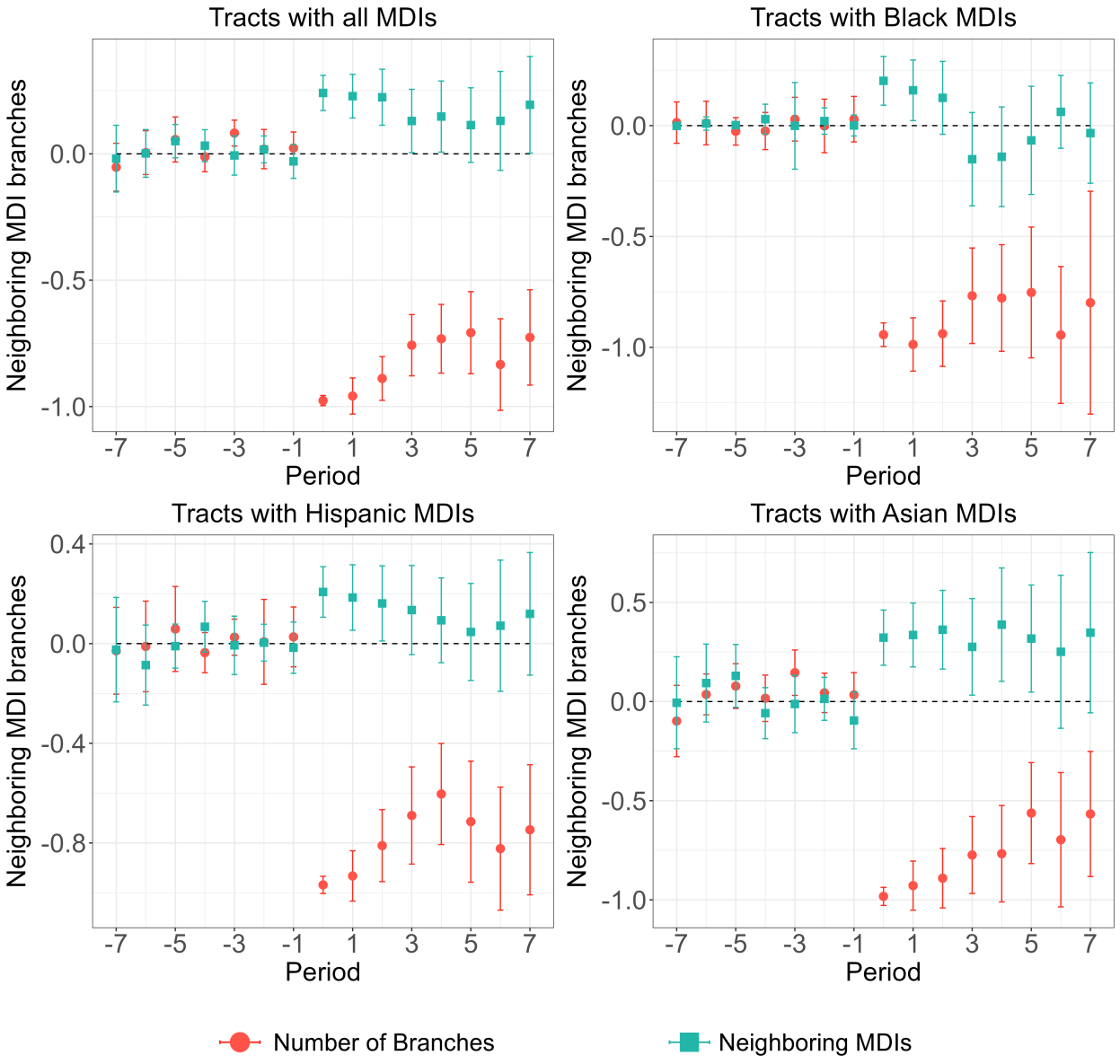


Figure G1: MDI branch closures and the number of MDIs in neighboring tracts

Notes: The plots represent estimates from Callaway and Sant'Anna (2021).

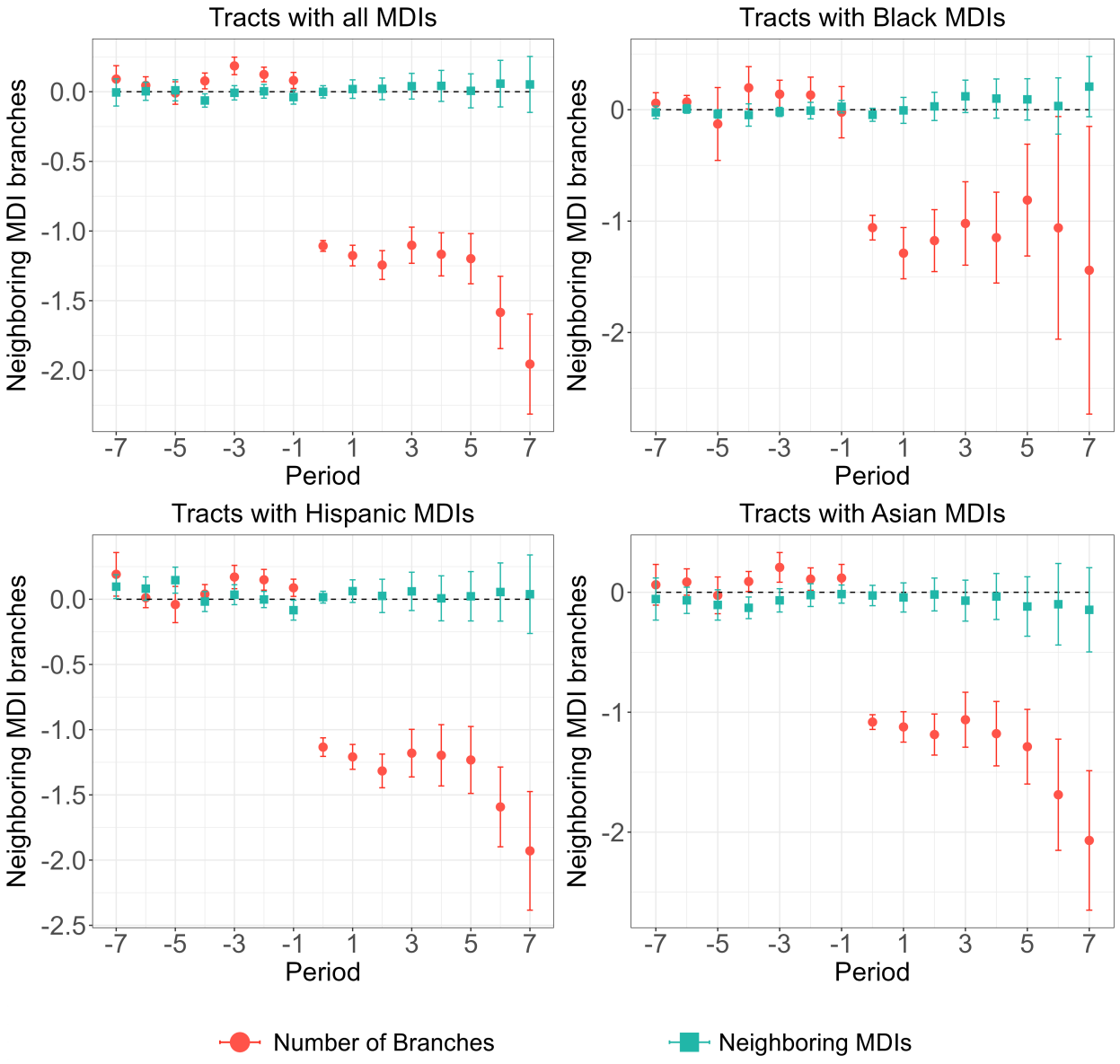


Figure G2: Non-MDI branch closures and and the number of MDIs in neighboring tract

Notes: The plots represent estimates from Callaway and Sant'Anna (2021).

H Appendix: Distribution of MDIs and credit unions across the US

Unlike banks and more traditional retail financial institutions, end to avoid places with a high concentration of retail banks and also tend to be located in non metro counties. This implies that credit unions do not follow the "herd" mentality shown by traditional retail banking institutions which tend to locate close to each other. Instead credit unions cluster around common bonds of association. Hence they end up capturing a different market than traditional banks and do not engage in direct competition with retail banks. The figure next page shows the number of MDI branches per county in 2011 and the number of credit unions serving per 10k population per county in 2011 (Deller and Sundaram-Stukel, 2012).

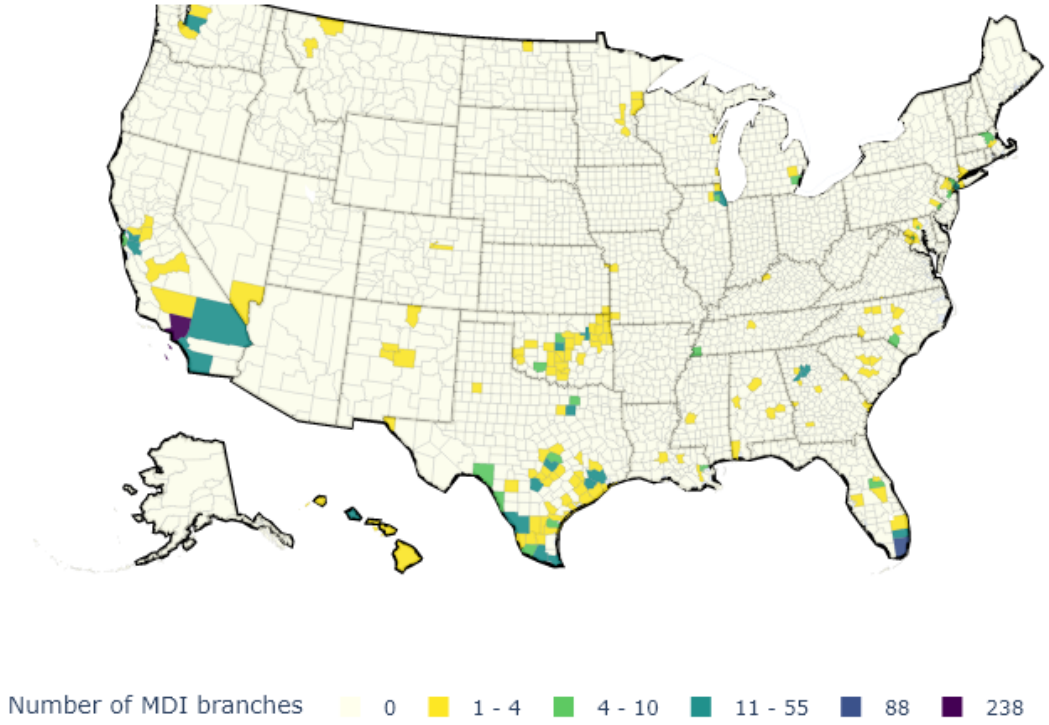


Figure H1: Counties with MDIs in 2011

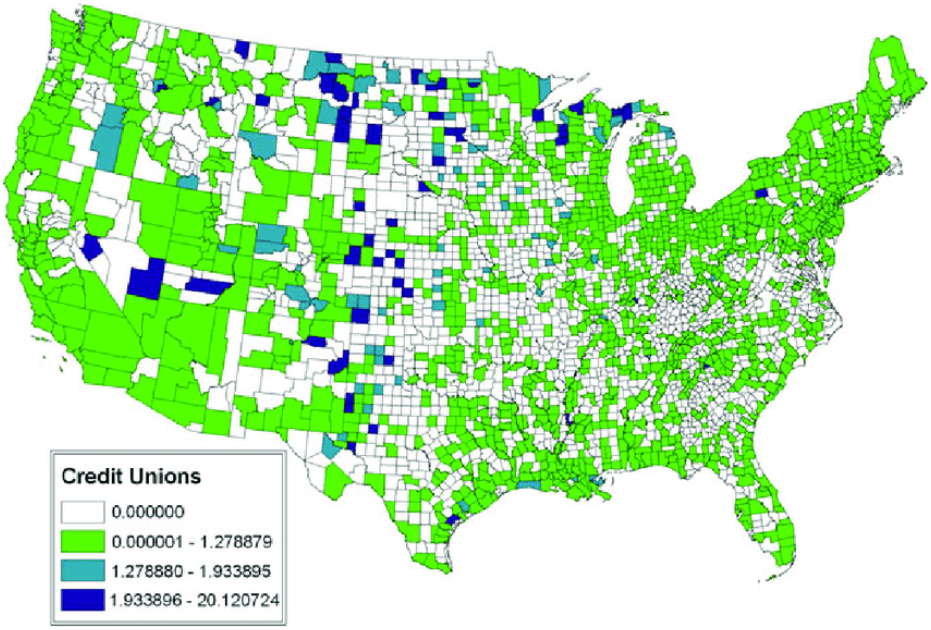


Figure H2: Counties with credit unions per 10k population.

Figure H3: **Credit unions vs MDI branches** Figure shows credit unions per 10k population in 2011 and MDI branches per county in 2011.