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Mortgage Supply and the US Housing Boom: The Role of the Community Reinvestment Act

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Abstract

This paper studies the role of the Community Reinvestment Act (CRA) in the US housing boom-bust cycle. I find that the enhancement in CRA enforcement in 1998 increased the growth rate of mortgage lending by CRA-regulated banks to CRA-eligible census tracts. I show that during the boom period house price growth was higher in the eligible census tracts because of the shift in mortgage supply of regulated banks. Consequently, these census tracts experienced a worse housing bust. I find that CRA-induced mortgages went to borrowers with lower FICO scores and encountered more frequent delinquencies.

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Between 1998 and 2006 house prices in the US rose by about 90% in real terms and then fell by about a third until 2010. These house price developments helped fuel enormous financial instability, large scale output losses in many countries around the world, and the collapse or near collapse of numerous financial institutions. Most academic research has focused on the role of credit market conditions in this boom-bust cycle: Short-term interest rates that were too low for too long (Maddaloni and Peydró, 2011; Ioannidou, Ongena, and Peydró, 2015) together with or caused by a global saving glut (Bernanke, 2005; Himmelberg, Mayer, and Sinai, 2005; Caballero, Farhi, and Gourinchas, 2008), branching deregulation of the banking industry (Favara and Imbs, 2015) or securitization wave (Mian and Sufi, 2009) resulted in lax credit conditions that may have boosted credit supply and housing demand and consequently the sharp rise in house prices in the US.

In this paper, I examine the role of the US government policy in encouraging home ownership as an additional driver of the increase in mortgage supply and house prices from 1998 to 2006. In particular, I focus on the amendments introduced to the Community Reinvestment Act (hereafter, CRA) in 1995. The CRA was originally enacted in 1977 to address potential discriminatory credit practices against households in low- and moderate-income neighbourhoods (a practice called *redlining*). However, this act was not fully enforceable in the first two decades after its passing. The lack of objective and measurable criteria for assessing banks' compliance, and credible sanctions against noncompliant banks rendered the act ineffective in its original form. It was only in the 1990s that the CRA started to be credibly enforced. A major amendment was introduced to the act in 1995 with the purpose of boosting compliance rates of financial institutions by designing objective and formal criteria to assess banks' CRA performance. Moreover, for the first time noncompliance became punishable in that the regulator could decline violating banks' applications for any type of expansion or merger. The main purpose of this paper is to document the contribution of this enhancement in the CRA enforcement to the recent boom-bust cycle in the US housing market.

The identification strategy of this paper rests on three important institutional features of the CRA. First, the amendment that was introduced in 1995 and came fully into effect

in 1998 provides an exogenous variation over time. Second, the CRA designates those census tracts with a median family income less than 80% of the median family income in their respective metropolitan statistical area (MSA) as *CRA-eligible*. Hence, whether in a given census tract the CRA requirements apply depends not only on the income level of the census tract itself but additionally on the income level of the corresponding MSA. Hence, census tracts with similar median family income may be classified as CRA-eligible or ineligible, depending on the median family income of the MSA they are located in. This allows me to compare census tracts with similar median family income in different MSAs in the same state and further restricting the analysis to observations around the 80% threshold. Note also that CRA-eligibility is explicitly defined based on an observable characteristic, i.e., relative income. Hence, it eliminates concerns about biases arising from selection on unobservable characteristics. Third, not all financial institutions are subject to the CRA. Hence, there exist three exogenous variations for identification that allow for comparison of mortgage origination of CRA-regulated institutions with non-regulated institutions in otherwise-similar CRA-eligible and ineligible census tracts, before and after 1998.

The main findings of the paper are as follows. First, I show that CRA-regulated banks, unlike other financial institutions, increased their mortgage supply to CRA-eligible census tracts across the income distribution. Second, I estimate the causal effect of mortgage supply on house prices. Consistent with this finding, I show that CRA-eligible census tracts experienced a higher house price growth during the boom because of the shift in mortgage supply by CRA-regulated banks. I also find that the collapse of house prices from 2007 to 2009 was more severe in CRA-eligible census tracts. Finally, I document that CRA-induced mortgages were slightly riskier ex-ante but experienced considerably more frequent delinquencies ex-post.

Figure 1 presents the first result of the paper. It shows that after 1998, when CRA-enforcement was strengthened, regulated banks accelerated their lending to CRA-eligible census tracts while their mortgage origination in non-CRA census tracts continued its pre-1998 trend. Figure 2, on the other hand, presents the results of the same exercise but

for mortgage originations of institutions that are not subject to the CRA and shows no difference between the growth rate of mortgages for eligible and ineligible census tracts neither before nor after 1998. Formally, in a difference-in-differences matching estimation, I find that the annual percentage growth of mortgage lending by CRA-regulated institutions in CRA-eligible census tracts from the 1993-1997 period to the 1998-2002 period increased by approximately 4.8 to 5.7 percentage points, relative to the growth in mortgages by the same institutions in a matched control group of CRA-ineligible census tracts. Furthermore, I show that the estimated effect mostly comes from adjustments at the extensive rather than the intensive margin: the growth in the number, rather than the size, of mortgages drives the largest part of difference. For mortgage originations by non-regulated institutions I find no difference in the growth rates between CRA-eligible and CRA-ineligible census tracts.

Based on this evidence, I examine whether CRA-eligible neighbourhoods experienced a higher house price appreciation and whether and by how much the increase in house prices can be linked to the positive shift in the supply of mortgages due to the CRA. Theory suggests a positive effect of mortgage supply on prices. In particular, Adelino, Schoar, and Severino (2012) argue that easier access to mortgage credit may generate higher demand for housing by increasing the number of households that are able to bid on houses. If the housing supply is not perfectly elastic, for instance due to limited developable land as in Saiz (2010), house prices will rise due to the higher demand. In addition, cheaper funds enable unconstrained buyers to bargain less hard for reductions in prices, which subsequently allows house prices to rise further.

Estimating the elasticity of house prices to mortgage supply, however, is non-trivial due to biases arising from omitted variables and reverse causality. In particular, demand effects has been shown to be important factors in building up bubbles where traders extrapolate future returns based on past returns and form expectations about the future price that further induces higher prices and higher trading volume (Barberis, Greenwood, Jin, and Shleifer, 2018). Additionally, a higher collateral value of the real estate in regions with growing prices enables otherwise borrowing constrained households to apply

for new mortgages (Kiyotaki and Moore, 1997). I use the exogenous shift in mortgage supply originated by the CRA enforcement in 1998 as an instrument to overcome such endogeneity issues and estimate the elasticity of house price growth to credit supply. I find that a one percentage point increase in annual mortgage supply growth rate generates a 0.7 percentage points rise in the annual house price growth rate. This finding supports Favara and Imbs (2015), Di Maggio and Kermani (2017) and Adelino et al. (2012) who also argue in favour of a causal link from credit to house prices.

Consistent with the established causal link from credit supply to house prices, I find that house prices grew faster between 1998 and 2006 for CRA-eligible census tracts relative to comparable tracts. Figure 3 plots house prices for CRA-eligible and ineligible census tracts separately, and for each quartile of census tract median family income. During the boom period, house prices increased faster for eligible census tracts irrespective of their absolute level of income. Also, when the housing market collapsed, the drop in house prices was more severe for eligible census tracts. These results can partially explain the findings in Gropp, Krainer, and Laderman (forthcoming) as presented in Figure 4. House price appreciation prior to the crisis and its subsequent depreciation during the crisis were substantially heterogeneous. neighbourhoods with the highest rise in prices during the boom period were the ones that subsequently experienced sharper declines during the bust period. Both of these observations are consistent with the credit-induced boom-bust cycle to which the CRA contributed as I document in this paper.

Finally, the practice of redlining is perhaps best understood as a form of statistical discrimination (Phelps, 1972; Arrow, 1973), based on borrowers' neighbourhoods, which is an optimal risk management policy from the perspective of the banks. The CRA in effect undermined this method of borrower screening and might have resulted in CRA-regulated banks originating more risky mortgages. Consistent with this view, I find that mortgages originated by CRA-regulated banks in CRA-eligible census tracts went to borrowers with approximately 1.7 points lower FICO scores. Banks seem to have compensated for this

risk by charging higher interest rates.[1] Finally, ex-post, the likelihood that CRA-induced mortgages encountered delinquency was about 7.3 percentage points higher.

The CRA, as it was implemented in the late 1990s and early 2000s, was a welfare-decreasing policy considering that it led to significant shifts in the volume and riskiness of the mortgage market and a more severe crash in the housing market. However, a more understated aspect of any credit-induced boom in the housing market is its distortionary effects on the real economy. For instance, Chakraborty, Goldstein, and MacKinlay (2018) argue that house price appreciations crowd out commercial and industrial loans as they make mortgage markets relatively more attractive for banks. In the case of the CRA this crowding-out effect might have also happened for the sake of compliance. Furthermore, Laeven and Popov (2016) show that the US real estate boom had asymmetric effects on skill formation whereby returns on unskilled labour went up due to increased demand for construction and retail services, hence reducing investments in schooling.

1. Literature

My paper contributes to the broader literature on the underlying reasons behind the rise in real estate prices in the early 2000s. Shiller (2005) argues that the boom in the housing market was more related to behavioural biases than to fundamentals and attributes the boom to *mass psychology*. On the other hand, however, there is a significant literature that emphasizes the role of the credit markets. Most importantly, Himmelberg et al. (2005) suggest that the rise in prices was due to the very low long-term interest rates coupled with increased income growth at a time when house prices were historically low. However, in a recent paper, Favilukis, Ludvigson, and Nieuwerburgh (2017) show that the relaxation of credit constraints, as opposed to the low interest rates, drives the boom in house prices. Mayer and Sinai (2009) argue that lending market efficiency directly affected house prices through lower origination costs for higher property prices and also created a greater use of subprime mortgage. Laxer credit standards might have been

[1] These two results together are consistent with the findings in Canner, Laderman, Lehnert, and Passmore (2002) that CRA-regulated institutions did not carry lower spreads on their CRA mortgages, controlling for mortgage risk.

facilitated by the agency problems associated with the rise in securitization markets, as shown in Keys, Mukherjee, Seru, and Vig (2009) and Keys, Mukherjee, Seru, and Vig (2010), among others. My paper adds to this strand of literature by studying CRA as an additional factor contributing to the rise in size and riskiness of the mortgage market. CRA may have been another reason why banks started to employ laxer screening practices in the late 1990s, and eliminated some of the credit constraints in the mortgage market (Favilukis et al., 2017). This would in turn, through competition channels, urge other financial institutions that were not directly regulated under the CRA to engage in riskier lending to preserve their market shares.[2]

My paper is also related to the debate on the exposure of different income groups to the boom in mortgage and housing markets in the early 2000s. Specifically, Adelino, Schoar, and Severino (2016) find that mortgage growth increased significantly for all income groups and thus emphasize the role of higher demand for mortgages, rather than supply shocks, to be responsible for the rise in pre-crisis housing markets. On the other hand, Mian and Sufi (2009) attribute the mortgage boom to subprime lending and to low income neighbourhoods and argue that it was driven mainly by the securitization wave. My results contribute to this debate in two ways: first, I document a distinct supply shock that affected both the mortgage and the housing markets in this period. Second, I show that although mortgage origination and house prices expanded for each income quartile, within each quartile CRA-eligible neighbourhoods experienced higher mortgage and house price booms. This observation relates to the findings in Mian and Sufi (2009) in that within-county analyses may be confounded by CRA effects and hence bias the results towards concluding that it was the lower income groups who were responsible for the excessive growth in the mortgage market. As I will show, CRA-eligibility is not based on absolute but rather relative income, and therefore many middle-income households also qualified for CRA mortgages. An analysis in which one fixes the county and compares

[2]In fact the then governor of the Federal Reserve System explains the competition effects of the CRA as follows: *"[...] CRA also has stimulated competition for loans and banking services in low- and moderate-income communities, leading many institutions on a continuing search for techniques to help better understand and mitigate consumer lending risks."*. For the complete speech see http://www.federalreserve.gov/Boarddocs/Speeches/1998/19980512.htm.

low- versus high-income ZIP codes within one county is permeated with the effects of the CRA on the mortgage market. Therefore, my results propose CRA as an additional channel and highlight the importance of CRA loans that were originated not because of securitization but for the sake of compliance with government regulations.

Finally, this paper is related to a number of papers that study whether or not the CRA incentivized banks to generate more and/or riskier loans. My results are consistent with Demyanyk and Van Hemert (2011) and Agarwal, Benmelech, Bergman, and Seru (2012) who find more and riskier lending caused by the CRA. There exists, however, a number of studies with contrasting findings. While Gabriel and Rosenthal (2009) find no impact of the CRA on the overall volume of mortgage lending by the regulated banks, Bhutta (2011) shows that at least in larger MSAs CRA induced higher mortgage activity. Ringo (2015) finds that CRA increases refinancing activity, even though lenders do not receive CRA credit for refinancing mortgages. Ringo also shows that CRA-induced mortgages have lower probability of default while Avery and Brevoort (2014) does not find evidence in favour of riskier lending due to the CRA. Some of the studies mentioned above use a regression discontinuity (RD) design in which they compare mortgage activities of banks in census tracts just below and just above the 80% threshold. This approach generates a *local* estimation of the desired effect; finding no result at the immediate bound around the cutoff does not necessarily imply that the effect is insignificant further away from the threshold too. Moreover, if for any reason this cutoff rule is not exact and sharp, then it is not surprising that the RD estimations will show no difference in outcomes around the threshold. Therefore, the identification strategy of this paper is designed such that it finds consistent results for CRA-induced mortgage lending both around the threshold and elsewhere.

2. Institutional Setting

The Community Reinvestment Act of 1977 (12 U.S.C. 2901), implemented by Regulation BB (12 CFR 228), was enacted by the Congress with the purpose of enforcing

depository institutions to satisfy the credit needs of their local community in which they were chartered and were acquiring deposits. CRA was a reaction to concerns regarding the geographical mismatch between banks' deposit-taking and lending activity. This concern applied particularly to disadvantaged areas, where consumers would deposit their savings in the local banks, but due to *redlining* practices would not benefit from their local bank's credits. Redlining can be defined as the refusal of a bank to extend credit to a customer solely due to the customer's place of residence, no matter whether she is creditworthy or not. Therefore, CRA explicitly encourages banks to provide loans to low- and moderate-income neighbourhoods, while ensuring their safety and soundness.

Banking institutions whose deposits are insured by the Federal Deposit Insurance Corporation (FDIC) need to comply with the CRA. These are national banks, savings associations, and state-chartered commercial and savings banks. Federal financial institution regulators, i.e. The Office of the Comptroller of the Currency (OCC); the Board of Governors of the Federal Reserve System (FRB) and the Federal Deposit Insurance Corporation (FDIC), are responsible for the assessment of each bank's CRA performance. On the other hand, CRA does not apply to credit unions and independent mortgage companies. Credit unions are supervised by the National Credit Union Association (NCUA) and independent mortgage companies and non-bank entities exempt from the CRA are supervised by the Consumer Financial Protection Bureau.

In the early years of the CRA, compliance was measured through each bank's self-reported *CRA Statement*. The CRA statements had to be publicly available and included a delineation of the area that comprised the institutions community, and a list of principal types of credit that the institution is prepared to extend to its community. It was only in 1989 and 1990 when the supervisory agencies started examining the CRA statements, and conducted a four-tier grading system (i.e., outstanding, satisfactory, needs to improve, or substantial noncompliance). The grading was based on five areas of activity: (i) determining community credit needs; (ii) marketing of the credit offered; (iii) geographic distribution and record of office locations; (iv) discrimination; (v) community development (Overby (1995)).

At the time, there were two crucial issues with regards to compliance to and enforcement of the CRA. First, the grading system originated too many *satisfactory* cases. In fact, congress provided little specific guidance in the act as to what was satisfactory or unsatisfactory performance with regards to community reinvestment. Second, although CRA performance had to be *taken into account* when a bank applied for expansion[3], banks were able to acquire the supervisors' consent in almost all cases.

The problems mentioned above resulted in a comprehensive revision of the CRA, which was eventually approved in late April of 1995. The new regime became effective in July 1997 for small banks (less than $250 million) and in July 1998 for large banks (Agarwal et al. (2012)). Under the new guidelines the prior subjective and *efforts-based* criteria for assessing whether an institution is meeting community credit needs was abandoned and replaced by a more quantitative evaluation procedure designed to measure actual *results* in meeting the credit needs of the institution's assessment area (Overby (1995)). The new guideline defines three tests; for each a bank receives a numerical rating and ultimately its overall CRA rating: lending, investment, and service tests.

The *lending test* measures an institution's home mortgage lending, small business and small farm loans, community development lending and in some cases, consumer loans (only if the main business of the bank is consumer loans). The *investment test* similarly measures each bank's realized community development investments. Finally, the *service test* is focused on banks' provision of retail-banking services and the extent and innovativeness of its community development services. Each test is then given a score based on a grading scale as in Table I and the final rating is calculated based on bank's performance in each test. The lending test is the most important part of the overall CRA rating, for at least three reasons. First, as we see in Table I, the lending test has the highest weight among the three tests.[4] Second, banks in fact are not eligible to receive

[3]These applications may be (1) applications for a national bank or federal savings and loan charter; (2) applications for deposit insurance for a newly chartered state bank, savings and loan, or similar institution; (3) applications to establish a domestic branch; (4) applications to relocate a home office or a branch office; (5) applications for mergers, consolidations, asset acquisitions, or liability assumptions that otherwise require regulatory approval; and (6) applications to acquire shares in, or assets of, a regulated institution that otherwise require regulatory approval.Overby (1995)

[4]This grading scale only applies to large banks, i.e., banks bigger than $250 million in assets. For small banks the rules are more lenient.

an *outstanding* grade on any of the other two tests unless they score outstanding on their lending test. Third, institutions must also earn at least a *low satisfactory* on lending to receive a *satisfactory* score overall.

Figure 5 shows the annual frequency of each CRA rating as a share of total number of CRA examinations from 1990 onward. Consistent with the new enforcement mechanism introduced in mid-1990s, we observe a significant drop in the share of banks receiving an outstanding rating. In fact, *outstanding* rating is the only rating that experiences a sharp decline in this period. On the other hand, there is an equal surge in the share of banks with a *satisfactory* rating. These two observations jointly suggest that in the mid 1990s a large share of examined banks were *downgraded* from outstanding to satisfactory. This is a strong evidence of enhanced enforcement with significant signalling effect about the regulators' stance on the CRA. We also observe bumps in the share of *needs to improve* and especially *substantial non-compliance*, which again suggest tougher enforcement.

Another significant modification in 1995 amendments to the CRA is the replacement of the previously used concept of *communities* with *assessment areas*. CRA assessment areas are the areas in which an institution operates its branches and deposit-taking ATMs and any surrounding areas in which it originates or purchases a substantial portion of its loans. The CRA tests emphasize specifically bank's CRA activities within the low- and moderate-income neighbourhoods within a bank's assessment area. Low- and moderate-income neighbourhoods are census tracts with median income less than 80% of their respective MSAs' median income.

Finally, a set of sanctions can come into effect against the non-compliant banks. If a bank scores poorly in its CRA assessments, the regulators may order that a bank's interstate branch(es) be closed, will not permit the bank to open a new branch, will issue a notice to the bank or will conduct a hearing. Moreover, applications for mergers and acquisitions could be stalled if communities believed that the banks involved had not lived up to their responsibilities under the CRA.[5]

[5]A famous example is the Citicorp's commitment to extending CRA loans at the time it planned to acquire Travelers in 1998: http://www.nytimes.com/1998/05/05/business/communities-to-receive-115-billion-citigroup-says.html?mcubz=0.

3. Identification Strategy

The identification strategy of this paper relies on three exogenous variations stemming from the timing and the design of the CRA: First, I make use of the changes in enforcement that came into effect in 1998 and compare the desired outcome variables before and after 1998. Second, the act designates CRA-eligible and ineligible census tracts, which provide for a treatment and control group of census tracts. Finally, only some of the financial institutions are subject to the CRA regulations, which creates a third variation to be exploited in this paper. My identification strategy relies on these three pillars to isolate the effect of increased enforcement of the CRA on banks' supply of mortgages. The hypothetical experiment that one would ideally like to run is to find two census tracts with the same median family income, where one is located in an MSA with a slightly higher median family income and hence is a CRA-eligible census tract while the other one is not. To clarify this experiment, let us look at the diagram presented in Figure 6. The two big black boxes represent two different MSAs, in the same state, and each smaller box represents a census tract. The height of the boxes proxy median income at that region. Therefore, MSA 1 has a higher median family income relative to MSA 2. Therefore, the green census tract will be coded as CRA-eligible while the census tract with the exact similar median income located in MSA 2 will not.

Therefore, identification strategy in this paper relies on the local relativity of the 80% rule in determining whether a census tract is or is not eligible for CRA mortgages. I take advantage of this arbitrary rule and compare similar-income census tracts within the same state and with relative incomes around the 80% threshold. I compare mortgage originations, in terms of total volume, number of originations, and the size of the average mortgage, as weel as, mortgage application rejection rate, and house price growth before and after 1998 between each CRA-eligible census tract and a matched ineligible census tract from another MSA but within the same state. Finally, I run this exercise separately for both types of mortgage providers, i.e., CRA-regulated institutions and non-regulated institutions.

3.1. Price of Housing

Better access to a mortgage can generate higher demand for housing. If housing supply is not perfectly elastic, for example due to local geography as in Saiz (2010), house prices are expected to rise. In addition, cheaper funding allows unconstrained buyers to bargain less hard for reductions in prices, again resulting in house price increases (Adelino et al. (2012)). However, it has been a challenge to estimate an unbiased estimate of the elasticity of house prices to mortgage supply for multiple reasons. First, equilibrium mortgage and house prices are determined simultaneously. Second, higher expected house prices increase borrower's collateral value and hence, their borrowing capacity. Therefore, it is difficult to disentangle the supply effects of mortgage on house prices from the demand effects due to higher expected growth opportunities. In this paper, I use CRA regulation as an instrumental variable for mortgage supply. CRA-eligible census tracts, starting from 1998, were plausibly exposed to a shift in mortgage supply that was unrelated to the actual or expected house prices. I use this exogenous variation in exposure to the CRA regulation as an instrument to estimate the elasticity of house price growth to credit supply. To be a valid instrument, CRA needs to satisfy two conditions. First, it has to be correlated with mortgage supply and second, be unrelated to house prices through any other channel except mortgage supply after controlling for the observables, i.e. exclusion restriction assumption. The first condition is testable. In fact, the first part of the paper is intended to test whether or not the CRA affected mortgage supply to CRA-eligible census tracts. Second, the exclusion restriction, despite being untestable, warrants some discussion. Note that I can control for the observable differences among census tracts. These observables are median family income, initial house prices (as a measure of collateral value), population, and elasticity of housing supply as suggested by Saiz (2010). Therefore, the exclusion restriction assumption is that, after controlling for the observable characteristics, CRA status of a census tract affects house prices only through increased mortgage supply by CRA-regulated institutions to the CRA-eligible tracts. Hence, unobservable characteristics, like expected house prices, which drive demand for housing in each tracts are assumed to be unrelated to the CRA regulations. To verify this

assumption, I run a placebo test, using non-regulated institutions mortgage origination, that confirms that omitted variables, such as demand, in the first-stage IV regression do not correlate with the dummy variable *CRA*.

4. Data

I use the home mortgage disclosure act (HMDA) data of mortgage originations from 1993 until 2002. HMDA is at the loan application level and includes information on the applicant, the issuing institution and the loan itself. For example, it records the applicants' income, sex and race, the institutions' type, and the loans' purpose, amount, status, and more. I restrict my sample to the loans originated for the purpose of home purchase. Next, I distinguish between the issuing institutions by their relation to the Federal Financial Institutions Examination Council (FFIEC). As discussed earlier, only those institutions that are supervised by the OCC, FRS, FDIC and OTS are subject to the CRA regulations. Therefore, I aggregate the loans for the two types of regulated and non-regulated mortgage providers up to the census tract level in each year.[6] I generate measures of the total amount, total number, and the average size of mortgages originated by the two types of institutions in each census tract. Furthermore, I calculate annual mortgage application rejection rate at the census tract level by dividing the number of denied applications (coded as 3 in the entry *type of action*) by the total number of applications, separately for regulated and non-regulated institutions.

According to the CRA, census tracts with a median family income of less than 80% of the median family income of their respective MSA are considered to be low- and moderate-income tracts and are classified as CRA-eligible. I use median family income at the census tract and MSA level from the decennial data of census 2000 to find the CRA eligible tracts based on this criteria. My final census tract-level sample contains information on the amount, number and size of mortgages originated by CRA-regulated and non-regulated

[6]Census tract definitions change with every decennial census. Moreover, HMDA updates its definition of census tracts after each new decennial census is out. For example, HMDA uses census 1990 definitions until 2002. Therefore, in the mortgage analysis section I restrict the sample to 1993 until 2002 to abstract from changes in the definition of census tracts. This then leads to two five-years periods of [1993,1997] and [1998,2002] in my difference-in-differences analysis.

institutions and census-tracts' and MSAs' median family income. I restrict the sample to the common support of the income distribution. I.e., I drop CRA-eligible census tracts that could not be CRA-ineligible in any of the MSAs (the poorest census tracts), and CRA-ineligible census tracts that could not be CRA-eligible in any of the MSAs (the richest census tracts). Therefore, my final census tract-level sample contains 362,314 tract-year observations of 13,289 unique CRA-eligible and 24,852 ineligible census tracts.

House price data at the census tract level are collected from Federal Housing Finance Agency (FHFA). FHFA reports single-family house price index that is a weighted, repeat-sales index, and measures average price changes in repeat sales or refinancings on the same properties. The data provides 149,851 tract-year observations of house prices for 3,915 unique CRA-eligible and 14,362 ineligible census tracts. This is about 30% of the total number of census tracts in the US. I use the annual change in the price index as the measure of house price growth. I also define a new variable, *Log(initial price)*, which is the natural logarithm of the index at the beginning of my period of study, i.e., 1993. Finally, I collect the number of housing units and the vacancy rates at the census tract level from the 1990 census. The summary statistics of this sample are presented in Table II.

5. The CRA and Mortgage Supply

Table II presents the summary statistics of the sample. The sample covers the period from 1993 until 2002, which is symmetric around the year 1998 in which the new CRA requirements became effective for all CRA-regulated financial institutions. Total regulated mortgages represent the total volume of all mortgages originated in a census tract by all institutions that are subject to the CRA regulations. Total non-regulated mortgages is the total volume of mortgages originated by all other institutions in each census tract. On average, regulated institutions provided about $5.7 million worth of mortgages per year to the average census tract while this number for non-regulated institutions is about $2.6 million. The difference is due to the number of mortgages originated, not their size. The

size of the average mortgage originated is $115 thousand and $112 thousand, respectively.

The first piece of evidence on the effect of the CRA on mortgage supply is provided in Figure 1. Prior to 1998, mortgage growth did not systematically differ between CRA-eligible census tracts and other tracts. However, starting from 1998 there is a clear upward shift in mortgage origination in CRA-eligible census tracts by CRA-regulated institutions. In Figure 2, I redo the same exercise but using mortgages originated by non-regulated institutions. The graph shows no difference in the growth of non-regulated mortgages between CRA-eligible and ineligible census tracts, neither before nor after 1998. These two graphs provide a first indication that the CRA regulations affect the supply of mortgages by regulated institutions to CRA-eligible census tracts, starting from 1998.[7]

Motivated by this preliminary finding, I now proceed with a matching estimation to compare the growth of mortgages, from the pre-1998 period to the post-1998 period, in a representative CRA-eligible census tract with a comparable ineligible tract that has the same median family income but is not CRA-eligible only due to the fact that it is placed in a MSA, in the same state, with slightly lower median family income. In the main analysis, the number of matches are chosen to be one and the caliper to be $10. The results are robust to the choice of these parameters. Finally, I allow for replacement of the matched observations in all specifications. CRA-eligible census tracts are different from CRA-ineligible census tracts especially in terms of income distribution. Table III compares observable characteristics of the two types of census tracts before and after matching them on median family income. Panel A of the table shows that before matching CRA-eligible census tracts have significantly lower median family income and receive much lower mortgage both from the CRA-regulated and non-regulated institutions. They also have a much higher rejection rates both from regulated and non-regulated institutions and the differences are economically and statistically significant. Interestingly, house prices and house price growth rates are similar across the two types of eligible and ineligible census tracts before 1998, though housing units and vacancy

[7]In Figure A1 in the appendix, I report the same graphs for an extended sample period that covers 1993 to 2009 and reflect the longer term dynamic effects of the credit expansion.

rates are different. Matching on tract median family income resolves these differences. As presented in Panel B of Table III, the matching strategy generates comparable groups in terms of median family income, pre-1998 mortgage originations, rejection rates, house price growth, housing units, vacancy rates, and finally, the elasticity of housing supply following Saiz (2010).

The results of the difference-in-differences matching estimations are presented in Table IV. Each cell in this table presents the matching estimate of the average treatment effect on the treated, where the treated group is the set of CRA-eligible census tracts. Panel A of Table IV presents the results of the matching exercise using all the observations in the sample. The first, second and third rows present the effect on the total amount of mortgages, size of the average mortgage, and the number of mortgages, respectively. The results show that annual volume of mortgages originated by CRA-regulated institutions in CRA-eligible census tracts increased by 5.7 percentage points more after 1998, compared to the matched ineligible census tracts. The right-most column in Table IV presents the results for the non-regulated institutions and indicates no significant difference in growth of total mortgages between CRA-eligible and the matched set of CRA-ineligible census tracts.

Although I compare similar-income census tracts to each other, they are placed in MSAs with different income levels, hence affecting their relative attractiveness and growth potential versus their surrounding. First, note that if there were different demand effects between eligible and matched ineligible census tracts we would find significant results for the mortgages originated by non-regulated institutions too. Second, and to address this issue more directly, I confine the sample to census tracts that have an income ratio in the vicinity of the 80% threshold. Panel B (Panel C) of Table IV presents the results in the sample restricted to census tracts with a median family income in the range of $[0.6, 1.0]$ ($[0.7, 0.9]$) relative to their MSA. The estimates are again strongly significant for mortgage originations by the regulated institutions and insignificant for the mortgages

originated by the non-regulated institutions.[8]

The estimated effect comes from both the intensive and the extensive margin: Both the size of the average mortgage and the total number of mortgages differ. However, the effect on the number of originated mortgages is twice as large as the effect on the average size of the mortgage. This is consistent with the fact that the purpose of the CRA was to incentivize banks to provide mortgages to otherwise-constrained borrowers and not to provide larger mortgages to unconstrained homeowners. The annual number of mortgages originated by the CRA-regulated institutions grew by about 3.4 percentage points more in an average eligible census tract compared to ineligible census tracts, while the growth in the size of the average mortgage was about 1.8 percentage points larger.

The effects on the number of mortgages are insignificant for non-regulated institutions. However, although non-regulated institutions did not have to comply with the CRA regulations, I find that the average size of the non-regulated mortgages also increase significantly. One reason for this observation may be the fact that, as we will see in Section 6, house prices react positively to increased mortgage supply in CRA-eligible census tracts, hence increasing the size of mortgage needed to buy a house. Moreover, the negative estimate for the number of non-regulated mortgages suggests a weak crowding-out effect of non-regulated institutions by CRA-regulated institutions. I find that rejection rates drop after 1998 for both type of institutions, pointing towards a laxer lending standard employed by the originators. Finally, the last row in each panel of Table IV presents the effect on house price growth rate. House prices grow annually by 3.2 percentage points more in CRA-eligible census tracts.[9] In Section 6, I show that the estimated increase in house price growth is in fact due to the CRA-induced shift in mortgage supply.

The aggregate growth in mortgage lending as a result of the CRA, from 1998 to 2002, measured as a share of total growth in mortgage lending in this period relative to a

[8]To further ensure the robustness of these findings to differential local demand, especially through gentrification, I run robustness checks using the increase in the share of *educated* residents within each census tract as a proxy for the extent of gentrification and show that the findings remain unchanged. These results are presented in Section 7.7.1.

[9]The estimate of house prices become inaccurate when looking at the narrow window of $[0.7, 0.9]$ because the sample size is too small (there are only 59 CRA-eligible census tracts in that sample with non-missing data for house prices.).

counterfactual linear growth based on the pre-1997 trend, is between 4.9% and 6.6%, depending on different estimates in this paper. To arrive at this number, I take the end-of-1997 total lending of CRA-regulated banks in CRA-eligible tracts and calculate the additional, CRA-induced, growth in mortgages using the annual percentage growth of 4.8% or 5.7% (Table IV, Panel C and Panel A, respectively) over the five years including and after 1998. I then divide this number by the growth in total mortgage originations by both types of institutions recorded in HMDA in each of the five years from 1998 to 2002, relative to a counterfactual linear growth based on pre-1997 trend in total lending.

In interpreting this aggregate estimates some reservations need to be taken into account. The focus of this paper has been on mortgage originations for the purpose of purchasing a residential property, and all the estimates refer to this definition of mortgage lending, while leaving out refinancing, home equity, and other types of lending.[10] Furthermore, the analysis is only restricted to the five-year period from 1998 to 2002 and therefore has limited implications for the longer term aggregate effects of the CRA.

5.1. External Validity

The size of the sample of matched census tracts is much smaller than the population of census tracts. This is a result of the strict matching policy that ensures comparability of observations in the two groups of eligible and ineligible tracts. Nevertheless, to examine the external validity of the findings for the population of census tracts, I run difference-in-differences regressions using a census tract-by-year sample, without matching. I report the results in the appendix in Table A1. The outcome variables are natural logarithm of total volume of mortgage originations, as well as the average size, and the number of originations, in addition to house price growth rate. I control for observable characteristics interacted with time dummies, plus time and state fixed effects. The observable characteristics included are census tract median family income, population, and

[10]HMDA does not cover the population of mortgage lending. The smallest institutions and those without a branch in an MSA need not report their data to HMDA. Moreover, lenders do not report mortgages taken out for reasons other than purchasing a residential property, refinancing, or home improvement. In comparison to Equifax, one of the nationwide consumer credit agencies, HMDA includes about 90% of mortgages for the purpose of purchasing a residential property or refinancing an outstanding mortgage. (Federal Reserve Bulletin, November 2017, Vol. 103, No 6)

elasticity of housing supply. Panel A reports the results of the *full sample* and shows that the CRA-regulated institutions increased lending, in terms of total, size, and number of loans, to CRA-eligible census tracts significantly more after 1998. Non-regulated institutions, on the other hand, show an increase in lending to CRA-eligible census tracts but it is only significant when looking at total loans, while the results are insignificant for the number and the size of loans. Furthermore, the effect on total loans is half as large as that of the CRA-regulated institutions. Again, I find a positive and strong effect on house price growth rate in CRA-eligible census tracts.

To improve the comparability between the CRA-eligible and ineligible groups of census tracts, I next use the *common support sample*. As mentioned before, this sample differs from the full sample in that it excludes the poorest CRA-eligible and the wealthiest ineligible census tracts because for those there will be no comparison in the data. The results are presented in Panel B of Table A1. We see that the increase in total, size, and the number of originations are only significant for the CRA-regulated institutions. The difference between panels A and B highlights the general issue of trade-off between causality and external validity. In order to get close to a causal analysis, one is usually forced to focus on a narrow subset of observations in a population and hence has to compromise on external validity. This paper is no exception. Nevertheless, we see that the implications of the full sample results are not much different from the most stringent matching analysis. The findings in these two tables show that the results are not an artefact of the matching strategy and in general hold in the population of the census tracts too.

5.2. The CRA across the Income Distribution

The role of different income groups in generating the growth in the mortgage market prior to the financial crisis is the subject of many studies. This paper contributes in particular to Adelino et al. (2016) who argue that mortgage growth was not concentrated within the low-income group of households. More importantly, they emphasize the demand view of the pre-crisis housing market and explain that positive expectations about

growth in the housing market led to higher demand for housing across all income groups. This view is different to Mian and Sufi (2009) who argue that mortgage growth in the early 2000s were primarily driven by a growth in supply to the subprime borrowers, which itself was due to lower underwriting standards facilitated by a securitization boom. My paper contributes to this debate by showing that the CRA played an important role in generating an upward shift in mortgage supply, which is not necessarily concentrated in a particular income group. To verify this claim, let us consider Table V. This table presents the growth in mortgage volume in CRA-eligible and matched CRA-ineligible census tracts from the period 1993-1997 to the period 1998-2002, separately for mortgages originated by CRA-regulated and non-regulated institutions in Panels A and B, respectively. Furthermore, I split the sample to four groups based on the quartiles of census tracts median family income. The results show that CRA-regulated institutions' mortgages grew by about 14.6% to 23.2% per annum in CRA-eligible census tracts depending on the income group (except the top quartile in which there is no CRA-eligible census tract) and by about 9.7% to 18.3% for matched CRA-ineligible census tracts. The differences are between 4.8 to 6.0 percentage points, which are close to the previous estimates and do not vary much across different income groups. However, if I repeat the same exercise using mortgages originated by non-regulated institutions, as before, I find economically small, and statistically insignificant, differences in mortgage growth between CRA-eligible and matched ineligible census tracts, in each of the three income groups.

These findings confirm that, within each income group, those census tracts that fall below 80% of their own MSA's median family income experienced a stronger positive shift in mortgage origination. This confirms that CRA mortgages are not all necessarily lent to low-income neighbourhoods. In fact, CRA-eligibility is defined based on local relative income. This may comprise part of the effect that Mian and Sufi (2009) capture by running within-county regressions. Within each county, especially in those with higher income variation, it is most likely that the low-income census tracts were CRA-eligible too.

Panels C and D in Table V present the results regarding the effect of the CRA on

house prices, both in terms of levels and growth rates, across census tract median family income quartiles. There is suggestive evidence that house prices increased across the income distribution and the effects are not confined in the lowest-income neighbourhoods.

6. Mortgage Supply and the Price of Housing

Does a shift in mortgage supply generate extra growth in prices in the housing market? The real estate literature offers at least two reasons why this may be the case. Adelino et al. (2012) argue that a shift in supply of mortgages may enable more households, who would otherwise be out of the market for housing, to enter the market and bid on the existing properties and push real estate prices upward. Furthermore, for those borrowers who are already in the market but now have access to cheaper funds higher property prices may still be attractive hence they bargain less hard on the price.

Despite intuitive reasons why mortgage growth may generate higher house prices, empirical estimation of the size of this effect has been proven to be challenging. Particularly, demand effects have been shown to be an important factor in building up bubbles where traders extrapolate future returns based on past returns and form expectations about the future price, which furthermore encourages higher prices and higher trading volume (Barberis et al. (2018)). In addition, higher collateral value of the real estate in regions with growing prices enables borrowing-constrained households to apply for new mortgages (Kiyotaki and Moore (1997)). Therefore, it is crucial for any econometric estimate of supply effects of mortgage on house prices to make sure that the estimation approach is able to isolate a pure supply factor. Thus, in this section I make use of the CRA setting as an exogenous shift in the supply of mortgages in 1998 to estimate this causal effect. The CRA originated an outward shift in mortgage supply that is unrelated to the actual or expected house prices, hence is a valid instrument in a regression of house price growth on mortgage growth.

The two-stage least square estimation results are presented in Table VI. For each census tract, I use the change in CRA-regulated institutions' mortgage origination and

house price growth rate, from 1993-1997 period to 1998-2002 period, and use the dummy variable CRA as an instrument. Remember that identification relies on a between-MSA comparison of eligible and ineligible census tracts. Controlling for census tract median family income and state fixed effects is akin to comparing census tracts within the same state, with similar income but in MSAs with different MSA median family income, making some census tracts CRA-eligible and others not. Standard errors are clustered at the state level, to account for any possible within-state correlation of house prices (Petersen, 2009; Angrist and Pischke, 2009).

The first column in Table VI provides the estimates of the first-stage regression of the change in mortgage growth on CRA ratio, controlling for census tract median family income and other variables. Conditional on having the same median family income, CRA-eligible tracts experienced higher mortgage growth. The test of weak instrument is rejected, based on the first-stage Sanderson-Windmeijer F-statistic and P-values reported in Table VI (Sanderson and Windmeijer, 2016). Column 2 presents the results of the second-stage regressions. The coefficient estimate of 0.7 means that for every one percentage point higher annual growth of mortgage supply, house price growth rate will rise by 0.7 percentage point. In columns 3 and 4, I control for elasticity of housing supply following Saiz (2010). The sample size is smaller because of the missing housing supply elasticity data for several MSAs. Nevertheless, the results remain unchanged. To further study the validity of the exclusion restriction assumption, I use mortgage origination by non-regulated institutions and rerun the IV estimates. This can be viewed as a placebo test for the exclusion restriction assumption that we need in the instrumental variable analysis: if, after controlling for income and other observables, (unobserved) demand for housing correlates with the variable *CRA*, we should also observe correlation between mortgage originated by non-regulated institutions and the dummy variable *CRA*. Results in Table VIII do not support this idea. The evidence also corroborates the hypothesis that the higher house price growth in CRA-eligible tracts was in fact partly caused by the shift in the supply of mortgages by the CRA-regulated banks.

In sum, the positive causal effect of mortgage supply on house prices generated a

more pronounced boom-bust cycle in CRA-eligible census tracts. Table VII shows that not only house price growth was higher during the 1998-2002 boom period, they also declined more during the 2007-2009 period. This pronounced boom-bust cycle is partly responsible for the higher delinquency rates of mortgages, a results that I will discuss in Section 7.

7. Ex-ante versus Ex-post Riskiness of CRA-induced Mortgages

Whether or not the CRA set the stage for riskier lending by the affected banks is still an unresolved debate both in the academic and in the policy sphere. While Avery and Brevoort (2014) finds little evidence for higher price or delinquencies of CRA mortgages, Demyanyk and Van Hemert (2011) and Agarwal et al. (2012) document significantly lower quality for CRA mortgages. In this section, I revisit this question with an eye on the differences between the ex-ante and the ex-post riskiness of CRA-induced mortgages. As before, I compare mortgages extended to two census tracts with similar income levels while one is CRA-eligible and the other is not. I conduct this exercise both for mortgages originated by CRA-regulated institutions and non-regulated institutions.

The analysis in this section is at the mortgage level. I use Fannie Mae and Freddie Mac's Single Family Loan Level Datasets that both are publicly available data of fully amortizing, 30-year fixed-rate mortgages provided by the two institutions. Both include higher-quality loans, conforming to agency guidelines (Adelino et al. (2016)). I match this data to the mortgage origination data from HMDA based on the size of the mortgage, (3-digit) ZIP code, occupancy, and purpose of the loan. Of course, these few variables are not enough for a one-to-one match between HMDA and Fannie Mae and Freddie Mac's Single Family Loan Level Dataset. Therefore, I keep only those observations that are uniquely identified by the set of matching variables. This rather strict criteria thus reduces the size of the sample to about 394,540 mortgage originated by CRA-regulated institutions and 109,234 by non-regulated institutions out of a total of 5.5 million observations in the

population of Fannie Mae and Freddie Mac's data. The advantage, however, is that we can make sure the origination and performance information pertain to the same mortgage. This matching then allows us to have the census tract information from HMDA.

The Fannie Mae's data starts in 2000 and Freddie Mac's in 1999. Therefore, I match this data with HMDA for the years from 1999 until 2006 and track performance information up until the end of 2016. Summary statistics presented in Table IX confirm that the matched sample is similar in characteristics to the population of mortgages in Fannie Mae and Freddie Mac's datasets. Mortgages have economically similar average size, FICO score and interest rate, and thus resemble a random sample from the population.

The estimation in this section is in essence similar to the previous sections. Conditional on census tract income level, I compare mortgage characteristics between those that are extended to households living in a CRA-eligible census tract to those from an ineligible census tract, within the same state. Moreover, I do this exercise separately for CRA-regulated and non-regulated institutions. The outcome variables of interest are the borrower's FICO score (the ex-ante measure of risk), the original interest rate of the mortgage contract, and finally a dummy variable that indicates whether the mortgage became delinquent or not (the ex-post measure of risk). Delinquent mortgages are the ones that are at least 90 days past due on their monthly payments, are in foreclosure, or are real estate-owned. I construct this variable by using Fannie Mae and Freddie Mac's mortgage performance data.

The results are presented in Table X for the mortgages originated by the CRA-regulated institutions. The coefficient estimate of the dummy variable *CRA* on the first column indicates that the mortgages extended to CRA-eligible census tracts by CRA-regulated institutions went to borrowers with about 1.7 points lower FICO score. This effect is about 3% of the standard deviation of FICO score in my sample. The second column indicates that these loans also had higher interest rates of about 0.04 percentage points. More importantly, using a probit model, I find that the probability of CRA-induced mortgages becoming delinquent were higher than similar loans that were extended to borrowers in ineligible census tracts. This finding is in line with the findings

in Demyanyk and Van Hemert (2011) and Agarwal et al. (2012) who also find higher delinquency rates for CRA-induced mortgages. The estimates in columns 3 imply an 0.6% higher probability of delinquency for CRA mortgages. Considering that the average delinquency rate in my sample is 4.2%, CRA mortgages are 14% more likely to become delinquent than an average mortgage. The higher delinquency likelihood of CRA mortgages is economically considerably large. In contrast to the small ex-ante differences in riskiness of CRA mortgages, ex-post they default disproportionately more frequently.

The reason for large differences in the probability of delinquency are the additional exposure of mortgages to a more pronounced boom-bust cycle in CRA-eligible census tracts. First, note that the differences persist even after controlling for mortgages' ex-ante risk characteristics. In column 4, I control for FICO score and interest rates, and the effect still is positive and significant. In column 5, I control for the extent of the boom and the bust in house prices. The effect becomes insignificant only after controlling for both ex-ante mortgage risk and the extent of housing boom-bust cycle. This evidence is consistent with the view that the larger number of defaults in CRA-eligible census tracts was partly due to the more severe house price collapse in these neighbourhoods. Furthermore, this finding, combined with the results in Section 5 regarding the larger size of mortgages in CRA-eligible census tracts, suggests that the higher house prices (that were partly driven by the CRA-induced shift in mortgage supply as shown in Section 6) forced borrowers in these regions to take on larger mortgages, which subsequently made the households more sensitive to declines in house prices during the collapse of the housing markets.

I repeat the same analysis for mortgages generated by non-regulated institutions and find that they do not exhibit different FICO scores and delinquency rates between CRA-eligible and ineligible census tracts, but they show significant differences in terms of interest rates (Table XI). Overall, there is more evidence for the riskiness of the CRA-regulated institutions' mortgages in CRA-eligible census tracts than for mortgages of non-regulated institutions, even though the difference-in-differences results are not statistically significant as shown in Table A2.

7.1. Gentrification and the CRA

Even though in the earlier sections we saw that house prices, number of housing units and vacancy rates were comparable in the matched sample, there might still exist unobserved demand effects that might confound the estimates of the effect of the CRA. If we believe that borrower demand for mortgage is symmetric across CRA-regulated and non-regulated institutions, then the concern that the results are driven by demand, rather than supply through the CRA, are less worrying as there is no evidence of increased lending by non-regulated institutions in CRA-eligible census tracts. Nevertheless, in this section, I discuss a crucial element of higher demand for housing, namely gentrification, that could have potentially important interactions with the CRA.

Gentrification creates demand for housing by replacing the relatively poorer residents of a neighbourhood with more affluent newcomers. In that sense, one would expect to see an improvement in the credit risk profile of neighbourhoods that are more influenced by gentrification. In particular, one expects an ex-ante improvement in credit scores and an ex-post improvement of loan performances. My findings, as presented in Table X do not confirm these hypotheses. First, I find that the borrowers in CRA-eligible areas have a lower FICO score. Second, mortgages generated from 1999 until 2006 became delinquent more often in CRA-eligible tracts. These findings are more consistent with a supply-side relaxation of credit constraints through the CRA, rather than a demand-side improvement in credit quality through gentrification. Nonetheless, I specifically test for the confoundedness of my results with gentrification. Following Ellen, Mertens Horn, and Reed (2017) and McKinnish, Walsh, and White (2010), I use the increase in the share of educated individuals (those with at least a bachelors degree or professional education) from 1990 to 2000 as a proxy for the intensity of gentrification at the census tract level and run a triple interaction model the results of which are presented in Table A3. *Gentrified* is a dummy that equals one for census tracts that experienced an increase in the share

of educated population that places them in the top 10% of the distribution.[11] The triple interaction term is positive, but it is small and statistically insignificant. If gentrification was an important confounding factor for the CRA, we should have found a large and positive estimate for the triple interaction term, which is not the case.

8. Conclusion

In this paper, I studied the role of the CRA in the US housing boom-bust cycle in the 2000s. I showed that the CRA significantly contributed to the rise in the supply of mortgages and consequently to the surging prices in the real estate sector. I also showed that CRA-induced mortgages were riskier and defaulted more often. I used the strengthened enforcement of the CRA in 1998 as a quasi-experiment to instrument for the supply of credit, and estimated the elasticity of house price growth to mortgage supply.

My results document a clear mortgage supply channel as an additional contributing factor to the risks building up prior to the crisis, as proposed by Mian and Sufi (2009). However, I also show that the rise in mortgage and housing market was not concentrated only at the low-income segments of the market. CRA originated a shift in mortgage supply throughout the income distribution while within each income quartile more exposure to the CRA was associated with higher growth in mortgage supply and house prices. These findings are important in our thinking of the role of different income groups in generating the financial crisis.

Put together, this study documents a clear example of the unintended consequences of well-intentioned policies towards increasing homeownership among the less-advantaged households. A natural follow-up to this study will be to analyze the possible crowding-out effect on the commercial and industrial loans due to the CRA enforcement and its real effects. Furthermore, studying the competitive effects of the CRA on the quantity and the quality of mortgage originations by independent mortgage companies can inform the design and the supervision of the CRA in the future.

[11] The results are robust to alternatively classifying the top 25% of census tracts as *Gentrified*.

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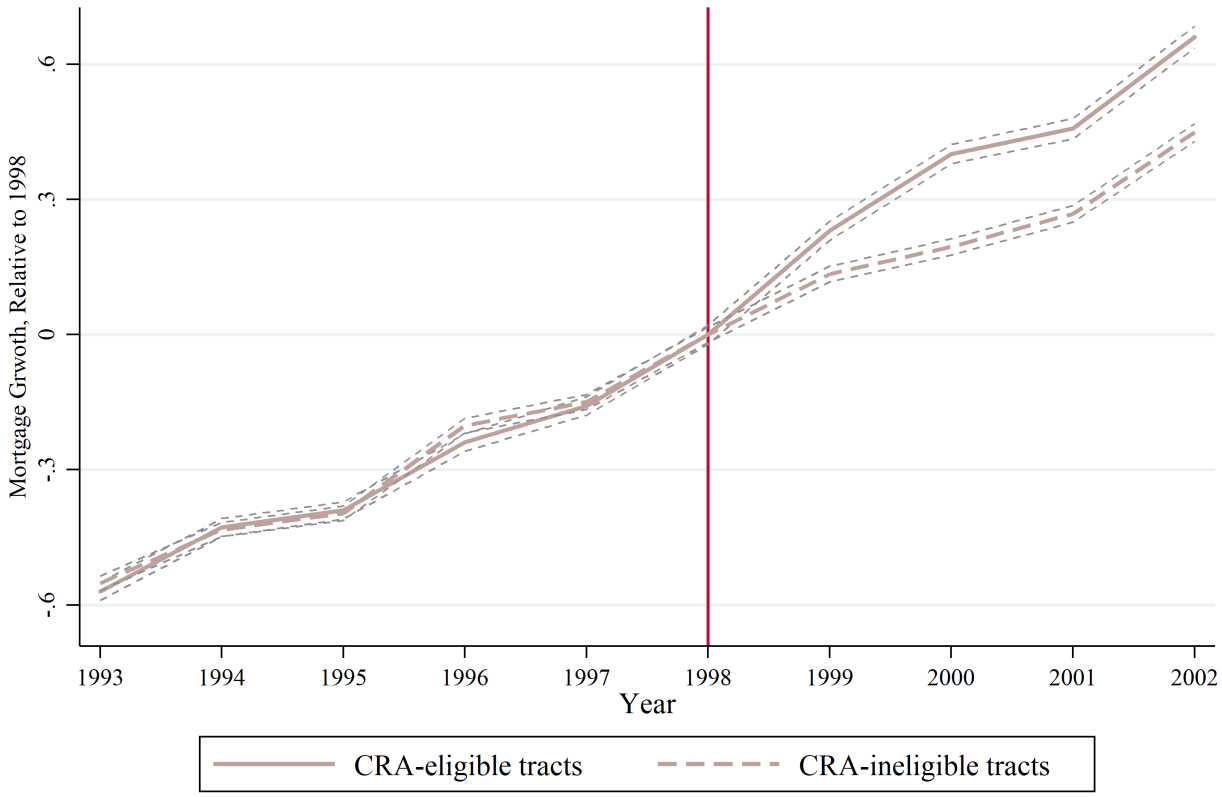
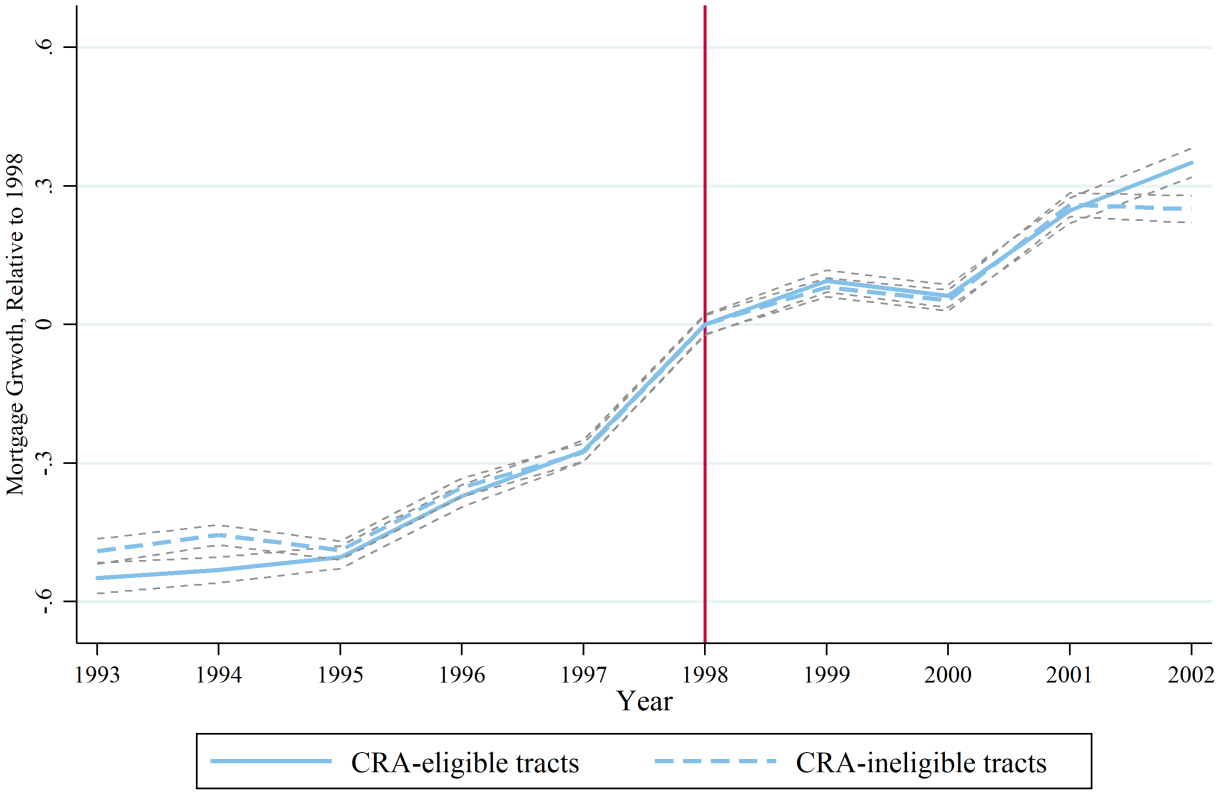
9. Figures

Figure 1. Growth in total amount of mortgage origination by CRA-regulated institutions



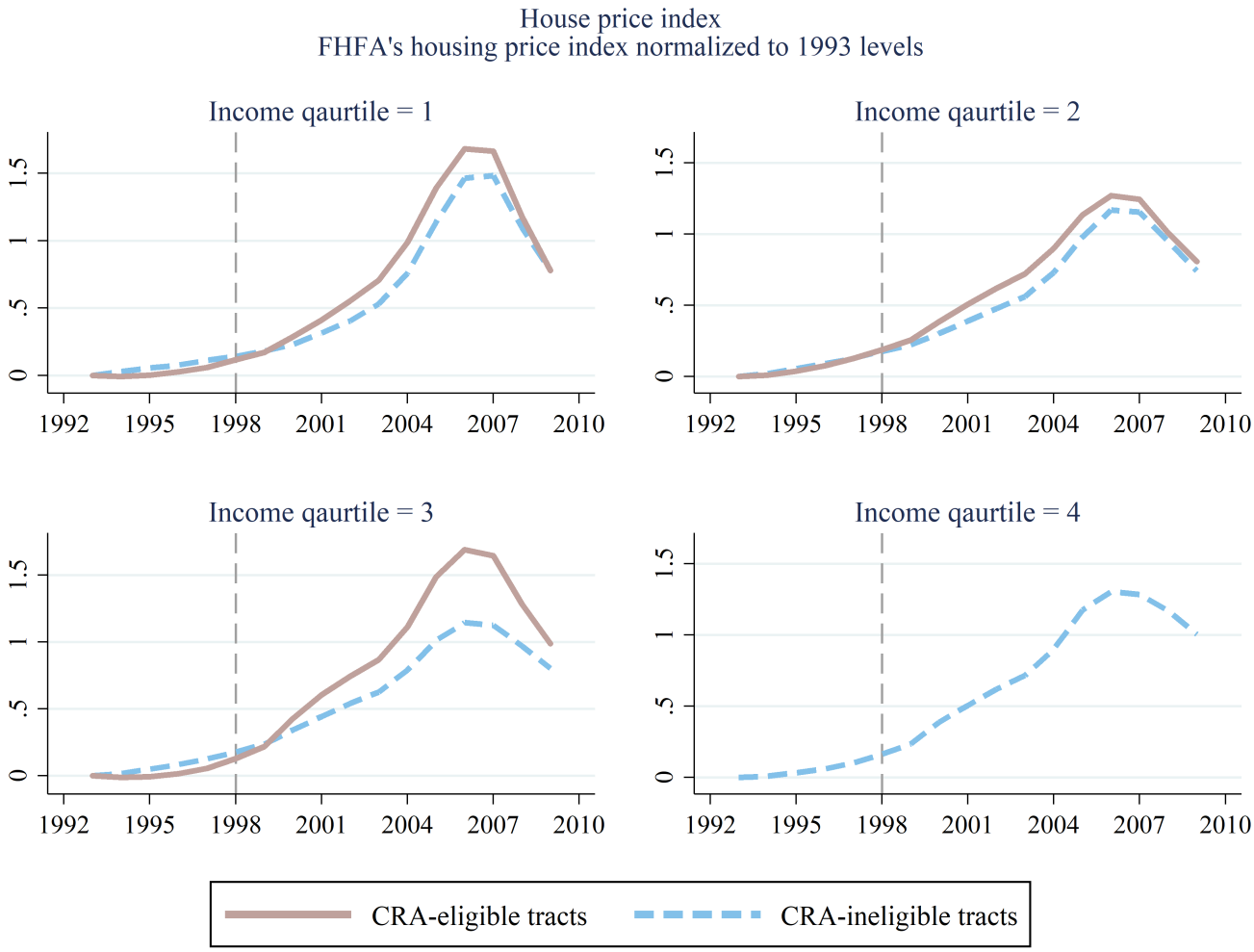
This figure illustrates total mortgage origination by CRA-regulated institutions in CRA-eligible and ineligible census tracts. CRA-regulated institutions are those supervised by the FDIC, FRB, OCC and OTS. CRA-eligible census tracts are census tracts with a median family income of less than 80% of their respective MSA's median family income. Following Khwaja and Mian (2008), I normalize the y-axis so that the logarithm of total mortgage for both CRA-eligible and ineligible census tracts is forced to be 0 in 1998. Therefore, the time series illustrates the log-ratio of total mortgages in any given year relative to 1998, i.e., when the new enforcement mechanisms of the CRA became fully effective. The y-axis values can then be interpreted as growth rates in lending relative to 1998. The dashed lines represent the 5% confidence interval. The sample is originated as explained in Section 4.

Figure 2. Growth in total amount of mortgage origination by non-regulated institutions



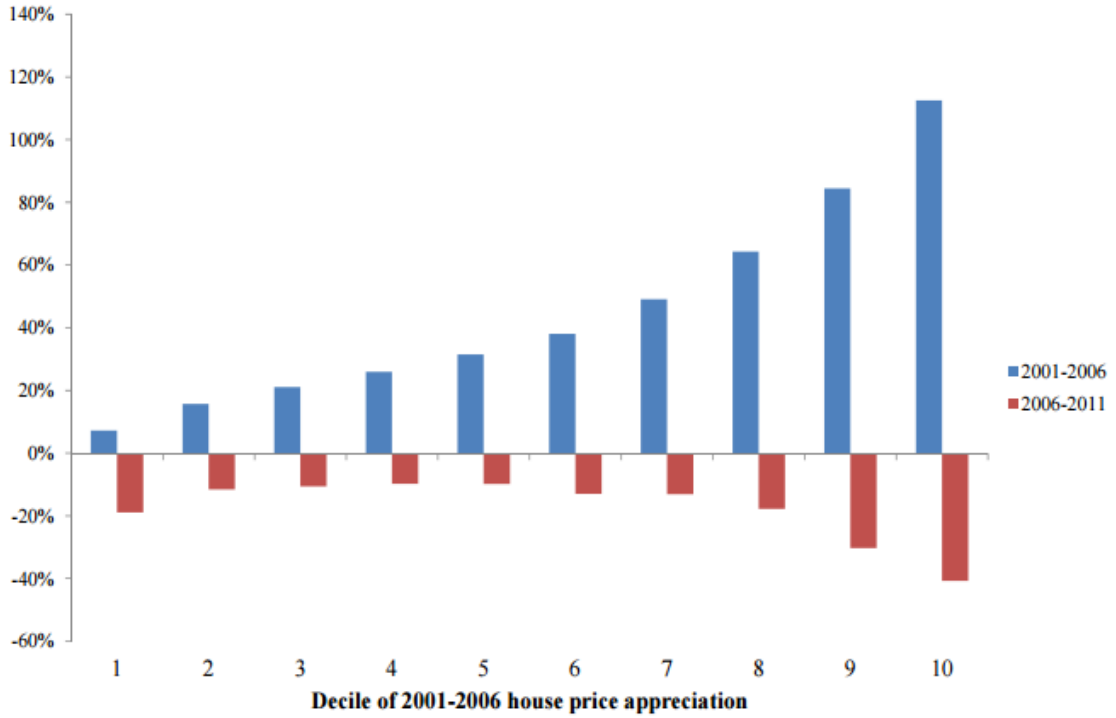
This figure illustrates total mortgage origination by CRA-regulated institutions in CRA-eligible and ineligible census tracts. Non-regulated institutions are those that are supervised by NCUA and HUD and are not subject to the CRA regulations. CRA-eligible census tracts are census tracts with a median family income of less than 80% of their respective MSA's median family income. Following Khwaja and Mian (2008), I normalize the y-axis so that the logarithm of total mortgage for both CRA-eligible and ineligible census tracts is forced to be 0 in 1998. Therefore, the time series illustrates the log-ratio of total mortgages in any given year relative to 1998, i.e., when the new enforcement mechanisms of the CRA became fully effective. The y-axis values can then be interpreted as growth rates in lending relative to 1998. The dashed lines represent the 5% confidence interval. The sample is created as explained in Section 4.

Figure 3. House price dynamics in CRA-eligible and ineligible tracts within each income quartile



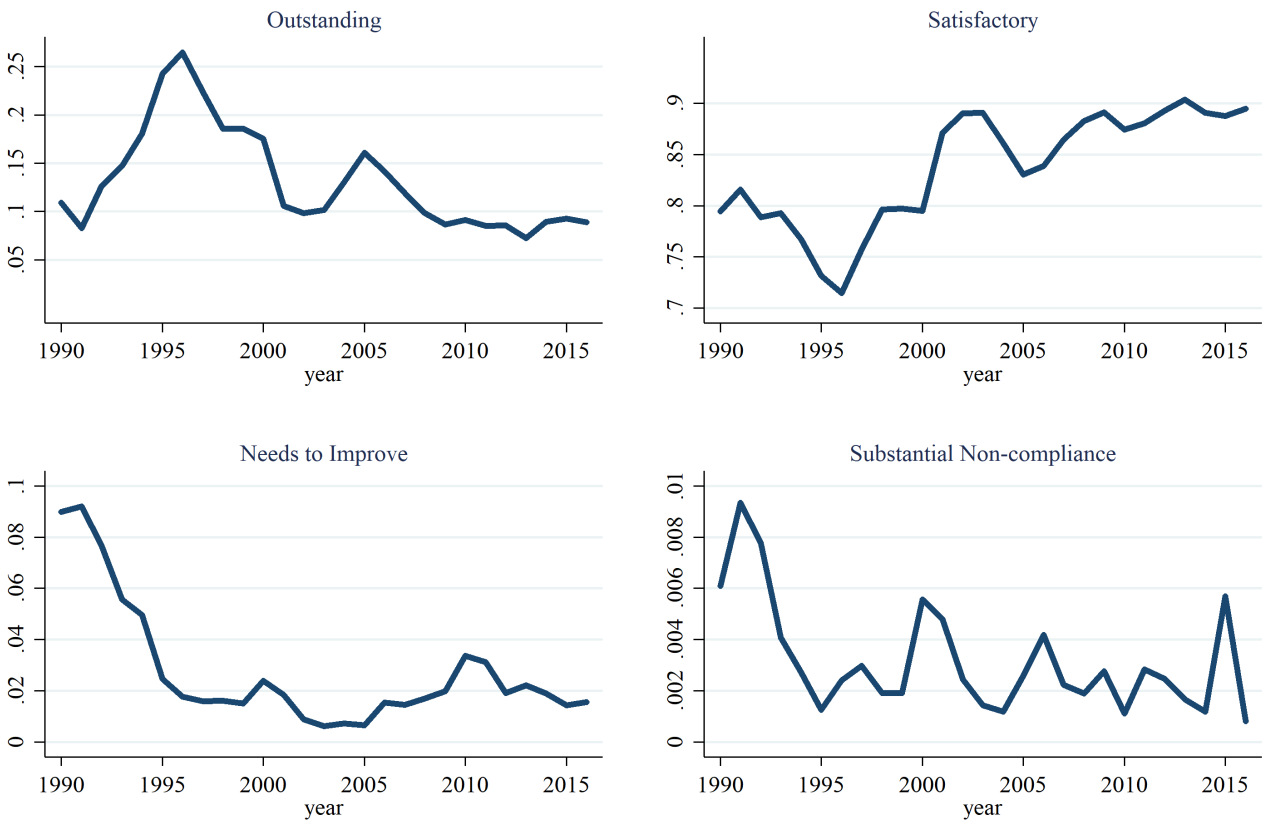
This figure illustrates the dynamics of house prices, normalized to 1993 levels, for CRA-eligible and ineligible census tracts within each income quartile. CRA-eligible census tracts are those with a median family income lower than 80% of their respective MSA's median family income. House price data is collected from the Federal Housing Finance Agency (FHFA).

Figure 4. Distribution of house price boom and bust at the county-level



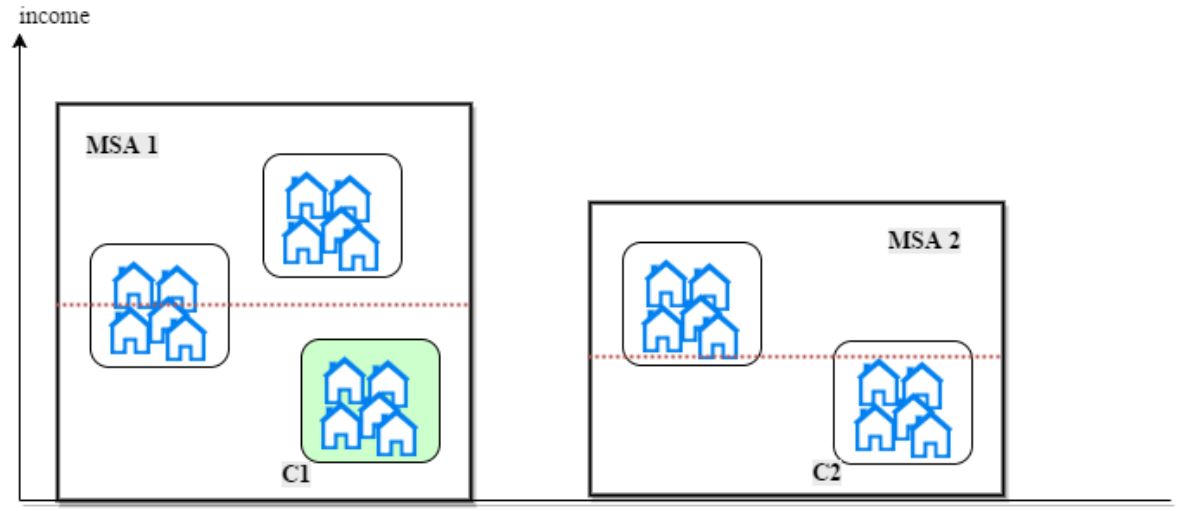
This figure is from Gropp et al. (forthcoming) and shows the heterogeneity in house price appreciation during the boom and depreciation during the bust period.

Figure 5. CRA ratings



This figure illustrates the frequency of each CRA rating as a share of all CRA examinations. *Outstanding* is the best rating followed by *Satisfactory*, *Needs to Improve*, and *Substantial Non-compliance*. The data is collected from the Federal Financial Institutions Examination Council's (FFIEC) web site.

Figure 6. Census tracts, metropolitan statistical areas and CRA-eligibility



This sketch shows the overlap of census tracts (small blocks) and MSAs (large blocks). Where the geographical areas lie on the y-axis indicates their median family income. For instance, the dotted line indicates the median family income in each MSA. Census tract *C1* is therefore CRA-eligible because its median family income is less than 80% of the median family income of MSA 1. Census tract *C2* in the neighbouring MSA has the same median family income as census tract *C1* but is not CRA-eligible because its median family income is above 80% of median family income of MSA 2.

10. Tables

Table I. CRA test components and rating scales

	CRA Test Components			Overall Rating
	Lending	Investment	Service	
Outstanding	12	6	6	20-24
High Satisfactory	9	4	4	11-19
Low Satisfactory	6	3	3	
Needs to Improve	3	1	1	5-10
Substantial Noncompliance	0	0	0	0-4

This table presents the grading scale for the three tests that the CRA regulators perform to assess banks' compliance with the CRA requirements. The three test are: lending, investment and service tests.

Table II. Summary statistics of the census tract level sample

	N	Mean	Std. Dev.	Min	Max
Total CRA-regulated mortgages (Mil. $)	362314	5.716	8.911	0.002	702.0
Average CRA-regulated mortgage (Mil. $)	362314	0.115	0.079	0.002	3.000
Number of CRA-regulated mortgages per tract	362314	44.18	47.45	1.000	3923
Rejection rate by CRA-regulated institutions (%)	362314	11.44	5.074	2.988	26.53
Total non-regulated mortgages (Mil. $)	362314	2.581	4.436	0.001	610.8
Average non-regulated mortgage (Mil. $)	362314	0.112	0.074	0.001	4.000
Number of non-regulated mortgages per tract	362314	21.90	30.60	1.000	4029
Rejection rate by non-regulated institutions (%)	362314	12.73	7.254	2.260	36.43
Annual housing price growth (%)	149851	4.819	6.444	-39.41	76.23
Tract MFI (Tsd. $)	362314	53.99	24.94	0.000	200.0
MSA MFI (Tsd. $)	362314	54.11	7.842	26.00	71.33
Income Ratio	362314	0.996	0.419	0.000	4.508
Vacancy rate (%)	353953	7.628	7.273	0.000	100.0
Housing units	354290	1658	784.1	0.000	11003
Supply elasticity	237235	1.602	0.917	0.600	5.450

This table reports the summary statistics of the census tract-by-year sample that covers the period 1993 to 2002. The sample is originated as explained in Section 4. Mortgage origination data is collected from HMDA. *Regulated mortgages* denotes to the mortgages originated by CRA-regulated institutions. *Non-regulated mortgages* denotes to the mortgages originated by institutions that are not subject to the CRA. I calculate annual mortgage application rejection rate at the census tract level by dividing the number of denied applications (coded as 3 in the entry *type of action* in HMDA) by the total number of applications, separately for CRA-regulated and non-regulated institutions. Census tract and MSA median family incomes (MFI) are collected from census data. *Income Ratio* is the ratio of each census tract's median family income to its respective MSA's median family income. House price data is collected from the Federal Housing Finance Agency (FHFA) and is at the census tract level. Vacancy rates and the number of housing units are collected from the 1990 census. Supply elasticity is borrowed from Saiz (2010) and measures the elasticity of housing supply at the MSA level. The sample is created as explained in Section 4.

Table III. Matching quality

	CRA-eligible	CRA-ineligible	%bias	t-statistic
Panel A: Before matching				
Num. of Census Tracts	13,289	24,852		
Census tract median family income	31,624	64,260	-180.8	-23.12
Population	3,789	4,597	-38.3	-6.87
Pre-1998 total CRA-regulated mortgages	1.171	5.283	-97.0	-16.46
Pre-1998 total non-regulated mortgages	0.747	2.439	-76.4	-9.68
Pre-1998 rejection rate by CRA-regulated inst.	14.68	9.806	104.2	13.18
Pre-1998 rejection rate by non-regulated inst.	16.57	10.66	88.7	13.00
Pre-1998 house price index	103.3	104.9	-19.0	-1.24
Pre-1998 house price growth rate	2.001	2.329	-8.4	-0.47
Housing units	1,503	1,688	-23.3	-7.49
Vacancy rate	10.15	6.618	47.6	6.21
Supply elasticity	1.589	1.598	-1.0	-0.33
Panel B: After matching				
Num. of Census Tracts	1,037	806		
Census tract median family income	41,254	41,254	0.0	0.94
Population	4,290	4,391	-4.3	-1.07
Pre-1998 total CRA-regulated mortgages	1.802	1.831	-0.7	-0.30
Pre-1998 total non-regulated mortgages	1.236	1.076	7.2	1.07
Pre-1998 rejection rate by CRA-regulated inst.	13.65	14.17	-11.0	-0.96
Pre-1998 rejection rate by non-regulated inst.	14.34	16.26	-28.8	-1.96
Pre-1998 house price index	101.6	100.7	10.3	0.70
Pre-1998 house price growth rate	1.166	0.544	15.9	0.97
Housing units	1,635	1,700	-8.2	-0.83
Vacancy rate	8.039	8.831	-10.7	-1.00
Supply elasticity	1.449	1.697	-27.2	-1.24

This table presents matching quality diagnostics. It shows the differences in census tract characteristics before and after matching on census tract median family income. The prefix *Pre-1998* denotes to the five-year period 1993 to 1997 and indicates that the reported variable is the averaged over that period for each census tract. % *bias*, is the % difference of the sample means in the CRA-eligible and ineligible samples as a percentage of the square root of the average of the sample variances in the respective groups. *t-statistic* is the test statistic of the difference in means across the two groups. Standard errors are corrected for clustering at the state level. The variables are defined in Section 4.

Table IV. Mortgage growth: Difference-in-differences matching estimation

	CRA-regulated institutions		Non-regulated institutions
Panel A: Full sample			
Total mortgages	5.70***		0.71
	(0.68)		(0.77)
Size of mortgages	1.76***		0.64***
	(0.24)		(0.26)
Number of mortgages	3.43***		-0.11
	(0.51)		(0.60)
Rejection rate	-0.02*		-0.14***
	(0.01)		(0.03)
House price growth		3.16***	
		(0.87)	
Panel B: Income Ratio ∈ (0.6, 1.0)			
Total mortgages	5.19***		0.48
	(0.73)		(0.86)
Size of mortgages	1.73***		0.65***
	(0.26)		(0.29)
Number of mortgages	3.05***		-0.34
	(0.55)		(0.65)
Rejection rate	-0.02**		-0.18***
	(0.01)		(0.04)
House price growth		2.27***	
		0.99	
Panel C: Income Ratio ∈ (0.7, 0.9)			
Total mortgages	4.82***		-0.65
	(1.08)		(1.25)
Size of mortgages	1.64***		0.94***
	(0.40)		(0.44)
Number of mortgages	2.76***		-1.82*
	(0.80)		(0.99)
Rejection rate	0.01		-0.17***
	(0.01)		(0.06)
House price growth		1.09	
		(1.36)	

This table reports the results of difference-in-differences matching estimations, using the nearest neighbour, separately for mortgages originated by the CRA-regulated and non-regulated financial institutions. For each census tract the total amount, number and size of the mortgages are averaged over each of the two periods of 1993-1997 and 1998-2002. The annual percentage growth rate of each of the variables is calculated for each census tract between these two periods. Finally, every CRA-eligible census tract is matched to a CRA-ineligible census tract from the same state with similar median family income. The reported estimates are the average treatment effect on the treated, taking CRA-eligible census tracts as the treated group and the matched CRA-ineligible census tracts as the control group. Income Ratio is the ratio of each census tract's median family income to its respective MSA's median family income. The sample is created as explained in Section 4. Standard errors are heteroskedasticity-consistent analytical standard errors proposed by Abadie and Imbens (2006). *, **, and *** denote significance at the 10, 5, and 1 percent level, respectively.

Table V. Mortgage growth across income distribution and CRA eligibility

Income quartiles	CRA-eligible tracts	Matched ineligible tracts	ATET	t-statistic
Panel A: CRA-regulated institutions				
1 (low income)	14.64	9.70	4.94	2.99
2	15.87	9.90	5.97	7.78
3	23.15	18.33	4.82	1.74
4 (high income)	-	-	-	-
Panel B: Non-regulated institutions				
1 (low income)	13.82	11.48	2.03	1.15
2	12.35	12.05	0.30	0.34
3	15.38	14.42	0.96	0.40
4 (high income)	-	-	-	-
Panel C: House price index				
1 (low income)	33.87	11.28	22.58	2.70
2	37.84	23.12	14.72	4.30
3	51.47	29.84	21.63	3.06
4 (high income)	-	-	-	-
Panel D: House price growth rate				
1 (low income)	13.88	4.74	9.14	2.94
2	8.82	5.68	3.15	3.22
3	13.60	12.39	1.30	0.58
4 (high income)	-	-	-	-

This table reports the results of the difference-in-differences matching estimation of growth in total CRA-regulated mortgages (Panel A), non-regulated mortgages (Panel B), house price index (Panel C), and house price growth (Panel D), between the 1993-1997 period and the 1998-2002 period across the income distribution. The sample is split based on quartiles of census tract median family income. Panel A and Panel B show the results for growth in mortgages originated by CRA-regulated and non-regulated institutions, respectively. For each census tract, the annual percentage growth rate is calculated between the pre- and post-1998 periods. Each CRA-eligible census tract is matched to a CRA-ineligible census tracts from the same state with similar median family income. The reported estimates are then the average treatment effect on the treated, taking CRA-eligible census tracts as the treated group and the matched CRA-ineligible census tracts as the control group. Standard errors are heteroskedasticity-consistent analytical standard errors proposed by Abadie and Imbens (2006). *, **, and *** denote significance at the 10, 5, and 1 percent level, respectively. The sample is created as explained in Section 4.

Table VI. The effect of mortgage supply on house price growth

	ΔMortgage growth (1st Stage)	ΔHPG (2nd Stage)	ΔMortgage growth (1st Stage)	ΔHPG (2nd Stage)
CRA	1.571***		1.072*	
	(0.572)		(0.554)	
Δ Mortgage growth		0.723***		0.704**
		(0.198)		(0.329)
Tract MFI	−0.029**	0.023***	−0.047***	0.027
	(0.014)	(0.007)	(0.012)	(0.017)
Initial house price index	−0.006	0.009***	−0.005	0.010***
	(0.004)	(0.003)	(0.004)	(0.004)
Ln(Population)	0.098	−0.275	−0.527	−0.291
	(0.415)	(0.250)	(0.416)	(0.406)
Elasticity			−0.698	−0.149
			(0.953)	(0.660)
State FE	Yes	Yes	Yes	Yes
Observations	14704	14704	9079	9079
F-statistic	7.55		3.75	
P-value	0.009		0.062	

This table reports the results of the instrumental variable analysis at the census tract level. The change, from the 1993-1997 period to the 1998-2002 period, in house price growth is regressed on the change, between the same periods, in mortgage growth (of the CRA-regulated institutions) using the dummy variable *CRA* as an instrument. The F-test statistics and p-values for tests of weak excluded instruments in the first-stage regressions are reported based on Sanderson and Windmeijer (2016). House price data is collected from the Federal Housing Finance Agency (FHFA) and is at the census tract level. The sample is created as explained in Section 4. Standard errors are corrected for clustering at the state level. *, **, and *** denote significance at the 10, 5, and 1 percent level, respectively.

Table VII. CRA-induced growth in house prices: The boom-bust cycle

	House price growth rate			
	The boom period [1998,2006]		The bust period [2007,2009]	
CRA	0.826***	0.548***	−1.850***	−0.744*
	(0.143)	(0.151)	(0.486)	(0.381)
Tract MFI # Year	Yes	Yes	Yes	Yes
Population # Year	Yes	Yes	Yes	Yes
Elasticity # Year	No	Yes	No	Yes
State FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	151621	93379	35851	22049
Adj. R^2	0.362	0.386	0.405	0.413

This table reports the results of the effect of CRA-regulations on annual house price growth rates during the boom period, defined as 1998 to 2006, and the bust period, defined as 2007 to 2009 at the census tract level. House price data is collected from the Federal Housing Finance Agency (FHFA) and is at the census tract level. The sample is created as explained in Section 4. Standard errors are corrected for clustering at the state level. *, **, and *** denote significance at the 10, 5, and 1 percent level, respectively.

Table VIII. IV analysis: Placebo tests

	ΔMortgage growth (1st Stage)	ΔHPG (2nd Stage)	ΔMortgage growth (1st Stage)	ΔHPG (2nd Stage)
CRA	0.497		0.700	
	(0.638)		(0.484)	
Mortgage growth		2.263		1.083
		(2.717)		(0.792)
Tract MFI	−0.080***	0.181	−0.064***	0.063
	(0.012)	(0.218)	(0.014)	(0.053)
Initial house price index	−0.012**	0.034	−0.013**	0.020
	(0.005)	(0.044)	(0.005)	(0.013)
Ln(Population)	0.595	−1.547	−0.001	−0.663
	(0.400)	(2.043)	(0.445)	(0.542)
Elasticity			−0.482	−0.122
			(0.546)	(0.896)
State FE	Yes	Yes	Yes	Yes
Observations	14723	14715	9087	9082
F-statistic	0.62		2.06	
P-value	0.437		0.161	

This table reports the results of the placebo tests of the instrumental variable analysis. The change, from the 1993-1997 period to the 1998-2002 period, in house price growth is regressed on the change, between the same periods, in mortgage growth (of the non-regulated institutions) using the dummy variable *CRA* as an instrument. The F-test statistics and p-values for tests of weak excluded instruments in the first-stage regressions are reported based on Sanderson and Windmeijer (2016). House price data is collected from the Federal Housing Finance Agency (FHFA) and is at the census tract level. The sample is created as explained in Section 4. Standard errors are corrected for clustering at the state level. *, **, and *** denote significance at the 10, 5, and 1 percent level, respectively.

Table IX. Mortgage risk characteristics: Population versus the matched sample

	Obs.	Mean	Std.	Min	Max
Population of mortgages from Freddie Mac					
Mortgage size (Tsd. $)	5504439	157.5	77.65	1.00	802.0
FICO score	5504439	726.7	54.91	300.0	850.0
Interest rate (%)	5504439	6.56	0.93	2.99	13.50
Matched sample of mortgages from Freddie Mac and HMDA					
Mortgage size (Tsd. $)	503781	166.5	85.96	4.00	802.0
FICO score	503781	724.4	55.14	300.0	850.0
Interest rate (%)	503781	6.67	0.93	2.99	11.50

This table compares the characteristics of the population of mortgages in Fannie Mae and Freddie Mac's Single Family Loan-Level Datasets and the matched sample to the universe of mortgages in Home Mortgage Disclosure Act (HMDA). I match mortgages in Freddie Mac's data to HMDA by using the size of the mortgage, ZIP code, occupancy, and purpose of the loan and only keep the unique matches.

Table X. Mortgage risk: CRA-regulated mortgages

	FICO	Int. Rate	Delinquent	Delinquent	Delinquent	Delinquent
CRA	−1.677**	0.038***	0.006***	0.005**	0.005*	0.004
	(0.763)	(0.006)	(0.002)	(0.002)	(0.003)	(0.002)
Tract MFI	0.137***	−0.001***	−0.000***	−0.000***	−0.000***	−0.000***
	(0.016)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Mortgage Size	0.001	−0.001***	0.000	0.000*	0.000	0.000*
	(0.004)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
FICO Score				−0.001***		−0.001***
				(0.000)		(0.000)
Int. Rate				0.020***		0.020***
				(0.001)		(0.001)
HPG (Boom)					−0.008***	−0.007***
					(0.003)	(0.002)
HPG (Bust)					−0.014***	−0.011***
					(0.002)	(0.002)
Observations	394547	394547	394540	394540	394540	394540
Adj. (pseudo) R^2	0.021	0.781	0.034	0.130	0.035	0.131
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

This table reports the results of the effect of CRA-regulations on mortgage risk for mortgages originated by CRA-regulated institutions. The sample includes mortgages from Fannie Mae and Freddie Mac's Single Family Loan-level datasets and spans the years from 1999 to 2006. Standard errors are corrected for clustering at the state level. *, **, and *** denote significance at the 10, 5, and 1 percent level, respectively.

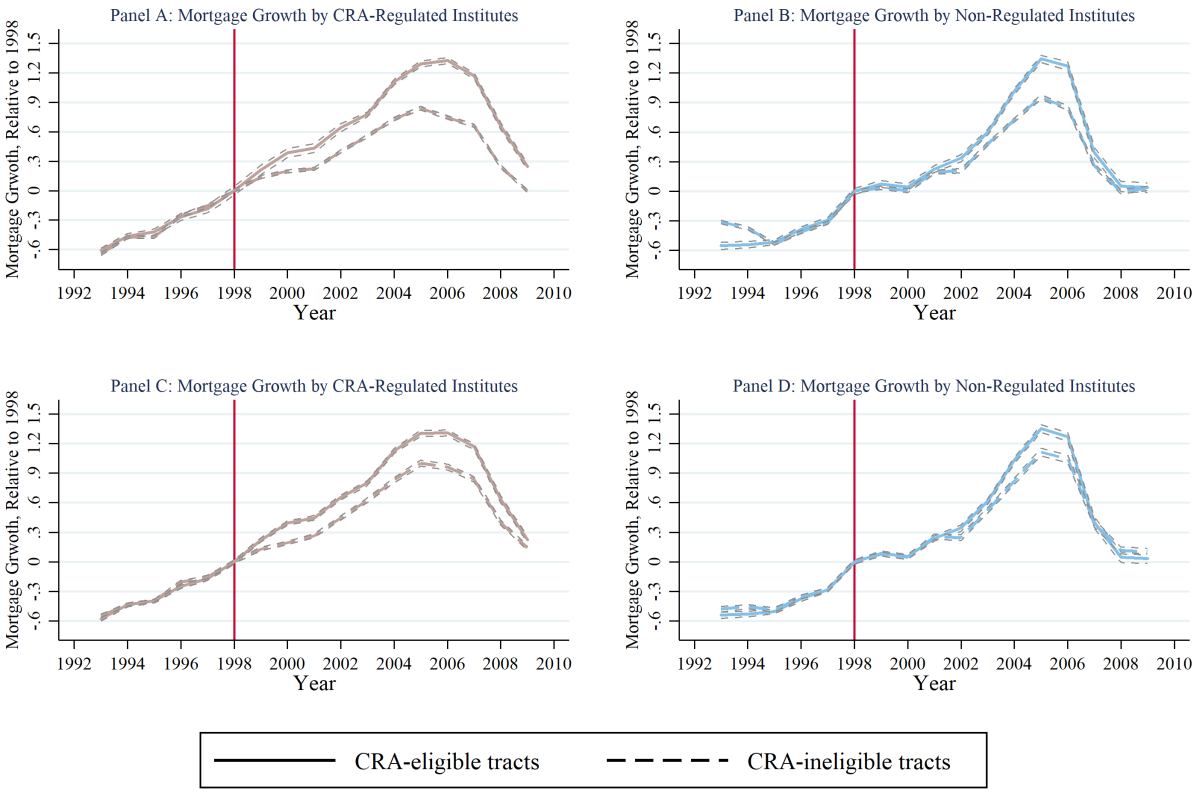
Table XI. Mortgage risk: Non-regulated mortgages

	FICO	Int. Rate	Delinquent	Delinquent	Delinquent	Delinquent
CRA	−2.172	0.046***	0.003	0.000	0.003	0.000
	(1.377)	(0.009)	(0.002)	(0.002)	(0.002)	(0.002)
Tract MFI	0.103***	−0.000***	−0.000***	−0.000***	−0.000***	−0.000***
	(0.019)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Mortgage Size	−0.004	−0.001***	−0.000***	−0.000	−0.000***	−0.000
	(0.007)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
FICO Score				−0.001***		−0.001***
				(0.000)		(0.000)
Int. Rate				0.018***		0.018***
				(0.002)		(0.002)
HPG (Boom)					−0.005***	−0.003***
					(0.001)	(0.001)
HPG (Bust)					−0.011***	−0.008***
					(0.002)	(0.002)
Observations	109234	109234	109234	109234	109234	109234
Adj. (pseudo) R^2	0.020	0.777	0.034	0.152	0.034	0.153
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

This table reports the results of the effect of CRA-regulations on mortgage risk for mortgages originated by CRA-regulated institutions. The sample includes mortgages from Fannie Mae and Freddie Mac's Single Family Loan-level datasets and spans the years from 1999 to 2006. Standard errors are corrected for clustering at the state level. *, **, and *** denote significance at the 10, 5, and 1 percent level, respectively.

Appendix A. Further Results

Figure A1. Mortgage Growth - Extended sample period



This figure illustrates total mortgage origination by CRA-regulated (Panels A and C) and non-regulated (Panels B and D) institutions in CRA-eligible and ineligible census tracts. Panels A and B are based on the *full sample*, while in Panels C and D I use the *common support sample*, which differs from the *full sample* in that it excludes CRA-eligible census tracts that do not have a similar-income counterpart in the sample of ineligible census tracts, and vice versa. CRA-regulated institutions are those supervised by the FDIC, FRB, OCC and OTS. Non-regulated institutions are those that are supervised by NCUA and HUD and are not subject to the CRA regulations. CRA-eligible census tracts are census tracts with a median family income of less than 80% of their respective MSA's median family income. Following Khwaja and Mian (2008), I normalize the y-axis so that the logarithm of total mortgage for both CRA-eligible and ineligible census tracts is forced to be 0 in 1998. Therefore, the time series illustrates the log-ratio of total mortgages in any given year relative to 1998, i.e., when the new enforcement mechanisms of the CRA became fully effective. The y-axis values can then be interpreted as growth rates in lending relative to 1998. The dashed lines represent the 5% confidence interval. The sample is originated as explained in Section 4.

Table A1. Difference-in-Differences Analysis

	CRA-Regulated institutions			Non-regulated institutions			HPG
	Ln(Total mortg.)	Ln(Avg. Size)	Ln(# Mortg.)	Ln(Total mortg.)	Ln(Avg. Size)	Ln(# Mortg.)	
Panel A: Full sample							
CRA	−0.613***	−0.083***	−0.473***	−0.600***	−0.050***	−0.473***	−0.351*
	(0.020)	(0.013)	(0.016)	(0.021)	(0.011)	(0.023)	(0.201)
CRA × After	0.120***	0.052**	0.046*	0.069***	0.012	0.028	1.803***
	(0.027)	(0.024)	(0.024)	(0.026)	(0.021)	(0.033)	(0.280)
Observations	237235	237235	237235	237235	237235	237235	92289
Adj. R^2	0.706	0.677	0.649	0.603	0.639	0.523	0.303
Panel B: Common support sample							
CRA	0.015	0.048***	−0.042**	0.045	0.066***	−0.028	0.154
	(0.018)	(0.015)	(0.018)	(0.035)	(0.016)	(0.031)	(0.305)
CRA × After	0.153***	0.046*	0.099***	0.060	0.039	0.020	1.477**
	(0.027)	(0.025)	(0.024)	(0.041)	(0.024)	(0.041)	(0.573)
Observations	145887	145887	145887	145887	145887	145887	43299
Adj. R^2	0.630	0.539	0.623	0.571	0.522	0.532	0.248
Tract MFI # Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population # Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Elasticity # Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table reports the results of difference-in-difference analyses using samples at the census tract-by-year level. Panel A corresponds to the results using the *full sample*, i.e., the largest sample of non-missing observations. Panel B, on the other hand, uses the *common support sample*, i.e., a sample that excludes observations that do not lie on the common support in terms on census tract median family income across the two groups of CRA-eligible and ineligible census tracts. In other words, this sample excludes CRA-eligible census tracts that do not have a similar-income counterpart in the sample of ineligible census tracts, and vice versa. Standard errors are corrected for clustering at the state level. *, **, and *** denote significance at the 10, 5, and 1 percent level, respectively.

Table A2. Mortgage risk: Dif-in-Dif Analysis

	FICO	Int. Rate	Delinquent
CRA	−1.439	0.039***	0.004
	(1.328)	(0.009)	(0.003)
Regulated	−1.928***	−0.003	−0.001
	(0.393)	(0.004)	(0.001)
CRA×Regulated	−0.399	0.001	0.002
	(0.753)	(0.007)	(0.002)
Tract MFI	0.130***	−0.001***	−0.000***
	(0.015)	(0.000)	(0.000)
Mortgage Size	0.000	−0.001***	−0.000
	(0.004)	(0.000)	(0.000)
Observations	503781	503781	503781
Adj. (pseudo) R^2	0.020	0.785	0.032
State FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

This table reports the difference-in-differences results of the effect of CRA-regulations on mortgage risk. The sample includes mortgages from Fannie Mae and Freddie Mac's Loan-level datasets and spans the years from 1999 to 2006. Standard errors are corrected for clustering at the state level. *, **, and *** denote significance at the 10, 5, and 1 percent level, respectively.

Table A3. Gentrification and CRA Lending

	CRA-Regulated institutions		Non-Regulated institutions	
	Ln(Total Mortg.)	Ln(# Mortg.)	Ln(Total Mortg.)	Ln(# Mortg.)
CRA	−0.014	−0.050***	0.046	−0.018
	(0.018)	(0.019)	(0.033)	(0.031)
CRA × After	0.148***	0.096***	0.055	0.019
	(0.028)	(0.026)	(0.040)	(0.040)
CRA × Gentrified × After	0.030	0.008	0.019	−0.014
	(0.062)	(0.045)	(0.050)	(0.043)
CRA × Gentrified	0.180***	0.068**	0.023	−0.017
	(0.037)	(0.029)	(0.031)	(0.027)
Gentrified × After	0.080***	0.046**	0.062	0.025
	(0.030)	(0.020)	(0.039)	(0.033)
Gentrified	0.100***	−0.041***	−0.101***	−0.214***
	(0.022)	(0.014)	(0.029)	(0.024)
Tract MFI # Year	Yes	Yes	Yes	Yes
Population # Year	Yes	Yes	Yes	Yes
Elasticity # Year	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	145887	145887	145887	145887
Adj. R^2	0.635	0.623	0.571	0.537

This table reports the results of a triple-difference analysis of the interaction between the CRA and gentrification. *Gentrified* is a dummy variable that equals one for census tracts in which the change in the share of educated residents (those with at least a bachelors degree or professional education), from the 1990 census to the 2000 census, are at the top 10% of the distribution, and zero otherwise. Standard errors are corrected for clustering at the state level. *, **, and *** denote significance at the 10, 5, and 1 percent level, respectively.

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