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"Don't Know What You Got Till It's Gone"—The Community Reinvestment Act in a Changing Financial Landscape

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"Don't Know What You Got Till It's Gone" — The Community Reinvestment Act in a Changing Financial Landscape

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Abstract

This study provides new evidence on the impact of the Community Reinvestment Act (CRA) on mortgage lending by taking advantage of an exogenous policy shock in 2014, which caused significant changes in neighborhoods' CRA eligibility in the Philadelphia market. The loss of CRA coverage leads to an over 10 percent decrease in purchase originations by CRA-regulated lenders. While nondepository institutions replace approximately half, but not all, of the decreased lending, their increased market share was accompanied by a greater involvement in riskier and more costly FHA lending. This study demonstrates how different lenders respond to the incentive of CRA credit.

Keywords: Mortgage, Housing, Community Reinvestment Act, Bank Lending

JEL classification: D14, G21, G23, G28

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1. Introduction

In response to charges that financial institutions were engaging in redlining and discrimination, the Community Reinvestment Act (CRA) was enacted in 1977 to encourage federally regulated depository institutions to meet the credit needs of all communities, including those of low and moderate income (LMI). If the CRA has successfully achieved this goal, changes in CRA coverage could impact the volume, sources, and possibly the cost of mortgage credit in the targeted areas. However, empirical evidence on the significance, magnitude, and mechanisms of the CRA effects on mortgage lending is still inconclusive (Getter, 2015). With the shifting regulatory environment in recent years, in conjunction with the boom of lending institutions that are not subject to the CRA in the mortgage market, whether and how the CRA continues to serve as an effective tool to make mortgages and other financial services more accessible are still empirical questions.

Taking advantage of a unique opportunity provided by an exogenous policy shock, this study examines the impact of the CRA on mortgage lending in the formerly five-county Philadelphia Metropolitan Division (MD). As a result of the statistical area revision made by the Office of Management and Budget (OMB) in 2013, the income threshold (80 percent of area median family income, or MFI) for CRA-eligible neighborhoods decreased from $61,120 to $43,360 from 2013 to 2014 in the new Philadelphia MD but increased from $61,120 to $76,320 in the three relatively wealthier suburban counties. Consequently, over one-third of the census tracts in the new Philadelphia MD that were once eligible for CRA credit became ineligible after 2014, while the number of CRA-eligible tracts in the suburban counties tripled from 2013 to 2014. Across all the major metropolitan areas in the U.S., the Philadelphia area experienced the most

radical change in terms of the prevalence of neighborhoods with changed CRA eligibility status from 2013 to 2014.[1] The change in CRA eligibility status represents a shift toward more or less prescriptive regulation for mortgage lending in these tracts, which enables us to identify the CRA effects using a difference-in-differences framework.

This study makes contributions to the literature on the impact of the CRA in several ways. First, the unique natural experiment induced by the policy shock provides us a unique opportunity to overcome the identification challenges and data constraints in early studies. Most existing empirical studies on the CRA rely on a regression discontinuity design by comparing outcomes in tracts just above and below the 80 percent threshold (Avery, Calem, and Canner, 2003; Berry and Lee, 2008; Gabriel and Rosenthal, 2009; Bhutta, 2011; Avery and Brevoort, 2015). However, in order to make the treatment and control groups more comparable, researchers need to focus on neighborhoods that are barely CRA eligible (those with 70 percent–80 percent or 75 percent–80 percent of the area median) and those barely CRA ineligible. This identification strategy may be biased if the CRA effect on neighborhoods with incomes farther from the threshold is systematically different from the effect on those close to the threshold. Several new studies have explored the impact of the CRA using new identification strategies (e.g., Agarwal, et al. 2012; Ringo, 2017). This research focuses on neighborhoods in a much larger income range, from as low as 57 percent of the old area median among the newly ineligible tracts to as high as 100 percent of the area median among the newly eligible tracts. In the Philadelphia MD, the treatment group represents over one third of the previously CRA-eligible tracts and about half of CRA-eligible lending. Another data challenge in early studies is that because there are

[1] About one in five of all the tracts in the U.S. with changed CRA eligibility status from 2013 to 2014 were in the Philadelphia MD.

very few tracts in the narrow income window, researchers need to use a sample of tracts in many different markets which likely face significantly different market conditions. Focusing on physically adjacent tracts should mitigate this concern; however, even fewer adjacent tract pairs that also meet the income criteria may exist, and this could yield rather imprecise results. Fortunately, the large number of neighborhoods with changed CRA eligibility status in a single market and the difference-in-differences framework employed in this study can help overcome many of these challenges and better identify the effects of the CRA.

Second, this study contributes to the literature by providing novel evidence on the effects of the CRA in the aftermath of the Great Recession. The post-Great Recession mortgage market is characterized by a radically changed regulatory environment and a shrinking market share of CRA-regulated lenders. Nationally, the landscape of the mortgage lending market has shifted from a market dominated by large banks to one in which more mortgage loans are originated by nondepository institutions (Lux and Greene, 2015; Bhutta, Laufer, and Ringo, *forthcoming*). Increased adoption of mobile and online banking also reduces the demand for branch transactions, and a significant number of bank branches have been closed in recent years. Since the CRA does not cover nondepository institutions and banks' CRA evaluations are tied to areas where a bank has branches and takes deposits, does the designation of CRA-eligible neighborhoods still matter in the inflow of mortgage credit, given the increased use of mobile and online banking and a smaller market share of depository institutions? What have been the quality and costs of mortgages originated by nondepository institutions and their interplay with depository institutions in the mortgage market, especially in lower-income communities? Results from this study should help shed light on these important questions.

Findings from this study suggest that the designation of CRA-eligible neighborhoods still matters in the mortgage market. We find evidence that the loss of CRA eligibility status in a neighborhood leads to a decrease of about 10 percent to 20 percent (depending on the models and specifications used) in the volume of purchase mortgage originations by CRA-regulated lenders. And the decreased lending by CRA-regulated lenders cannot be explained by the increased lending in neighborhoods that remained CRA eligible alone: The increase in CRA-eligible tracts is not significantly different from that in the neighborhoods that remained CRA ineligible. About half of the decline in lending by CRA-covered lenders can be offset by the increased lending by nondepository institutions, though the lower-than-expected increase in purchase originations at the market level is statistically insignificant in tract-level regressions. The CRA effects are more pronounced among minority borrowers and borrowers who used to qualify for CRA credit but became newly ineligible. Without the incentive of the CRA, it seems depository institutions are less likely to keep up or expand their supply of mortgage credit in lower-income neighborhoods; instead, they tend to scale back their lending from these neighborhoods by reducing the supply of mortgage credit to minority borrowers and borrowers who no longer qualify for CRA credit. Overall, the changed lending patterns in the newly ineligible neighborhoods are consistent with the notion that the CRA has made mortgage credit more accessible for households in lower-income communities.

Gaining CRA coverage, however, has little impact in the suburban neighborhoods that became eligible for the CRA, at least in the short term. The CRA is expected to have a less significant impact if the credit needs of the borrowers in these relatively wealthier neighborhoods have been

adequately served, even without the incentive of the CRA. It also needs to be noted that the policy change took effect during a period characterized by significant regulatory changes and relatively tight credit; thus, lenders may already be reluctant or slow to engage in more innovative practices that could expand access of credit to less-than-pristine borrowers. If credit conditions ease in the future and the market regains its appetite for risk, the effects of gaining CRA eligibility status may get more momentum.

Nondepository institutions have offered more opportunities to borrowers in the neighborhoods from which the depository institutions are withdrawing. But we have found a relatively greater involvement in Federal Housing Administration (FHA) lending in neighborhoods that became CRA ineligible, largely driven by the nondepository institutions. Relative to typical conventional mortgages, FHA mortgages, which are popular among first-time homebuyers and lower-income borrowers, generally have higher cost and a slightly higher default rate. With the boom of nondepository institutions in the mortgage market, how to encourage all lenders — including lenders that are regulated by the CRA and those that are not — to meet the credit demand in underserved neighborhoods in a safe and sound manner is still an unanswered question.

The rest of the paper is organized as follows: Section 2 provides background information about the CRA, the relevant literature on CRA effects, and the implications of the new MD definitions; Section 3 describes the methodology and data in more details; Section 4 presents the empirical results; and Section 5 concludes.

2. Background and Literature

2.1. Background of the CRA

The CRA is a law that requires depository institutions to help meet the credit needs of lower-income households and neighborhoods in which they operate in a manner consistent with safe and sound operation (Bernanke, 2007). Regulators, including the Federal Reserve System, Office of the Comptroller of the Currency (OCC), and Federal Deposit Insurance Corporation (FDIC), conduct periodic examinations of the CRA performance of institutions they regulate, including commercial banks and thrifts. The CRA, however, does not apply to independent mortgage companies, which have been originating a significant share of mortgages, and credit unions. The performance of large institutions is measured under three categories of bank activities: lending, services, and investment, with the lending test carrying the most weight (at least 50 percent). The performance of smaller institutions is primarily measured by their lending activities. The lending test examines the amount and proportion of lending activities made within an institution's assessment area, generally the metropolitan statistical area (MSA) or county where a bank has branches and takes deposits.[2] A good record of providing loans and other financial products and services to LMI neighborhoods (those with an MFI of less than 80 percent of the area median) in a lender's assessment areas would improve its CRA rating (Avery, Bostic, and Canner, 2000). Having a satisfactory or better CRA rating is desirable when banks apply for a merger, acquisition, or branch opening, in addition to the reputational considerations. CRA ratings have been made publicly available, giving community groups a basis for which to demand redress. CRA ratings, as well as the process of the CRA examination itself, provide community groups

[2] The CRA assessment area for a retail-oriented banking institution must include "the areas in which the institution has its main office or operates branches and deposit-taking automated teller machines and any surrounding areas in which it originated or purchased a substantial portion of its loans" (Avery, Bostic, and Canner, 2000, p. 712).

and other organizations an opportunity to challenge banks perceived to have failed to meet their CRA obligations (Bostic and Robinson, 2003; Immergluck, 2004). At the time of the writing of this paper, the CRA is facing a major overhaul to better reflect structural and technological changes in the banking industry and address the credit needs of LMI communities (Office of the Comptroller of the Currency, 2018).

There are at least three possible CRA effects on mortgage lending (Avery, Calem, and Canner, 2003; Avery and Brevoort, 2015). First, the CRA may have little or no effect on mortgage lending if the credit needs of the entire community have been adequately served even without the incentive of the CRA. If so, gaining and losing CRA coverage would not alter the volume, pricing, or sources of mortgage credit in a neighborhood. Second, CRA-covered lenders may have extended more credit in targeted neighborhoods but have accomplished this through increased capacity or greater community outreach and marketing, instead of changed pricing or underwriting standards of mortgage loans. In this case, gaining CRA coverage could alter the sources of mortgage credit in targeted areas (e.g., CRA-covered lenders could increase their lending by taking market share from institutions not covered by the CRA), without resulting in a net change in lending activities at the market level. Finally, CRA-covered lenders may have responded to the CRA by providing products with lower costs or more flexible underwriting standards (such as requiring low down payments, alternative credit verification, and higher debt-to-income thresholds) to borrowers from targeted neighborhoods. They could also require and even fund homeownership counseling for potential borrowers to improve their creditworthiness. These responses should increase the share of lending accounted for by CRA-regulated

institutions as well as the volume of credit extended at the market level in the targeted communities.

2.2. Literature on the Effects of the CRA

The limited existing studies on the link between the CRA and mortgage lending activity generally suggest that the CRA has expanded access to credit in LMI communities, but the magnitude of the increase and the mechanisms of the impact of the CRA are far from conclusive. Belsky, Schill, and Yezer (2001) find that, during the 1993–1999 period, lenders subject to the CRA originated a higher portion of loans to LMI borrowers and neighborhoods than did nonregulated institutions in the same market or regulated lenders operating outside their assessment area. Bostic and Robinson (2003) find that the number of newly initiated CRA agreements is associated with significant increases in CRA, minority, and overall conventional mortgage lending. They point out, however, that the effectiveness of CRA agreements in increasing lending activity largely depends on the effectiveness and sophistication of community groups in monitoring compliance with these agreements. Avery, Bostic, and Canner (2005) use survey responses from banks to conclude that there was an increase in mortgage lending in response to the CRA, although accomplishing CRA goals has exacted a price for some lenders. Gabriel and Rosenthal (2009) find that the CRA expands the availability of mortgage loans and leads to a small increase in homeownership rates in eligible areas.

While the studies mentioned above have found some positive impact of the CRA on the access to credit in LMI communities, a few others failed to find a significant and positive CRA effect. The

CRA seemed to have no or less significant impact in certain study periods, such as its early years. Dahl, Evanoff, and Spivey (2002), for example, find that banks' lending in LMI neighborhoods did not increase after getting a poor CRA examination rating between 1991 and 1995. Berry and Lee (2008) compare origination rates for borrowers just above and below the 80 percent threshold, but their test does not support the notion that the CRA has increased the credit supply. Bhutta (2011) finds that the CRA had a significant effect on mortgage lending during the late 1990s and early 2000s in large metropolitan areas but had little impact during the mid-2000s. He suggests that CRA effects only become significant when and where the CRA is most binding and that the CRA can be justified by the depressed credit supply due to the existence of information externalities in the mortgage market.

A related question that had received significant attention is whether CRA-induced lending has a higher risk and had contributed significantly to the most recent housing crisis. The empirical studies (including Laderman and Reid, 2008; Ding et al, 2011; Ghent, Hernández-Murillo, and Owyang, 2015; and Avery and Brevoort, 2015) provide a variety of evidence that mortgage loans induced by the CRA performed no worse, and often better, than their non-CRA counterparts such as subprime loans; thus, the CRA did not contribute significantly to the subprime crisis.

2.3. The New Metropolitan Division Definition and Its Implications for CRA Lending

The previous five-county Philadelphia MD, as part of the Philadelphia-Camden-Wilmington MSA, contained over four million residents and spanned Philadelphia, Delaware, Bucks, Chester, and Montgomery counties in Pennsylvania as of 2013. Among these five counties,

Bucks, Chester, and Montgomery are suburban counties characterized by residents with higher socioeconomic status and higher homeownership rates. Philadelphia County, with a total population of over 1.5 million, shares the same borders with the city of Philadelphia and serves as the largest central city of the whole metropolitan area. Located southwest of Philadelphia County, Delaware County has more lower-income, inner-suburban neighborhoods than the other three suburban counties. The Philadelphia area had a relatively healthy housing market and a lower foreclosure rate than many other large metro areas during the most recent housing crisis, but it also experienced a moderate decline in housing prices and construction from 2008–2010 and a slow recovery from the housing crisis (Pew Charitable Trusts, 2011). With a vibrant downtown and several strong anchor institutions (e.g., the University of Pennsylvania and Temple University), the city of Philadelphia has experienced population growth after 2006 and significant gentrification in certain neighborhoods (Ding, Hwang, and Divringi, 2016).

The OMB issues new statistical definitions and revises existing ones periodically to better reflect economic and demographic realities. In 2013, the OMB published a new set of MSA/MD definitions as part of its comprehensive review of statistical area standards and definitions after the 2010 Census.[3] According to the revised MSA/MD, the previous five-county Philadelphia MD was split into two: the new Philadelphia, PA MD (Philadelphia County and Delaware County) and the Montgomery County–Bucks County–Chester County, PA MD (or the MBC MD) (Figure 1). The 2013 MSA/MD definitions led to radical changes in area MFI (or AMFI), which is defined as the MFI of the corresponding MD in the Philadelphia area.[4] As the revised

[3] See more details at www.ffiec.gov/cra/OMB_MSA.htm.
[4] AMFI is defined as the MFI for the MD if a family or geography is located in an MSA that has been subdivided into MDs. The Federal Financial Institutions Examination Council (FFIEC) estimates MFI for MSAs, MDs, and nonmetropolitan portions of each state.

MSA/MD delineations became effective for Home Mortgage Disclosure Act (HMDA) and CRA data collection in 2014, there was a decrease of $22,200 in AMFI for neighborhoods in the new Philadelphia MD (from $76,400 in 2013 to $54,200 in 2014) and an increase of $19,000 for those in the new MBC MD (from $76,400 in 2013 to $95,400 in 2014).

Because the income levels of neighborhoods in CRA performance evaluations are based on the ratio of the tract-to-area MFIs, the substantial changes in the AMFI in the Philadelphia area has led to abrupt changes in the income designations for many tracts.[5] As mentioned earlier, lenders subject to the CRA can receive CRA credit for their mortgage lending, services, or other eligible activities in LMI tracts, or CRA-eligible tracts, which have an MFI below 80 percent of the AMFI.[6] The income designations of 102 tracts were changed from "moderate-income" in 2013 to "middle-income" in 2014, thus making these tracts ineligible for CRA credit (see Figure 1), even though their economic condition or population profile remained largely unchanged during the two-year period. In contrast, the income levels of 80 tracts in the suburban MBC MD were changed from "middle-income" in 2013 to "moderate-income" after 2014, thus making them CRA eligible. Lending in a census tract in the inner city of Philadelphia with an MFI of $44,000 has been considered ineligible for CRA credit since 2014, while lending in a tract with an MFI as high as $76,000 in suburban Montgomery County has become CRA eligible. Putting this into context, about one-third (34.5 percent) of previously CRA-eligible tracts in the new Philadelphia

[5] The income designation is based on the tract-to-area MFI ratio, which is obtained by dividing the MFI of a tract by the AMFI. If the tract-to-area MFI ratio is below 50 percent, the tract is considered low-income; if between 50 percent and 79.9 percent, moderate-income; if between 80 percent and 119.9 percent, middle-income; and if 120 percent or higher, upper-income. An LMI tract represents one in the income level of low-income or moderate-income.

[6] We use the term "CRA-eligible tract" as shorthand only to mean that the tract is an LMI tract with an MFI below the threshold of 80 percent relevant to CRA regulation. This does not necessarily mean that none of the lending to a CRA-ineligible neighborhood qualifies for CRA credit. For example, lending to LMI borrowers in middle- or upper-income neighborhoods is still eligible for CRA credit.

MD became CRA ineligible after 2014, while the number of CRA-eligible tracts in the MBC MD tripled from 2013 to 2014 (an increase from 40 tracts to 120 tracts). The Philadelphia area was the only major metropolitan area across the nation that had experienced such radical changes in CRA eligibility status for a large number of its neighborhoods from 2013 to 2014.

The abrupt change in the LMI status of a tract could lead to changes in residential mortgage lending activities in the neighborhood in many ways. Without the incentive of the CRA, for example, it is possible that CRA-regulated institutions will act less aggressively than before in learning about and taking advantage of all possible lending opportunities for borrowers and communities initially targeted by the CRA. This could change both the sources of mortgage credit and the volume of credit at the market level. If lenders subject to the CRA closely monitor the changes in neighborhoods' CRA eligibility status and make strategic adjustments in their lending behavior accordingly, we should be able to isolate the CRA effects by identifying the shift in the lending activity in the newly eligible/ineligible tracts.

There have been no known rigorous empirical studies focusing specifically on the effects of the CRA on mortgage lending in the post-crisis environment. The radical changes in the income designations of a large number of neighborhoods in the Philadelphia area thus provide us a unique opportunity to improve the identification strategy by investigating how different lenders have responded to the shock of gaining or losing CRA coverage.

3. Methodology and Data

This study uses a set of difference-in-differences (DID) models to compare the volume and outcomes of purchase loan applications during the two years before and the two years after January 1, 2014, in the neighborhoods with changed CRA eligibility status (treatment) and in those of the control group. Here, the nearby neighborhoods with slightly higher or slightly lower income and the nondepository institutions that are not subject to the CRA are used as control groups. Intuitively, in the absence of the 2013 OMB revision, we would not expect any sharp changes in lending patterns in the treatment group after January 1, 2014, relative to the control group. Thus, we attribute any significant differences in lending activity between the treatment group and the control group to the effect of the CRA regulation (gaining or losing CRA coverage).

3.1. Tract-Level Difference-in-Differences Regression Models

Only federally regulated depository institutions are subject to the CRA and only the lending activities in areas where a depository institution has branches and takes deposits (assessment areas) will be evaluated in the CRA lending test. In this tract-level analysis, we consider depository institutions with local branches in the same county as a proxy of CRA-regulated lenders (these two terms are used interchangeably, hereafter). Since depository institutions may be required to use a larger geographic area, such as the whole MSA, as their assessment area, we also consider all depository institutions as another proxy of CRA-regulated lenders. More specifically, we try to identify the CRA effects by comparing the changes in lending activities by

CRA-regulated lenders in the treatment tracts before and after the policy change with those of the control group. The two-way, tract-level DID model can be specified as:

$$Y_{it} = \beta_0 + \beta_1 * TREAT_i + \beta_2 * POST_t + \beta_3 * TREAT_i * POST_t + \gamma * N_i + \varepsilon_{it}, \quad (1)$$

where Y_{it} represents the value of the outcome measure Y for tract i in year t. $TREAT_i$ represents whether tract i is one that became newly eligible/ineligible after 2014 (omitted in the estimation because we have controlled tract dummies). $POST_t$ is the time dummy and is assigned a value of one for the post-2014 period. $TREAT_i * POST_t$ is the two-way interaction of the time and treatment dummies. The coefficient of the two-way interaction term β_3 is expected to capture the CRA effect on outcome measure Y. N_i represents the fixed effect of tract i, which helps control for tract-level unobserved heterogeneity. Considering the different direction of the possible CRA effects in the new Philadelphia MD and the MBC MD as well as the significant differences in their market conditions, we ran regressions separately for individual MDs.

Assuming lending by nondepository institutions is not directly impacted by the CRA, we could also employ a three-way DID regression to subtract the correlated market trends. The three-way DID model compares the mortgage activities by CRA-regulated lenders in newly eligible/ineligible tracts after 2014: (a) with the activities by CRA-regulated lenders before the policy change, (b) with the activities in tracts with slightly different income but unchanged CRA eligibility status, and (c) with the activities of nondepository institutions. The basic setup is that outcomes — in this case, measures of lending activities in a census tract—are observed for four groups for two time periods (before and after 2014). One group (CRA-regulated lenders in the

treatment tracts) experienced changes in the CRA eligibility status (becoming eligible/ineligible) in the second period. The other three groups (CRA-regulated lenders in the control tracts, nondepository institutions in the treatment tracts, and control tracts) should not have been exposed to changes in CRA coverage during either period. The DID estimate starts with the time change in lending activities of CRA-regulated lenders in a treatment tract and then nets out the change for CRA-regulated lenders in the control tracts and the change for nondepository institutions in the treatment tracts. The hope is that this controls for two kinds of potentially confounding trends: the changes in the market condition between treatment and control groups (that would have nothing to do with the CRA) and the time trend in the treatment group. The three-way DID regression structure can be formally written as:

$$Y_{it} = \beta_0 + \beta_1 * TREAT_i + \beta_2 * BANK_{it} + \beta_3 * POST_t + \beta_4 * (TREAT_i * BANK_{it}) + \beta_5 * (TREAT_i * POST_t) + \beta_6 * (BANK_{it} * POST_t) + \beta_7 * (TREAT_i * BANK_{it} * POST_t) + \gamma * N_i + \varepsilon_{it}, \quad (2)$$

in which most of the terms have been defined early except $BANK_{it}$, which is a dummy representing the CRA-regulated lenders in tract i and year t. $TREAT_i * BANK_{it}$, $TREAT_i * POST_t$, and $BANK_{it} * POST_t$ are the two-way interactions of the time dummy, the CRA-regulated lenders dummy, and the treatment dummy. $TREAT_i * BANK_{it} * POST_t$ is the three-way interaction of these three dummy variables, and the coefficient of the three-way interaction β_7 captures the CRA effect on mortgage lending by isolating the change in mortgage activity of CRA-regulated institutions in the treatment tracts after the policy change ($TREAT * BANK * POST$ is equal to 1). After controlling for neighborhood fixed effects and market trends, we attribute the relative changes in the mortgage activities of CRA-covered lenders to the CRA. Of course, if depository

institutions crowd out nondepository institutions in CRA-targeted tracts, then this estimator will be biased upward, so the estimated CRA effect could serve as an upper bound.

For the new Philadelphia MD, the control group for the 102 tracts in the treatment group (previously CRA eligible but became CRA ineligible in 2014) is defined as (Figure 2):

- Tracts that remained eligible or ineligible for CRA credit in both 2013 and 2014, within a 0.5-mile radius of a newly ineligible tract, and with an MFI between 80 percent and 90 percent of the AMFI in 2013 or between 50 percent and 80 percent of the AMFI in 2014 (tract MFI between $61,120 and $68,760 in 2013 or $27,100 and $43,360 in 2014). While most early studies have used the 70 percent to 90 percent relative income window to define the sample of tracts in studies of the CRA, we further include neighborhoods with income lower than those in the treatment group to have a more balanced sample (similar number of tracts on both sides).

For the MBC MD, the control group for the 80 tracts in the treatment group (previously CRA ineligible but became CRA eligible in 2014) is defined as:

- Tracts that remained eligible or ineligible for CRA credit in both 2013 and 2014, within a 0.5-mile radius of a newly eligible tract, and with an tract MFI between $27,100 and $61,120 in 2013 or $76,320 and $85,860 in 2014 (between 44 percent and 80 percent of the AMFI in 2013 or between 80 percent and 90 percent of the AMFI in 2014).

Eventually, 150 tracts were identified as the control group for the newly ineligible tracts and 73 tracts as the control group for the newly eligible tracts. All the tracts in the control group are in the same submarket as and have slightly higher or slightly lower income than those in the treatment group, but they did not experience any changes in their CRA eligibility status from 2013 to 2014 (Table 1). Of course, some decisions we made to identify the control group may be arbitrary, such as the range of the income window, so we conducted a set of sensitive analyses using alternative control groups to discern how sensitive the results are to some of our analytical decisions, which will be discussed later.

We use the following outcome measures to capture the volume, disposition, and composition of mortgage lending:

- Number of purchase mortgage applications in a tract
- Number of purchase mortgage originations in a tract
- Dollar amount of purchase mortgage originations in a tract
- Denial rate of purchase mortgage originations in a tract
- Share of FHA mortgage originations in a tract

Here, the study period is from 2012 to 2015.[7] We include only those applications for first-lien home purchase mortgages (purchase mortgages, hereafter) and exclude those applications with large loan amounts (above $1 million). We focus on applications for home purchase loans only

[7] A small share of tracts changed their CRA eligibility status in 2012 and 2017 because of the use of new census data to determine the CRA eligibility of the neighborhood, which prevents us from including data before 2012 and after 2017. A robustness check suggests the results are quite consistent (both in terms of sign and significance of the CRA effects) by further including the 2016 data.

instead of refinance loans, which have an indirect impact on homeownership and are more sensitive to interest rate changes and neighborhood income.

3.2. Data

Data used in this study are from several different sources. Information on mortgage lending activities comes from HMDA data; HMDA requires mortgage lending institutions with offices in metropolitan areas to disclose to the public detailed information about their home lending activity each year. HMDA data include the disposition of each application for mortgage credit; the type, purpose, and size of each loan; loan pricing information (high cost or not); demographic information about loan applicants, including gender, race, ethnicity, and income; the census tract location of the properties securing the loan; and information about whether the loan was sold. HMDA data also report the institution's name, address, and regulator. For example, we identify the depository institutions that are likely subject to the CRA by focusing on those that are supervised by the OCC, Federal Reserve System, FDIC, and Consumer Financial Protection Bureau (CFPB).[8]

This study also uses the FDIC's Summary of Deposits (SOD) data, which provide an annual enumeration of all branches belonging to FDIC-insured depository institutions. The SOD data provide a limited amount of branch-level information, including deposits, street address, and the branch's latitude and longitude. We merge all the depository institutions with branches in the

[8] Credit unions also take deposits but are not considered as depository institutions here as they are not subject to the CRA. The regulatory agency for the large national banks has been reported as "CFPB" in the HMDA data, though they are generally regulated by both the CFPB and the OCC.

Philadelphia MD during 2012–2015 with the lenders in the HMDA data by lenders' names. We corrected some typos and spelling issues with lender names in both data sets and merged about 98 percent of all the branches of the FDIC-insured institutions with HMDA lenders.[9] Of course, not all FDIC-insured depository institutions originate mortgages so it is not surprising that we could not merge all FDIC-insured lenders with HMDA lenders.

4. Empirical Results and Discussion

This section first describes the results from a descriptive analysis and then discusses results from the baseline regressions, the heterogeneity in the CRA effects, and results from some robustness checks. As defined earlier, the control group generally refers to the tracts within 0.5 mile of any neighborhoods in the treatment group and with slightly higher or lower income.

4.1. Results from the Descriptive Analysis

We observe a smaller increase (or a larger decline) after 2014 in the total number of purchase mortgage applications and originations by CRA-regulated lenders, relative to the control group, in the newly ineligible tracts (Table 2). The number of purchase applications accepted by CRA-regulated lenders declined slightly in the newly ineligible tracts in the new Philadelphia MD, compared with a moderate increase for the control group (−2.4 percent versus 13.1 percent). The number of purchase originations by CRA-regulated lenders experienced a moderate increase in the newly ineligible tracts after 2014 but the increase was lower than that of the control group (a

[9] The name of the same lender could be different in the SOD and HMDA data because there are some typos and different abbreviations used in different datasets. For example, we believe "Bank of America, National Association" in the SOD data and "Bank of America, N.A." in the HMDA data should represent the same lender. Furthermore, the SOD data may continue to use a lender's old name in the year in which the lender had been merged with another one, while HMDA data have been using the name of the merged lender.

6.2 percent increase in the treatment tracts, 15.5 percentage points lower than the 21.7 percent increase for the control group).

Changes in market conditions between treatment and control groups may help explain the smaller increase in mortgage lending in the newly ineligible tracts. However, results from the descriptive analysis suggest that the smaller increase in mortgage lending by CRA-regulated lenders could not be fully explained by the market trend, which is proxied by changes in lending by nondepository institutions that are not impacted by the CRA directly (Table 2). During the same study period, the purchase mortgage lending by nondepository institutions experienced a much higher growth (an increase of more than 35 percent for either the treatment or the control group), but the difference between the treatment and control tracts was much smaller (a difference of 3.4 percentage points compared with the 15.5 percentage points for CRA-regulated lenders). At the market level (by all lenders), the observed lending growth was about 10.8 percentage points less in the treatment tracts than that in the control tracts.

In the MBC MD, we observe a slightly larger increase (or less decline) in purchase applications and originations by CRA-regulated lenders as well as a slightly lower increase (or larger decline) by nondepository institutions. As Table 3 shows, there was a slight increase in the number of applications by CRA-regulated lenders for the treatment groups compared with a decline in the control group of 0.5 percent (5.0 percentage points higher than the −4.5 percent change for the control group). The number of originations by CRA-regulated lenders in the newly eligible tracts increased slightly after 2014, while that of the control group declined (5.4 percent versus −2.0 percent). In contrast, the increase in purchase mortgage originations by nondepository

institutions had been smaller in the newly eligible tracts than in the control group, though both groups had experienced significant growth during the study period (e.g., a 40.8 percent increase, 4.7 percentage points lower than the 45.5 percent increase in originations for the control group). With a larger increase in purchase lending by CRA-regulated lenders and a smaller increase by nondepository institutions, the difference in the changes in lending activities was quite small at the tract level between the treatment group and the control group (e.g., a 20.6 percent increase versus a 20.2 percent increase in purchase mortgage originations).

At the same time, we do not observe a significantly larger increase in denial rates by CRA-regulated lenders in the Philadelphia MD post-2014: The decline in denial rate for the treatment group was even slightly larger (−4.4 percentage points versus −4.0 percentage points, see Table 3). In the MBC MD, the denial rates of both groups also experienced a similar level of decline (−2.5 percentage points for the treatment group compared with −2.6 percentage points for the control group). In terms of the composition of mortgage products, the share of FHA originations had declined for all subgroups after 2014, but the decline was larger for CRA-regulated lenders; and relative to the control group, the decline in FHA share in the newly ineligible tracts was less for nondepository institutions than for CRA-covered lenders (a decline of 1.4 percentage points lower for nondepository institutions, higher than a decline of 0.3 percentage points lower for CRA-regulated lenders).

Overall, the descriptive analysis suggests that, relative to the control group (both the control tracts and nondepository institutions), there was a smaller increase in the volume of applications and originations of purchase mortgages after 2014 in neighborhoods that became CRA ineligible. There was also a slightly larger increase in purchase lending activities by CRA-regulated lenders in the newly eligible tracts. While this is consistent with the notion that the CRA encourages

depository institutions to increase the supply of mortgage credit in lower-income neighborhoods, we want to verify these findings by the regression analysis using data aggregated at the tract level.

4.2. Regression Results

This subsection summarizes results from the two-way DID regressions. Because the CRA effects are generally small and statistically insignificant for the MBC MD, our discussion primarily focuses on the results for the new Philadelphia MD. A significant and negative value of the CRA effect, captured by the coefficient for the $TREAT * POST$ variable, indicates that becoming CRA ineligible leads to a decrease in the value of the corresponding outcome measure in the new Philadelphia MD (Table 4). Results suggest the volume of home purchase lending by CRA-regulated lenders is negatively impacted when a lower-income neighborhood loses its LMI status. But about half of the decreases in purchase lending by CRA lenders can be substituted by nondepository institutions.

Effects of the CRA on the Volume of Home Purchase Lending

Regression results generally provide quite consistent evidence that the loss of CRA coverage leads to a significant decline in purchase mortgage lending by CRA-regulated lenders. Becoming CRA ineligible in the Philadelphia MD leads to an average decline of 1.49 purchase applications

per tract-year by CRA-regulated lenders (or 11.9 percent of the 2013 mean[10]) and a decrease of 0.82 purchase originations per tract-year (or 9.8 percent of the 2013 mean) (Table 4). The CRA effects on the dollar amount of the purchase originations, however, are statistically insignificant. The CRA effects on lending volume of all depository institutions are negative and highly significant as well (−2.54 for applications and −1.58 for originations). The CRA effects on all lending volume measures, however, become statistically insignificant for nondepository institutions and at the aggregate level (all lending institutions). But the sign of the CRA effects at the aggregate level is still negative, and the magnitude is quite similar to those for CRA-regulated lenders (−1.79 for applications and −0.75 for originations).

The results from the three-way DID model are generally consistent with those from the two-way DID regressions in terms of the signs and significance of the CRA effects (Table 5). The CRA effects, as captured by the coefficients of the $BANK * TREAT * POST$ variable in this model, are negative and significant for purchase mortgage applications and originations in the new Philadelphia MD. Relative to the control groups, a tract that becomes CRA ineligible leads to a decrease of 2.26 purchase applications (or 18.0 percent of the 2013 mean) and a decline of 1.67 purchase originations (or 19.9 percent of the 2013 mean) by CRA-regulated lenders. The changes in the lending volume at the aggregate level are statistically insignificant but have the same sign and similar magnitude as those for CRA-regulated lenders (−2.39 for applications and −1.47 for originations). Interestingly, the magnitude of the CRA effects from the three-way DID model is larger than that identified in the two-way DID model (e.g., a 9.8 percent relative

[10] In 2013, the average number of purchase loan applications was 12.6 among newly ineligible tract. The 2013 means of different outcome measures for the corresponding subpopulation can be found in Table 2; the relative changes are not included in the tables summarizing the regression results.

decrease in originations from the two-way DID model versus a 19.9 percent decrease from the three-way DID model). If there was a partial substitution by nondepository institutions, the three-way DID regressions likely overestimate the CRA effects, and, thus, the estimated coefficients are expected to serve as an upper bound of the true effects.

Whether the CRA can increase the volume, in addition to the sources, of credit extended in the targeted communities is a key research question when evaluating the CRA effects. To evaluate whether and how a decline in lending by CRA-regulated lenders has led to a decrease at the aggregate level, we compared the magnitude of estimated CRA effects for CRA-covered lenders, nondepository institutions, with that of all lending institutions.[11] The results suggest that the increased lending by nondepository institutions can substitute about half of the decreased lending by CRA lenders (an increase of 0.83 purchase mortgages by nondepository institutions, which offsets about 52.0 percent of the decline of 1.58 mortgages by depository institutions). Consequently, the net effect of the CRA on purchase originations at the tract level is a decline of 0.75 mortgages per tract-year, though the decline is relatively small and statistically insignificant (about 2.8 percent of the 2013 tract average). So the empirical results suggest lending by nondepository institutions helps offset part, but not all, of the decreased lending by CRA-regulated lenders in neighborhoods that are no longer CRA eligible. Results from this exercise illustrate the interplay between CRA-covered lenders and those that are not subject to the CRA and demonstrate how the CRA can change the sources as well as the volume of mortgage credit in lower-income communities.

[11] Of course, not all the coefficients are statically significant, but such an exercise is still of merit. The lack of significance in some of the regressions may partly be due to our relatively small size of study sample, compared with other studies using national data.

Gaining CRA eligibility status, however, generally has not had a significant impact (and the magnitude is small) on mortgage lending in the MBC MD. While the statistically insignificant results are more consistent with the hypotheses that the CRA has little or no impact on mortgage lending, the results may not be taken as definitive proof that the CRA does not have any significant effect. It is likely that the credit needs of the households in these relatively wealthy neighborhoods (with an MFI about $61,100 to $76,300) have been well-served even in the absence of the CRA. It is also possible that risk-averse lenders may have been reluctant in expanding their lending in an environment with tightened regulation. Furthermore, the CRA may impact certain subpopulations more significantly, though the effect is insignificant at the aggregate level, which will be discussed later in this paper.

Effects of the CRA on Other Lending Outcomes

The nondepository institutions have taken a larger market share and continue to offer opportunities to borrowers in the neighborhoods from which the depository institutions are withdrawing. However, people are concerned about the cost and quality of the mortgage products that these lenders are providing. This study evaluates one aspect of the quality of mortgage originations: the mortgage product composition as measured by the share of FHA purchase originations. FHA mortgages, which are best suited for first-time homebuyers or borrowers with low-credit scores or less cash to make the down payment, generally have a higher cost and a slightly higher default rate. Results, as shown in Table 4, suggest that losing CRA coverage leads to a significant increase in the share of FHA originations (by 7.3 percentage

points) for nondepository institutions. The share of FHA originations increases at the market level (a significant increase of 4.9 percentage points) as well when a lower-income neighborhood loses CRA coverage. The three-way DID regression models also confirm that relative to the change for nondepository institutions, the share of FHA lending by CRA-regulated lenders has decreased more sharply in newly ineligible tracts (by −7.4 percentage points). This is not surprising because nondepository institutions, relative to CRA-regulated depository institutions, are more likely to specialize in FHA lending in recent years (Getey and Reher, 2017). Results suggest that nondepository institutions are more likely to originate more mortgages, a disproportionately large share of which are FHA loans, in response to the decreased lending by CRA-regulated lenders when a neighborhood loses its CRA eligibility status.

The CRA effects on mortgage denial rates have been insignificant in all regression models. One possible explanation is that the reduced supply of purchase mortgage credit in newly ineligible tracts is largely due to the decreased number of applications accepted, rather than tighter underwriting standards. However, as many researchers have pointed out, the mortgage application denial rate has some limitations as a measure of underwriting standard (Li et al., 2014).

Heterogeneity in CRA Effects

We conducted additional analyses to better understand the more significant effects of the CRA on mortgage lending in the new Philadelphia MD. First, we examined whether there are any significant variations in the CRA effects over time. Table 6 summarizes the CRA effects by year

(2014 and 2015) as estimated by a two-way DID model, which uses two post-2014 yearly dummies (2014 and 2015) instead of one post-2014 dummy. The results suggest that the negative impact of losing CRA coverage on mortgage lending is more significant in 2015, with a decrease of 1.11 purchase originations (or 13.3 percent of the 2013 mean) in 2015 by CRA-regulated lenders compared with an insignificant change in 2014 (and with a much smaller magnitude of −0.53). The CRA effects on the number of applications and the dollar values of purchase originations are also more significant in 2015. The temporal variation in the significance and magnitude of CRA effects makes sense if lenders did not notice the changes and had not adjusted their lending behavior immediately after the policy change. It is also possible that CRA-regulated lenders had reacted to the new lending opportunity provided by the significant reduction in FHA mortgage insurance premiums in January 2015 less aggressively in the newly ineligible neighborhoods.[12]

Regression results also suggest a more significant impact of the CRA on minority borrowers and CRA-targeted LMI borrowers. The CRA does not target specific racial or ethnic groups, but the change in neighborhood CRA eligibility may have a larger impact on minorities if the CRA expands access to credit more successfully among minorities than others or if minorities are more concentrated in the newly eligible or newly ineligible neighborhoods. As Table 7 shows, the CRA effect is significant and larger among minority borrowers:[13] Losing CRA coverage leads to a decline of 0.56 purchase originations to minority borrowers per tract-year (about 14.3

[12] In January 2015, the FHA announced a sharp reduction in the annual premium. For a typical home purchase loan with loan amount of $625,000 or less, a loan-to-value ratio greater than 95 percent, and a loan term longer than 15 years, the annual insurance premium was reduced by 50 basis points (a reduction from 135 basis points to 85 basis points).

[13] Here, minority borrowers include African American, Hispanic, and other minority borrowers who are not non-Hispanic whites.

percent of the 2013 mean, larger than the average effect of 9.8 percent). The decline of 0.56 originations to minorities accounts for over two-thirds of the total decrease by CRA-regulated lenders (about 68.3 percent of the decrease of 0.82 originations). The magnitude of the declines among minorities is similar when all lending institutions are considered (−1.17 for purchase originations and −0.56 for purchase originations, but the latter is statistically insignificant).

Because the CRA targeted both LMI neighborhoods and LMI borrowers,[14] lending to LMI borrowers could still be eligible for CRA credit whether or not the neighborhood of the borrower is CRA eligible. We expect that changes in CRA eligibility status have a larger impact on borrowers who became newly CRA ineligible/eligible, such as borrowers in the newly ineligible tracts who had income below the 2013 LMI threshold but above the 2014 threshold (between $44,000 and $61,000). Regression results confirm that losing CRA coverage has a significant and larger impact on borrowers who were no longer eligible for CRA credit after 2014 (previously LMI, hereafter) than on LMI borrowers who remained CRA eligible after 2014 (a decrease of 0.38 originations for previously LMI borrowers versus an insignificant effect for LMI borrowers who remained CRA eligible). The CRA effects, however, have been insignificant at the aggregate level, except a significant increase in FHA lending among previously LMI borrowers. Overall, the findings are consistent with the notion that the suppressed growth in mortgage lending by CRA-regulated lenders in newly ineligible tracts can largely be explained by the withdrawal in lending to borrowers no longer targeted by the CRA.

[14] The HMDA data report borrowers' income (in $1,000s), which may be different from borrowers' actual family income. For example, if a two-wage earner family decides to apply for a mortgage using the income of one of the wage earners, the borrower income reported in the HMDA data could be significantly lower than the actual family income.

4.3. Identification Assumptions

There are important assumptions for the DID approach used in this study. The parallel trend assumption, which assumes parallel trends prior to the treatment, is the most critical one to ensure internal validity of DID models. One way to assess this identifying assumption is to look at the trends in outcomes leading up to the 2013 statistical area revisions. The descriptive charts based on the treatment and control groups suggest that the trends for neighborhoods in the treatment group and those in the control group are quite similar for all outcome variables during the pre-2014 period (Figure 3 provides one example by showing the time trends in purchase mortgage originations by CRA-regulated lenders and nondepository institutions).[15]

We conduct additional falsification tests for other periods, based on the idea that the CRA effects we found based on the exogenous policy shock in 2014 using the 2012–15 data would not exist in the pre-treatment periods. To do this, we repeat the regression models for each four-year episode during the post-subprime boom period, from 2006–2009 to 2013–2016. If we find a significant effect in periods before 2013, it may present that there were some unobserved characteristics between the treatment and control tracts that potentially yielded biased estimates. Since the results for other outcomes are largely insignificant, here we focus on the volume of mortgage lending, measured by the numbers of applications and originations, by all depository institutions and FHA lending by nondepository institutions. The results are shown in Figure 4. The dots represent the estimated coefficients of the interaction term, and the vertical bars are the 95 percent confidence interval of the coefficients.

[15] The time trends of the number of applications and denial rates are quite parallel before 2014 for the treatment and control groups as well.

In general, the estimated treatment effects among depositary institutions are insignificantly different from zero during the pre-event years. The estimated coefficients of the interaction variables are generally insignificant in earlier years; but they become significant and have the expected sign for the periods that include the 2013–2014 break (the 2012–2015 or the 2013–2016 episode), with one exception of a significant coefficient (*Ineligible*Post*) in 2012 (the 2010–2013 episode) for one outcome (loan applications). In other words, the newly eligible and ineligible tracts had no systemic difference in purchase mortgage lending in years before the policy shock in 2014 compared with those control tracts, which supports the idea that the CRA effects found in this paper were mainly due to the exogenous policy shock in 2014. The equality of pre–2014 trends lends confidence for the use of DID as the identification strategy here.

4.4. Robustness Check

We conducted additional analyses to evaluate whether there are any other possible explanations of our empirical results. Most importantly, with the changed CRA-targeted areas, lenders could have increased their lending capacity and marketing efforts in neighborhoods that have remained CRA eligible after 2014. As such, the observed differences between the treatment and the control tracts could be due to a surge in lending activities in the neighborhoods that remained CRA eligible alone, even when the lending in newly ineligible tracts remained unchanged. To evaluate whether this alternative explanation holds, we created two separate control groups: one including tracts that remained CRA eligible only ("*Remained Eligible*") and the other one comprising those remaining CRA ineligible only ("*Remained Ineligible*"). We ran the same two-way DID regressions using the treatment group and new control groups separately, and the results are summarized in Table 8. The qualitative results are generally consistent no matter if the "*Remained Eligible*" group or the "*Remained Ineligible*" group was used as the control. The

magnitude of the CRA effects, however, is slightly larger and more significant when the "*Remained Eligible*" group is used as the control compared with that for the "*Remained Ineligible*" group (−1.63 versus −1.31 for purchase applications and −0.98 versus −0.66 for purchase originations, but the latter is statistically insignificant). However, the differences in lending volumes between the two alternative control groups are small and insignificant, except a significant decline in FHA share in tracts that remained CRA eligible. The results confirm that losing CRA coverage can induce decreased lending by CRA-regulated lenders, which cannot be explained by the increased lending in the lowest income neighborhoods alone.

In addition, several Philadelphia-specific factors need to be evaluated that may provide alternative explanations for more significant CRA effects in the new Philadelphia MD. For the sake of brevity, we discuss general patterns here without presenting the detailed results. With the ongoing gentrification in certain neighborhoods in the city, some neighborhoods have experienced larger increases in the flow of capital, home value appreciation, and property taxes than others. If recent neighborhood changes and the introduction of the new tax assessment system in Philadelphia[16] had induced higher demand for housing and mortgage credit for neighborhoods in the control group while depressing the demand for credit to a larger degree in those in the treatment group, this could help explain the observed differences in mortgage lending activities between these two groups. However, our evaluation, based on public records data, suggests that the changes in property taxes, assessed values, and the volume of market sales are quite similar for the treatment and control tracts in the city of Philadelphia, likely because

[16] The city of Philadelphia adopted a new tax assessment system, the Actual Value Initiative (AVI), in 2014. Philadelphia had not assessed its properties, particularly older ones, for decades until the launch of the AVI program to simultaneously assess properties based on their actual market values.

tracts in the control group are adjacent to the treatment tracts and are likely to be in the same housing submarkets.

Finally, as mentioned earlier, there are concerns on how to construct the right counterfactual for neighborhoods with changed CRA eligibility status in the control group. We used several alternative control groups to discern how sensitive the results are to some of our analytical decisions. Here, we only mention some general patterns. When all neighborhoods with slightly lower or higher income — not just those adjacent to the treatment tracts — serve as the control group, the results are generally consistent with the results from the two-way DID regressions in terms of the significance and the magnitude of the CRA effects. When we use tracts within a larger income range (an income window of 0 percent to 100 percent of AMFI, instead of a window of about 50 percent to 90 percent), we find that the results for the new Philadelphia MD are quite consistent, while the CRA effects become more significant (statistically significant and positive) for the newly eligible tracts in the MBC MD. The generally consistent results from the various robustness checks give us more confidence in the results from our primary regression model.

5. Conclusion

This study provides new empirical evidence on the effects of the CRA on mortgage lending activities in the aftermath of the Great Recession. The revision in MSA/MD definitions has generated unintended consequences on CRA lending activities in the Philadelphia market by causing radical changes in CRA eligibility status for a large number of neighborhoods. Lenders

are quite responsive to changes in the availability of CRA incentives, but the CRA effects are more evident when a lower-income neighborhood loses its CRA eligibility status than when a higher-income neighborhood becomes eligible for the CRA. Lending by CRA-regulated lenders is expected to be at least 10 percent lower when a lower-income neighborhood loses its CRA coverage. The decrease is largely due to the withdrawal in lending to minority borrowers and to borrowers no longer targeted by CRA. At the aggregate level, we also observe a smaller increase in purchase applications and originations in neighborhoods that became CRA ineligible, although these changes are insignificant in tract-level regressions. Overall, the results are consistent with the contention that the CRA has made mortgage credit more accessible to lower-income communities and families by changing the sources and likely the volume of credit.

This study also demonstrates how CRA-regulated lenders and non-CRA-regulated lenders respond differently to the incentive of CRA credit. Results suggest that, without the incentive of the CRA, depository institutions are more likely to reduce their supply of mortgage credit in lower-income neighborhoods. Nondepository institutions that are not covered by the CRA can partially offset the supply of mortgage credit in the neighborhoods from which the depository institutions are withdrawing. The partial substitution effect between the CRA-covered lenders and nondepository institutions helps explain the observed larger decreases (or smaller increases) in lending volume in neighborhoods that lost CRA coverage than similar neighborhoods in the control group. A CRA designation still matters in a changing financial landscape.

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Table 1. Descriptive Statistics of the Study Sample Used in Tract-Level Regressions (2013 Statistics)

Variable	Philadelphia MD				MBC MD			
	Newly Ineligible		Control		Newly Eligible		Control	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Number of Applications	38.81	29.29	28.91	23.40	43.85	25.78	40.92	25.79
Number of Applications by Depository Institutions	20.81	14.61	15.60	12.69	21.84	12.32	20.63	13.79
Number of Applications by Depository with Local Branches	12.57	9.62	9.58	8.54	12.06	7.06	11.81	8.87
by Borrowers Who Remained LMI	5.12	4.34	4.59	4.35	5.69	4.06	5.27	3.42
by Previously LMI Borrowers	3.04	2.60	1.83	2.12	3.81	2.61	3.93	2.69
by Minority	6.03	5.55	4.77	4.53	1.35	1.87	1.84	2.08
Number of Originations	27.17	22.77	19.77	18.32	32.15	18.25	29.77	20.24
Number of Originations by Depository Institutions	14.20	11.36	10.35	9.67	15.86	8.42	15.15	11.25
Number of Originations by Depository with Local Branches	8.36	7.21	6.38	6.59	8.81	4.95	8.81	6.82
to Borrowers Who Remained LMI	3.37	3.33	2.92	3.40	1.73	1.65	1.49	1.74
to Previously LMI Borrowers	2.09	2.07	1.29	1.76	1.26	1.37	1.01	1.37
to Minority	1.35	1.87	1.84	2.08	0.89	1.36	1.21	1.35
Origination Amount ($1,000)	4,046.3	5,035.8	3,036.4	4,171.9	5,991.0	3,507.5	5,885.8	4,917.6
Origination Amount by Depository Institutions ($1,000)	2,059.6	2,289.1	1,572.7	2,186.0	2,886.2	1,588.3	2,976.0	2,685.6
Origination Amount by Depository with Local Branches ($1,000)	1,203.1	1,321.9	961.5	1,409.9	1,593.7	1,010.9	1,648.5	1,591.2
Denial Rate (%)	19.24	9.87	22.84	15.44	12.31	8.02	14.53	8.49
Denial Rate of Depository Institutions (%)	22.69	13.39	25.12	17.18	13.83	9.50	15.89	10.30
Denial Rate of Depository with Local Branches (%)	24.38	17.30	24.06	18.65	13.80	12.68	15.88	10.99
Share of FHA Originations (%)	49.29	24.04	51.23	25.00	25.63	15.46	29.22	17.70
Share of FHA Originations by Depository Institutions (%)	45.70	25.98	48.31	30.16	20.99	15.49	23.19	19.75
Share of FHA Originations by Depository with Local Branches (%)	37.65	28.33	38.63	32.17	16.17	19.03	17.00	19.51
Median Family Income ($)	52,769.5	4,850.4	42,669.2	13,274.0	69,296.2	4,241.8	65,747.1	16,473.7
Share of Minority (%)	57.16	31.61	71.23	29.78	20.93	13.04	32.23	21.81
Owner-Occupied Housing Units	1,005.2	504.3	862.0	434.1	925.4	433.4	912.2	560.7
Number of Housing Units	1,546.0	695.1	1,592.7	641.5	1,221.3	535.7	1,282.9	617.2
Number of Observations	100		150		80		73	

Note: Two newly ineligible tracts were dropped due to missing data. All statistics are for the year 2013. Sample sizes for the denial rates may be different.
Sources: HMDA data, FFIEC census data, and FDIC SOD data.

Table 2. Descriptive Analysis of Changes in Purchase Mortgage Lending by Neighborhood Pre- and Post-2014 in the New Philadelphia MD

	Applications		Originations		Origination Volume ($)		Denial Rate (%)		FHA Share (%)	
	Newly Ineligible	Control	Newly Ineligible	Control	Newly Ineligible	Control	Newly Ineligible	Control	Newly Ineligible	Control
Depository Institutions with Local Branches										
2012–2013	2,422	2,818	1,577	1,836	218,895	272,320	23.6%	23.4%	44.8%	41.1%
2014–2015	2,365	3,188	1,675	2,234	257,005	358,337	19.2%	19.4%	34.1%	30.1%
% Change	−2.4%	13.1%	6.2%	21.7%	17.4%	31.6%	−4.4%	−4.0%	−10.7%	−11.0%
Difference in Differences	−15.5%		−15.5%		−14.2%		−0.4%		0.3%	
Nondepository Institutions										
2012–2013	3,504	3,914	2,370	2,613	356,866	406,140	17.5%	17.8%	50.4%	47.5%
2014–2015	4,578	5,306	3,212	3,630	506,240	604,808	13.4%	14.7%	45.4%	41.0%
% Change	30.7%	35.6%	35.5%	38.9%	41.9%	48.9%	−4.1%	−3.0%	−5.1%	−6.5%
Difference in Differences	−4.9%		−3.4%		−7.1%		−1.1%		1.4%	
All Lending Institutions										
2012–2013	7,548	8,497	5,087	5,656	736,112	856,983	19.6%	20.0%	50.7%	46.9%
2014–2015	8,551	10,559	6,046	7,331	950,675	1,205,136	15.4%	16.2%	41.5%	36.9%
% Change	13.3%	24.3%	18.9%	29.6%	29.1%	40.6%	−4.3%	−3.8%	−9.2%	−10.0%
Difference in Differences	−11.0%		−10.8%		−11.5%		−0.4%		0.8%	

Notes: The control group refers to the tracts within 0.5 mile of any neighborhood in the treatment group and with slightly lower or slightly higher income (about 50%–90% AFMI). Changes for the volume of applications and originations are relative changes; changes for the denial rate and FHA share are absolute changes.
Source: Authors' calculation based on HMDA data and FDIC SOD data.

Table 3. Descriptive Analysis of Changes in Purchase Mortgage Lending by Neighborhood Pre- and Post-2014 in the MBC MD

	Applications		Originations		Origination Volume ($)		Denial Rate (%)		FHA Share (%)	
	Newly Eligible	Control	Newly Eligible	Control	Newly Eligible	Control	Newly Eligible	Control	Newly Eligible	Control
Depository Institutions with Local Branches										
2012–2013	1,867	1,685	1,357	1,221	238,937	228,304	15.1%	16.0%	19.5%	19.6%
2014–2015	1,877	1,609	1,430	1,196	270,861	244,026	12.6%	13.4%	14.7%	14.5%
% Change	0.5%	-4.5%	5.4%	-2.0%	13.4%	6.9%	-2.5%	-2.6%	-4.8%	-5.0%
Difference in Differences	5.0%		7.4%		6.5%		0.1%		0.3%	
Nondepository Institutions										
2012–2013	3,285	2,699	2,436	1,939	462,559	386,712	11.2%	13.4%	35.4%	32.9%
2014–2015	4,526	3,771	3,430	2,822	664,546	582,848	9.7%	10.2%	31.5%	29.7%
% Change	37.8%	39.7%	40.8%	45.5%	43.7%	50.7%	−1.6%	−3.2%	−4.0%	−3.2%
Difference in Differences	−1.9%		−4.7%		−7.1%		1.6%		−0.8%	
All Lending Institutions										
2012–2013	6,661	5,642	4,906	4,116	906,113	807,171	12.9%	14.2%	30.9%	28.8%
2014–2015	7,826	6,606	5,916	4,947	1,141,405	1,025,781	10.5%	10.6%	26.2%	24.2%
% Change	17.5%	17.1%	20.6%	20.2%	26.0%	27.1%	−2.4%	−3.5%	−4.7%	−4.6%
Difference in Differences	0.4%		0.4%		−1.1%		1.1%		−0.1%	

Notes: The control group refers to the tracts within 0.5 mile of any neighborhoods in the treatment group and with slightly lower or higher income (about 50%–90% AFMI). Changes for the volume of applications and originations are relative changes; changes for the denial rate and FHA share are absolute changes.
Source: Authors' calculation based on HMDA data and FDIC SOD data.

Table 4. Summary of the CRA Effects on Purchase Mortgage Lending Activity from the Two-Way Difference-in-Differences Regressions (Coefficients of the Interaction, *Treat* ∗ *Post*)

	Philadelphia MD		MBC MD	
	Coefficient	Std. Err.	Coefficient	Std. Err.
Depository Institutions with Local Branches				
Purchase Applications	−1.490***	0.539	0.590	0.699
Purchase Originations	−0.821**	0.419	0.634	0.566
Purchase Originations ($)	−94.6	89.8	98.4	124.6
Denial Rate (%)	−1.006	2.383	1.193	2.221
Share of FHA (%)	4.523	3.230	1.285	2.726
All Depository Institutions				
Purchase Applications	−2.540***	0.737	0.265	0.953
Purchase Originations	−1.580***	0.557	0.456	0.76
Purchase Originations ($)	−169.2	134.2	54.2	169.8
Denial Rate (%)	0.276	1.882	0.63	1.577
Share of FHA (%)	3.635	2.761	2.574	2.134
Nondepository Institutions				
Purchase Applications	0.751	0.848	0.414	1.277
Purchase Originations	0.829	0.655	0.165	0.991
Purchase Originations ($)	85.7	148.7	−81.0	239.7
Denial Rate (%)	−1.605	2.288	0.277	1.595
Share of FHA (%)	7.276**	2.832	1.605	2.557
All Lending Institutions (Depository Institutions and Nondepository Institutions)				
Purchase Applications	−1.789	1.294	0.679	1.609
Purchase Originations	−0.751	0.988	0.621	1.253
Purchase Originations ($)	−83.6	251.2	−26.8	310.5
Denial Rate (%)	−0.962	1.424	0.744	1.160
Share of FHA (%)	4.936***	2.073	1.647	1.779

Notes: ***, **, * represent significant at 0.01, 0.05, or 0.1 level. Results are from a set of two-way difference-in-differences models predicting the volume of purchase mortgage applications/originations and other outcomes. Coefficients can be interpreted as the change in mortgage lending activity in tracts with changed CRA eligibility status relative to that of the control group. Tract fixed effect is controlled in the model. Estimation is based on HMDA data and FDIC SOD data.

Table 5. Summary of the CRA Effects on Purchase Mortgage Lending Activity from the Three-Way Difference-in-Differences Regressions (Coefficients of the Interaction, *Treat ∗ Bank ∗ Post*)

	Philadelphia MD		MBC MD	
	Coefficient	Std. Err.	Coefficient	Std. Err.
Depository Institutions with Local Branches				
Purchase Applications	-2.260*	1.250	0.135	1.820
Purchase Originations	-1.665*	0.994	0.442	1.411
Purchase Originations ($)	-179.0	216.6	176.0	325.7
Denial Rate (%)	-1.124	2.891	-1.528	2.529
Share of FHA (%)	-7.425**	3.590	-2.162	3.142
All Lending Institutions				
Purchase Applications	−2.387	1.922	0.331	2.403
Purchase Originations	−1.469	1.476	0.510	1.844
Purchase Originations ($)	−145.8	349.9	68.6	440.3
Denial Rate (%)	0.933	2.193	−1.023	1.761
Share of FHA (%)	−2.148	3.357	−0.563	3.041

Notes: ***, **, * represent significant at 0.01, 0.05, or 0.1 level. Results are from a set of three-way difference-in-differences models predicting the volume of purchase mortgage applications/originations and other outcomes. Tracts in the control group and the nondepository institutions serve as control groups. Tract fixed effect is controlled in the model. Estimation is based on HMDA data and FDIC SOD data.

Table 6. Summary of Regression Results of CRA Impact over Time on Purchase Mortgage Lending Activity in the New Philadelphia MD

		Philadelphia MD	
		Coefficient	Std. Err.
Depository Institutions with Local Branches			
Purchase Applications	Newly Ineligible & 2014	−1.124*	0.657
	Newly Ineligible & 2015	−1.853***	0.658
Purchase Originations	Newly Ineligible & 2014	−0.530	0.510
	Newly Ineligible & 2015	−1.111**	0.511
Purchase Originations ($)	Newly Ineligible & 2014	−5.8	108.7
	Newly Ineligible & 2015	−182.8*	108.9
Denial Rate (%)	Newly Ineligible & 2014	−0.479	2.932
	Newly Ineligible & 2015	−1.453	2.885
Share of FHA (%)	Newly Ineligible & 2014	1.061	3.953
	Newly Ineligible & 2015	7.979**	3.942
All Lending Institutions			
Purchase Applications	Newly Ineligible & 2014	−1.787	1.539
	Newly Ineligible & 2015	−1.762	1.542
Purchase Originations	Newly Ineligible & 2014	−0.513	1.172
	Newly Ineligible & 2015	−0.967	1.175
Purchase Originations ($)	Newly Ineligible & 2014	70.6	300.2
	Newly Ineligible & 2015	−233.5	300.8
Denial Rate (%)	Newly Ineligible & 2014	−1.774	1.737
	Newly Ineligible & 2015	−0.171	1.729
Share of FHA (%)	Newly Ineligible & 2014	4.706*	2.534
	Newly Ineligible & 2015	5.194**	2.536

Notes: ***, **, * represent significant at 0.01, 0.05, or 0.1 level. Results are from a set of two-way difference-in-differences models predicting the volume of purchase mortgage applications/originations and other outcomes. Coefficients can be interpreted as the change in mortgage lending activity in tracts with changed CRA eligibility status relative to that of the control group. Tract fixed effect is controlled in the model. Estimation is based on HMDA data and FDIC SOD data.

Table 7. Summary of Regression Results of CRA Impact for Lower-Income and Minority Borrowers in the New Philadelphia MD

	Minority Borrowers		LMI Borrowers ($43,000 or lower)		Previously LMI Borrowers ($44,000-$61,000)	
	Coefficient	Std. Err.	Coefficient	Std. Err.	Coefficient	Std. Err.
Depository Institutions with Local Branches						
Purchase Applications	−1.125***	0.371	−0.275	0.358	−0.632**	0.199
Purchase Originations	−0.560*	0.293	0.022	0.288	−0.380**	0.163
Purchase Originations ($)	−51.3	44.9	18.1	49.0	−52.9**	23.8
Denial Rates (%)	−0.337	3.210	−1.521	3.518	3.012	4.845
Share of FHA (%)	4.071	4.185	4.496	4.196	0.179	6.027
All Lending Institutions						
Purchase Applications	−1.170*	0.648	−0.780	0.597	−0.235	0.416
Purchase Originations	−0.561	0.481	−0.139	0.456	−0.053	0.324
Purchase Originations ($)	−29.9	72.6	56.9	71.4	12.1	51.6
Denial Rates (%)	−0.078	1.923	−1.166	1.892	−0.733	2.31
Share of FHA (%)	3.525	2.765	0.812	2.683	7.247**	3.688

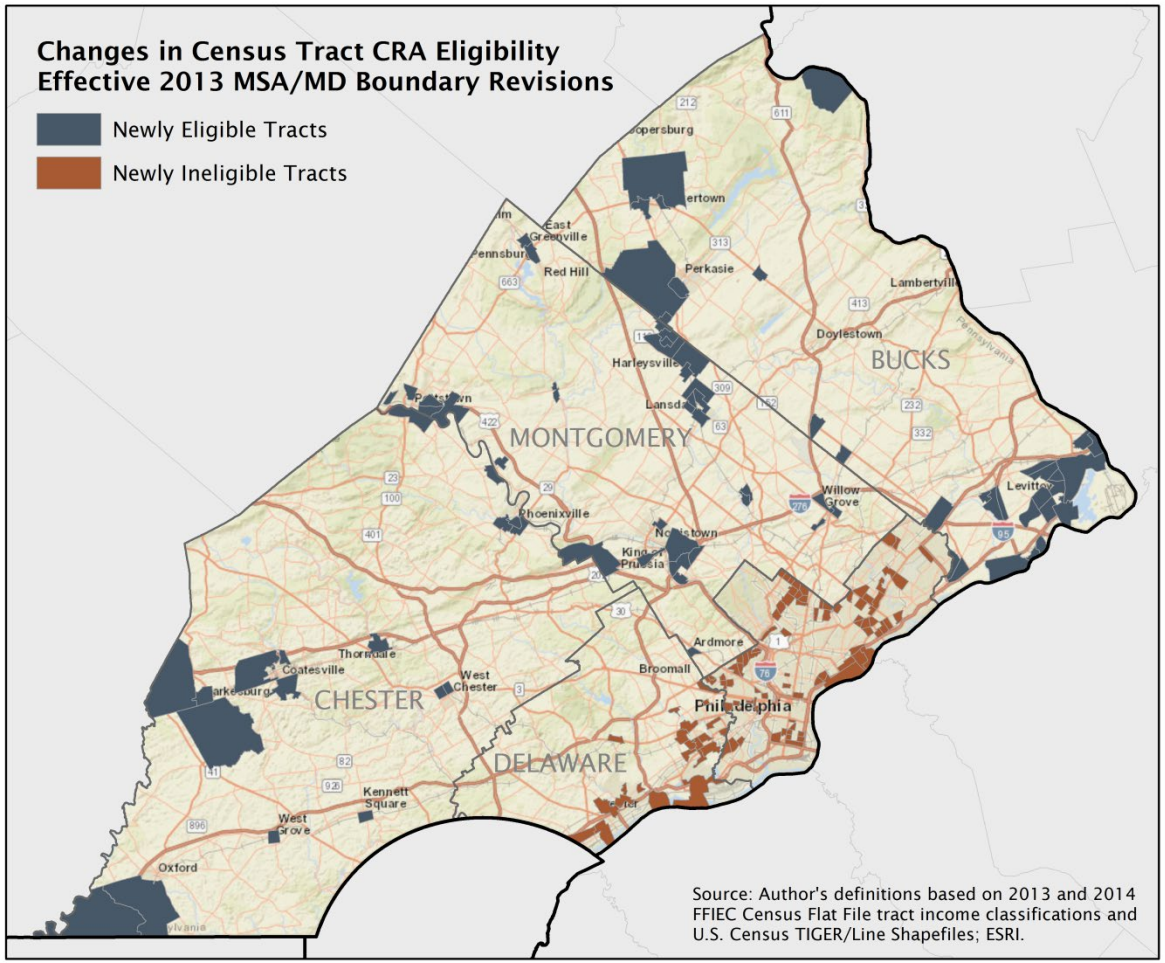
Notes: ***, **, * represent significant at 0.01, 0.05, or 0.1 level. Results are from a set of two-way difference-in-differences models predicting the volume of purchase mortgage applications/originations and other outcomes. Coefficients can be interpreted as the change in mortgage lending activity in tracts with changed CRA eligibility status, relative to that of the control group. Tract fixed effect is controlled in the model. Estimation is based on HMDA data and FDIC SOD data.

Table 8. Summary of Robustness Check Using Alternative Control Groups in the New Philadelphia MD

	Newly Ineligible vs. Remained Eligible		Newly Ineligible vs. Remained Ineligible		Remained Eligible vs. Remained Ineligible	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Depository Institutions with Local Branches						
Purchase Applications	−1.627***	0.583	-1.307*	0.796	0.138	0.760
Purchase Originations	−0.983**	0.448	-0.655	0.625	0.151	0.611
Purchase Originations ($)	−121.8	95.8	-218.3	151.2	-133.0	1510.0
Denial Rates (%)	−0.530	2.637	-2.040	3.096	-1.407	3.172
Share of FHA (%)	6.241*	3.510	0.229	4.284	-5.585	4.695
All Lending Institutions						
Purchase Applications	-1.854	1.427	-2.427	1.841	-1.193	1.900
Purchase Originations	-0.947	1.088	-0.634	1.378	-0.180	1.428
Purchase Originations ($)	-82.4	278.6	-463.6	387.5	-496.2	405.8
Denial Rates (%)	-0.428	1.561	-2.359	1.698	-2.084	2.245
Share of FHA (%)	6.169***	2.259	1.261	2.707	-5.974*	3.133

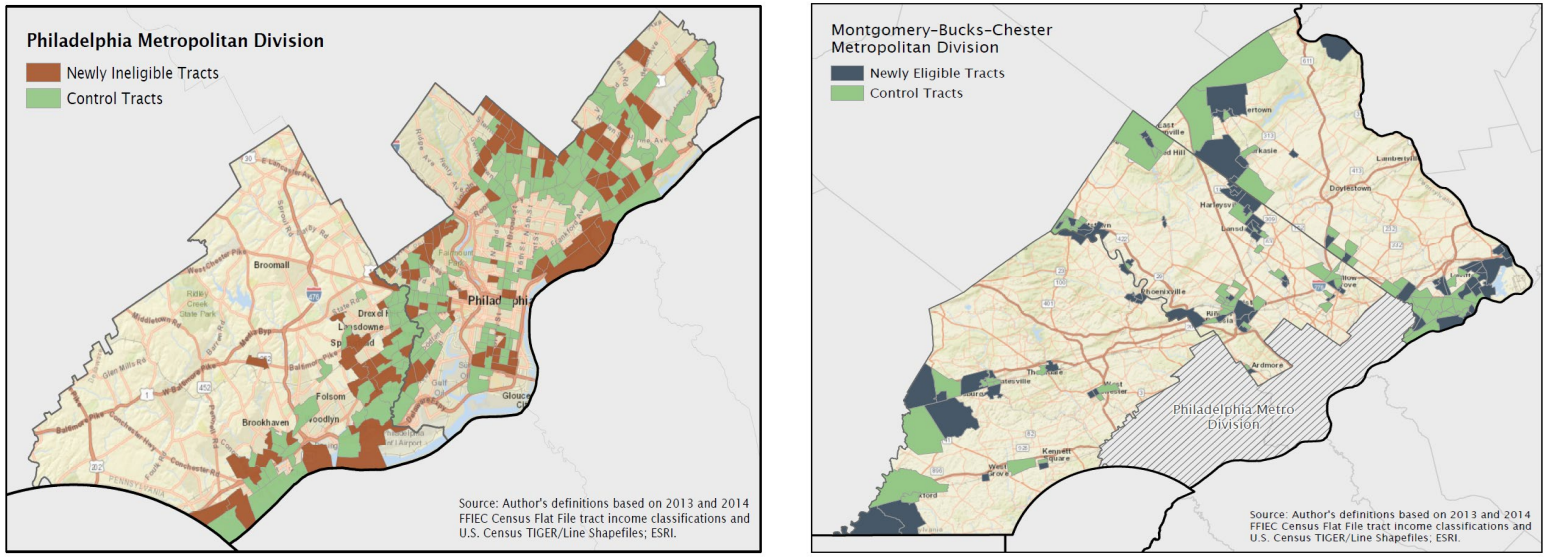
Notes: ***, **, * represent significant at 0.01, 0.05, or 0.1 level. AMFI represents area median family income. Results are from a set of two-way difference-in-differences models predicting the volume of purchase mortgage applications/originations and other outcomes. Coefficients can be interpreted as the change in mortgage lending activity in treatment tracts relative to that of the control group. The "*Remained Eligible vs. Remained Ineligible*" comparison used tracts remaining CRA eligible (and above 50% AMFI) as the treatment and tracts that remained CRA ineligible and within 0.5 mile radium as the control. Tract fixed effect is controlled in the model. Estimation is based on HMDA data and FDIC SOD data.

Figure 1. Changes in Census Tract CRA Eligibility in the Philadelphia and MBC Metropolitan Divisions



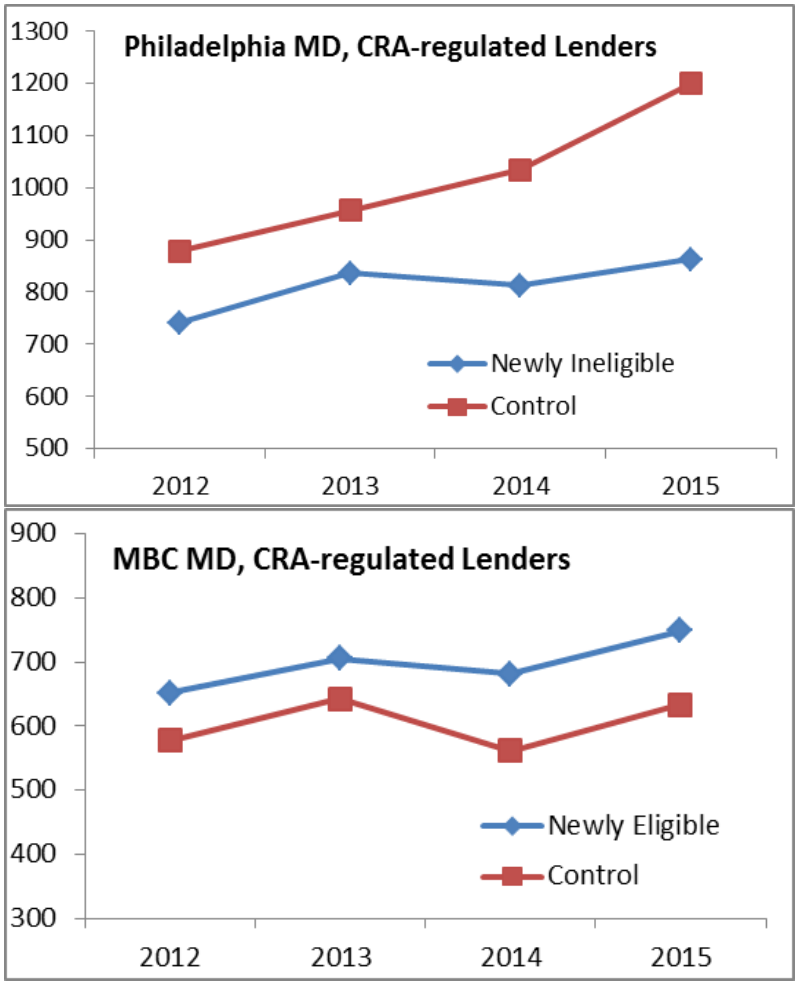
Note: Based on the 2010 Census tract definition.
Source: Authors' definition based on 2013 and 2014 FFIEC Census data and U.S. Census TIGER/Line Shapefiles; ESRI.

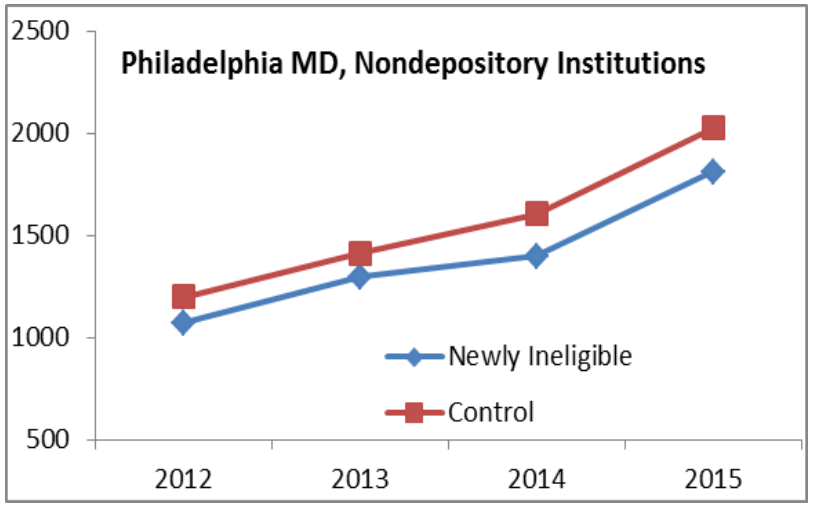
Figure 2. Census Tracts with Changed CRA Eligibility Status and Tracts in the Control Group

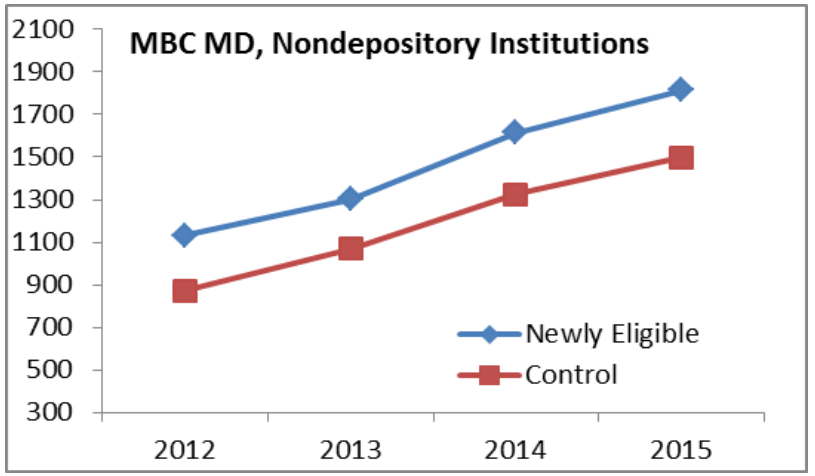


Note: Tracts in the control group are (1) within 0.5 mile of those in the treatment group, (2) with unchanged CRA eligibility status, and (3) with slightly higher income and slightly lower median income than those in the treatment group.
Source: Authors' definition based on 2013 and 2014 FFIEC Census data and U.S. Census TIGER/Line Shapefiles; ESRI.

Figure 3. Number of Purchase Mortgage Originations by CRA-regulated Depository Institutions or Nondepository Institutions by Neighborhood Type, 2012–2015



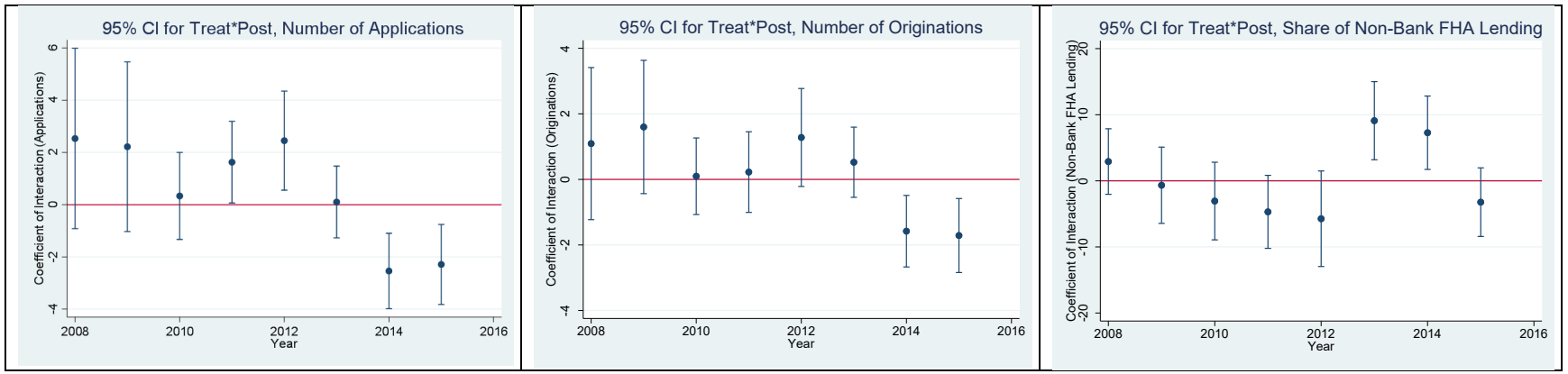




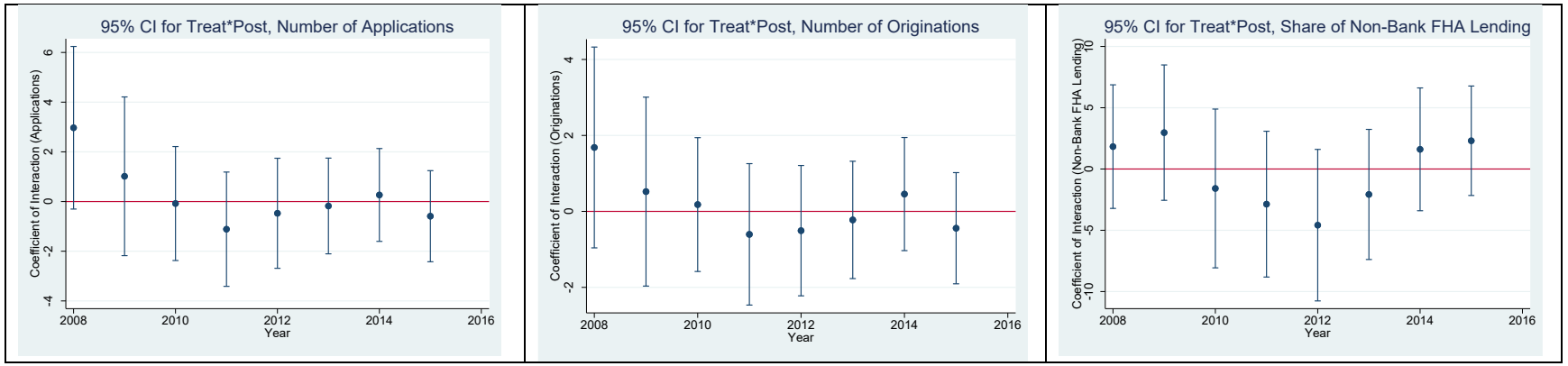
Source: Authors' calculation based on HMDA data and FDIC SOD data.

Figure 4. Estimated Coefficients of the Interaction Variable (*Treat * Post*) for the 2008–2015 Period, Mortgage Lending by All Depository Institutions and Share of FHA Lending by Nondepository Institutions

A. Newly Ineligible Tracts



B. Newly Eligible Tracts



Source: Authors' calculation based on HMDA data. Control tracts are within 0.5 mile of treatment tracts and have median family income between about 50 percent and 90 percent of AFMI). Tracts with changed boundaries were not included for regressions before 2012, because HMDA uses 2000 census tract definition before 2012. Tracts with changed CRA eligibility status from 2011 to 2012 (38 treatment tracts and 26 control tracts) because of the use of new 2006–2010 ACS data were dropped from the regression for the 2012 regression (the 2010–2013 episode).