Mortgage Lending, Default, and the Community Reinvestment Act

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Federal Reserve Board

June 15, 2017

Abstract

The Community Reinvestment Act (CRA) provides incentives for banks to supply credit to low and moderate income individuals in the communities they serve. In the wake of the subprime crisis, the act came under fire for potentially having promoted risky lending. This paper estimates the effect of the CRA on the supply of mortgage credit. I exploit variation in the set of banks whose lending performance is assessed in a given neighborhood caused by the redefinition of Metropolitan Statistical Areas in late 2003. I find evidence of a substantial increase in mortgage lending due to the CRA, especially among low income borrowers, accomplished without a measurable increase in the likelihood of default.

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1 Introduction

With low interest rates and relaxed underwriting standards, the availability of real-estate secured loans grew to unprecedented levels in the early years of the new century. The rapid expansion of mortgage credit was followed by a collapse in home prices and a wave of defaults. In seeking a cause for the crisis, attention quickly turned to the part financial regulation may have played in encouraging irresponsible - or even predatory - lending. Some commentors, such as Wallison (2009) and Pinto (2010), argued for the culpability of a particular law, the Community Reinvestment Act (CRA).

The CRA was passed in 1977 to promote the availability of credit in neighborhoods that were being underserved by their local financial intermediaries. At the time there was concern that banks were "redlining", i.e. discriminating against lower income and minority borrowers by refusing to do business within certain geographic areas. The CRA prohibited redlining, and encouraged depository institutions to meet the credit needs of all the members of their communities. In the mid 1990s, the provisions of the CRA were strengthened by requirements that regulatory agencies rate FDIC insured lending institutions on the quantitative record of their lending activities within the communities they serve. A good record of providing loans and other financial products to low and moderate income neighborhoods would enhance a credit supplier's CRA rating. This rating is taken into account by the regulatory agencies if the lender applies for a merger or expansion, and is also made publicly available. In particular, the ratings give community groups a basis for which to demand redress.

This paper estimates the effect the CRA had on the supply of loans and their subsequent performance. While the act does provide some incentives for banks to increase their lending to low and moderate income (LMI) borrowers and in LMI census tracts, the relatively weak enforcement mechanism may not have been enought to spur them into action. Even if the CRA did compel some banks to supply more credit, the equilibrium response is theoretically ambiguous. Loans from institutions not subject to the CRA may be crowded out, dampening the net increase in supply. Alternatively, positive information externalities from mortgage

lending could pull even more lending into the targeted areas. Lang and Nakamura (1993) show that with uncertain returns to investment, a local under-supply of credit (relative to the efficient level) can be self sustaining. In this case a policy induced boost in lending could be welfare enhancing, and tip the market from a low to high equilibrium of supply. The CRA could therefore have a large effect on total lending even without strong incentives. We would expect any such (positive) externality effects to be strongest in areas where the mortgage market was relatively depressed.

In this paper, I identify the CRA's effect on credit supply is by exploiting an unintended change in lenders' incentives. Each regulated banking institution is rated based on its lending within a designated assessment area—supposedly the community the lender serves. These areas are usually defined along county or Metropolitan Statistical Area (MSA) lines. In 2003, the Office of Management and Budget published a new set of MSA definitions to better reflect demographics and commuting patterns. This redefinition caused thousands of census tracts (the neighborhood definition used for CRA purposes) to be incorporated into either a pre-existing or newly formed MSA. Many lenders' CRA assessment areas expanded to reflect the new boundaries. I use this redefinition to estimate the effect of a change in the local number of banks with a CRA incentive to supply loans on the total lending in a tract.

Previous work in this literature has reached mixed conclusions as to the CRA's effect. Several authors have used varieties of a regression discontinutiy strategy. Lenders get CRA credit for their activity in LMI census tracts, and loans made to LMI borrowers. A tract is defined as LMI if the tract's median family income (MFI) is below 80% of the MFI of the local MSA, or the non-MSA portion of the state in non-MSA tracts. Borrowers are similarly considered LMI if their incomes are below the 80 % threshold.[1] Studies that compare outcomes in tracts or applicants just above and below this threshold include Bhutta (2011), Berry and

[1]There is a slight difference in the definitions of MSA MFI for determining borrower and tract LMI status. Borrower income is compared to an annual estimate of MSA MFI published by the Department of Housing and Urban Development, while tract MFI is compared to MSA MFI drawn from the most recent census.

Lee (2008) and Gabriel and Rosenthal (2009). The general conclusion from this literature is that the effect of the CRA is small or zero. While the argument for the identification of local average treatment effects using the regression discontinuity approach is strong, the external validity of these estimates may be suspect. Lower income tracts and borrowers, far from the LMI threshold, may be less well served by the normal functioning of the credit market and thus recieve a greater boost to lending from the CRA. Regression discontinuity estimates would then tend to underestimate the effects of the Act. Alternatively, banks may have focused their CRA efforts on the highest income (and potentially most profitable) customers that count for CRA credit, inflating the estimated discontinuity in lending.

The approach taken in this paper allows me estimate the effect othe CRA on lending to borrowers who are not close to the LMI threshold. Among previous work that makes use of other approaches than the regression discontinuity strategy, some authors have found a substantial effect of the act. Avery, Bostic and Canner (2005) use survey responses from banks to conclude that there was a large increase in lending in response to the CRA. Agarwal et al. (2012) find that banks increase the volume of their lending in the months around CRA examinations.

The results of this paper show the CRA was apparently effective in increasing the availability of mortgage loans in targeted areas, particularly to LMI borrowers. Giving one additional bank CRA incentives to lend in a given tract increased mortgage lending to LMI borrowers in that tract by 2 to 4 percent. The effect was strongest among low income borrowers, i.e., those households earning less than 50 percent of the MSA MFI. The increase in lending occurred entirely through institutions subject to the CRA - there was no effect on LMI lending by non-banks.

The CRA is intended to encourage banks to meet the credit needs of their communities in a manner consistent with safe and sound operation. However, the incentives to increase lending to low income borrowers and communities could have led banks to ease their underwriting standards and make riskier loans. Agarwal et al. (2012) also find an increase

in default rates which they attribute to the CRA. In contrast, Avery and Brevoort (2014), Ding et al. (2011) and Hernández-Murillo, Ghent and Owyang (2012) provide a variety of evidence that any loans induced by the CRA performed no worse, and possibly better than, their non-CRA counterparts. I find, despite the increase in LMI lending, there was no discernible effect of the CRA on the *ex ante* riskiness or *ex post* performance of mortgage loans. This finding conflicts with the suggestion that the CRA was a contributor to the financial crisis.

The rest of the paper is organized as follows. Section 2 details a toy model of lending under CRA incentives which will help clarify ideas for the empirics. Section 3 presents the identification strategy and estimation procedure. Section 4 describes the data used. In section 5 I present the results, as well as analysis of pre-trends to validate the instrument. The paper concludes with a discussion of the findings in section 6.

2 A Model of Lending and the CRA

This section presents a simple extension of the Cournot model of competition to illustrate how shifting CRA assessment area boundaries affects the total supply of credit. First, define a market for mortgage lending by location and the income of potential borrowers. Let Q_d, the quantity of mortgage loans demanded by LMI borrowers in a particular census tract, follow the function:

$$Q_d = A - B \cdot p \tag{1}$$

where p is the price of the loan, which we can think of as an abstraction of the interest rate, fees and various loan features which trade off between borrower and lender surplus.

Let there be two types of banks. For banks of type 1, the tract is not in their assessment area and so LMI lending there does not count towards their CRA performance examination. Bank i of type 1 chooses the quantity of mortgage loans to supply to the market, q_i, to

maximize its profit function:

$$\pi_i = q_i \cdot p - C \cdot q_i \tag{2}$$

where C is the constant marginal cost of producing a loan. For banks of type 2, the tract is in their assessment area and so they receive an additional marginal benefit, α, from originating LMI loans there. Bank j of type 2 chooses the quantity of mortgage loans to supply, q_j, to maximize its profit function:

$$\pi_j = q_j \cdot p - C \cdot q_j + \alpha \cdot q_j \tag{3}$$

Banks are price takers, and choose their optimal quantity of supply simultaneously. Total quantity supplied, Q_s is the sum of each individual bank's quantity supplied.

Suppose N banks compete in this market, N_1 of which are type 1 and $N_2 = N - N_1$ of which are type 2. In equilibrium, type 1 banks each supply q_1^* loans, where

$$q_1^* = \frac{A - BC - \alpha B N_2}{N + 1} \tag{4}$$

and type 2 banks each supply q_2^* loans, where

$$q_2^* = \frac{A - BC + \alpha B(N_1 + 1)}{N + 1} \tag{5}$$

Because each LMI loan improves bank j's expectation of getting a positive rating on its CRA performance examination, banks of type 2 will supply more loans if they value a good CRA rating (i.e. if $\alpha > 0$). Banks of type 1 do not receive the same benefit, and are partially crowded out by their type 2 counterparts, as q_1^* is decreasing in α. The equilibrium total quantity of loans supplied is therefore

$$Q^* = \frac{\alpha B N_2}{N + 1} + \frac{N}{N + 1}(A - BC) \tag{6}$$

This paper tests for an effect of the CRA on mortgage lending by exploiting a shift in assessment area boundaries. After the MSA redefinitions, some banks found new tracts included in their assessment areas. In the context of the model outlined above, this is equivalent to shifting some banks from type 1 to type 2 for a particular tract. If Q^* is the quantity supplied under present conditions, let Q' be the quantity supplied where $N_2' = N_2 + n$ and $N_1' = N_1 - n$. The effect of giving n additional banks a CRA incentive to lend to LMI borrowers in the tract is the difference between these quantities:

$$Q' - Q^* = \frac{\alpha B n}{N+1} \tag{7}$$

If the CRA provides enough incentive to induce banks to increase their LMI lending (that is, if $\alpha > 0$), then shifting assessment area boundaries so additional banks are assessed in a given tract should increase lending there, as $\frac{\alpha B n}{N+1} > 0$. The more banks that are so shifted (i.e the larger n is), the greater the expected increase in lending. In the next section, I describe how I test for an effect of the CRA by estimating the effect of assessing n additional banks in a tract on total LMI lending there. If $\alpha = 0$, then the CRA has no effect and $Q' = Q^*$, regardless of n. The model would then collapse to the standard Cournot oligopoly.

3 Estimation

The CRA provides a potential incentive for lenders to increase supply in their assessment areas. Any effects of the act should therefore be mediated through the presence of institutions covered by the CRA. As described in Section 2, if the act motivates lenders to supply more credit, increasing the number of institutions assessed in a tract should increase the amount of lending activity there. A simple regression of lending volume on the number of locally-assessed banks at the tract level is likely to be biased, however. The concentration of banks or other mortgage providers in an area is indicative of local economic conditions. I therefore need a quasi-experimental source of variation in the number of locally assessed lenders that

is uncorrelated with the local demand for credit or market structure.

On June 6, 2003, the Office of Management and Budget announced a new set of MSA definitions. MSA boundaries are drawn for statistical purposes, and were not intended to have any legal or jurisdictional impact. However, they have proven to be a convenient definition of large-scale, but still local, markets. When defining their CRA assessment areas, lenders were prohibited from drawing irregular boundaries to exclude LMI tracts. Assessment area boundaries must generally coincide with those of an MSA or some political unit (i.e. county or town)[2]. Banks select their own assessment areas, but are required to follow these strictures. Many banks whose assessment area as of 2003 constituted the entirety of an MSA, updated their assessment area with the change in MSA definitions. For the tracts newly incorporated into an MSA, approximately 30% of the lenders assessed MSA-wide in 2003 added the new tract to their assessement area in 2004[3].

This suggests an instrument for the number of locally-assessed lending institutions. Suppose, in 2003, a bank's assessment area consists of MSA m. With the MSA redefinitions, the boundaries of m get extended to include several new tracts in 2004. The bank has a reasonable probability of continuing to define its assessment area by the MSA boundaries, and therefore include the newly added tracts. In MSAs with many banks whose assessment area coincides with the MSA boundaries, the newly incorporated tracts will be added to more assessment areas and receive a greater CRA induced boost to local lending. The average number of banks assessed per tract in m in 2003 therefore predicts the number of banks assessed in the tracts newly incorporated in m in 2004. It is important to use the potential number of banks that could expand their assessment areas in this way, rather than the actual number who chose to expand, because any particular bank's choice may be endogenous to local market conditions.

To define the instrument more formally, let $N_2^{i,t}$ be the number of lenders assessed (equiv-

[2] `http://www.philadelphiafed.org/bank-resources/publications/consumer-compliance-outlook/2014/first-quarter/understanding-CRAs-assessment-area-requirements.cfm`, accessed 9/18/2014

[3] Author's calculations, from the FFIEC Raw CRA Data File

alently, the number of assessment areas that overlap) in tract i in year t. In the terminology of the model in Section 2, this is the number of type 2 banks competing in tract i in year t. For each year 2003 MSA (and the non-MSA portion of each state), m_{2003}, take the mean number of lenders assessed per tract in m_{2003}. That is,

$$\bar{N}_2^{m,2003} = \frac{1}{||m||} \sum_{j \in m_{2003}} N_2^{j,2003} \tag{8}$$

where $||m||$ is the number of tracts in m in 2003. Let $Z_{i,t} = \bar{N}_2^{m,2003}$, where $i_t \in m$. $Z_{i,t}$ is the average number of type 2 banks per tract in 2003, for whichever MSA or non-MSA portion of the state tract i is in in year t, and is used to instrument for $N_2^{i,t}$. The value of the instrument for any particular MSA is fixed at its 2003 level, so variation across time derives entirely from tracts switching into new MSAs. No time series variation in the actual concentration of lenders is used, so any changes in economic conditions should not contaminate the instrument. The idea is that for tracts newly assigned to an MSA, the more densely overlapping assessment areas are concentrated in that MSA, the more new assessment areas the tract is likely to be included in.

Validity requires that the instrument, $Z_{i,t}$, be uncorrelated with unobserved determinants of lending. Because lending to non-LMI borrowers does not receive the same treatment under the CRA as LMI lending does, they can be used as a control group to absorb any tract-by-year specific shocks that may be correlated with the change in (instrumented) N_2. Tract-by-income group (LMI vs non-LMI) fixed effects can be used to absorb any permanent differences between LMI and non-LMI lending that may be correlated with concentration of assessed banks. The identifying assumption is that changes in the relative number of loans going to LMI versus non-LMI borrowers in a particular tract are correlated with changes in the instrumented number of assessed banks in that tract only through the effect of the CRA. This assumption is validated by the pre-trends analysis in Section 5, which shows that the relative growth of LMI versus non-LMI lending was uncorrelated with the instrument before

2004 when the actual change in assessment area boundaries occurred.

While there is not an explicit formula for assigning CRA ratings, under the "lending test" examiners typically look at a few common lending metrics. These are the proportion of loans to LMI borrowers and to borrowers living in LMI tracts, for all tracts in the banks assessment area. Additionally, examiners look at the ratio of total lending to borrowers inside versus outside the assessment area. All else equal, higher levels of all these metrics (in particular, relative to comparable lenders in the same area) lead to higher performance ratings. When a tract is added to a bank's assessment area, we might therefore expect to see an increase in all lending, but particularly to LMI borrowers or in LMI tracts. Outcome variables are defined at the tract level as the log of home purchase and refinance loans, broken down by borrower income, y, (LMI and non-LMI). Because LMI is defined relative to MSA MFI, the income threshold that qualifies a borrower as LMI changes for the treatment tracts as they are added to an MSA, and could induce a spurious change in the measured number of loans to LMI borrowers. I therefore define LMI borrowers as those whose reported income falls below 80 percent of MSA MFI taken from 2004, so the criteria for inclusion as an LMI borrower is constant across years for a given tract. I model the tract-level quantity of lending, Q, in tract i at time t to borrowers of income group y, as follows:

$$\ln Q_{i,t}^{y} = \beta_y \ln N_2^{i,t} + \delta_{i,t} + \theta_{i,y} + \phi_{y,t} + \epsilon_{i,y,t} \tag{9}$$

The parameter β_y is the effect of additional assessed banks of type 2 on lending to borrowers of income y. I assume that $\beta_y = 0$ for non-LMI borrowers. The estimator will therefore miss any effect the CRA may have on lending to non-LMI borrowers, e.g. to those in LMI tracts. This specification controls for a tract-by-year fixed effect, δ, a tract-by-income fixed effect, θ, and an income-by-year fixed effect, ϕ. Differencing across income groups within tract and year, equation 9 becomes

$$\Delta_y \ln Q_{i,t} = \beta \ln N_2^{i,t} + \Theta_i + \Phi_t + \varepsilon_{i,t} \tag{10}$$

The main parameter of interest, β, measures the elasticity of LMI lending to the number of assessed banks per tract. The set of fixed effects simplifies to a tract specific fixed effect, Θ, and a year fixed effect, Φ.

I instrument for $N_2^{i,t}$ using $Z_{i,t}$. Intuitively, the MSA redefinitions changed the number of lenders with a CRA incentive to do business in particular tracts. Validity requires that the average number of banks and thrifts assessed per tract in an MSA does not predict short term secular changes in lending to LMI households in newly added tracts relative to their non-LMI neighbors in the same tract. Restricting the estimation window to two time periods, one pre- and one post-redefinition, the fixed-effects estimator is equivalent to a first differences estimator, where equation 10 becomes:

$$\Delta_{y,t} \ln Q_i = \beta \Delta_t \ln N_2^i + \gamma + \mu_i \tag{11}$$

The instrument for ΔN_2^i would then be ΔZ_i.

4 Data

Data for this project comes from four sources. The Home Mortgage Disclosure Act (HMDA) directs covered institutions to report every mortgage application they receive, along with the action taken (originated or denied, e.g.), the amount and purpose of the loan, the census tract of the property, the applicant's income, and other information. HMDA reporting institutions originate the vast majority of mortgage loans in the U.S., but lenders in non-MSA areas are less likely to be required to report. To eliminate selected censoring caused by the redrawing of MSA boundaries, I use only loan data from institutions that reported in both 2003 and 2004.

The other source of loan data is loan servicing records from McDash analytics. This data source is drawn from the portfolios of the top residential mortgage servicers in the US, covering approximately two thirds of the market. Underwriting criteria that are predictive

of borrower risk are collected, including FICO credit score, loan to value (LTV) ratio, debt service payments to income (DTI) ratio, and indicators for low or no documentation of borrower income. Borrower with subprime FICO scores, defined as those below 620, are particularly at risk for default. Also available are characteristics of the loan itself that may lead to greater risk of default, such as an initial interest-only period or an option ARM feature. Finally, the servicing records track the loan over time and record when the borrower misses scheduled payments or the property goes into foreclosure, REO or is otherwise involuntarily liquidated. I measure loan performance as an indicator for whether a borrower had ever been delinquent (30 days, 60 days, or 90 or more days) prior to the end of 2008, as delinquencies in this period were part of the catalyst for the financial crisis. To get borrower income and tract matched to this data, we use a merge between the McDash and HMDA records based on loan amount, purpose, type, origination date, occupancy type and a Zip code to census tract crosswalk.

Lender-level data on CRA assessment areas comes from the Federal Financial Institutions Examination Council CRA Raw Data File. Before 2005, banks and thrifts with over $250 million in assets reported, annually, the list of census tracts in which they were assessed and the amount of small business lending conducted there. There were 2,101 and 1,995 such reporting institutions in 2003 and 2004 respectively. After 2005, the reporting threshold increased to $1 billion in assets, indexed to the CPI. Finally, MSA MFI is sourced from the Department of Housing and Urban Development.

There are 2,185 tracts in that were added to an MSA by the redefinitions in 2004. 27 tracts were dropped due to having zero loans or zero assessed banks, as the estimator uses a log specification. Summary statistics for the years 2002-2005 are provided in Table 1. LMI lending has somewhat lower volumes than to non-LMI borrowers, and LMI loans appear riskier and more likely to have gone delinquent.

5 Results

This section presents estimates of the effect of the CRA on lending and loan performance. As mentioned previously, lenders who were assessed MSA-wide in 2003 had about a 30% probability of adding a tract to their assessment areas if the tract was newly incorporated into the MSA in 2004. To confirm the instrument is relevant, I show results from the first stage in Figure 1, regressing (in logs) the number of banks assessed in a tract, $N_2^{i,t}$, on the 2003 average number of assessed banks per tract in the current MSA $Z_{i,t}$. First differenced results are shown, to clean out tract-specific fixed effects. The estimated coefficient on Z_i is highly statistically significant, easily passing weak instrument tests. The point estimate suggests an elasticity of about 0.5. The average value of Z in the estimation sample rose by a little over 50 percent between 2003 and 2004, suggesting the MSA redefinitions increased the number of assessed lenders per affected tract by about 25 percent—just under 1.5 additional assessed banks per tract.

5.1 Effect on Lending

Adding a tract to a lender's CRA assessment area has a direct effect on that lender's incentives to conduct business in the tract. The local effect of the CRA should be a function of the number of lenders thus assessed. I estimate equation 11 for the number of mortgage loans to LMI borrowers by 2SLS and present results in the second column of Table 2. The estimated elasticity of LMI lending to the number of banks newly assessed in a tract as a result of the MSA redefinitions is about 0.1, and statistically significant at the 5 percent level. With an average of 5.5 assessed banks per tract in the estimation sample, these results suggest incorporating a typical tract into one additional bank's assessment area would increase mortgage lending there approximately 2 percent. Results from estimating equation 11 via OLS are presented in column 1 for comparison.

Expanding the window of time over which I estimate an effect on lending, the influence

of the newly CRA-incentivized banks seems to increase. Columns 3 and 4 of Table 2 repeat the estimation of equation 11 over the 4 years 2002-2005. The elasticity of mortgage lending to the number of locally assessed lenders is 0.2 over this period. One possibile explanation is that banks could not immediately ramp up their lending activity in response to their new assessment area boundaries, taking time to adjust their staffing or advertising campaigns, for example.

5.1.1 Loan Purpose

Banks are generally credited for mortgage lending in their CRA exams without regard to the specific purpose of the loan. A bank has an equal incentive to originate a refinance loan as it does a home purchase loan under the CRA. The value of different types of loans to LMI communities and borrowers may not be the same, however. The CRA can only encourage homeownership to the extent that it leads to new purchase loans. Refinance lending may be valuable to existing homeowners, as it can lower their monthly payments when interest rates fall or let them tap equity in their homes, but necessarily serves a different population. Both kinds of lending could contribute to systematic risk as well. During the housing boom, home purchase loans became available to many subprime borrowers who would not have qualified under normal underwriting conditions, and these borrowers defaulted at extraordinary frequency in subsequent years. In addition, the mid-2000's saw a wave of equity extraction refinancings which also performed poorly.

In the second and third rows of Table 2 I estimate the effect of additional CRA-assessed banks on home purchase and refinance lending separately. The point estimates are all positive, but only clear traditional statistical significance thresholds for home purchase loans in the broader, 2002-2005 time window. Firm conclusions are difficult, given the imprecision of the estimates, but the point estimates suggest both refinance and home purchase lending were encouraged by the CRA.

5.1.2 Type of Lender

Even if the CRA encouraged more lending from banks, the effect on the net supply of loans could be diminished if bank lending crowds out lending by non-banks, which are not subject to the CRA. For this reason I include all lending, regardless of originator, in the baseline specification to determine the effects of the act on the total volume of lending. We can derive useful information by looking at different lender types individually, however.

In addition to originating the loans themselves, banks can receive credit in their CRA performance examinations by buying mortgages on the secondary market. If the CRA stimulates more demand for LMI loans in this market, non-banks (i.e. independent mortgage companies and credit unions) may originate more such loans with the intent to distribute. In this section I estimate the effect of increasing the number of assessed banks in a tract on LMI lending for banks and non-banks separately.

I divide the sample up based on the type of lender. Loans originated by affiliates and subsidiaries of banks and thrifts can be included in the depository institution's CRA exam, and so these entities are grouped together in the "Bank" category, as their lending is directly covered by the CRA. "Non-banks" include credit unions and independent mortgage companies which are not affiliated with an institution subject to the CRA. Equation 11 is re-estimated on both sub-samples, and results are presented in the fourth and fifth row of Table 2.

The fourth row of Table 2 shows the estimated elasticity of LMI lending by banks to the number of assessed banks, using both the 2003-2004 and 2002-2005 windows described in Section 5.1. Bank lending is apparently responsive to the CRA, with significant effects very similar in magnitude to those shown for overall lending. In contrast, the fifth row shows the estimated effect on non-bank lending. There is no statistically significant effect, with point estimates very close to zero.

Although non-banks are not subject to the CRA, this estimation is not quite a placebo test. As mentioned above, the secondary market provides a potential channel by which the

CRA could induce more non-bank lending. That said, it would by disquieting if non-bank lending was as or more responsive to the CRA than bank lending. Finding a null effect on non-bank lending suggests that the CRA did not spur demand in the secondary market enough to boost the quantity of new originations supplied across all lender types, at least in the short term.

5.1.3 Borrower Income

As mentioned in the introduction, much of the literature on the CRA has concentrated on effects around the LMI threshold at 80% of area median family income, where regression discontinuity techniques may be used. This leaves us with little information about how the CRA influences lending to lower income borrowers and communities far from the 80% cutoff.

The approach taken in this paper can overcome this particular weakness of the regression discontinuity approach. In this section I test for differential effects by borrower income, subdividing my sample into further income categories and running the estimator separately for each one. I estimate the elasticity of lending to the number of assessed banks for borrowers with incomes between 70-80%, 50-70% and less than 50% of area median family income. The comparison group is always non-LMI borrowers in the same census tract. Results are presented in the sixth through eighth rows of Table 2

An interesting pattern emerges from these results. While the point estimates suggest positive effects of the CRA on lending to all income catergories, lending to the lowest income borrowers is most sensitive to CRA incentives. While the elasticity of lending to assessed banks is between 0.2 and 0.3 for borrowers with less than 50% of area median family income, and statistically significant at the 1 percent level, the estimated elasticity for borrowers between 70 and 80% of the area median family income is around 0.1 and statisically insignificant. These findings suggest that RD studies may be underestimating the effect of the CRA on lending, as lending to borrowers near the LMI threshold is least affected by the CRA.

5.2 Pre-trends and Effects Over Time

The instrumental variables estimates presented in this paper rely on the assumption that the instrument, Z_i, is partially correlated with the outcome variables only through the causal effect of the marginal assessed lender. If the local trends in lending to LMI borrowers over time were correlated with the number of banks newly assessed in each tract as a result of the MSA redefinitions, the instrument would be invalid and the estimator inconsistent. To test for this possible violation of the identifying assumption, I run a series of placebo tests, estimating the "effect" of the 2003-2004 increase in the number of assessed banks on growth in LMI lending in years prior to the MSA redefinitions. Finding a significant effect would suggest that the instrument is being confounded by some other unobserved variable. Finding that the pre-trends were similar across values of the instrument, in contrast, would suggest that the changes in lending observed after the 2004 redefinitions were indeed caused by the expansion of CRA assessment areas.

To see how changes in the number of assessed banks correlates with LMI lending over time, I re-estimate equation 11 for every year from 1999-2008 in sequence, using 2003 as the comparison year. Estimated elasticities of LMI mortgage lending to the number of assessed banks are plotted by year in Figure 2. For example, the 1999 data point plots the estimated effect of the increase in the number of assessed banks from 2003 to 2004 on loan growth from 1999 to 2003, while the 2006 data pooint plots the estimated effect on loan growth from 2003 to 2006. Point estimates and 95 percent confidence intervals are shown.

The increase in the number of assessed banks between 2003 and 2004 shows no statistically significant relationship with LMI loan growth up to 2003 for any choice of base year. These succesful placebo tests bolster the argument that the MSA redefinitions provide quasi-experimental variation in the number of assessed banks, as LMI lending trends prior to the redefinitions show little correlation with the eventual change in assessment areas. In contrast, an increase in the number of assessed banks is associated with increased LMI lending for years after the change. From 2004-2007, an increase in the number of assessed banks

causes a statistically significant increase in mortgage loans to LMI borrowers. In 2008, the effect dips just below the threshold of significance. The turmoil in the housing and mortgage markets around this time may have begun to overwhelm any CRA incentive to engage in LMI lending.

5.3 Effect on Performance and Risk

The evidence presented so far suggests the CRA induced more lending to LMI borrowers. Did lenders achieve this increase by lowering their underwriting standards? Critics of the act have suggested that it encouraged lenders to extend credit to borrowers who would not otherwise have qualified for a loan, increasing systemic risk. To test whether the CRA led to an increase in risky lending, I turn to the merged HMDA/McDash data which tracks loan performance and a variety of risk metrics.

If the CRA induced loans to LMI borrowers were particularly risky, then neighborhoods that had a greater CRA induced bump in lending from 2003 to 2004 should exhibit a relative decline in their risk characteristics and subsequent performance. To test for such a decline, I repurpose equation 9. At the loan level, I estimate the effect of the number of CRA assessed banks in the census tract and year the loan was originated on risk measures for LMI loans relative to their non-LMI peers. The same instrumental variables strategy as in Section 5.1 is used.

First, I test for whether CRA-induced loans were more likely to become delinquent at any point prior to the end of 2008. I use three different measures of delinquency: whether the borrower was ever 30, 60 or 90 or more days delinquent on a payment. Estimates are presented in Table 3 using originations from both the two year window 2003-2004 and the four year window 2002-2005. Standard errors are clustered at the county level. In no instance do I find a significant effect on delinquencies, and the estimated signs are not consistent across specification.

There is no evidence from these regressions that the CRA led to a higher rate of defaults,

but it is still possible lenders relaxed their underwriting standards in order to accumulate more LMI loans. Relaxed underwriting could take the form of accepting more applications with low credit scores (particularly subprime borrowers, defined as those with FICO scores below 620), high loan-to-value (LTV) ratios or high debt service payment-to-income (DTI) ratios. Banks could also accept more applications with low or no documentation of income (these so-called "liar loans" originated during the housing boom years were particularly likely to default). In addition, banks could originate more loans with risky features that were nonetheless appealing to borrowers, like option ARM and interest-only mortgages which require only very low payments in the early years of the loan, but become more burdensome later.

To test whether the CRA lead to more overall lending by encouraging risky loans in particular, I again re-estimate equation 9 using the above mentioned risk characteristics as outcome variables. The regression is run at the loan level, with standard errors again clustered at the county level. Results are presented in Table 3. Increasing the number of assessed banks in a tract has no significant effect on the risk characteristics of loans originated there for any of the measures I test. Banks must have used some method other than lowering their underwriting standards to encourage more borrowing in response to the CRA.

While I do not find any evidence that the CRA caused banks to lower their lending standards, or that it caused LMI borrowers to default at higher than expected rates, this does not mean the CRA played no role at all in increasing aggregate risks. As can be seen in Table 1, LMI households were riskier borrowers and had higher delinquency rates, on average, than non-LMI households. By increasing lending to these households, even while holding underwriting standards fixed, the pool of outstanding mortgages necessarily became somewhat riskier. By increasing the supply of mortgages, particularly home purchase loans, the CRA may also have contributed to driving up home prices.

6 Conclusion

I estimate the effect of the CRA on the supply and performance of home mortgage loans. Exploiting a shift of the geographic areas in which lenders had a CRA incentive to conduct business, I find the act substantially increased the availability of credit for home loans. I show that the CRA prompted banks to increase their lending, but not at the expense of deteriorating underwriting standards. I find no evidence of any increase in default risk.

Considering the CRA is still on the books and being enforced, it may be encouraging to supporters of the Act to find no negative effect on loan performance. Perhaps a broader takeaway is that banks will respond to a regulatory light touch. The CRA contains no explicit quotas to meet or threat of fines or lawsuits. The determination that the lender has a satisfactory record of lending is made in the context of other competitors in the same market. The punishment for failing to meet the regulator's standard is only the negative publicity of the rating and the potential for difficulties when applying for expansion. Yet this is enough to encourage a substantial increase in mortgage lending. If policy makers wish to change the lending behavior of banks, these results suggest draconian regulations may be unnecessary.

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Table 1: Summary Statistics

Unit of Observation	Variable	Borrower Income		Observations with Non-Missing Data
		LMI	Non-LMI	
Tract/Year	Purchase Loans	20.5	47.9	
		(19.7)	(64.2)	
	Refinance Loans	30.9	81.4	
		(29.4)	(89.3)	
	Assessed Banks (N)	5.74		
		(3.03)		
	MSA Average Assessed Banks (Z)	6.67		
		(4.64)		
Loan	90 Days Delinquent	0.11	0.05	314,478
		(0.32)	(0.23)	
	60 Days Delinquent	0.15	0.07	314,478
		(0.36)	(0.26)	
	30 Days Delinquent	0.26	0.17	314,478
		(0.44)	(0.37)	
	FICO Score	692.7	708.9	266,757
		(72.2)	(64.6)	
	Subprime	0.17	0.10	266,757
		(0.37)	(0.30)	
	Option ARM	0.20	0.26	52,315
		(0.40)	(0.44)	
	Loan to Value Ratio	75.3	73.7	305,539
		(20.69)	(19.5)	
	Debt to Income Ratio	36.5	31.3	145,940
		(14.2)	(14.3)	
	Low or No Documentation	0.35	0.37	169,303
		(0.48)	(0.48)	
	Interest Only	0.02	0.04	314,478
		(0.14)	(0.19)	

Note: This table presents sample means and sample standard deviations (in parenthesis) of the various data used in this paper. LMI borrowers are those with incomes below 80 percent of the median family income in their 2004 MSA.

Table 2: Elasticity of LMI Mortgage Supply to the Number of CRA Assessed Banks

			Years			
			2003-2004		2002-2005	
Borrower Income	Mortgage Purpose	Lender Type	OLS	IV	OLS	IV
$< 80\%$ AMFI	All	All	0.035	0.101*	0.081**	0.193**
			(0.027)	(0.046)	(0.03)	(0.061)
	Purchase	All	0.017	0.083	0.080	0.261**
			(0.036)	(0.057)	(0.041)	(0.086)
	Refinance	All	0.057*	0.071	0.046	0.088
			(0.027)	(0.042)	(0.029)	(0.050)
	All	Banks	0.046	0.101*	0.071*	0.169**
			(0.030)	(0.045)	(0.033)	(0.058)
	All	Non-Banks	-0.015	-0.0035	0.006	0.020
			(0.015)	(0.021)	(0.011)	(0.020)
$70\% - 80\%$ AMFI	All	All	0.059	0.072	0.065	0.122
			(0.035)	(0.051)	(0.036)	(0.062)
$50\% - 70\%$ AMFI	All	All	-0.002	0.065	0.102*	0.212**
			(0.026)	(0.045)	(0.041)	(0.081)
$< 50\%$ AMFI	All	All	0.097*	0.223**	0.117**	0.295**
			(0.038)	(0.065)	(0.043)	(0.083)

Note: This table represents tract-level estimated elasticities of LMI mortgage lending, relative to non-LMI lending, to an increase in the number of banks which include that tract in their assessment area using a first-differences estimator. The instrument is the average number of banks assessed per tract, measured in 2003, for the MSA or non-MSA portion of the state the tract is included in. AMFI is the median family income of the MSA the tract is included in in 2004. Banks refers to lending by banks, thrifts, and any of their affiliates or subsidiaries. Non-Banks refers to independent mortgage companies and credit unions, whose lending is not subject to the CRA. Standard errors, shown in parenthesis, are clustered at the county level.

* $p \leq .05$

** $p \leq .01$

Table 3: Effect of the Number of CRA Assessed Banks on LMI Loan Riskiness and Performance

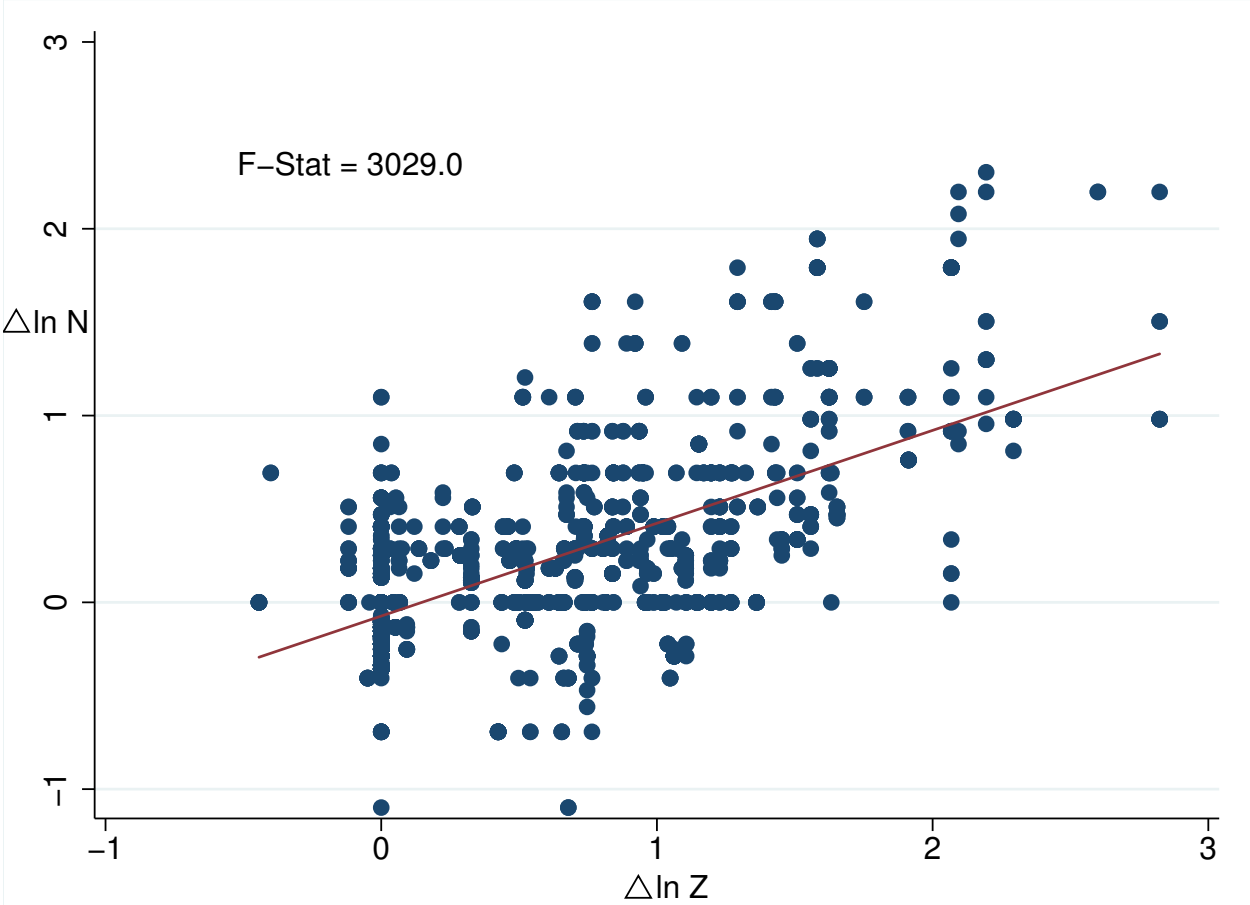
	Years			
	2003-2004		2002-2005	
Outcome	Estimate	N	Estimate	N
90 Days Delinquent	-0.001	174,140	0.013	314,478
	(0.022)		(0.032)	
60 Days Delinquent	-0.005	174,140	0.008	314,478
	(0.026)		(0.035)	
30 Days Delinquent	0.001	174,140	0.010	314,478
	(0.032)		(0.039)	
FICO Score	0.019	149,340	-2.917	266,757
	(6.301)		(6.603)	
Subprime	0.028	149,340	0.041	266,757
	(0.024)		(0.026)	
Option ARM	-0.025	27,258	-0.018	52,315
	(0.061)		(0.061)	
Loan to Value Ratio	-2.416	169,155	-2.305	305,539
	(2.038)		(2.307)	
Debt to Income Ratio	-0.619	80,444	-0.037	145,940
	(0.136)		(1.499)	
Low or No Documentation	0.002	68,039	-0.022	169,303
	(0.052)		(0.053)	
Interest Only	0.022	174,140	0.011	314,478
	(0.016)		(0.064)	

Note: This table represents loan-level estimated effects of the log number of banks that include the tract in which the loan was originated in their assessment area on risk and performance of LMI mortgage loans, relative to non-LMI loans. The instrument is the average number of banks assessed per tract, measured in 2003, for the MSA or non-MSA portion of the state the tract is included in. Standard errors, shown in parenthesis, are clustered at the county level.

* $p \leq .05$

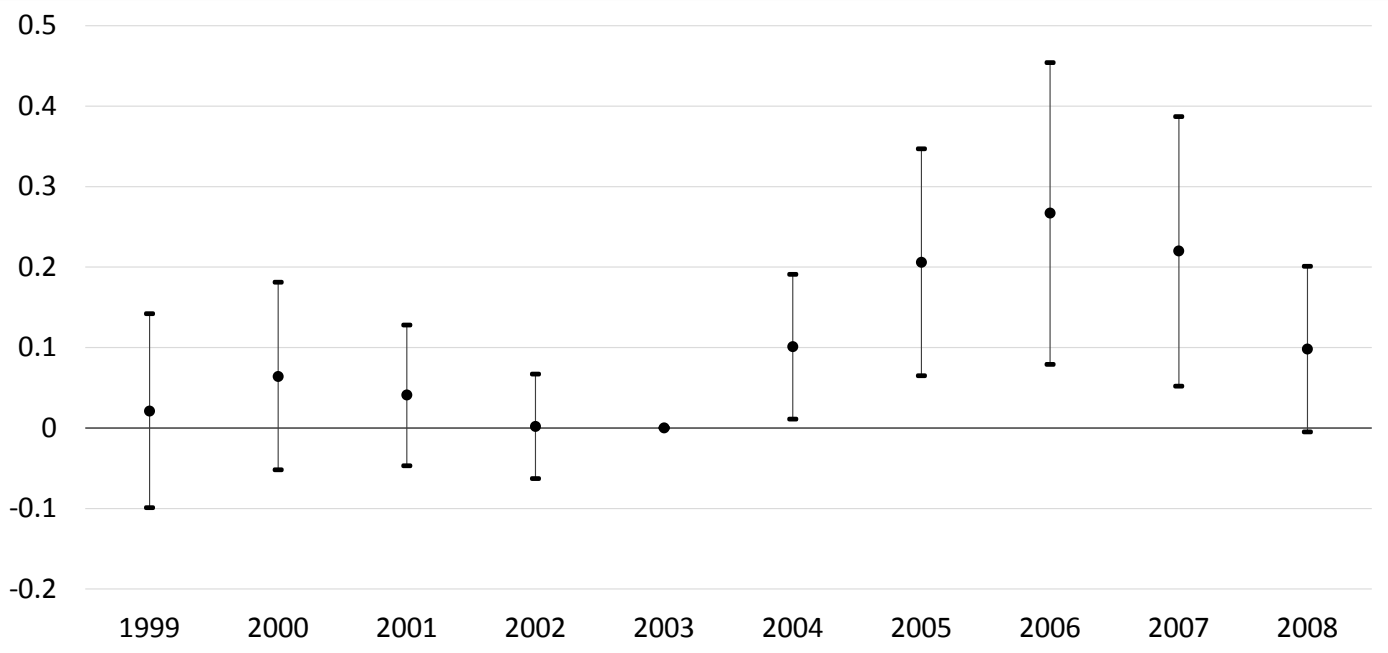
** $p \leq .01$

Figure 1: First Stage - Regression of Change in Number of CRA Assessed Banks on Change in Average Number of Assessed Banks in Current MSA



Note: Tract level data plotted as circles. The vertical axis depicts the growth from 2003 to 2004 in the log number of banks that include each tract in their assessment areas. The horizontal axis depicts the instrument, $\Delta \ln Z$, defined as the change from 2003 to 2004 in the log average number of banks per tract, measured in 2003, for the MSA or non-MSA portion of the state the tract is included in. The red line displays the OLS fit of the series.

Figure 2: Elasticity of LMI Loan Growth to the Number of CRA Assessed Banks, Relative to 2003



Note: Figure depicts tract-level estimated elasticities of LMI mortgage lending, relative to non-LMI lending, to an increase from 2003 to 2004 in the number of banks which include that tract in their assessment area over time. The horizontal axis plots the base year, while the comparison year is always 2003. Estimates in years prior to 2003 function as placebo tests, as the 2003-2004 increase in the number of CRA assessed banks should not be correlated with prior LMI loan growth if the instrument is valid. Estimates in 2004 and after show the persistent effect of increasing the number of CRA assessed banks on LMI lending. Circles represent point estimates, while the bars show 95 percent confidence intervals. Standard errors clustered at the county level.