DO THE GSEs MATTER TO LOW-INCOME HOUSING MARKETS?
An Assessment of the Effects of GSE Loan Purchase Activity
on California Housing Outcomes

by

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Abstract

This study evaluates the effects of GSE mortgage purchase activity on homeownership and housing conditions among communities that are the focus of the 1992 GSE Act and the HUD affordable housing goals. To identify GSE effects, the test framework exploits differences in the definition of lower-income neighborhoods under the 1992 GSE Act, which establishes regulation for the GSEs, and the 1977 Community Reinvestment Act, which lays out regulation for Federally-insured depository institutions. Research findings indicate limited direct effects of GSE loan purchase activity on local housing markets. However, results do evidence a threshold level of GSE activity below which significantly adverse local housing market outcomes are recorded. These findings suggest the importance of GSE home loan purchases among low-income neighborhoods in efforts to achieve the GSE and HUD affordable housing goals.

I. Introduction

Recent years have witnessed ongoing research and policy debate as regards the adequacy of government-sponsored enterprise (GSE) mortgage purchase activity in lower-income and underserved housing markets. While the GSEs originally were established to provide liquidity to mortgage markets and to mitigate severe cyclical fluctuations in housing, those entities are intended as well to support the provision of affordable housing and the attainment of homeownership in lower-income and minority communities. Indeed, federal regulators have devoted much attention of late to the performance of Fannie Mae and Freddie Mac in promoting the flow of funds and hence the widespread availability of mortgage finance among targeted and underserved communities.[1]

The secondary mortgage market derived largely from a recognized need to reduce the non-price rationing of mortgage credit.[2] Accordingly, academic research and policy analysis largely has focused on whether the increased liquidity and implicit Federal guarantee associated with GSE operations have influenced the stability of mortgage market operations and the pricing of mortgages. Ambrose and Warga (1996) show that the GSEs have a costs of funds advantage over banking and other financial institutions on the order of 75 basis points. Similarly, Hendershott and Shilling (1989) and Cotterman and Pearce (1996) compare the mortgage rates on conforming loans, which the GSEs can purchase, and jumbo loans, which the GSEs can not, and show that the presence of the GSEs is associated with a 25 to 40 basis point reduction in interest rates. Other researchers argue that the GSEs have had at best a limited beneficial impact on mortgage pricing (Passmore and Sparks, (2003).

Additionally, the GSEs are intended to promote mortgage and homeownership opportunities among the full range of urban communities. The 1992 Federal Housing Enterprise Financial Safety and

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1. Fannie Mae, the Federal National Mortgage Association, was created in 1938 and established for the first time a secondary market in home mortgages. In order to enhance liquidity to home mortgage lenders and induce competition in the secondary mortgage market, the government in 1968 created the Federal Home Mortgage Loan Corporation, now known as Freddie Mac.

2   Further, federal regulators sought to geographically redistribute loanable funds from areas of excess savings to areas of excess demand for those funds.

Soundness Act of 1992 (GSE Act of 1992) increased the level of support the GSEs provide to lower-income and minority communities and authorized the Secretary of the Department of Housing and Urban Development to establish "affordable housing goals" for the GSEs.[3] The goals outlined in the GSE Act specify that, of each GSE's portfolio of loan purchases, a defined proportion must derive from:

- lower-income borrowers (the "low- and moderate-income" goal);

- borrowers residing in lower-income communities and borrowers in certain "high minority" neighborhoods (jointly, the "geographically targeted" or "underserved areas" goal); and

- very low income borrowers and low-income borrowers living in low-income areas (the "special affordable" goal).

The GSE Act defines lower-income borrowers (for the low- and moderate-income goal) as having incomes less than the metropolitan area median income. Under the geographically targeted goal, lower-income neighborhoods are defined as having a median income less than 90 percent of the area median income, and high minority neighborhoods are defined as having a minority population that is at least 30 percent of the total population and a median income of less than 120 percent of the area median. For the special affordable goal, very low income borrowers are those with incomes of less than 60 percent of the area median income. The final group targeted by the GSE Act includes borrowers living in low-income areas with incomes less than 80 percent of the area median income.

The goals specify a percentage of GSE loan purchases for each category. The specific percentages are adjusted periodically, as market conditions shift. The most recent HUD rules, set in November 2004 for purchase activity from 2005 through 2008, established the low- and moderate-income goal at 54 percent, the geographically targeted goal at 38.5 percent, and the special affordable goal at 24 percent.[4] These categories are not mutually exclusive, so a single purchase can count towards multiple goals.

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3 This additional responsibility was added in part because of a belief that returns to GSE shareholders benefited from the federal line of credit available to the GSEs.

    [4] These figures are averages over the 4-year period. Actual percentages vary from year to year.

In recent years, a sizable literature has emerged which examines the success of the GSEs in meeting the broad objectives laid out in the 1992 GSE Act. Bunce and Scheessele (1996) examine GSE purchase activity using data collected pursuant to the Home Mortgage Disclosure Act (HMDA) and find that the "shares of the GSEs' business going to lower income borrowers and underserved neighborhoods typically fall short of the corresponding shares of other market participants" (p. 3). Other researchers, including, Manchester, Neal, and Bunce (1998), Bunce (2002), and Case, Gillen, and Wachter (2002), have reached similar conclusions. Of these, Case, Gillen, and Wachter (2002) use a slightly different approach. They augment the HMDA data with HUD public use data base (PUDB) information on GSE purchases and compare the distribution of purchases to the distribution of mortgage origination Looking at 44 metropolitan areas over 1993 to 1996, they find that the GSEs are less likely to purchase loans extended to lower-income borrowers, minority borrowers, borrowers in lower-income neighborhoods, and borrowers in central cities.

Taking a different approach, Canner, Passmore and Surette (1996) employ a measure of risk exposure to loans extended to lower-income and minority populations as an indication of institutional impact on targeted communities. The authors examine loans eligible for insurance under the Federal Housing Administration (FHA) rules and evaluate how the risk associated with these loans is distributed among four classes of institutions: government mortgage institutions, private mortgage insurers, the GSEs, and banking institutions that hold loans in their portfolio. The results indicate that the FHA, the largest of the government mortgage institutions, bears the largest share of risk associated with FHA-eligible lending to lower-income and minority populations, with the GSEs lagging far behind. These findings thus are consistent with the above discussed studies.

However, research such as Listokin and Wyly (2000) and Temkin, et al. (2001) has also shown that the GSEs responded to the affordable housing goals by enhancing their product offerings so as to facilitate more purchases of loans from targeted communities. These new products often feature underwriting criteria that depart from industry norms and allow for higher risks. Moreover, Bunce and Scheessele (1996), Bunce (2000), and others have shown that in the years following the enactment of

the 1992 GSE Act, the GSEs have increased the proportion of their loan purchases to targeted populations in their portfolio. For example, between 1992 and 1995, Fannie Mae doubled the share of loan purchases from lower-income borrowers and Freddie Mac increased its share by about 50 percent. Manchester (1998) documents considerable GSE improvement in GSE loan purchases among lower-income and targeted communities; in 1995, Fannie Mae and Freddie Mac both surpassed the affordable housing goals established by HUD. Overall, the emergent literature suggests that the GSEs have been one of a number of players important in enhancing lower-income and minority access to mortgage credit. By some measures, the GSEs have been relatively smaller players. Nonetheless, since the passage of the 1992 GSE Act, GSE performance appears to have improved significantly.

The GSEs, however, may have enhanced mortgage market functions and support of lower-income and minority communities independent of their direct loan purchase activity. For example, Harrison, Archer, Ling, and Smith (2002) focus on whether the GSEs serve to reduce the prevalence of information externalities in mortgage lending markets. Information externalities are potentially an important factor in the provision of mortgages to lower-income and minority communities because these areas often have low transaction volumes (i.e., "thin markets"), a characteristic that has been shown to be negatively associated with the probability of having a mortgage application approved.[5] If the GSEs help to enhance the number of transactions in thin markets, then they can thus improve the prospects for individuals in lower-income and minority communities seeking homeownership, regardless of whether the mortgage is subsequently purchased by a GSE or not. The authors find that the GSEs in general, and Fannie Mae in particular, do indeed help to increase the number of transactions in thin markets in Florida and thus help to mitigate the effects of information externalities.

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[5]Lang and Nakamura (1990) develop a model of mortgage lending that shows that, because of higher uncertainty, mortgage applications for properties located in neighborhoods with low transaction volumes (sometimes known as "thin markets") will be deemed riskier than applications from neighborhoods with high transaction volumes ("thick markets"). Many studies have since found empirical evidence in support of the theory, including Harrison (1999), Calem (1996), and Ling and Wachter (1998).

As a second example, Myers (2002) examines the effects of GSE activity on loan origination. In so doing, he argues that lenders have a greater incentive to approve those loans most likely to be purchased by the GSEs, because increased liquidity is realized only if the GSEs purchase the originated loans. Myers specifically tests whether primary market lenders favor higher income borrowers, white borrowers, borrowers in higher-income neighborhoods, and borrowers in the suburbs, since these are the populations that have been shown to receive considerable GSE support. While Myers does find that loans with a lower probability of being sold to the GSEs do have a lower likelihood of being approved overall, he does not find support in the data for this incentive-based explanation for the observed disparities by race in mortgage approvals. This is because the estimated effect is of limited magnitude or does not exist across all metropolitan areas.

II. Research Question and Approach

Rather than further explore how GSE activity has influenced mortgage lending, this paper seeks evidence of direct effects of GSE loan purchase activity on local housing markets. In that regard, the study attempts to determine whether GSE mortgage purchase activity is associated with improvements in housing conditions and homeownership attainment among communities that are the focus of the 1992 GSE Act and the affordable housing goals set by HUD. The geographic focus is the State of California.

We evaluate this question by exploiting variation in regulation that governs the mortgage loan purchase activities of the GSEs (the 1992 GSE Act) and that which governs the mortgage loan origination activities of banking institutions (The Community Reinvestment Act of 1977). The Community Reinvestment Act (CRA) derived in part from concerns that banking institutions were engaged in "redlining," a practice by which lenders would fail to seek out credit-granting opportunities in minority or lower-income neighborhoods. The resultant lack of available capital, it was argued, held back the economic development of those communities. The CRA directs the federal banking regulatory agencies to encourage federally-insured banking institutions to assist in meeting the credit needs of all communities in their service areas, including lower-income areas, while maintaining safe and sound

operations.[6]   In the context of federal bank examinations, regulators are directed to assess the institution's record of meeting the credit needs of all communities in their service area and to consider the institution's CRA performance when assessing an application for merger, acquisition, or other structural change.

CRA examinations of banking institutions scrutinize their geographic distribution of lending activities. Among other tests, these examinations compare (1) the proportion of loans extended within the institution's CRA assessment area as compared to the proportion of loans extended outside of its assessment area, and (2) the distribution of loans within the institution's CRA assessment area across neighborhoods with differing incomes, with lending in lower-income neighborhoods receiving particular weight.[7]   Here, lower-income neighborhoods are defined as those neighborhoods (typically defined as census tracts) that have a median family income of less than 80 percent of the median family income of the metropolitan area in which the census tract is located.

There is considerable evidence indicating that banking institutions have responded to the CRA by increasing the resources and lending directed to lower-income areas within their assessment areas. Avery, Bostic, and Canner (2003), for example, show a limited increase in the percentage of institutions engaged in community lending activities because of the CRA. As another example, Schwartz (1998) and Bostic and Robinson (2003a, 2003b) examine the effects of CRA agreements, which are pledges lenders make to extend specified volumes of lending to targeted communities, and find evidence suggesting increased levels of lending on the part of banks.

In our study, the test framework capitalizes on variation in the regulatory definition of lower-income neighborhoods under the 1992 GSE Act and the 1977 CRA. For the GSE geographically targeted

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[6]The federal regulatory agencies are the Board of Governors of the Federal Reserve System, the Office of the Comptroller of the Currency, the Federal Deposit Insurance Corporation, and the Office of Thrift Supervision.

[7]Banking institutions specify their CRA assessment area, a geographic area that roughly corresponds to the areas where the institution operates branches and where it does considerable lending, in order to facilitate CRA performance evaluations. CRA assessment areas must be approved by the federal regulatory agencies. The CRA regulations also require that examiners evaluate the distribution of loans within its assessment area across borrowers of different economic standing. For more information on the regulations implementing the CRA, see Board of Governors (2000).

loan purchase goal, the GSE Act uses 90 percent of area median income as the threshold for defining lower-income neighborhoods. By contrast, the CRA establishes an 80 percent threshold for identifying lower-income neighborhoods within a banking institution's loan origination assessment area. Given these definitions, it is clear that a subset of neighborhoods is the focus of GSE but not banking institution regulation. In particular, while census tracts with a median income of less than 80 percent of the area median income are of regulatory concern to both banking institutions governed by CRA and the GSEs, those neighborhoods with median incomes between 80 and 90 percent of the area median income only fall under the regulatory attention of the GSEs. We thus can use changes in measures of neighborhood and housing market activity in this latter set of census tracts, compared to changes in similar census tracts not covered by GSE regulation, as an indication of the impact of GSE activities. This is a direct and relatively powerful test of the GSEs' impact on local housing markets.

The form of our empirical test follows Avery, Calem, and Canner (2003), who conduct a similar analysis of the impact of the CRA on local communities. As in that study, the challenge is to establish the counterfactual of local housing market activity in the absence of GSE loan purchase activity. While it is relatively straightforward to identify the treatment group (census tracts with median incomes between 80 and 90 percent of the area median), there are no census tracts in the same median income range that do not receive regulatory treatment by either the banking institutions or the GSEs. As in Avery, Calem, and Canner (2003), we address this challenge by identifying a control group as close as possible to the treatment group.[8]

The analysis here follows this general methodology, but uses the lower-income threshold as defined by the 1992 GSE Act as the key cutoff. Accordingly, our study focuses on the 90 percent threshold that defines the marginal impact of the GSE regulations alone. We compare outcomes among tracts distributed about the GSE Act threshold and use a range of 10 percentage points (80-90 percent

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8 In the Avery et al (2003) study, the control group is the set of census tracts just above the lower-income neighborhood threshold as defined by the CRA regulations, under the reasoning that these tracts could be CRA-eligible with only a slight change in their populace.

versus 90-100 percent of area median income).[9] The key outcomes of interest are changes in three local housing market indicators, the homeownership rate, the vacancy rate, and the median house value.

A key advantage of our approach is its simplicity. Because the tracts in the control and treatment groups are located in the same metropolitan areas and often are in close proximity to each other, they face many of the same economic and demographic forces that influence metropolitan housing markets. This obviates the need to control for many factors, including technology, metropolitan economic performance, and new mortgage and other lending practices.

III.   **GSE Activity in California**

Before proceeding to the statistical analysis, it is useful to document the extent of GSE loan purchase activity in California over the course of the 1990s. Public data on GSE activity available from the U.S. Department of Housing and Urban Development indicate a substantial GSE loan purchase volume in the State of California (table 1). During the 1990s, the annual GSE loan purchase volume in California averaged 435,500 loans per year, with annual activity ranging between roughly 300,000 to 650,000 loan purchases. Data on loan origination volume and GSE purchase activity between 1994 and 1999 reported by banks as a result of the Home Mortgage Disclosure Act of 1975 suggest that, on an annual basis, the GSEs purchased an average of 29.5 percent of the conventional owner-occupied 1-4 family home purchase loans originated in California. This compares with a 32.1 percent share of comparable loans nationwide. By this metric, the GSEs were relatively underrepresented in California despite the high absolute level of activity. This is due in large part to the high price of housing in California, which resulted in many homes priced beyond the range of conforming loans. If attention is restricted to the market for conventional conforming loans, the gap actually reverses, with GSE market share in California (41.2 percent) substantially exceeding the GSE market share, nationwide. Among the GSEs and as is the case nationally, Fannie Mae purchased a larger share of California's conventional loan portfolio, and its presence increased slightly over the course of the decade.

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[9] Avery, Calem, and Canner (2003) establish the robustness of their observed relationships by varying the range of tracts about the CRA threshold. Such an approach is not possible for this study because of the small sample

Table 1 indicates the inter-metropolitan distribution of GSE activity in California. The data show some concentration of activity in coastal southern California, the Inland Empire (Riverside and San Bernardino counties), Sacramento, and the San Francisco Bay Area. GSE purchase activity in these areas together accounted for over three-fourths of all purchase activity in the state in 1994 and 1999. This concentration of activity was greater than the concentration of population in the state, as these areas jointly accounted for slightly more than two-thirds (68 percent) of the state's population (not shown). The Bay Area's GSE purchase share, at about 20 percent, was nearly twice its population share (about 10 percent). By contrast, the Los Angeles-Long Beach GSE loan purchase share was about 5 percentage points less than its population share.

A majority of GSE loan purchase activity in California during the 1990s took place in higher income neighborhoods (61.4 percent), in relatively integrated neighborhoods (46.2 percent), and for loans originated among higher income borrowers (60.5 percent). The data show that these proportions generally rose during the 1990s, so that these populations comprised an even greater share of the GSE purchase activity by the end of the decade (Table 2). Both the Fannie Mae and Freddie Mac loan purchase portfolios also showed an increased representation of lower-income borrowers. These distributions and trends are broadly consistent with the findings in prior research, although the degree of improvement evidenced in California was somewhat damped relative to other parts of the United States.

IV.   GSE Activity in the Los Angeles Metropolitan Area

Prior to assessing the results of the statistical analysis, it is useful to examine the spatial distribution of housing market attributes and GSE loan purchases. These distributions provide a baseline for understanding the key relationships that this study seeks to identify and explain. Given the size and diversity of California metropolitan areas, it is perhaps most instructive to demonstrate the basics of the approach with application to a single metropolitan area. For that purpose, we focus on the Los Angeles-Long Beach metropolitan area.

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sizes that would result from using small income ranges.

Figures 1 and 2 indicate the spatial distribution of Los Angeles County neighborhoods by income and minority (black and Hispanic) representation. The charts suggest a negative correlation between neighborhood income level and the degree of minority representation among its population. Higher-income neighborhoods are clustered along the Pacific coastline, the San Fernando Valley to the northwest, and along the County's border with Orange and Riverside Counties to the southeast. By contrast, neighborhoods with high levels of minority representation tend to be clustered toward the center of the County, with the extent of a minority presence declining with distance from the center.

For purposes of this study, we focus on those neighborhoods that are close to the GSE-eligible threshold of 90 percent of the area median income. Figure 3 shows the spatial distribution of these neighborhoods. As evidenced, these neighborhoods are in close proximity to each other, which in turn suggests that they face many of the same economic and demographic forces. The geographic proximity of the GSE-eligible neighborhoods reduces the need to exhaustively control for all metropolitan forces that might influence housing market outcomes, since the influence is likely to be near identical within the treatment and control groups.

Turning to GSE purchase activity, we observe that GSE activity is not randomly distributed across the Los Angeles metro area (figure 4). For example, in 1994 purchase activity was relatively more concentrated in the north central portion of the county, which includes the San Fernando and San Gabriel valleys, the near coastal areas, including Torrance, and the I-605 corridor, which encompasses the communities of Cerritos, Downey, Whittier, and Baldwin Park. The central core of the county has not seen high levels of GSE loan purchase activity, in part because there are fewer home purchases in these areas. Over time, the distribution of GSE loan purchases has changed only slightly, although in recent years the intensity of activity has risen across much of the county, just as it has nationwide in the context of the more favorable housing finance environment (figure 5). It is not appropriate, however, to conclude from this evidence that the GSEs have not served lower-income communities that fall under their mandate, for homeownership is not randomly distributed across the metro area either (figure 6).

Indeed, the distribution of homeowners in Los Angeles County roughly mirrors the distribution of GSE loan purchases.

V. Data

This study uses data from the 1990s to assess the effects GSE home loan purchase activity on local housing market outcomes. The analysis employs census tract-level data compiled via the 1990 and 2000 Censuses to establish the initial housing market conditions in a neighborhood and to measure how those conditions changed over the decade. We focus on three measures of housing market conditions: the homeownership rate, the vacancy rate, and the median house value.[10] Our interest is to test whether these three measures are sensitive to GSE support of home purchase activity in the neighborhood and whether GSE activity has had a significant positive impact on neighborhood housing markets. In accordance with to the identification strategy described above, the analysis is restricted to California metropolitan area census tracts with median family incomes between 80 and 100 percent of the area median family income.

Because trends in the homeownership rate, vacancy rate, and median house values are influenced by factors beyond GSE activity and because the relationship between GSE activity and changes in housing market conditions might also be affected by these factors, we also compiled demographic, economic, and housing-related data for each census tract. We use these data items, which include youth, elderly, and minority population shares, average household size, percentage of all units in the tract that are 1-4 family units and that are owner-occupied, to control for differences across tracts, noting as well that these differences can mediate the relationship between GSE activity and housing market outcomes in important ways. As discussed below, our analysis also controls for possible endogeneity between GSE loan purchase activity and neighborhood housing market conditions. This procedure allows us to identify causal outcomes rather than correlations in the data.

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[10] In this study, the homeownership rate is defined as the number of owner-occupied 1-to-4 family housing units divided by the total number of 1-to-4 family housing units in a tract, while the vacancy rate is defined as the number of vacant housing units divided by the total number of housing units in the tract We also used total number of housing units in the tract as the denominator in this ratio. The results remained qualitatively unchanged.

For the comparisons we examine to be meaningful, it is necessary that the 1990 and 2000 data pertain to the same geographic space. Because tract boundaries change between each decennial Census, we were not able to use the primary data that is publicly available from the Bureau of the Census. Instead, we use a dataset constructed by Pci, Incorporated that recomputed the 2000 Census data based on the 1990 census tract boundaries. Roughly, the process involves reconstituting each census tract using 1990 Census boundaries as a weighted combination of the 2000 census tracts.[11]

The final sample includes 1122 census tracts. Table 3 presents information concerning the sample as a whole as well as regards the subgroups of tracts on either side of the 90 percent GSE eligibility threshold. Overall, the tracts in the sample had relatively young and minority populations, as the share of young people and minorities exceeded state and national norms. Moreover, sample tracts trailed the state as a whole along a number of housing market dimensions. Sampled tracts recorded relatively low homeownership rates and house values, with the median house value falling well below the state median. Tracts in the sample did generally witness improvement in housing market conditions between 1990 to 2000, as homeownership rates and median house values increased while vacancy rates fell substantially.

In comparing tracts just above and below the GSE income eligibility threshold, the data show that the tracts are similar along many dimensions. For example, tracts with median family incomes of 80-90 percent of metropolitan area median family income and tracts with median family incomes of 90-100 percent of metropolitan area median family income had statistically similar elderly and Asian population shares as well as statistically similar average household sizes. However, they did differ in some respects, as GSE-eligible tracts had statistically elevated percentages of children and minorities. For example, tracts just below the GSE threshold with 80-90 percent of area median income had about 35 percent minority population share, compared with a 28 percent minority share for those tracts with 90-100 percent of area median income. Further, the GSE-eligible tracts also saw lower wage growth during the 1990s than those tracts just above the eligibility threshold.

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[11] For example, if a 1990 census tract was the equal product of 3 tracts using 2000 Census definitions, then the average house value for the tract would be calculated as the average house values in the three 2000 tracts.

Finally, in terms of housing market indicators, tracts just below the GSE threshold began the decade with an average homeownership rate and average median house value significantly lower than tracts just above the GSE's 90 percent of the metropolitan area median family income threshold. In both cases, the average values for tracts below the GSE threshold were about 10 percent lower than those for tracts just above the threshold. The two groups of tracts did not show a significant difference in terms of vacancy rates, with both groups showing an average vacancy rate of between 5.5 and 6 percent.

Despite these initial differences, tracts with median family incomes just above and below the GSE threshold did not evidence significant differences in housing market performance during the 1990s. These groups of tracts recorded statistically comparable increases in homeownership rates of about 4-1/2 percentage points. Average vacancy rate declines were also of similar magnitude across the two sample groups, as was the percentage increase in the average median house value. These small differences in the average housing market experiences of tracts that fall just below and beyond the GSE threshold suggests that GSE activity might not have a significant impact on local housing market outcomes. However, the univariate statistics in table 3 do not take into account the correlations between housing market outcomes and other important determinants of housing market outcomes and thus leaves open the possibility that these correlations mask the effects of GSE activity. The analysis below incorporates such correlations in order to obtain a clear signal regarding the effects of GSE activity on local housing market outcomes.

VI.   Results

The statistical analysis seeks to assess the effects of GSE loan purchase activity on housing market indicators among California census tracts that are the focus of the 1992 GSE Act and HUD affordable housing goals. The analysis regresses levels and changes in census tract housing market conditions on levels and changes in census tract measures of GSE loan purchase intensity and other local market characteristics. As noted above, the sample is restricted to tracts with median incomes between 80 and 100 percent of the area median. The empirical structure enables comparison of housing market performance among those census tracts that fall under the GSE affordable goals but outside the CRA

umbrella (tracts with median family incomes of 80-90 percent of the metropolitan area median) with the performance in those census tracts just outside the GSE affordable goals umbrella (tracts with metropolitan area median family incomes of 90-100 percent of the area median). Given our use of census data, market performance is measured from 1990 to 2000.[12]

Table 4 shows the coefficient estimates for a categorical variable indicating whether the Census tract had a median income of less than the 90 percent threshold for determining whether the tract is a focus of GSE activities under the GSE Act.[13] Each row represents a separate regression of a measure of housing conditions. The first set of results, shown in the first three rows, show that, controlling for tract and metropolitan area characteristics, GSE-targeted tracts characterized by median incomes of 80-90 percent of the metropolitan area average had significantly lower levels of homeownership and house values. Thus, targeted tracts lagged others in the metropolitan area in terms of housing market conditions, in turn suggesting the appropriateness of the GSE Act targeting approach. The key regressions of interest, however, involve *changes* in the local housing market measures across targeted and non-targeted census tracts. These results, shown in the bottom three rows of table 4, suggest that there was little difference in trends during the 1990s between the two groups of tracts save a slightly lower rate of growth in the median house value among GSE-targeted tracts. However, all the estimated

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[12] While changes in census tract housing market conditions are measured for the period between the decennial censes of 1990 and 2000, note that the GSE Act was not passed until 1992 and the first goals were not established until 1995. It is plausible to assume, however, that the GSEs were aware of GSE Act provisions in advance of the passage of the legislation. Federal legislation rarely occurs without broad debate and discussions about various provisions and incentives, and it is unlikely that the GSEs were unaware of deliberations surrounding the GSE Act and its provisions. If true, then prior to the Act's passage, the GSEs might have internalized a number of its incentives, which would suggest a behavioral response earlier than the 1990s. Note further that California experienced a deep recession in the early 1990s with house prices tumbling by upwards of 15 percent. In such an environment, home sales were relatively low and GSE mortgage purchase activity was unlikely to play a significant role in shaping local housing outcomes. The state's economy started to regain its footing only in 1993, had virtually returned to its 1990 position by 1995, and was primed for the strong growth than ensued from this point. In this view, much of the benefit that GSEs afford would have been evidenced primarily in the 1995-2000 period.

[13] The empirical specification for the regressions in table 4 includes PMSA-level economic variables as controls for metropolitan area variation. The full regression results are shown in Appendix A. Regressions using PMSA-level fixed effects as alternative controls yield identical qualitative results, although the level of statistical significance is in some cases is reduced.

coefficients are negative, which implies that targeted tracts did tend to lag non-targeted tracts characterized by median incomes just above the 90 percent threshold.

Note, however, that the above results make no distinction as to the extent of *actual* GSE activity within a tract and thus provide limited indirect evidence as to the effects of GSE loan purchase activity on local housing market indicators. Alternatively, we can measure the intensity of GSE activity within a given census tract. For each tract, we calculate the average number of purchases made by the GSEs between 1994 and 1999 using HMDA data. We then create two variables: (1) the ratio of average GSE purchases to the average number of loans originated in the tract during the same period, and (2) the ratio of average GSE purchases to the number of units in the tract. The former measure captures the extent to which the GSEs contribute to capital flows in a neighborhood, whereas the latter measure captures the idea that intensity might be important only to the extent that it reaches broadly into a neighborhood's physical structure.

Table 5 provides some sample statistics for the two measures of average intensity of GSE activity for the tracts in the sample as well as for the State of California as a whole. As might be expected given the state's high cost of housing, when intensity is measured in terms of loan purchases, GSE activity in the sample tracts (those with median incomes in the range of 80-100 percent of metropolitan area average) exceeds that of other California tracts. Perhaps surprisingly, this is not as clearly the case when one uses a GSE activity measure based on the number of units in a census tract. Here, we see that the broader dispersion of GSE housing market support among all California tracts pulls the mean level of unit-based intensity above that for the tracts in the sample. Within the sample, tracts with median incomes above the GSE Act threshold of 90 percent tended to see higher GSE intensity than tracts with median incomes below that level. This trend held for both the loan purchase and unit-based measures of GSE activity.

In that little is known about how the intensity of GSE loan purchase activity might be related to local housing market outcomes, we incorporate GSE purchase intensity into the original empirical specification in a number of different ways. In addition to incorporating intensity in a linear fashion,

several categorical variables are also constructed by rank ordering California tracts according to their level of GSE loan purchase activity so as to create quartile indicator variables. The tables that follow present coefficients from the specifications where quartile indicator variables are used. The overall results are relatively robust to these alternative specifications of GSE loan purchase intensity measures.

A problem in interpreting the regression results presented in table 4 as causal is that the change measures for the dependent variable and the GSE purchase activity indicators may be endogenous. To address this concern, we use an instrumental variable approach to estimate loan purchase intensity for our sample of census tracts in the 1990s. We regress the measures of GSE loan purchase intensity in the 1990s on neighborhood and housing market conditions during the 1980s, the results of which are shown in Appendix table A.2, and then calculate predicted GSE loan purchase intensity indicators for each tract. These predicted values are then utilized to explain differences across tracts in housing market conditions during the 1990s.

Table 6 displays the coefficients of the GSE loan purchase quartiles for regressions in which the homeownership rate, vacancy rate, and median house value are the dependent variables, respectively.[14] Focusing first on the homeownership rate, we see that the GSEs were generally active in tracts which had lower initial levels of tract homeownership, with the results being largely insensitive to the degree of GSE purchase intensity in the tract. This is consistent with an objective of the 1992 GSE Act, namely increased attention on locations which had relatively low levels of homeownership.

The more important result involves the relationship between the intensity of GSE activity in a tract and changes in the tract's homeownership rate during the 1990s. Our fndings here indicate that not having intense GSE home loan purchase activity is unambiguously adverse for local homeownership. GSE-eligible tracts with the lowest intensity of GSE activity (quartile 1) had significantly smaller increases in homeownership than tracts just beyond the threshold laid out in the 1992 GSE Act. Those results are observed across both measures of GSE loan purchase intensity. An examination of the estimated coefficients vector indicates a positive and monotonic relationship between the intensity of

GSE loan purchase activity in a tract and changes in the tract's homeownership rate. In fact, results suggest that the highest intensities of GSE loan purchase activity (quartile 4) are associated with increases in the homeownership rate above what is experienced in control group tracts.

The results for vacancy rates offer similar conclusions. Relatively low levels of GSE loan purchase intensity are associated with significant increases in a tract's vacancy rate (regardless of GSE loan purchase intensity measure), whereas relatively high levels of GSE loan purchase activity are associated with sharp declines in the rate of vacancy growth These results hold even though the initial tract vacancy rate is not significantly associated with the relative intensity of GSE activity in that tract.

The results for median house values provide a different message. Here, the intensity of GSE activity is negatively associated with improvements in housing market conditions, as measured by rates of growth in median house values in the census tract. Those GSE-targeted census tracts with the highest degree of GSE attention recorded significantly lower rates of growth in median house values than census tracts with median incomes above the 90 percent of area median threshold. We further note that tracts just below the 90 percent threshold had significantly lower median house values than those above the threshold.

The above results pool data from geographically-distinct urban housing markets in California. As is well appreciated, California markets vary considerably in degree of housing supply constraint, pace of construction activity, and level of housing affordability. Accordingly, we reran the change in housing market conditions regressions, this time geographically stratifying the census tracts so as to reflect the unique market characteristics of the coastal and interior markets. Indeed, much of the housing development in the state is occurring in interior markets, which diverge sharply from coastal California (San Francisco, Los Angeles and the like) in terms of the ease of getting land entitled, pace of construction activity, and level of housing affordability.

Stratification of the sample across these disparate markets yielded only limited results. Coastal markets showed GSE loan purchase effects similar to those reported for the sample overall. In coastal

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[14] The full regression results are reported in Appendix A.3.a – A.3.c.

markets, higher levels of GSE loan purchase intensities (by both the loans and units measures of GSE loan purchase activity) were associated with improving homeownership conditions. By contrast, interior markets revealed depressed rates of homeownership change throughout. Indeed, some of the remote Central Valley markets (Bakersfield, Fresno) evidenced depressed housing market conditions over the course of the 1990s even as robust activity was being recorded along the coast Results for the vacancy rates measure suggest limited sensitivity of this measure of local housing market conditions to GSE loan purchase activity. Relative to coastal markets, however, estimated findings for California interior markets suggest substantially larger declines in vacancy rate growth in the wake of higher levels of GSE activity. Findings further reveal little systematic variability between coastal and interior markets in the house price effects of GSE loan purchase patterns.

VII.   Conclusion

This paper assesses the direct effects of GSE loan purchase activity on local housing markets. In so doing, the study seeks to determine whether GSE mortgage purchase activity is associated with improvements in homeownership and housing conditions among communities that are the focus of the 1992 GSE Act and the affordable housing goals set by HUD. The test framework exploits differences in the regulatory definition of lower-income neighborhoods under the 1992 GSE Act, which establishes regulation for the GSEs, and the 1977 Community Reinvestment Act, which lays out regulation for Federally-insured depository institutions. In defining lower-income neighborhoods, the GSE Act establishes a neighborhood median family income of 90 percent of area median family income as the threshold, while the CRA establishes a neighborhood median family income of 80 percent of the area median family income as the threshold. These definitions leave census tracts with median incomes between 80 and 90 percent of the area median family income as the clear GSE treatment group. We use changes in measures of housing market outcomes, including house prices, vacancy rates, and homeownership, among these GSE-targeted census tracts compared to changes in these measures among a control group of census tracts to indicate the impact of GSE activities. GSE impact is proxied using two distinct measures: (1) the ratio of average GSE purchases to the average number of loans originated

in the tract during the 1990-2000 period, and (2) the ratio of average GSE purchases over that period to the number of units in the tract.

Research findings suggest that the degree of GSE loan purchase activity can influence housing market outcomes for lower-income neighborhoods. The results suggest that *low* intensity GSE activity in GSE-targeted tracts is generally associated with adverse housing market trends – including lower homeownership rates and higher vacancy rates – relative to trends in a group of control tracts that fall just above the 90 percent threshold established by the GSE Act. Further, while *higher* intensity GSE activity in GSE-targeted tracts generally is associated with improved housing market trends – higher homeownership rates and lower vacancy rates – relative to those in the control group, these results are often not statistically significant. Also, GSE-targeted census tracts with the highest intensity of GSE loan purchase activity recorded significantly lower rates of growth in median house values than census tracts with median incomes above the 90 percent of area median threshold. Finally, research findings indicate some limited variability in GSE effects across coastal and interior areas of the state. In coastal markets, higher levels of GSE loan purchase intensities were associated with improving homeownership conditions. In contrast, interior markets evidenced depressed rates of homeownership change throughout.

The results of this research suggest limited direct effects of GSE loan purchase activity on local housing markets. However, results do clearly evidence a threshold level of GSE activity below which significant adverse local housing market outcomes are recorded. The tracts in our sample that did not receive this threshold level of GSE support fell behind others and did not share fully in the benefits of economic expansion and prosperity that California experienced through the 1990s. In light of this, efforts should be made to promote an adequacy of GSE home loan support across low-income neighborhoods. This may involve expanding the set of loans the GSEs can purchase to include subprime and other non-standard loan products, since the residents of targeted tracts typically have lower credit quality than consumers as a whole. Further, revisiting the methodology for determining the conforming

loan limit might be warranted, so that more homes in expensive markets are able to fall under the GSE umbrella.

This study also raises questions for future research. One obvious question is whether the GSE effects observed for California hold in markets with very different economic and demographic characteristics. Of particular interest is whether the inverse relationship between GSE loan purchase intensity and the change in median house values persists in markets that do not exhibit the particular dynamics of California. An expansion of the analysis to other U.S. metropolitan areas would be useful in addressing this issue.

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Table 1.

Distribution of GSE Loan Purchases among selected California MSAs (1994 and 1999)

	1994			1999		
	Fannie Mae	Freddie Mac	Total	Fannie Mae	Freddie Mac	Total
Metropolitan statistical area						
Los Angeles-Long Beach (4480)	24.7	23.7	24.3	21.6	20.6	21.5
Alameda-Contra Costa (5775)	8.8	8.9	8.9	8.9	9.9	9.3
Orange (5945)	8.8	9.5	9.1	10.6	9.7	10.2
Riverside-San Bernardino (6780)	9.0	8.3	8.7	9.2	9.0	9.1
Sacramento (6920)	5.9	6.2	6.0	6.6	6.6	6.6
San Diego (7320)	9.1	9.0	9.0	10.7	8.9	9.9
San Francisco (7360)	4.2	4.6	4.4	4.5	4.2	4.3
Santa Clara (7400)	6.3	6.2	6.3	5.9	5.7	5.8
Remainder	23.2	23.6	23.3	22.0	25.4	23.3
Total	100.0	100.0	100.0	100.0	100.0	100.0
Number of purchases (000s)	228	192	420	357	265	621

Table 2
Distribution of GSE Purchases in California by Borrower and Tract Characteristics
(1994 and 1999)

	1994			1999		
	Fannie Mae	Freddie Mac	Total	Fannie Mae	Freddie Mac	Total
Tract median income (relative to MSA median)						
120 percent or more	35.6	38.3	36.3	40.9	40.7	40.8
100-120 percent	24.4	25.8	25.1	25.7	26.0	25.8
90-100 percent	13.0	12.7	12.9	12.2	11.8	12.0
80-90 percent	10.2	9.4	9.8	9.1	9.4	9.3
Less than 80 percent	17.8	13.7	15.9	12.1	12.0	12.3
Tract income missing	0.0	0.1	0.1	0.0	0.1	0.1
Borrower median income (relative to MSA family median)						
120 percent or more	45.3	47.8	46.4	46.0	49.2	47.4
100-120 percent	14.0	14.2	14.1	13.4	14.0	13.7
80-100 percent	13.8	13.8	13.8	13.4	14.6	13.9
Less than 80 percent	16.8	16.2	16.5	19.0	20.1	19.5
Borrower income missing	10.2	8.0	9.2	8.1	2.0	5.5
Percent minority						
50 percent or more	26.2	22.2	24.4	18.6	18.1	18.4
30-49 percent	22.3	20.9	21.7	21.5	21.1	21.3
10-30 percent	44.6	48.1	46.2	51.3	51.5	51.4
5-10 percent	6.6	8.3	7.4	8.2	8.8	8.5
Less than 5 percent	0.3	0.4	0.3	0.4	0.4	0.4
Tract percent missing	0.0	0.1	0.0	0.0	0.1	0.0
Total share	54.4	45.6	100.0	57.4	42.6	100.0
Number of purchases (000s)	228	192	420	357	265	621

Table 3
Selected Sample Averages

	All tracts in sample	Tracts just above GSE margin	Tracts just below GSE margin
Housing market indicators			
Homeownership rate, 1990	46.50	48.46	**44.36*****
Vacancy rate, 1990	5.72	5.85	5.59
Median house value, 1990	$181,668	$191,768	**$170,626*****
Homeownership change, 1990s (percent)	4.36	4.28	4.46
Change in vacancy rate, 1990s (percent)	-10.81	-12.00	-9.49
Change in median house value, 1990s (percent)	17.10	17.97	16.2
Demographic characteristics			
Percentage aged 17 or less, 1990	25.38	24.94	**25.86***
Percentage aged 65 or older, 1990	11.54	11.29	11.82
Percent minority, 1990	31.35	28.41	**34.57*****
Percent Asian, 1990	9.61	10.11	9.06
Household size, 1990	2.89	2.86	2.92
Percent 1-4 unit structures, 1990	72.74	74.13	**71.21****
Percent single family homes, 1990	76.29	77.16	75.33
Number of owner-occupied units, 1990	1095	1135	**1051***
Change in the number of units, 1990s	6.57	6.74	6.39
Change in family household income, 1990s	33.41	34.24	32.50
Metropolitan area characteristics			
Per capita income in PMSA, 1990	$22,355.7	$22,553.7	$22,139.3
Employment in PMSA, 1990 (000s)	57.45	58.08	**56.76***
Per capita wages in PMSA, 1990	$25,692	$25,851	$25,517
Change in PMSA per capita income, 1990s (percent)	50.03	51.21	48.75
Change in PMSA employment, 1990s (percent)	3.42	3.45	3.39
Change in PMSA per capita wages, 1990 (percent)	54.00	55.54	**52.25***
Memo: Number of tracts	1122	586	536

Note: Values are reported for the entire sample of census tracts, for census tracts with median family incomes between 90 and 100 percent of the area median family income (tracts just above the GSE margin), and for census tracts with median family incomes between 80 and 90 percent of the area median family income (just below the GSE margin). An asterisk (*) indicates a value that is statistically different from the 90-100 percent sub-sample (***- $p < .001$, ** - $p < .01$, * - $p < .05$).

Table 4
Regression Results by Treatment Variable

Regression	Coefficient (Standard error)
1990 Level	
Homeownership rate	-1.64*** (0.43)
Vacancy rate	-0.076 (0.333)
Median house value	-9,677.03*** (2,649.01)
Percent change, 1990-2000	
Homeownership rate	-1.09 (0.70)
Vacancy rate	-3.31 (4.36)
Median house value	-3.21*** (0.93)

NOTE: ***- $p < .001$, ** - $p < .01$, * - $p < .05$. Regressors for the levels regression include household size, the percentage of units that are 1-4 family structures, the percentage of units that are single family structures, the MSA level of employment and per capita wages, and indicator variables for child population share, elderly population share, minority (black and Hispanic) population share, Asian population share, and whether the tract was urban. Regressors for the percent change regressions include 1990 levels and changes during the 1990s in all of these variables plus the 1990 level of the dependent variable. Full regression results are in Appendix A.1.a and A.1.b.

Table 5
Average intensity of GSE activity in California, 1994-1999

	Definition 1: Percentage of loans				Definition 2: Percentage of units			
	California	Sample	80-90	90-100	California	Sample	80-90	90-100
Mean	20.86	22.00	21.19	22.74	1.24	0.98	0.92	1.03
Median	20.98	22.34	20.86	23.44	0.85	0.87	0.81	0.93
Maximum	100.00	47.85	46.58	47.85	115.85	7.79	7.79	5.57
75th pct.	13.54	28.17	27.60	28.71	1.38	1.22	1.17	1.29
25th pct.	27.82	15.56	14.51	16.18	0.16	0.56	0.49	0.59
Minimum	0.00	3.13	3.13	4.07	0.00	0.04	0.04	0.08
N		1122	536	586		1122	536	586

NOTE: The sample is restricted to metropolitan tracts with average median incomes of 80-100 percent of the metropolitan area average. Entries to the "Sample" columns are computed as the average of the entries in the 80-90 and 90-100 percent of area median income columns, weighted by their respective sample sizes.

Table 6
Regression Results for the GSE-Targeted Tract/GSE Intensity Interactions

	1990 Level		Percent change, 1990-2000	
	i by loans	ii by units	iii by loans	iv by units
Homeownership rate				
Quartile 1	-1.83*	-2.71***	-3.25**	-3.37**
	(0.74)	(0.75)	(1.07)	(1.06)
Quartile 2	-2.02**	-3.13***	-1.10	-1.94
	(0.63)	(0.60)	(1.01)	(1.04)
Quartile 3	-1.35*	-1.06	-0.96	-1.01
	(0.67)	(0.59)	(1)	(0.97)
Quartile 4	-1.36*	1.37	0.50	1.53
	(0.68)	(0.82)	(1.05)	(1.04)
Vacancy rate				
Quartile 1	-0.24	0.31	17.08*	19.60*
	(0.58)	(0.59)	(8.43)	(8.33)
Quartile 2	-0.16	-0.24	-9.52	-4.75
	(0.50)	(0.48)	(7.94)	(8.2)
Quartile 3	-0.26	-0.23	-11.75	-18.05*
	(0.52)	(0.47)	(7.83)	(7.66)
Quartile 4	0.32	0.13	-10.52	-10.60
	(0.53)	(0.65)	(8.28)	(8.17)
Median house value				
Quartile 1	-9,056.15*	-16,722.90***	0.00	-0.86
	(4,619.40)	(4679.69)	(1.73)	(1.72)
Quartile 2	-10,617.95**	-7,357.80*	-2.63	-3.95*
	(3,931.02)	(3795.54)	(1.63)	(1.69)
Quartile 3	-5,959.09	-4,909.91	-5.91***	-3.44*
	(4,143.27)	(3742.76)	(1.61)	(1.58)
Quartile 4	-12,751.19**	-16,191.91**	-5.97***	-6.76***
	(4,211.49)	(5173.09)	(1.69)	(1.68)

NOTE: ***- p < .001, ** - p < .01, * - p < .05. Standard errors are in parentheses. Regressors for the levels regression include household size, the percentage of units that are 1-4 family structures, the percentage of units that are single family structures, the MSA level of employment and per capita wages, and indicator variables for child population share, elderly population share, minority (black and Hispanic) population share, Asian population share, whether the tract was urban. Regressors for the percent change regression include 1990 levels and changes during the 1990s in all of these variables plus the 1990 level of the dependent variable. GSE intensities in the percent change regression are instruments created with the model in Appendix A.2. Full regression results are in Appendix A.3.a through A.3.c.

Table 7
Instrumental Regression Results for the GSE-Targeted Tract/GSE Intensity Interactions
for Different Geographic Sub-Samples

Dependent variable: Percent change of market outcomes in 1990s

	Interior California		Coastal California	
	iii by loans	iv by units	iii by loans	iv by units
Homeownership rate change, 1990s				
Quartile 1	-1.39	-1.69	-3.81**	-3.20*
	(1.67)	(1.73)	(1.46)	(1.45)
Quartile 2	-0.15	-3.23	-1.90	-1.76
	(1.97)	(2.63)	(1.12)	(1.07)
Quartile 3	-5.35	-2.14	-1.63	-1.74
	(2.96)	(2.52)	(1)	(1)
Quartile 4	-4.41	-0.07	0.48	0.72
	(3.14)	(2.44)	(1.05)	(1.12)
Vacancy rate change, 1990s				
Quartile 1	10.33	13.16	15.25	13.63
	(18.55)	(19.16)	(9.13)	(9.05)
Quartile 2	-26.95	-37.87	-7.07	1.24
	(22.06)	(29.15)	(7.02)	(6.69)
Quartile 3	-46.17	-36.68	-3.17	-7.59
	(33.24)	(27.95)	(6.24)	(6.28)
Quartile 4	-34.69	-26.42	-4.36	-7.05
	(35.06)	(27.37)	(6.57)	(7)
Median house value change, 1990s				
Quartile 1	-0.95	-0.53	-2.83	-4.89
	(2.36)	(2.42)	(2.53)	(2.5)
Quartile 2	-4.14	0.26	-3.38	-5.51**
	(2.79)	(3.67)	(1.93)	(1.85)
Quartile 3	-7.79	-9.67**	-4.73**	-2.07
	(4.19)	(3.52)	(1.73)	(1.73)
Quartile 4	-5.97	-6.36	-4.16*	-4.52*
	(4.44)	(3.41)	(1.81)	(1.93)

NOTE: ***- p < .001, ** - p < .01, * - p < .05. Standard errors are in parentheses. Models are estimated using sub-samples stratified with geography. Regressors include 1990 levels and changes during the 1990s in household size, the percentage of units that are 1-4 family structures, the percentage of units that are single family structures, the MSA level of employment and per capita wages, and indicator variables for child population share, elderly population share, minority (black and Hispanic) population share, Asian population share, whether the tract was urban plus the 1990 level of the dependent variable. GSE intensities in the percent change regression are instruments created with the model in Appendix A.2.

Figure 1
Los Angeles County Census Tracts
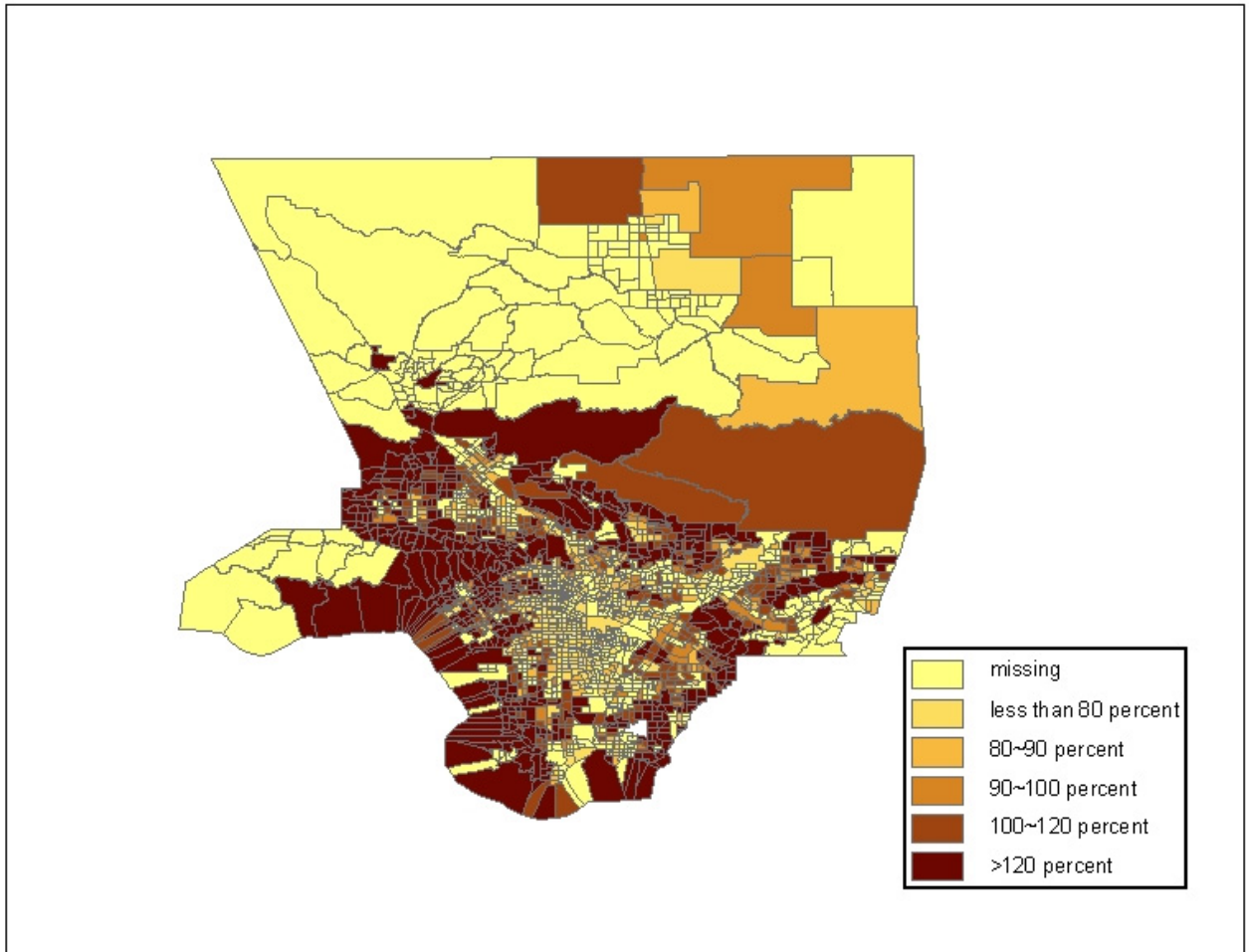**Grouped by Neighborhood Median Family Income in 1989**

Figure 2
Los Angeles County Census Tracts
Grouped by Neighborhood Minority Population Share in 1989

Legend:
- 0
- 1~5 Percent
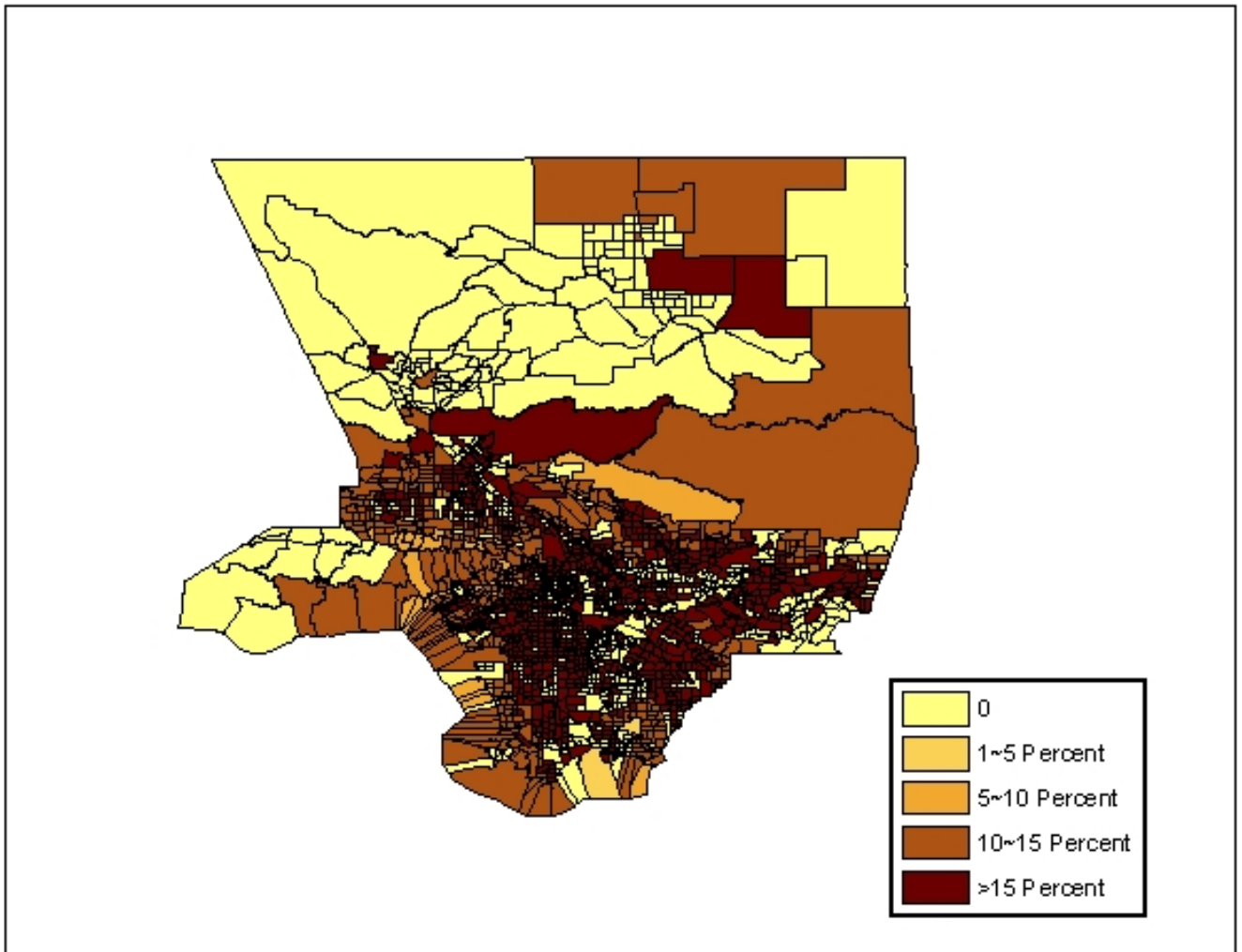- 5~10 Percent
- 10~15 Percent
- >15 Percent

Figure 3
Distribution of Los Angeles County Census Tracts
Grouped by Median Family Income between 80 and 90 percent of the MSA Median
Family Income and between 90 and 100 percent of the MSA Median Family Income, 1989
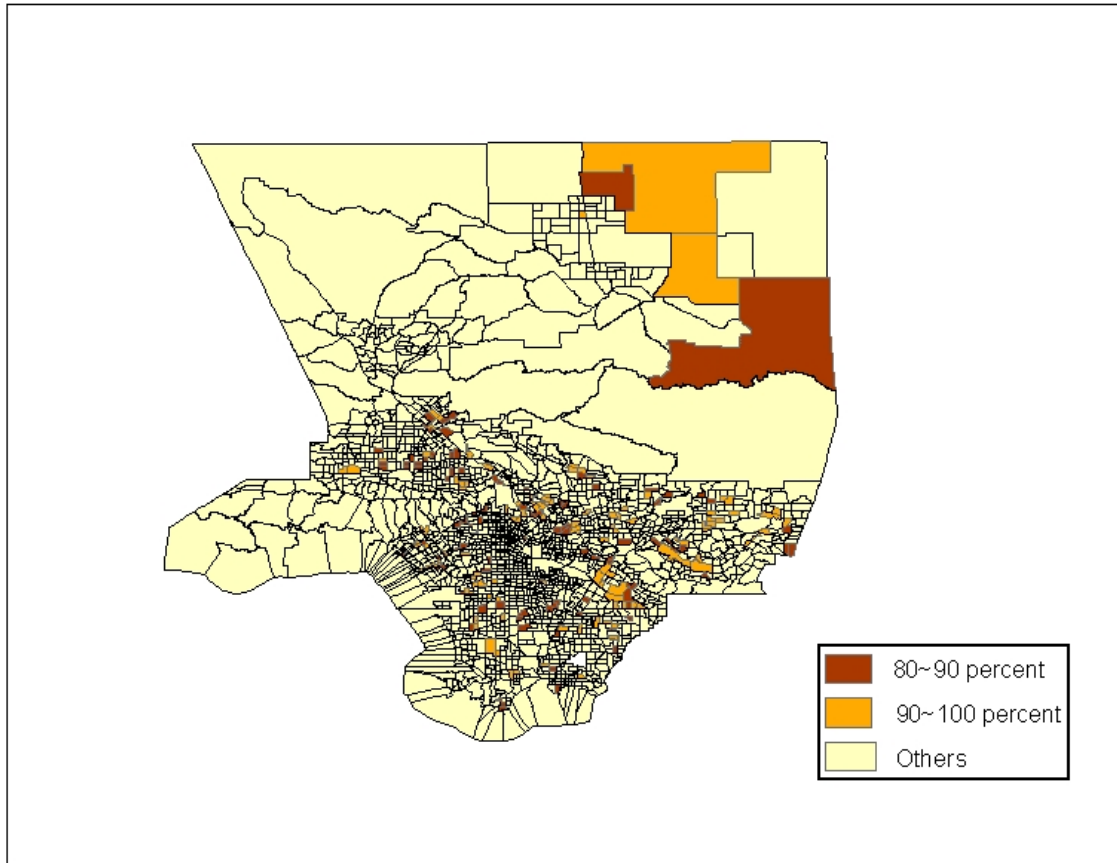
Figure 4
Distribution of GSE Loan Purchases in Los Angeles County Census Tracts, 1994

Legend:
- 0 - 20 Loans
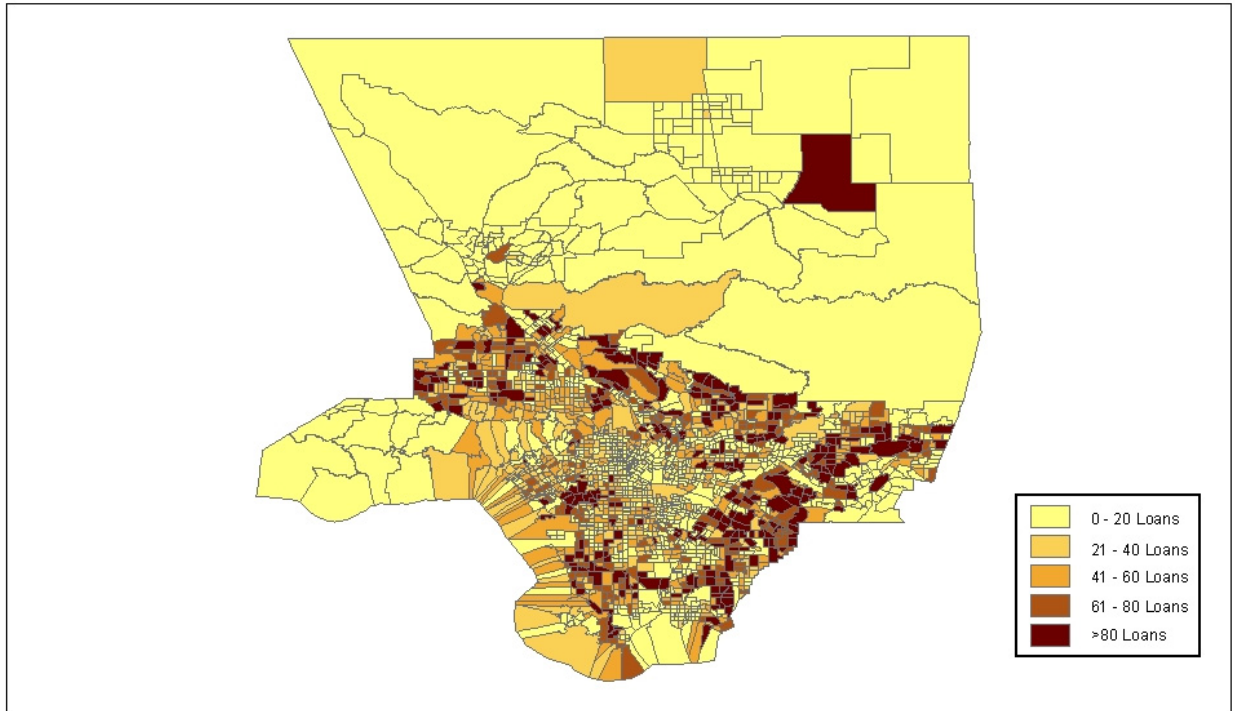- 21 - 40 Loans
- 41 - 60 Loans
- 61 - 80 Loans
- >80 Loans

Figure 5
Distribution of GSE Loan Purchases in Los Angeles County Census Tracts, 1999

Legend:
- 0 - 20 Loans
- 21 - 40 Loans
- 41 - 60 Loans
- 61 - 80 Loans
- >80 Loans
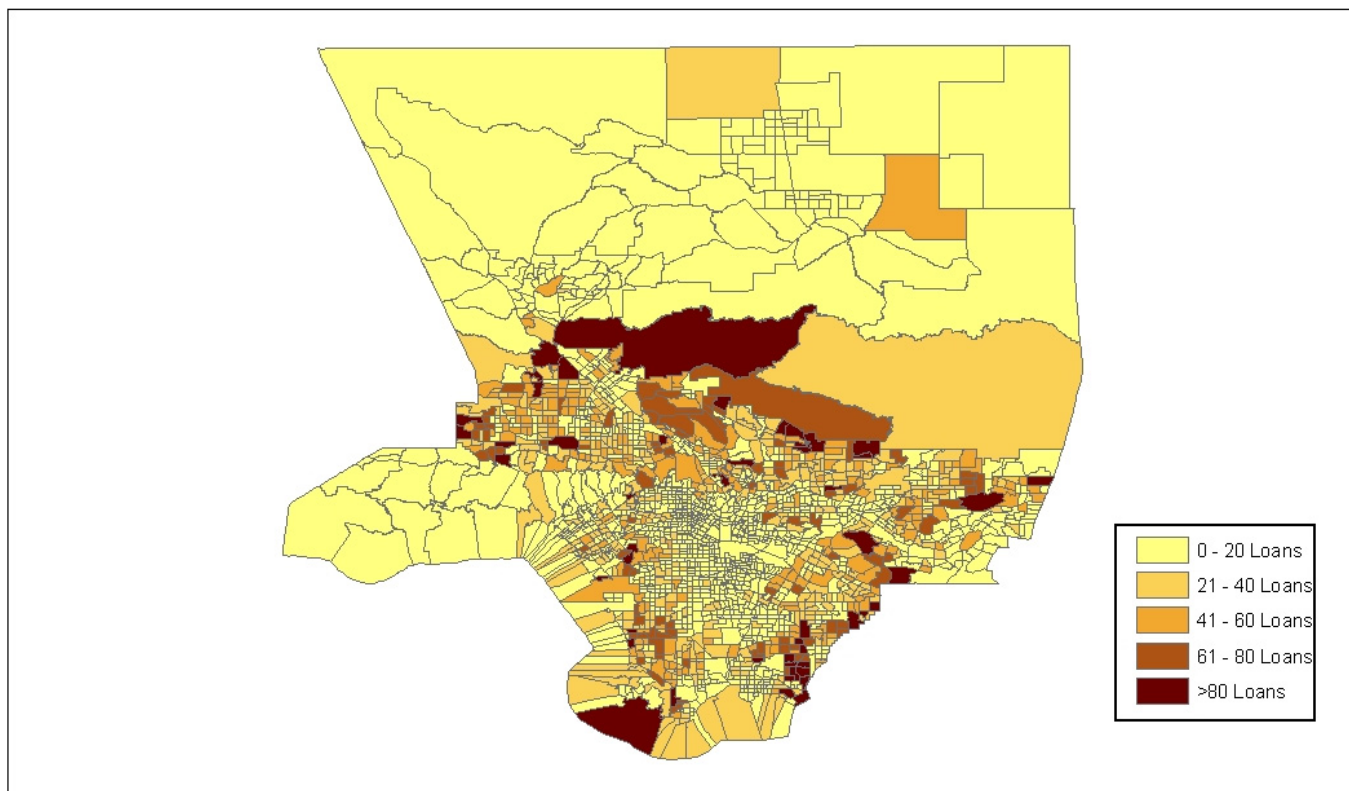
Table 6
Homeownership Rates among Los Angeles County Census Tracts, 1990

	0 - 20 Percent
	21 - 40 Percent
	41 - 60 Percent
	61 - 80 Percent
	81 - 100 Percent
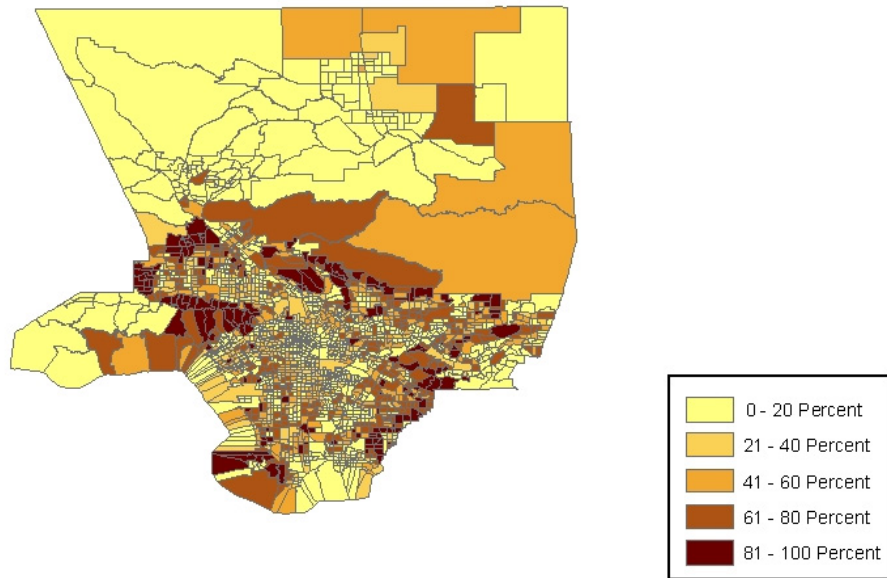
Appendix A.1a: Full regression results for baseline levels regressions (table 4)

Dependent variable: 1990 level of variable

Variable	Homeownership rate	Vacancy rate	Median house value
Intercept	-50.83***	22.24***	89248.00***
	(2.92)	(2.29)	(18175.00)
Indicator of GSE targeted tract	-1.64***	-0.08	-9677.03***
	(0.43)	(0.33)	(2649.02)
Percentage aged 17 or less, 1990	0.02	-0.18**	-5193.33***
	(0.07)	(0.05)	(415.29)
Percentage aged 65 or older, 1990	0.21***	-0.07*	-1783.27***
	(0.05)	(0.04)	(284.00)
Percent minority, 1990	-0.02	0.00	-362.11***
	(0.01)	(0.01)	(92.53)
Percent Asian, 1990	0.05*	-0.04*	225.07
	(0.03)	(0.02)	(159.06)
Household size, 1990	3.71***	-0.89	8743.60*
	(0.69)	(0.54)	(4291.13)
Indicator of urban tract, 1990	6.58***	-6.22***	-15638.00***
	(0.66)	(0.52)	(4139.07)
Percent 1-4 unit structures, 1990	0.58***	0.00	-104.65
	(0.01)	(0.01)	(87.73)
Percent single family homes, 1990	0.25***	-0.01	-380.03***
	(0.01)	(0.01)	(86.84)
Number of owner occupied units, 1990	0.00***	0.00	-0.27
	(0.00)	(0.00)	(2.26)
Employment in PMSA, 1990 (Jobs)	0.14***	-0.12***	1746.74***
	(0.04)	(0.03)	(241.93)
Per capita wages in PMSA, 1990	0.00	0.00*	7.13***
	(0.00)	(0.00)	(0.67)
N	1121	1121	1121
Adjusted R-Square	0.7888	0.2004	0.6856

NOTE: ***- p < .001, ** - p < .01, * - p < .05. Standard errors are in parentheses.

Appendix A.1b: Full regression results for baseline change regressions (table 4)

Dependent variable: Percent change in variable

Variable	Homeownership rate	Vacancy rate	Median house value
Intercept	-25.15***	55.35	7.82
	(5.18)	(32.37)	(6.93)
Indicator of GSE targeted tract	-1.09	-3.31	-3.21**
	(0.70)	(4.36)	(0.93)
Percentage aged 17 or less, 1990	0.44***	-0.14	-0.70**
	(0.11)	(0.71)	(0.15)
Percentage aged 65 or older, 1990	0.18*	0.63	0.03
	(0.07)	(0.46)	(0.10)
Percent minority, 1990	0.00	0.09	0.10**
	(0.02)	(0.16)	(0.03)
Percent Asian, 1990	-0.08*	0.15	-0.18**
	(0.04)	(0.26)	(0.05)
Household size, 1990	2.73*	-0.33	0.60
	(1.10)	(6.92)	(1.48)
Indicator of urban tract, 1990	-0.13	-13.55*	-7.54***
	(1.14)	(7.13)	(1.53)
Percent 1-4 unit structures, 1990	-0.03	0.86***	0.35***
	(0.04)	(0.24)	(0.05)
Percent single family homes, 1990	0.03	-0.02	0.02
	(0.03)	(0.16)	(0.03)
Number of owner occupied units, 1990	0.00*	-0.01	0.00***
	(0.00)	(0.00)	(0.00)
Change in the number of units, 1990s	0.12***	0.59***	0.05*
	(0.02)	(0.13)	(0.03)
Change in median family income, 1990s	0.20***	0.45***	0.37***
	(0.02)	(0.12)	(0.03)
Homeownership rate, 1990	-0.28***	-0.76*	-0.47***
	(0.06)	(0.35)	(0.07)
Vacancy rate, 1990	0.39***	-1.99***	0.05
	(0.07)	(0.41)	(0.09)
Median house value, 1990	0.00	0.00***	0.00***
	(0.00)	(0.00)	(0.00)
Per capita income in PMSA, 1990	0.00***	0.00	0.00
	(0.00)	(0.00)	(0.00)
Change in PMSA per capita income, 1990s	-0.11	-1.36**	0.55***
	(0.08)	(0.52)	(0.11)
Change in PMSA employment, 1990s	0.16	-0.22	0.30*
	(0.10)	(0.62)	(0.13)
Change in PMSA per capita wages, 1990	0.02	1.10**	0.11
	(0.07)	(0.43)	(0.09)
N	1121	1116	1121
Adjusted R-square	0.2762	0.1318	0.665

NOTE: ***- p < .001, ** - p < .01, * - p < .05. Standard errors are in parentheses.

Appendix A.2: Regression results for correlation between GSE intensity in 90s and housing market change in 80s

Dependent variable: GSE purchasing intensity in 1990s

	Intensity measure	
Parameter	by loans	by units
Intercept	0.2456***	0.0078***
	(0.0252)	(0.0016)
Percent change in total population	0.0363	-0.0042*
	(0.0318)	(0.0021)
Percent change in share of aged 17 or less and aged 65 or older	-0.0221	-0.0004
	(0.0275)	(0.0018)
Percent change in total housing units	-0.0730*	0.0023
	(0.0329)	(0.0022)
Minority population share, 1990	-0.0008***	-0.0001***
	(0.0002)	(0)
Percent change in minority population share	0.0114	0.0005
	(0.0062)	(0.0004)
Asian population share, 1990	0.0015***	0.0000
	(0.0003)	(0)
Percent change in Asian population share	-0.0008	0.0000
	(0.0006)	(0)
Percent change in household size	-0.0109	0.0072*
	(0.0474)	(0.0032)
Percent change in share of 1-4 unit housing units	0.0153	-0.0093***
	(0.0384)	(0.0026)
Share of single family housing units as of 1-4 unit housing units, 1990	-0.0004*	0.0000
	(0.0002)	(0)
Percent change in share of single family housing units	0.0595*	-0.0013
	(0.0286)	(0.0019)
Owner-occupied housing units, 1990	0.0000	0.0000
	(0)	(0)
Percent change in owner-occupied housing units	0.0288	0.0062***
	(0.0248)	(0.0017)
Percent change in median family income	-0.0226**	-0.0004
	(0.0076)	(0.0005)
Homeownership rate, 1990	0.0003	0.0000
	(0.0003)	(0)
Percent change in homeownership rate	-0.0389	0.0045
	(0.0359)	(0.0024)
Median house value, 1990	0.0000	0.0000
	(0)	(0)
Percent change in median house value	0.0197***	0.0004

	(0.0059)	(0.0004)
Vacancy rate, 1990	0.0024***	-0.0001
	(0.0006)	(0)
Percent change in vacancy rate	0.0015	0.0000
	(0.0028)	(0.0002)
Indicator of urban tract	-0.0234*	-0.0015*
	(0.0091)	(0.0006)
N	831	831
R-square	0.3941	0.3431
Adjusted R-square	0.3658	0.3134

NOTE: ***- $p < .001$, ** - $p < .01$, * - $p < .05$. Standard errors are in parentheses. This is the model which creates instruments for regressions in table 6 and 7.

Appendix A.3.a: Full regression results for homeownership regressions with basic intensity interaction (table 6)

Parameter	Homeownership rate, 1990		Homeownership change, 1990s	
	By loans	By units	By loans	By units
Intercept	-51.05***	-50.20***	-11.31*	-11.64*
	(2.94)	(2.90)	(5.16)	(5.14)
GSE-eligible*quartile 1	-1.83*	-2.71***	-3.25**	-3.37**
	(0.74)	(0.75)	(1.07)	(1.06)
GSE-eligible*quartile 2	-2.02**	-3.13***	-1.10	-1.94
	(0.63)	(0.60)	(1.01)	(1.04)
GSE-eligible*quartile 3	-1.35*	-1.06*	-0.96	-1.01
	(0.67)	(0.60)	(1)	(0.97)
GSE-eligible*quartile 4	-1.36*	1.37	0.50	1.53
	(0.68)	(0.82)	(1.05)	(1.04)
Percentage aged 17 or less, 1990	0.04	0.05	0.20	0.22*
	(0.07)	(0.07)	(0.11)	(0.11)
Percentage aged 65 or older, 1990	0.21***	0.21***	-0.07	-0.05
	(0.05)	(0.05)	(0.07)	(0.07)
Percent minority, 1990	-0.02	-0.01	-0.01	-0.01
	(0.01)	(0.01)	(0.02)	(0.02)
Percent Asian, 1990	0.05*	0.05*	-0.06	-0.05
	(0.03)	(0.03)	(0.04)	(0.04)
Household size, 1990	3.72***	3.39***	1.76	1.70
	(0.69)	(0.69)	(1.03)	(1.02)
Indicator of urban tract, 1990	6.62***	6.78***	-0.66	-0.68
	(0.67)	(0.66)	(1.19)	(1.18)
Percent 1-4 unit structures, 1990	0.58***	0.60***	0.00	0.01
	(0.01)	(0.01)	(0.04)	(0.04)
Percent single family homes, 1990	0.25***	0.25***	-0.02	-0.02
	(0.01)	(0.01)	(0.03)	(0.03)
Number of owner occupied units, 1990	0.00***	0.00***	0.00	0.00
	(0.00)	(0.00)	(0)	(0)
Employment in PMSA, 1990 (Jobs)	0.14***	0.15***		
	(0.04)	(0.04)		
Per capita wages in PMSA, 1990	0.00	0.00		
	(0.00)	(0.00)		
Change in the number of units, 1990s			0.06	0.05
			(0.03)	(0.03)
Change in median family income, 1990s			0.15***	0.15***
			(0.02)	(0.02)
Homeownership rate, 1990			-0.18***	-0.18***
			(0.05)	(0.05)
Vacancy rate, 1990			0.37***	0.39***
			(0.06)	(0.06)
Median house value, 1990			0.00**	0.00**
			(0)	(0)
Per capita income in PMSA, 1990			0.00***	0.00***
			(0)	(0)

Change in PMSA per capita income, 1990s			-0.19*	-0.17*
			(0.08)	(0.08)
Change in PMSA employment, 1990s			0.19	0.16
			(0.1)	(0.1)
Change in PMSA per capita wages, 1990s			0.11	0.09
			(0.07)	(0.07)
N	1121	1121	831	831
R-square	0.791283	0.795895	0.2344	0.2404

NOTE: ***- p < .001, ** - p < .01, * - p < .05. Standard errors are in parentheses. GSE intensities in the percent change regression are instruments created with the model in Appendix A.2.

Appendix A.3.b: Full regression results for vacancy regressions with basic intensity interaction (table 6)

Parameter	Vacancy rate, 1990		Vacancy change, 1990s	
	By loans	By units	By loans	By units
Intercept	22.05***	22.17***	76.26	72.26
	2.30	(2.30)	(40.47)	(40.34)
GSE-eligible*quartile 1	-0.24	0.31	17.08*	19.60*
	0.58	(0.59)	(8.43)	(8.33)
GSE-eligible*quartile 2	-0.16	-0.24	-9.52	-4.75
	0.50	(0.48)	(7.94)	(8.2)
GSE-eligible*quartile 3	-0.26	-0.23	-11.75	-18.05*
	0.52	(0.47)	(7.83)	(7.66)
GSE-eligible*quartile 4	0.32	0.13	-10.52	-10.60
	0.53	(0.65)	(8.28)	(8.17)
Percentage aged 17 or less, 1990	-0.17**	-0.18**	-0.50	-0.52
	0.05	(0.05)	(0.85)	(0.85)
Percentage aged 65 or older, 1990	-0.07*	-0.07*	0.51	0.47
	0.04	(0.04)	(0.55)	(0.54)
Percent minority, 1990	0.00	0.00	0.01	-0.04
	0.01	(0.01)	(0.19)	(0.19)
Percent Asian, 1990	-0.05*	-0.04*	-0.03	-0.07
	0.02	(0.02)	(0.3)	(0.3)
Household size, 1990	-0.92	-0.91	1.54	2.08
	0.54	(0.54)	(8.06)	(8.04)
Indicator of urban tract, 1990	-6.18***	-6.21***	-7.48	-7.03
	0.52	(0.52)	(9.35)	(9.3)
Percent 1-4 unit structures, 1990	0.00	0.00	0.76**	0.70*
	0.01	(0.01)	(0.29)	(0.29)
Percent single family homes, 1990	-0.01	-0.01	-0.19	-0.15
	0.01	(0.01)	(0.21)	(0.21)
Number of owner occupied units, 1990	0.00	0.00	-0.01	-0.01
	0.00	(0.00)	(0)	(0)
Employment in PMSA, 1990 (Jobs)	-0.12***	-0.12***		
	0.03	(0.03)		
Per capita wages in PMSA, 1990	0.00*	0.00*		
	0.00	(0.00)		
Change in the number of units, 1990s			1.60***	1.66***
			(0.23)	(0.23)
Change in median family income, 1990s			0.53***	0.51***
			(0.15)	(0.15)
Homeownership rate, 1990			-0.67	-0.65
			(0.42)	(0.42)
Vacancy rate, 1990			-1.69***	-1.76***
			(0.51)	(0.51)
Median house value, 1990			0.00***	0.00***
			(0)	(0)
Per capita income in PMSA, 1990			0.00	0.00

			(0)	(0)
Change in PMSA per capita income, 1990s			-1.20	-1.26*
			(0.64)	(0.64)
Change in PMSA employment, 1990s			-1.44	-1.47
			(0.8)	(0.8)
Change in PMSA per capita wages, 1990			1.07*	1.14*
			(0.53)	(0.53)
N	1121	1121	828	828
R-square	0.209669	0.209692	0.2014	0.2057

NOTE: ***- p < .001, ** - p < .01, * - p < .05. Standard errors are in parentheses. GSE intensities in the percent change regression are instruments created with the model in Appendix A.2.

Appendix A.3.c: Full regression results for median house value regressions with basic intensity interaction (table 8)

Parameter	Median house value, 1990		Median house value change, 1990s	
	By loans	By units	By loans	By units
Intercept	90249.05***	90074.26***	13.50	13.39
	(18282.53)	(18182.45)	(8.32)	(8.33)
GSE-eligible*quartile 1	-9056.15*	-16722.90***	0.00	-0.86
	(4619.40)	(4679.69)	(1.73)	(1.72)
GSE-eligible*quartile 2	-10617.90**	-7357.80*	-2.63	-3.95*
	(3931.02)	(3795.54)	(1.63)	(1.69)
GSE-eligible*quartile 3	-5959.09	-4909.91	-5.91***	-3.44*
	(4143.27)	(3742.76)	(1.61)	(1.58)
GSE-eligible*quartile 4	-12751.20**	-16191.90**	-5.97***	-6.76***
	(4211.49)	(5173.09)	(1.69)	(1.68)
Percentage aged 17 or less, 1990	-5225.94***	-5139.11***	-0.57**	-0.57***
	(422.77)	(416.28)	(0.17)	(0.18)
Percentage aged 65 or older, 1990	-1787.60***	-1767.08***	0.05	0.05
	(284.79)	(284.11)	(0.11)	(0.11)
Percent minority, 1990	-369.02***	-380.42***	0.07	0.08*
	(92.76)	(93.24)	(0.04)	(0.04)
Percent Asian, 1990	227.25	219.22	-0.19**	-0.20**
	(159.62)	(158.99)	(0.06)	(0.06)
Household size, 1990	9067.87*	9315.56*	0.35	0.24
	(4302.43)	(4309.66)	(1.66)	(1.66)
Indicator of urban tract, 1990	-15874.90***	-15894.60***	-8.23***	-8.25***
	(4157.44)	(4142.22)	(1.92)	(1.92)
Percent 1-4 unit structures, 1990	-106.24	-108.95	0.28***	0.27***
	(87.90)	(89.16)	(0.06)	(0.06)
Percent single family homes, 1990	-384.65***	-399.14***	-0.02	-0.02
	(87.01)	(87.09)	(0.04)	(0.04)
Number of owner occupied units, 1990	-0.35	-0.58	0.00***	0.00***
	(2.27)	(2.27)	(0)	(0)
Employment in PMSA, 1990 (Jobs)	1725.22***	1661.87***		
	(243.77)	(243.57)		
Per capita wages in PMSA, 1990	7.17***	7.28***		
	(0.67)	(0.68)		
Change in the number of units, 1990s			0.00	0.01
			(0.05)	(0.05)
Change in median family income, 1990s			0.38***	0.38***
			(0.03)	(0.03)
Homeownership rate, 1990			-0.36***	-0.36***
			(0.09)	(0.09)
Vacancy rate, 1990			0.25*	0.22
			(0.1)	(0.1)

Median house value, 1990			0.00***	0.00***
			(0)	(0)
Per capita income in PMSA, 1990			0.00	0.00
			(0)	(0)
Change in PMSA per capita income, 1990s			0.55***	0.53***
			(0.13)	(0.13)
Change in PMSA employment, 1990s			0.42*	0.46**
			(0.16)	(0.16)
Change in PMSA per capita wages, 1990			0.07	0.10
			(0.11)	(0.11)
N	1121	1121	831	831
R-square	0.689427	0.69097	0.6900	0.6890

NOTE: ***- $p < .001$, ** - $p < .01$, * - $p < .05$. Standard errors are in parentheses. GSE intensities in the percent change regression are instruments created with the model in Appendix A.2.

Appendix A.4: Non-instrumental regression results for the GSE-targeted tract/GSE intensity interactions

	1990 Level		Percent change, 1990-2000	
	i by loans	ii by units	iii by loans	iv by units
Homeownership rate				
Quartile 1	-1.83*	-2.71***	-2.93*	-5.16***
	(0.74)	(0.75)	(1.20)	(1.21)
Quartile 2	-2.02**	-3.13***	-0.60	-2.83**
	(0.63)	(0.60)	(1.02)	(0.97)
Quartile 3	-1.35*	-1.06	-1.50	-0.65
	(0.67)	(0.59)	(1.06)	(0.94)
Quartile 4	-1.36*	1.37	0.038	5.38***
	(0.68)	(0.82)	(1.07)	(1.31)
Vacancy rate				
Quartile 1	-0.24	0.31	17.63*	19.11*
	(0.58)	(0.59)	(7.45)	(7.64)
Quartile 2	-0.16	-0.24	-3.04	0.45
	(0.50)	(0.48)	(6.37)	(6.17)
Quartile 3	-0.26	-0.23	-5.26	-14.32*
	(0.52)	(0.47)	(6.58)	(5.98)
Quartile 4	0.32	0.13	-15.87*	-10.26
	(0.53)	(0.65)	(6.67)	(8.28)
Median house value				
Quartile 1	-9,056.15*	-16,722.90***	1.08	1.08
	(4,619.40)	(4679.69)	(1.60)	(1.64)
Quartile 2	-10,617.95**	-7,357.80*	-2.87*	-4.72***
	(3,931.02)	(3795.54)	(1.36)	(1.32)
Quartile 3	-5,959.09	-4,909.91	-3.94**	-3.86**
	(4,143.27)	(3742.76)	(1.41)	(1.28)
Quartile 4	-12,751.19**	-16,191.91**	-5.75***	-3.56*
	(4,211.49)	(5173.09)	(1.43)	(1.78)

NOTE: ***- $p < .001$, ** - $p < .01$, * - $p < .05$. Standard errors are in parentheses. The regression structures are the same as those in table 6. The only difference is that, here the GSE intensities in the percent change regression are real intensities in the 1990s rather than instruments.