HOW THE FEDERAL HOUSING ADMINISTRATION AFFECTS HOMEOWNERSHIP

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Abstract

In this paper, I attempt to determine how the Federal Housing Administration (FHA) affects homeownership. The FHA insures the full value of selected loans made by private lenders. I use changes in FHA underwriting criteria over time and the differential effects of these criteria across metropolitan areas to study the effects of the FHA on homeownership. To do this, I simulate the difference in the fraction of homes in his metropolitan area that a prospective homeowner could afford with FHA and conventional criteria, and see how the difference in affordability affects homeownership. I find that more generous FHA underwriting criteria increase homeownership. In the period from 1970 to 1990, FHA increased homeownership by an average of about 0.6 percentage points, and increased homeownership by 1.57 percentage points for those at the 90th percentile of effects of FHA on house purchase affordability. FHA also had greater effects on the homeownership of certain groups, especially Blacks and married couples with children.

I. Introduction

Congress created the Federal Housing Administration in 1934 as part of the National Housing Act. The Federal Housing Administration (FHA) promotes homeownership by insuring loans made by lenders to homebuyers. In particular, the FHA insures the full value of mortgages for qualifying homebuyers in case of default, making such loans risk-free for lenders. Placing the full faith and credit of the United States government behind selected mortgages was very important during the Great Depression as the banking system failed, paralyzing the housing market and causing housing starts to decrease from over 700,000 per year in the 1920s to 93,000 in 1933 (Vandell 1995). The FHA (along with general economic improvement) is credited with helping to increase the national homeownership rate from under 40% during the Great Depression to almost 67% today (Vandell 1995).

The Federal Housing Administration has a large role in contemporary mortgage markets. It insures 18% of all of the mortgage loans made in any particular year, and is particularly important in central cities and for minorities. Almost one-half of FHA's metropolitan area business is located in central cities (46%), while 38% of conforming conventional loans are within central cities. The FHA also insures a disproportionate amount of Black and Hispanic borrowers. Black and Hispanic borrowers account for almost one-quarter of FHA's business, but less than one-tenth of the conforming conventional mortgage market. In addition, FHA insures about one-half of all non-Veterans Administration insured mortgage loans (that is, those with under 20% down payment), and more in difficult economic times. Studies done using the American Housing Survey, Survey of Consumer Finances, and Home Mortgage Disclosure Act data

indicate that FHA borrowers tend to be younger, more credit-constrained, and live in neighborhoods characterized by slower house price appreciation and lower average incomes and house values[1]. Some observers have noted that FHA insures riskier borrowers and from this have concluded that FHA increases homeownership.

However, the fact that FHA covers a riskier set of borrowers than the private market does not mean that the private market would not lend to these borrowers in the absence of the FHA. Financial markets today are stronger and more sophisticated than they were in the 1930s when the FHA was created, and the free market offers private mortgage insurance to prospective homeowners that wish to buy homes with down payments as low as 5%. Given the uncertainty about the modern role of the FHA, many people (including many members of Congress) have questioned the usefulness of the FHA and suggest that its role would be better performed by the private sector.

In this study, I investigate whether and how the FHA affects homeownership. My methodology depends on the idea that similar families have their home buying ability differentially affected by the FHA because FHA rules change over time (owing to Congress) and are not equally generous everywhere in relation to the housing market. Even if FHA regulations are exactly the same across the nation, the regulations affect some areas more than others. This variation is expressed by simulating the fraction of homes in a particular metropolitan area a household can afford using FHA and conventional underwriting criteria. I then use the difference between FHA and conventional affordability as my primary measure of how the FHA affects housing affordability and thereby homeownership. In order to ensure that I am comparing truly similar households, I control diligently for households' incomes and demographic

[1] The information above comes from Bunce *et al* 1995.

characteristics and for the characteristics of housing markets. I also use a simulated instrumental variable design to isolate the variation caused by the FHA regulations, as opposed to unobserved differences among households or metropolitan areas. The variation in the regulations that I exploit can credibly show if the FHA affects homeownership and who is most affected.

I find that FHA increases homeownership. In the period spanning 1970 to 1990, FHA increased homeownership by an average of 0.6 percentage points, and by 1.57 percentage points for those at the 90th percentile of FHA's effects on house purchase affordability. During this period, FHA had different effects on different demographic groups. Blacks and married couples with children were most affected by FHA, with an increase in homeownership of 1.37 and 1.62 percentage points respectively, and 3.66 and 5.17 percentage points at the 90th percentile.

The next section presents basic facts about the FHA that can justify the empirical methodology. Section III gives the empirical methodology and some theoretical justification. Section IV describes the data, section V describes the results, and section VI concludes.

II. The Federal Housing Administration and Its Impact on Homeownership

As mentioned in the introduction, the FHA was created as a part of the National Housing Act of 1934 and was a response to the collapse of the housing market during the Great Depression[2]. At that time, most home mortgages were short-term (three to fifteen years) nonamortizable balloon instruments at loan-to-value (LTV) ratios below fifty to sixty percent. If a homeowner could not pay the entire amount of the balloon payment at

[2] Historical and other information in this section comes from Vandell (1996).

the end of the period, he would refinance the difference with the same or another lender, and thereby pay off his home. The banking crisis in the early 1930s forced lenders to call in the mortgages as they came due, and since all lenders were affected by the banking crisis, refinancing was not available and many borrowers were forced to default. Other borrowers became unemployed and could not make their mortgage payments, so lenders foreclosed on their homes. The situation was exacerbated as the weak economy caused property values to fall, moving borrowers into negative equity situations and giving them an incentive to default. In short, by 1934, many banks had numerous bad home loans on their books (loans for which the collateral—the home—was worth less than the value of the loan). Their lack of assets and their recent experience made them unwilling to extend new home loans.

Policy makers hoped that the FHA, by insuring mortgages, would jumpstart the market for home loans, thereby increasing housing starts and employment in the construction industry. The FHA revolutionized the mortgage market, not only by getting banks to start lending again, but also by changing (and standardizing) mortgage instruments and underwriting procedures. In particular, the FHA (Section 203b) insured 100 percent of qualified loans in case of default. At first, the FHA would qualify 20-year fully amortizable loans with an 80 percent LTV. Later, the FHA began to qualify 30-year loans with LTVs higher than 95 percent. The FHA's 100 percent insurance was very important because at that time there did not exist reinsurance markets in which banks could reduce their home loan risk.

Marginal borrowers may still benefit from the existence of FHA-insured loans because they can use several features of FHA loans that remain unavailable in

conventional loans. First, FHA loans allow higher loan-to-value ratios (LTVs) than conventional loans. Conventional loans, even for first-time homebuyers, tend to have down payments of at least 5%. FHA loans have down payments of 3 to 5%. Second, FHA allows home buyers to borrow mortgage insurance costs and closing costs, while most conventional loans demand that such costs be paid up front in addition to the down payment. Third, FHA loans allow for a larger percentage of income to be spent on housing costs than conventional loans do. These three features of FHA mortgages may allow some people to buy homes who would otherwise be unable to do so.

The FHA can have looser underwriting criteria than conventional lenders because it offers an implicit subsidy to homeowners. This subsidy comes from both the fact that the federal government serves as reinsurer (the federal government would give it a soft budget constraint in case of serious crisis, and so the FHA can be seen as risk neutral), and the FHA is supposed to incur neither accounting loss nor profit over time; that is, it does not have to earn a market rate of return on government funds. This implicit subsidy means even with private insurance available, the FHA is still the least costly provider of insurance for risky loans.

Also, the FHA can be presumed to be less discriminatory than private lenders. Discrimination in financial markets is well documented. (Munnell et al 1996; Kim and Squires 1998; Carr and Megbolugbe 1993) While the reasons for this discrimination are unclear, if private lenders discriminate on ethnic, racial, and neighborhood bases, and the FHA does not, then the removal of bias implicit in FHA underwriting will increase homeownership, especially among groups most affected by discrimination. While this

paper cannot test for the existence of discrimination in mortgage markets, it can show whether the FHA increases homeownership more for some groups than others.

On the other hand, there are a couple of reasons why FHA might have little effect on homeownership today. First, private mortgage and mortgage insurance markets are more sophisticated than they were in the 1930s. Advances in quantifying and diversifying risk increase the ability of private companies to identify whom is most and least likely to default on mortgages, and also increases the ability of these companies to diversify and better manage their risks to make sure that the insurance premiums they collect and reserves they accumulate can cover mortgage defaults. These advances might allow private lenders to take over the role of the FHA if the FHA were to be eliminated or privatized.

Second, the existence of FHA may affect the housing market in ways that do not affect homeownership. If FHA increases the demand for owner-occupied housing, this may increase the price of owner-occupied housing instead of increasing homeownership. The extent of this price effect would depend on the long-term supply elasticity of owner-occupied housing. If the long-term supply of owner-occupied housing is highly elastic (i.e. easy to build new owner-occupied homes or to convert rental homes to owner-occupied homes), then this price effect would be small. One would suspect that the long-term supply of owner-occupied housing would be highly elastic (the long-term supply elasticity of most objects is elastic), but this is difficult to test and beyond the reach of this paper. In addition, the looser underwriting criteria offered by the FHA might induce people to buy larger houses than they otherwise would, but not induce renters to be owners. This would be especially true if people's decision to rent or buy was not based

primarily on the size of home lenders would let them own, but rather on factors such as their own stability of income and/or lifestyle, and how long they intended to continue to live in one place.

III. An Empirical Strategy for Identifying the Effects of FHA on Homeownership

Several researchers have attempted to determine whether the FHA increases homeownership. A couple of these studies (Secura Group 1995, Canner and Passmore 1994, Bunce *et al* 1995) examine recent homebuyers and assign them to categories: those who could buy their actual home with a conventional loan insured by private mortgage insurance (PMI), those who could not buy their actual home with a PMI loan but could buy it with a Veterans Administration (VA) loan (this group consists entirely of veterans), and those who could not buy their actual home with a PMI loan or a VA loan but could afford to buy it with an FHA loan. The researchers then claim that the larger this last category is, the greater the number of people who would not own a home without the FHA. All of these studies find that FHA increases homeownership, but are far from definitive for two reasons. First, the fact that PMI does not cover some mortgages that are currently covered by FHA does not necessarily imply that the PMI market would not expand to cover such mortgages if the FHA were to disappear. Second, some homeowners who needed an FHA loan by the above standard would still have bought a home without the FHA because they would have bought a more modest home for which they could have used a conventional loan. Of course, some current homeowners would not have bought a more modest home; they would have remained renters if the only

homes accessible to them were more modest than their current home. This has been noted elsewhere—for instance, by Goodman and Nichols [1997].

Other studies (Savage and Fronczek 1993, Goodman and Nichols 1997) focus on a particular percentile in the income distribution and ask what percentage of homes a household in that point in the income distribution could afford. The results of these two studies suggest that FHA has a limited effect on homeownership, but there is no reason why the effects of FHA should be concentrated at a particular income percentile, and so these studies cannot provide definitive evidence of FHA's effect (or lack thereof) on homeownership.

Another study (Lafayette *et al* (1995)), uses data from the 1984 metropolitan American Housing Survey (AHS) and computes a nested logit model in which prospective homeowners choose between conventional adjustable rate mortgages, conventional fixed rate mortgages, or fixed-rate FHA mortgages. The authors conclude that the presence of FHA loans increases the homeownership rate by only 0.1-0.2 percent. However, their source of identifying variation is unclear: they do not explain which, if any, sources of variation occur in their data such that similar households have different costs in choosing different types of mortgages. An additional signal that their structural model is poorly identified is their having to adjust their coefficients to get enough prospective homeowners to choose FHA loans or conventional adjustable-rate loans.

Homeowners can be assumed to have the utility function

(1) $U=U(X, H)$

where X stands for other goods and H stands for housing. A household can choose whether to buy or rent, and essentially chooses the best (highest utility) solution between two problems. The budget constraints for an owner would be:

(2) $p_x X + p_o H = Y$

(3) $p_o H \leq zY$

where (2) represents the normal budget constraint with p_x the price of other goods, p_o the price of owner-occupied housing, and Y total income. Equation (3) represents the limit placed by a financial institution on the share of income (z) spent on owner-occupied housing.

If the household were to rent, it would have the same utility function, but it would not face a restriction on the share of income it could spend on housing. Therefore, its sole budget constraint would be

(4) $p_x X + p_r H = Y$

where p_r is the price of renter-occupied housing. If $p_o > p_r$, then the household would rent. However, if $p_r > p_o$, which is most likely because of the tax advantages that accrue to homeowners, then households may rent or own. If, using equations (1) and (2), the household chooses to spend less than z share of its income on housing, then the household will choose to rent. If the household wishes to spend more than that share of income on housing, then the household will compare the utility achieved by solving the renter's problem with the utility it would gain by consuming the maximum amount of owner-occupied housing possible. FHA loosens this constraint by allowing a larger amount of income to be used for housing, and thereby should increase the homeownership rate.

In order to correctly identify the effects of FHA on homeownership, I need a source of exogenous variation in the degree that FHA intervenes in the housing market. That is, I need to come as close as possible to an experiment in which multiple identical housing markets exist and the FHA is told to stay out of some of them and set up its program in others. If homeownership rates were to differ across the housing markets with and without FHA in such an experiment, it would be (1) because PMI companies did not relax their underwriting criteria to fill the gap left by FHA's absence and (2) because the decisions of some households to buy or rent depend on the difference between the quality of the home they could own with an FHA loan and the home they could own with a PMI loan (if any).

A. Conditionally Exogenous Sources of Variation

I rely on two sources of variation in FHA intervention. First, I exploit congressionally mandated changes in FHA underwriting criteria over time. The idea is that similar households experience different degrees of FHA intervention because FHA rules change over time. The time-series variation in FHA criteria is exogenous to the behavior of any individual household or state because Congress determines these criteria for the entire nation. One potential problem with the time-series variation is that changes in FHA criteria may be coincidentally (or even causally) correlated with other changes in the housing market. To use the time-series variation for credible identification, I control for other time-varying variables and include fixed effects for each time period. The time fixed effects pick up all factors that are common to the nation at a point in time. It is

important to control for these factors because some of these factors might induce Congress to change the FHA criteria.

I also rely on cross-sectional variation to identify the effect of FHA on homeownership. It is subtler to exploit the credibly exogenous cross-sectional variation than to exploit the aforementioned time-series variation, so I will explain by using an example.

Consider three households that are identical in all ways except that they live in metropolitan areas with, respectively, low, medium, and high housing costs. Apply the nation-wide FHA underwriting criteria to each household and determine the most expensive home that each household could afford with an FHA loan. We will find that the household in the low cost area will be able to afford the largest share of homes in its area with this loan, the household in the high cost area will be able to afford the smallest share of its area homes, and the household in the medium cost area will be somewhere in between. Naturally, much of the variation in the share of homes that the households can afford with the FHA loan has nothing to do with FHA. It is also the case that, with a conventional loan, the household in the low cost area could afford the largest share of area homes, the household in the high cost area could afford the smallest share of area homes, and so on.

Thus, in order to focus on the FHA criteria, I measure the share of area homes that a household can afford with an FHA loan that it could *not* afford with a conventional loan. For instance, the household in the low cost area might be able to afford 25 percent of area homes with a conventional loan and 35 percent with an FHA loan. Therefore, my measure would be 10 percentage points—the household could afford 10 percent more

homes in its area with an FHA loan. Hereafter, I call this measure the "FHA-conventional difference in affordability."

It is not obvious that this measure would vary at all among metropolitan areas. For instance, the three households might always be able to afford a $90,000 home with a conventional loan and a $150,000 home with an FHA loan. In all three metropolitan areas, the same share of homes might fall into this range. Thus, for a given type of household, the FHA-conventional difference in affordability only varies cross-sectionally because there are cross-metropolitan area differences in the *density* of homes in the crucial range where FHA and conventional loans differ. Such differences in density are probably driven largely by historical building patterns because housing is very durable. In the example above, it is not even clear in which metropolitan area (low cost, medium cost, or high cost) we should expect the relevant density to be highest. Moreover, even within a metropolitan area, households that are only slightly different may experience substantially different FHA-conventional differences in affordability. This would occur if, for instance, the density of homes between $90,000 and $150,000 were substantially different than the density of homes between $110,000 and $170,000.

In short, I exploit differences across and within metropolitan areas in the density of homes in the crucial range between FHA and conventional affordability. To ensure that these differences are conditionally exogenous, I control for many time-varying characteristics of metropolitan areas that might affect homeownership. I include all of the available control variables that might both affect homeownership and be correlated with a metropolitan area's average FHA-conventional difference in affordability. I attempt to include all such variables regardless of whether the correlation might arise

through sheer coincidence or through a real relationship. For instance, if house prices were always normally distributed in a metropolitan area (they are not, in fact), then density would be a systematic function of how far away the crucial range is from the median house price in the area. Thus, one of my key control variables is the income centile of the household in its metropolitan area. The household's income centile measures its distance from the median household; it is thus a good indicator of the density of households with similar income. The household's income centile also captures all the unobservable factors correlated with a person's *relative* income status within a metropolitan area that might cause him to be more or less likely to own his home.

In addition, I control for the median house price of the metropolitan area, a measure of house price dispersion (the Gini coefficient), and the share of homes in the metropolitan area that are affordable at the FHA "cap:" the maximum loan that FHA will insure. By controlling for several moments of the house price distribution as well as the household's income centile, I attempt to eliminate factors other than FHA regulations that might cause the FHA-conventional affordability difference to vary.

I include controls for the income distribution, including the median households income and the Gini coefficient of household income in the metropolitan area. Finally, I include a generous set of household-level variables, such as income, age, marital status, race, and number of children.

Using this strategy, it is not obvious whether or not to include metropolitan area fixed effects. On the one hand, metropolitan area fixed effects eliminate all characteristics of metropolitan areas that are constant over time. Some of these might be coincidentally correlated with homeownership and the FHA-conventional difference in

affordability. On the other hand, much of the exogenous variation in the FHA-conventional difference in affordability probably comes from historical differences in the housing stocks of metropolitan areas. Thus, eliminating fixed metropolitan characteristics eliminates an important source of credibly exogenous variation. Because it is unclear whether the specification should include metropolitan area indicator variables, I show results with and without them.

B. Purging Correlation between the FHA-Conventional Affordability Difference and a Household's Relative Position in its Metropolitan Area

It is possible that my controls for metropolitan area characteristics are insufficient to eliminate correlation between the FHA-conventional difference in affordability and unobserved characteristics of the household that affect its likelihood of owning a home. In particular, we might worry that, even with all the controls, the FHA-conventional difference in affordability still picks up a household's relative position in its city. Consider an extreme example, just to illustrate the point. Suppose that a household with a given income was middle-income in Arkansas, but low-income in northern California. Purely because middle-income households tend to be more prevalent than low-income households in any area (most metropolitan area income distributions are roughly log-normal), there might be a high density of houses in the FHA-conventional gap for the Arkansas household, but only a low density of houses in the same FHA-conventional gap for the northern California household. The household's FHA-conventional affordability difference would be correlated with its income centile in its metropolitan area. Although controlling for the linear effect of households' income centiles (the variable already

included in my specification) would greatly help in such a case, the FHA-conventional gap might pick up non-linear effects of a household's income centile.

Fortunately, it is possible to construct an instrumental variable for the FHA-conventional affordability difference that can purge the estimated effect of FHA of any correlation with a household's income centile. Using the following procedure, I exploit just the differences among metropolitan areas in the density of homes affected by the FHA rules.

(1) I look within each centile of the national income distribution, and I determine the median value (for those households) of the maximum house price affordable under FHA rules. Similarly, I look within each centile of the national income distribution and determine the median value (for those households) of the maximum house price affordable under conventional rules.

(2) I then calculate the FHA-conventional affordability difference for each metropolitan area, for each centile of the national income distribution (using the maximum FHA and conventional amounts obtained in the last step).

(3) Finally, I determine each household's income centile in the income distribution of its metropolitan area. I instrument for the household's actual FHA-conventional affordability difference with the affordability difference calculated in the last step, using the value for the national centile that matches the household's centile in its metropolitan area. For instance, if a household is at the 30^{th} centile of its metropolitan area, its FHA-conventional affordability difference is instrumented with the value of the FHA-conventional affordability difference for the 30^{th} centile of the national income distribution.

This procedure is a type of "simulated instrumental variables" procedure because the instrumental variable is constructed so that it purges suspect sources of variation (like the household's relative position being correlated with its FHA-conventional affordability difference). It is likely that controlling for many metropolitan area characteristics, as I do in my basic specification, is sufficient to generate consistent estimates of the FHA effect. However, the simulated instrumental variables procedure should alleviate remaining concerns.

The instrumental variables (IV) estimate has other good properties. In particular, it is relatively free of attenuation bias from measurement error that may plague the FHA-conventional affordability difference because the measure is based on a 1% sample of households in which the exact values of homes are not given. Also, it is possible that FHA affects prices for the houses that are made significantly more accessible by its regulations. If this is so, then the effects of FHA will shrink large FHA-conventional gaps and enlarge small FHA-conventional gaps. Such endogeneity would attenuate the estimate of the FHA-conventional gap. The IV estimate will be purged of such endogeneity bias because the simulated instrument does not directly reflect the distribution of house prices in the range actually purchased by the affected households.

C. Estimating Equations

In this study I estimate the following basic equation:

(5)

$$owner_{ijt} = \beta affdiff_{ijt} + \eta caffpr_{ijt} + \gamma downoinc_{ijt} + \lambda cdoin_{ijt} + \theta affcap_{jt} + \chi X_{ijt} + \mu Y_{jt} + \phi_t + \varepsilon_{ijt}$$

I focus on least squares and instrumental variables estimates of this equation, but I also estimated a logit version of the equation (Appendix Table 1).[3]

In the above equation, *owner* equals one if the household owns its home and equals zero otherwise; *affdiff* is the FHA-conventional difference in affordability; *caffpr* is the share of homes affordable with a conventional loan; *downoinc* is the additional down payment that would be required by a conventional lender (as opposed to FHA) for the maximum FHA affordable home, expressed as a share of total yearly household income; *cdoin* is the down payment required by conventional lenders for the maximum conventional affordable home, expressed as a share of total yearly household income; *affcap* is the fraction of homes affordable at the FHA mortgage cap for that year and metropolitan area; X_{ijt} is a matrix of household-level demographic variables, Y_{jt} is a matrix of MSA by year level demographic variables, φ_t is a matrix of time indicator variables, *i* indexes households, *j* indexes metropolitan areas, *t* indexes time, and ε_{ijt} is a normally distributed error term.

The household-level demographic variables include: race (Black, Asian, Native American, and other), a quartic in real total household income (1989 dollars), age (under 25, 25-34, 35-44, 55-64, 65-74, 75 and over), native status, dummies for family situation

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[3] The logit equation is summarized by the following regression equation:

$$(2)\ owner_{ijt} = L(\beta affdiff_{ijt}, \eta caffpr_{ijt}, \gamma downoinc_{ijt}, \lambda cdoin_{ijt}, \theta affcap_{jt}, \chi X_{ijt}, \mu Y_{jt}, \phi_t) + \varepsilon_{ijt}$$

where L() is the normal logit function: $e^{x_{ijt}\beta} / (1 + e^{x_{ijt}\beta})$.

(non-family household – defined as no one in household related to one another or one-person household, married couple with children, married couple without children, male head with children, male head without children, female head with children, and female head without children), education (dropout, high school diploma, some college, and college graduate), and veteran status. The metropolitan level by year demographic variables include the Gini coefficient of income, the real median house price of the MSA (1990 dollars), the Gini coefficient of housing values, and the fraction of the racial groups listed above in the MSA.

In my first variant on this basic specification, I include metropolitan area indicator variables. In my second variant, I instrument for the FHA-conventional difference in affordability using the simulated instruments described above. In my final variants, I reestimate the basic equation for various socio-demographic groups. This was done in order to find how FHA underwriting criteria have different effects for different groups. Separate regressions were run for household income quintiles (determined by year, total of five regressions), education level of household head (four regressions; high school dropout, high school graduate, some college education, college graduate), native status (two regressions; born in United States, foreign born), age of household head (seven regressions; under 25, 25-34, 35-44, 45-54, 55-64, 65-74, over 74), race (four regressions; White, Black, Asian, and Native American), and family situation (seven regressions; non-family household, married with children, married without children, male head with children, male head without children, female head with children, female head without children).

All equations have standard errors clustered at the metropolitan area-by-year level.

IV. Data Description

I use the Integrated Public Use Microdata Series (IPUMS) files for the 1970, 1980, and 1990 Censuses of Population and Housing. I keep all persons who lived in metropolitan statistical areas (MSAs) and aggregated the person-level data to the household level. I then determine each household's income, tax payments, and insurance payments and use the FHA underwriting criteria in force at the time of each census year (1970, 1980, 1990) to determine the most expensive home a household could afford with a FHA loan. Using the population of owner-occupied homes in each MSA and each year, this value is converted into the fraction of homes in the MSA in that particular Census year that the household could afford using an FHA loan. I then repeated the process using conventional underwriting criteria. In particular, for conventional underwriting criteria I use the Freddie Mac and Freddie Mae criteria because so many mortgages are resold to the secondary market. The FHA-conventional difference in affordability is the difference between the shares of homes affordable under my first (FHA) and second (conventional) calculations. Additional detail is found in the Data Appendix.

For some households, this difference is actually negative because FHA has a cap on the maximum mortgage it will insure. This is because some households can afford a house above the FHA cap by using a conventional loan. Clearly, the existence of FHA adds zero houses to the choice sets of such households (but does not decrease the homes

available to them in any way), so I substituted zero for negative values of FHA-conventional affordability difference.

Finally, I calculate two down payment variables. One variable is the down payment required by conventional lenders for the home that is the household's maximum affordable home with a conventional loan. This down payment variable is expressed as down payment divided by total yearly household income. The second down payment variable is the difference between the down payment that would be required by conventional lenders and that that would be required by FHA for the home that is the household's maximum affordable home with an FHA loan. This second down payment variable is always positive (FHA always allows lower down payments), and is also expressed as a share of total yearly household income.

Table 1 shows summary statistics for the data set. Sixty-one percent of the households in the sample live in owner-occupied housing. Over 42% of the households are headed by people of ages 25-44, with 19% of the household heads over 65 and 7% of household heads under 25. Mean real household income (in 1989 dollars) is $38,203, with a standard deviation of $31,171. Eleven and a half percent of household heads in the sample are Black, and 1.9% of the households have Asian household heads. United States natives head 90% of households in the sample. Fifty-nine percent of household heads are married, while 49% of households include children. Twenty-nine percent of household heads are high school dropouts and 21% are college graduates. Thirty-two percent of household heads are veterans.

The mean household has a 2.9% FHA-conventional affordability difference, with a standard deviation of 7.7%. This mean household has to pay an extra 12.3% of their

total yearly household income for a down payment using conventional guidelines, has an average minimum down payment of 20% of total yearly household income to buy the largest house that they could afford, and can afford 40% of the homes in their metropolitan area using conventional guidelines.

Table 2 gives the mean, median, 10^{th}, and 90^{th} percentiles of FHA-conventional affordability difference for different demographic groups. In general, the distribution of FHA-conventional affordability difference is skewed, with the variable being at or near zero for many of the observations. This is to be expected because many people can qualify for homes far above the FHA limit using a conventional loan, and for them FHA has no effect on affordability. The values of FHA-conventional affordability difference vary among the different demographic groups, and much of this probably has to do with income. For example, FHA-conventional affordability difference is largest among those with incomes between the 20^{th} and 40^{th} percentiles, Blacks and Native Americans, high school dropouts, and female headed households with children.

Tables 3 and 4 show the average and normalized size of FHA-conventional affordability difference in different municipal areas during different years. Each year is not strictly comparable because the IPUMS does not have the same metropolitan areas in each year and 1970 has about half the number of metropolitan areas (125) as the other two years. While imperfect, this gives the reader a general idea of where FHA is having the largest effect on housing affordability. Table 3 gives the unconditional mean of FHA-conventional affordability difference for the least and most affected metropolitan areas for each particular year. The values here are affected by both the income distributions and the house value distributions of people living in a particular MSA in a

particular year. In contrast, in Table 4 I calculate the median FHA-conventional affordability difference for households at various percentiles of the national income distribution (for the relevant year). Since income is held constant, the values in Table 4 represent how the house value distribution in a metropolitan area affects how people are affected by FHA regulations.

Strictly speaking, neither of these equations corresponds to the regressions I run. This is because my equation controls for a household's own income and for metropolitan area variables, so I effectively compare two otherwise identical households who are in otherwise identical metropolitan areas except that FHA makes more homes affordable to one household than the other. These tables exist to give the reader an idea of where FHA might be most important.

Table 3 shows the 10 MSAs where FHA has the most and least unconditional effect on housing affordability listed for 1970, 1980, and 1990. By and large, the places where FHA has the most effect is in areas with large amounts of people with modest incomes and modestly priced houses. The areas where FHA has the least unconditional effect on housing affordability are usually areas with historically high housing costs (Honolulu, Connecticut, California, New York City suburbs, Massachusetts).

Table 4 shows the 10 MSAs where FHA has the most and least conditional effect on housing affordability. The values for 1980 and 1990 are taken at the 25^{th} percentile of the national income distribution, while the value for 1970 is taken at the 20^{th} percentile because there is very little effect of FHA on housing affordability in the 25^{th} percentile in 1970. A look at Table 4 shows that the FHA has the largest normalized effect on housing affordability in different places in different years. In 1970 the list is spread all over the

country, while in 1980 the list moves to the upper Midwest and small metropolitan areas in the Northeast. In 1990, the list centers in Wisconsin and Texas. The areas where FHA has the smallest normalized effect on housing affordability are mostly high cost housing areas such as Alaska, Connecticut, Massachusetts, and California.

V. Results

Regression results are listed in Tables 5-8. Table 5 gives the preferred simulated instrumental variables (IV) specification. The IV results suggest that looser FHA underwriting criteria increase homeownership. A one-percentage point increase in the amount of additional homes available through the use of FHA increases homeownership by 0.196 percentage points. At the mean of the FHA-conventional affordability difference variable (0.0291), the above results suggest that FHA increases homeownership by almost 0.6 percentage points in the sample. At the 90^{th} percentile of the FHA-conventional affordability difference variable (0.0809), FHA increases homeownership by 1.59 percentage points. In the first-stage equation of the instrumental variables procedure, the t-value for the coefficient on the simulated instrument is 21.72, suggesting that the instrument is strong enough to avoid weak instrument problems.

Overall, the control variables had the correct signs and expected magnitudes. None of the other underwriting-related variables were statistically significant at the 10% level in the IV regression. Higher conventional down payments (divided by total yearly household income) seem to decrease homeownership. A one-standard deviation increase in conventional down payments decreases homeownership by 1.78 percentage points. Also, a one-percentage point increase in the fraction of homes available at the FHA cap

increases homeownership by 0.065 percentage points. The p-values of these coefficients were 0.179 and 0.134, respectively.

Homeownership increases monotonically with age, with householders over the age 75 being 55 percentage points more likely to own their homes than householders under the age of 25, and 15 percentage points more likely to own their home than householders between 45 and 54. Householders born in the United States are 7.2 percentage points more likely to own their homes than foreign-born householders, and Blacks and Native Americans are less likely to own their homes than Whites (by 10.8 and 9.4 percentage points respectively). Nonfamily households are the least likely to live in owner-occupied housing, and married couples with children are the most likely to own their homes (27.8 percentage points more likely than nonfamily households). High school dropouts are about 4 percentage points less likely to own their home than others. Some of the MSA-level variables also have significant coefficients, but they are difficult to interpret.

Table 6 gives results of alternative specifications. The first column gives the results of the IV regression with metropolitan area fixed effects. The choice of whether or not to include metropolitan area fixed effects is difficult. Including metropolitan area fixed effects may be preferable because it reduces the probability that spurious metropolitan area characteristics are correlated with the FHA treatment variables. On the other hand, much of the variation in the FHA-conventional affordability gap probably comes from historical variation in housing stock among metropolitan areas, and including metropolitan area fixed effects eliminates such good variation. Moreover, the estimate from any specification including metropolitan area fixed effects relies on changes in the

FHA-conventional affordability gap, over time within a metropolitan area. Such changes may well be correlated with problematic events —for instance, more houses may fall into the key price range because an area is declining and house prices are falling. In the IV specification with metropolitan area fixed effects, a one percentage point increase in FHA-conventional affordability difference increases homeownership by 0.166 percentage points, which is statistically significant at the 10 percent level. This implies that FHA increases homeownership by a mean of 0.48 percentage points in the sample, and 1.34 percentage points for someone at the 90^{th} percentile. Also, in this specification, an increase of one standard deviation in conventional down payments decreases homeownership by 3.21 percentage points. Note that the effect shown in the first column of Table 6 is slightly smaller than that shown in Table 5. It is possible that the effect is smaller because the metropolitan area effects eliminate spurious positive correlation between the FHA-conventional affordability gap and fixed metropolitan characteristics. It is just as likely that the effect is smaller because the within-metropolitan area variation in the FHA-conventional affordability gap is negatively correlated with an unobserved variable that lowers homeownership. In any case, the IV estimates from both Tables 5 and 6 estimates indicate that FHA increases homeownership by about one-half of a percentage point at the mean, and about three times that at the 90^{th} percentile of observations.

The next two columns give results from OLS specifications, with and without metropolitan area fixed effects. In the OLS regression without metropolitan area fixed effects, a one-percent increase in FHA-conventional affordability difference increases homeownership by 0.0624 percentage points. This suggests that the FHA increases

homeownership by an average of 0.18 percentage points in the sample, and by 0.50 percentage points for a person at the 90th percentile of FHA-conventional affordability difference. Also, in this specification one percentage point more homes available at the FHA cap increases homeownership by 0.077 percentage points. In this specification, all of the other variables relating to underwriting standards are statistically insignificant.

The results of the OLS regression with metropolitan fixed effects are listed in the last column of Table 6. Here, an increase in FHA-conventional affordability difference of one percentage point increases homeownership by 0.04 percentage points. This implies that FHA increases homeownership by an average of 0.12 percentage points in the sample, and 0.33 percentage points for someone at the 90th percentile of FHA-conventional affordability difference.

Note that the IV estimates are much larger than the OLS estimates. Recall that the simulated instrumental variables method generates estimates that are free of any bias resulting from correlation between the FHA-conventional affordability gap and the household's relative position in its metropolitan area's income distribution. One might expect the instrumental variables estimate to be smaller than the OLS estimate if relative poverty makes a household less likely to buy and the FHA-conventional affordability gap picks up relative income (as it might if income and the stock of housing were normally or log-normally distributed in each metropolitan area). However, the OLS estimate is already purged of the linear effect of the household's income centile, so the sign of the remaining bias purged by the IV method is unclear. Thus, one cannot say ex ante that the IV estimate should be smaller than the OLS estimate. Moreover, eliminating attenuation bias caused by measurement error will tend to make the IV estimate greater than the OLS

estimate. The sample includes only 1% of all households, and exact house value is not given, so the FHA-conventional affordability gap is measured with significant error that could cause attenuation bias. The IV estimate is purged of such bias. Finally, the IV estimate may be larger than the OLS estimate if FHA affects house prices so that the FHA-conventional affordability gap is endogenous to the effect of FHA. In this case, it seems that factors biasing the OLS coefficient downwards overwhelm those that might bias the OLS coefficient upwards.

We can further explore the effects of FHA by looking at various socio-demographic groups who are more or less likely to be highly affected by FHA. Table 8 shows OLS and IV estimates for various demographic groups. All regressions in Table 8 were run without metropolitan area fixed effects, but I ran identical regressions with metropolitan fixed effects and the pattern of results was sufficiently similar that it does not bear separate interpretation. In general, the estimates in Table 8 confirm our priors about which groups would be most affected by FHA. A look at first-stage results for all IV regressions shows that the instrument has a t-statistic of over 14 on all regressions (except those for income categories), suggesting that most regressions avoid weak-instrument problems. Assuming that the IV regressions are the most reliable, FHA has large positive effects on Blacks (1.37 percentage point mean increase in homeownership; 3.66 percentage points at the 90^{th} percentile), Native Americans (1.87 percentage point mean increase, 4.65 percentage points at the 90^{th} percentile), high school dropouts and high school graduates (1.71 and 1.54 percentage point increases at the mean, respectively, and 4.21 and 4.26 percentage point increases at the 90^{th} percentile, respectively), and

married couples with children (1.62 percentage point increase at the mean and 4.41 percentage points at the 90th percentile).

There are some surprises in the Table 8 IV results. First, FHA negatively affects Asians and foreigners (two heavily overlapping groups). Second, heads of households between the ages of 25 and 44 are the only households not positively affected by FHA. This is unexpected, but it is possible that 25 to 44 year olds are well served by the conventional mortgage market or that FHA affects 25-44 year olds through back-end (total monthly debt/income) requirements. Within smaller groups, there are more likely to be unpredictable interactions between where these groups choose to live and FHA-conventional affordability.

VI. Conclusions and Further Research

The Federal Housing Administration insures about 18 percent of all mortgage loans made in the United States. In spite of FHA's prevalence in mortgage insurance, prior studies have not provided credible evidence that the program actually affects homeownership. In this study, I use the variation provided by FHA underwriting changes over time and the interaction of those changes with local housing markets to investigate whether and how the FHA affects homeownership.

I find that FHA increased homeownership by an average of 0.6 percentage points during the period 1970 to 1990. In addition, those who were most strongly affected by FHA (90th percentile of FHA-conventional affordability difference) saw an increase in homeownership of 1.57 percentage points.

Moreover, the effect of FHA on the average American's likelihood of buying a home may not be what interests us. An individual who is strongly "treated" by FHA (whose FHA-conventional affordability difference is at the 90th percentile) has a 1.6 percentage point higher probability of owning a house because of FHA. We can see that the result for the strongly treated household makes sense if we look at the results for different socio-demographic groups. FHA affects Blacks more than other races. FHA also has much more effect on those below the 60th percentile in income. FHA affects most levels, but has its largest effects in households between the ages of 45-54. Lastly, FHA seems to have no effect on people in non-family households, and little effect on married couples without children; but it has large effects on both married couples with children and male- and female-headed households with children.

Furthermore, these results are probably underestimates because I was only able to determine how FHA affects homeownership through the channel of higher front-end (monthly mortgage payment/income) ratios due to a lack of wealth or debt data. FHA also allows higher back-end ratios (total monthly debt payments/income), a provision that could also increase homeownership. In addition, the absence of wealth data makes it impossible to estimate households' ability to make the necessary down payment for home purchase.

In this study, I control for many other factors that might affect homeownership, including down payment variables, conventional affordability measures, a quartic in household income, and a variety of metropolitan area characteristics (including several moments of the income distribution). I also offer simulated instrumental variables estimates of the effect of FHA; these estimates are effectively purged of bias from several

sources: effects of relative income on homeownership, measurement error, and house prices that are endogenous to FHA. Given all of the controls and the instrumental variables, I conclude that FHA's looser underwriting criteria probably do increase homeownership.

A consequence of the results just described is that we may be able to study the effects of homeownership using credibly exogenous variation in home-owning. The time-series and cross-sectional variation in FHA that allows me to estimate the effects of the program also should allow me to estimate the effects of homeownership. That is, FHA does not affect all similar households in the same way. Because Congress changes FHA underwriting criteria over time, the same household might be treated differently depending on whether the year was 1970 or 1980. Also, the same FHA underwriting criteria can be effectively more generous in some housing markets than in others. It is hoped that such variation will generate credible estimates of the effects of homeownership, a task that has long proved to be an empirical challenge.

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Table 1 – Summary Statistics

Variable	*Mean*	*Std. Dev.*	*Min*	*Max*
Homeowner	0.613	0.487	0	1
FHA-Conventional Affordability Difference	0.0291	0.0771	0	0.9536
Additional Down Payment w/Conventional	0.123	0.068	0	0.414
Conventional Down Payment/Income	0.202	0.073	0	0.431
Fraction of Homes Affordable w/Conventional	0.400	0.337	0	1
Fraction of Homes Affordable at FHA Cap	0.641	0.205	0.090	0.969
Age < 25	0.068	0.250	0	1
25< Age < 34	0.220	0.415	0	1
35 < Age < 44	0.201	0.401	0	1
55 < Age < 64	0.149	0.356	0	1
65 < Age < 74	0.119	0.323	0	1
Age > 74	0.075	0.264	0	1
Real Total Household Income (1989 dollars)	38203	31171	1	770868
Income Centile in MSA	0.510	0.283	0	1
Race = Black	0.115	0.319	0	1
Race = Native American	0.004	0.061	0	1
Race = Asian	0.019	0.137	0	1
Race = Other	0.002	0.041	0	1
U.S. Native	0.897	0.304	0	1
Married w/Children	0.369	0.483	0	1
Married w/o Children	0.228	0.420	0	1
Male Head w/Children	0.018	0.133	0	1
Male Head w/o Children	0.012	0.110	0	1
Female Head w/Children	0.095	0.293	0	1
Female Head w/o Children	0.014	0.116	0	1
High School Dropout	0.289	0.453	0	1
Some College	0.200	0.400	0	1
College Graduate	0.208	0.406	0	1
Veteran	0.318	0.466	0	1
MSA Household Income Gini Coefficient	0.401	0.028	0.320	0.489
MSA House Value Gini Coefficient	0.301	0.049	0.151	0.434
MSA Real Median House Value (1989 dollars)	91883	47191	32500	350000
MSA Real Median Household Income (1989 dollars)	31592.72	5083.478	16444.5	50800
MSA Fraction Black	0.117892	0.078864	0	0.440919
MSA Fraction Asian	0.019571	0.042676	0	0.586637
MSA Fraction Native American	0.00384	0.00511	0	0.05257
MSA Fraction Other Race	0.00175	0.00339	0	0.083007

Notes: All observations are at the household-level. There were a total of 1,606,433 observations. Demographic information (except for real total household income) pertains to the household head.

Table 2- FHA-Conventional Affordability Difference by Demographic Group

Income Quintile	*Mean*	*10th pctile*	*Median*	*90th pctile*
Household Income < 20th	0.0360	0	0.0027	0.0604
20th < Household Income < 40th	0.0491	0	0.0265	0.1077
40th < Household Income < 60th	0.0329	0	0.0053	0.0939
60th < Household Income < 80th	0.0200	0	0	0.0731
Household Income > 80th	0.0075	0	0	0.0068

Race	*Mean*	*10th pctile*	*Median*	*90th pctile*
White	0.0290	0	0.0001	0.0810
Black	0.0313	0	0.0028	0.0835
Asian	0.0153	0	0	0.0477
Native American	0.0350	0	0.0048	0.0871

Education	*Mean*	*10th pctile*	*Median*	*90th pctile*
High School Dropout	0.0400	0	0.0048	0.0982
High School Graduate	0.0305	0	0.0018	0.0845
Some College	0.0230	0	0	0.0706
College Graduate	0.0171	0	0	0.0538

Age of Household Head	*Mean*	*10th pctile*	*Median*	*90th pctile*
Age < 25	0.0322	0	0.0045	0.0754
25 <= Age <= 34	0.0247	0	0.0002	0.0695
35 <= Age <= 44	0.0226	0	0	0.0692
45 <= Age <= 54	0.0237	0	0	0.0737
55 <= Age <= 64	0.0295	0	0	0.0834
65 <= Age <= 74	0.0443	0	0.0115	0.1072
Age > 74	0.0424	0	0.0095	0.0977

Birthplace of Household Head	*Mean*	*10th pctile*	*Median*	*90th pctile*
United States	0.0232	0	0.0008	0.0705
Foreign Country	0.0297	0	0.0002	0.0819

Table 2- FHA-Conventional Affordability Difference by Demographic Group (continued)

Family Structure	*Mean*	*10^{th} pctile*	*Median*	*90^{th} pctile*
Non-Family Household	0.0235	0	0.0013	0.0495
Married Couple w/Children	0.0264	0	0	0.0844
Married Couple w/o Children	0.0330	0	0.0016	0.0911
Male head w/Children	0.0359	0	0.0022	0.1062
Male head w/o Children	0.0243	0	0	0.0709
Female head w/Children	0.0437	0	0.0093	0.1141
Female head w/o Children	0.0329	0	0.0030	0.0887

Notes: Income percentiles are calculated within years. Non-family households are one-person households or households in which no member of the household is related to any other household member. Affordability difference refers to the mean fraction of homes in the metropolitan area that can be purchased with FHA underwriting criteria minus the fraction of homes that can be purchased with conventional underwriting criteria. Male-headed of female-headed households are those in which the household head is unmarried, but at least two of the household members are related. The coefficient is the coefficient on the FHA-conventional affordability difference variable in a regression of all observations that belong to the relevant category in the first column. Total effect is the product of coefficient and affordability difference.

Table 3: Cities where FHA Had the Largest and Smallest Average Effect on Housing Affordability

	Cities Where FHA had the Largest Effect		
	1970	*1980*	*1990*
1	Huntington-Ashland, WV-KY-OH	Clarksville-Hopkinsville, TN-KY	Las Cruces, NM
2	Memphis, TN	Fall River, MA-RI	McAllen-Edinburg, TX
3	Augusta-Aiken, GA-SC	Columbus, GA	Brownsville, TX
4	Chattanooga, TN	Portsmouth, NH	Saginaw-Bay City, Midland, MI
5	Duluth-Superior, MN-WI	Sioux City, IA	Battle Creek, MI
6	Binghamton, NY	Duluth-Superior, MN-WI	Odessa, TX
7	Davenport-Rock Island, IA-IL	Fort Smith, AR	Ocala, FL
8	Louisville, KY	Fargo-Moorhead, ND-MN	Flint, MI
9	Omaha, NE	Parkersburg-Marietta, WV-OH	Benton Harbor, MI
10	Toledo, OH	Cumberland, MD	El Paso, TX
	Cities Where FHA had the Smallest Effect		
	1970	*1980*	*1990*
1	Bergen-Passaic, NJ	Honolulu, HI	Lawrence-Haverhill, MA-NH
2	San Francisco-Oakland, CA	San Jose, CA	Boston, MA
3	San Jose, CA	Anaheim-Santa Ana, CA	Salem-Gloucester, MA
4	Nassau-Suffolk, NY	Stamford, CT	Brockton, MA
5	Washington, DC	Washington, DC	Honolulu, HI
6	Anaheim-Santa Ana, CA	San Francisco-Oakland, CA	Lowell, MA-NH
7	Las Vegas, NV	Santa Cruz, CA	San Francisco, CA
8	Honolulu, HI	Santa Barbara, CA	Stamford, CT
9	Hartford, CT	Ventura-Oxnard, CA	Danbury, CT
10	Newark, NJ	Vineland-Millville-Bridgetown, NJ	Worcester, MA

Notes: The cities above refer to metropolitan areas (MSAs), as defined by the IPUMS and the Census for that year. The cities listed are in order, from the MSA where FHA had the most (or least) average effect on housing affordability (additional fraction of houses available from the availability of FHA), to where the FHA had the 10^{th} most (or least) average effect.

Table 4: Cities where FHA Had the Largest and Smallest Normalized Effect on Housing Affordability

	Cities Where FHA Had the Largest Effect		
	1970	1980	1990
1	Davenport-Rock Island, IA-IL	Lowell, MA-NH	Green Bay, WI
2	Portland-Vancouver, OR-WA	Binghamton, NY	Janesville-Beloit, WI
3	Binghamton, NY	Clarksville-Hopkinsville, TN-KY	Duluth-Superior, MN-WI
4	Toledo, OH	Fall River, MA-RI	Pueblo, CO
5	Wilmington, DE	Sioux City, IA	Las Cruces, NM
6	Louisville, KY	Duluth-Superior, MN-WI	Appleton-Oshkosh-Neenah, WI
7	Omaha, NE	Portsmouth, NH	McAllen-Edinburg, TX
8	Memphis, TN	Davenport-Rock Island, IA-IL	Odessa, TX
9	Huntington-Ashland, WV-KY-OH	Fargo-Moorhead, ND-MN	Monroe, LA
10	Duluth-Superior, MN-WI	Steubenville-Weirton, OH-WV	Wausau, WI
	Cities Where FHA Had the Smallest Effect		
	1970	1980	1990
1	Boston, MA	Honolulu, HI	Lawrence-Haverhill, MA-NH
2	St. Louis, MO	San Jose, CA	Lowell, MA-NH
3	Albany, NY	Anaheim-Santa Ana, CA	Boston, MA
4	Los Angeles, CA	Stamford, CT	Salem-Gloucester, MA
5	Peoria, IL	Anchorage, AK	Stamford, CT
6	Oklahoma City, OK	Ventura-Oxnard, CA	Brockton, MA
7	Beaumont, TX	Norwalk, CT	Danbury, CT
8	Hartford, CT	Danbury, CT	San Francisco, CA
9	Greenville-Spartanburg, SC	Santa Rosa-Petaluma, CA	Honolulu, HI
10	San Francisco-Oakland, CA	Nashua, NH	Worcester, MA

Notes: The cities above refer to metropolitan areas (MSAs), as defined by the IPUMS and the Census for that year. The cities listed are in order, from the MSA where FHA had the largest (or smallest) normalized effect on homeownership, to where the FHA had the 10^{th} largest (or smallest) normalized effect. The above values refer to the additional fraction of homes available to the prospective homeowner in that MSA and year if the homeowner is at the 25^{th} percentile in national income distribution for that year (20^{th} percentile in 1970).

Table 5 – IV Regression Results without Metropolitan Area Indicator Variables

Dependent Variable: Owner = 1	Coefficient	Std. Err	t	P>|t|
Additional Fraction of Homes Affordable w/FHA	0.196	0.091	2.14	0.033
Additional Down Payment w/Conventional	0.156	0.192	0.81	0.417
Conventional Down Payment/Income	-0.244	0.182	-1.34	0.179
Fraction of Homes Affordable w/Conventional	0.0202	0.0186	1.08	0.279
Fraction of Homes Available at FHA cap	0.0648	0.0432	1.5	0.134
Age < 25	-0.399	0.007	-59.54	0
25< Age < 34	-0.223	0.003	-67.78	0
35 < Age < 44	-0.071	0.002	-37.83	0
55 < Age < 64	0.073	0.003	29.04	0
65 < Age < 74	0.148	0.004	37.35	0
Age > 74	0.154	0.004	39.38	0
Real Total Household Income (1989 dollars)	-4.07E-07	9.34E-07	-0.44	0.663
Real Total Household Income^2	-1.78E-12	6.56E-12	-0.27	0.786
Real Total Household Income^3	1.07E-17	1.78E-17	0.6	0.55
Real Total Household Income^4	-1.06E-23	1.52E-23	-0.7	0.486
MSA Median Income	5.30E-06	1.30E-06	4.08	0
Income Centile in MSA	0.425	0.042	10.15	0
Race = Black	-0.108	0.005	-19.83	0
Race = Native American	-0.094	0.007	-13.18	0
Race = Asian	-0.014	0.010	-1.44	0.15
Race = Other	-0.080	0.010	-8.04	0
U.S. Native	0.072	0.005	14.62	0
Married w/Children	0.278	0.005	61.21	0
Married w/o Children	0.196	0.003	62.71	0
Male Head w/Children	0.104	0.005	19.11	0
Male Head w/o Children	0.116	0.005	21.4	0
Female Head w/Children	0.095	0.004	25.59	0
Female Head w/o Children	0.115	0.004	27.58	0
High School Dropout	-0.036	0.002	-20.91	0
Some College	0.0010	0.0018	0.55	0.583
College Graduate	0.0025	0.0026	0.96	0.339
Veteran	0.0043	0.0023	1.89	0.06
MSA Gini Coefficient of Income	-1.63	0.350	-4.67	0
MSA Real Median House Price	-1.93E-07	2.10E-07	-0.92	0.358
MSA Gini Coefficient of House Values	0.979	0.194	5.04	0
MSA Fraction Black	-0.187	0.058	-3.21	0.001
MSA Fraction Asian	-0.179	0.043	-4.13	0
MSA Fraction Native American	0.463	0.465	1	0.32
MSA Fraction Other Race	-1.734	1.194	-1.45	0.147
Year = 1980	0.050	0.021	2.42	0.016
Year = 1990	0.057	0.019	3.01	0.003

Notes: All variables are household-level and pertain to the head of household unless otherwise specified. Included years are 1970, 1980, and 1990. All observations are inside of an MSA, as defined by the IPUMS. The dependent variable equals one if the home is owner-occupied. The above regression was run by ordinary least squares (OLS) with clustering by MSA by year. Down payment is expressed as required down payment divided by total household income. Affordability refers to the fraction of homes in the metropolitan area that can be purchased given the appropriate (FHA or conventional) underwriting criteria and income of the household. There are 1,589352 observations. A full set of year indicator variables is included and the adjusted R-squared is 0.293.

Table 6 – Alternative Specifications

	IV with MSA Fixed Effects	OLS without MSA Fixed Effects	OLS with MSA Fixed Effects
FHA-Conventional Affordability Difference	0.166 (0.091)	0.0624 (0.0293)	0.406 (0.214)
Additional Down Payment w/Conventional Loans	0.062 (0.166)	-0.104 (0.072)	-0.163 (0.060)
Conventional Down Payment/Income	-0.440 (0.141)	-0.038 (0.101)	-0.260 (0.077)
Conventional Affordability	0.010 (0.020)	0.0073 (0.0175)	-0.005 (0.015)
Fraction of Homes Available at FHA Cap	-0.027 (0.020)	0.077 (0.041)	-0.017 (0.019)

There are 1,606,433 observations and a full set of year indicator variables in all regressions. A full set of year indicator variables is included in all regressions. The adjusted R-squared is 0.294 for the OLS regression without MSA fixed effects, and 0.3050 for the regression with MSA fixed effects.

Table 7- Mean Difference between FHA and Conventional Affordability, Results from Separate Regressions, and Implied Effects of FHA on Homeownership

Income Quintile	*Mean Affordability Difference*	*OLS Coefficient*	*IV Coefficient*	*OLS Effect*	*IV Effect*
Household Income < 20th	0.0360	0.0659**	0.6298	0.0024	0.0227
20th < Household Income < 40th	0.0491	0.1235**	0.2176	0.0061	0.0107
40th < Household Income < 60th	0.0329	0.0200	1.44	0.0007	0.0474
60th < Household Income < 80th	0.0200	-0.3298**	-0.3945	-0.0066	-0.0789
Household Income > 80th	0.0075	-0.0137	0.1672	0.0001	0.0047

Race	*Mean Affordability Difference*	*OLS Coefficient*	*IV Coefficient*	*OLS Effect*	*IV Effect*
White	0.0290	0.0458	0.2039**	0.0013	0.0059
Black	0.0313	0.1739**	0.4384**	0.0054	0.0137
Asian	0.0153	-0.1865**	-0.9921**	-0.0029	-0.0151
Native American	0.0350	0.0015	0.5344*	0.0001	0.0187

Table 7- Mean Difference between FHA and Conventional Affordability, Results from Separate Regressions, and Implied Effects of FHA on Homeownership (cont.)

Education	*Mean Affordability Difference*	*OLS Coefficient*	*IV Coefficient*	*OLS Effect*	*IV Effect*
High School Dropout	0.0400	0.0387	0.4283**	0.0015	0.0171
High School Graduate	0.0305	0.0862**	0.5038**	0.0026	0.0154
Some College	0.0230	0.0501	0.1341	0.0012	0.0031
College Graduate	0.0171	0.0611	0.0894	0.0010	0.0015

Age of Household Head	*Mean Affordability Difference*	*OLS Coefficient*	*IV Coefficient*	*OLS Effect*	*IV Effect*
Age < 25	0.0322	0.0211	0.6493**	0.0007	0.0209
25 <= Age <= 34	0.0247	0.0055	-0.0221	0.0001	-0.0005
35 <= Age <= 44	0.0226	0.1438**	0.0580	0.0032	0.0013
45 <= Age <= 54	0.0237	0.1539**	0.3729**	0.0036	0.0088
55 <= Age <= 64	0.0295	0.0340	0.3518**	0.0010	0.0104
65 <= Age <= 74	0.0443	0.0457	0.3615**	0.0020	0.0160
Age > 74	0.0424	0.0233	0.2712**	0.0010	0.0114

Birthplace of Household Head	*Mean Affordability Difference*	*OLS Coefficient*	*IV Coefficient*	*OLS Effect*	*IV Effect*
United States	0.0232	0.0558**	0.3149**	0.0013	0.0094
Foreign Country	0.0297	0.0894	-0.8043**	0.0027	-0.0187

Table 7- Mean Difference between FHA and Conventional Affordability, Results from Separate Regressions, and Implied Effects of FHA on Homeownership (cont.)

Family Structure	*Mean Affordability Difference*	*OLS Coefficient*	*IV Coefficient*	*OLS Effect*	*IV Effect*
Non-Family Household	0.0235	0.0102	-0.0937	0.0002	-0.0022
Married Couple w/Children	0.0264	0.1506**	0.6128**	0.0040	0.0162
Married Couple w/o Children	0.0330	0.0738*	-0.1263	0.0024	-0.0042
Male head w/Children	0.0359	0.0981*	-0.0998	0.0035	-0.0036
Male head w/o Children	0.0243	0.3295**	0.2727	0.0080	0.0066
Female head w/Children	0.0437	0.1360**	0.1721	0.0059	0.0075
Female head w/o Children	0.0329	0.0585	0.4970*	0.0019	0.0164

Notes: Income percentiles are calculated within years. Non-family households are one-person households or households in which no member of the household is related to any other household member. Affordability difference refers to the mean fraction of homes in the metropolitan area that can be purchased with FHA underwriting criteria minus the fraction of homes that can be purchased with conventional underwriting criteria. Male-headed of female-headed households are those in which the household head is unmarried, but at least two of the household members are related. The coefficient is the coefficient on the FHA-conventional affordability difference variable in a regression of all observations that belong to the relevant category in the first column. Total effect is the product of coefficient and affordability difference. Control variables are the same as the regression in Table 5.

Table 8- Difference between FHA and Conventional Affordability at 90th Percentile, Results from Separate Regressions, and Implied Effects of FHA on Homeownership

Income Quintile	*Affordability Difference at 90th Pctile*	*OLS Coefficient*	*IV Coefficient*	*OLS Effect*	*IV Effect*
Household Income < 20th	0.0604	0.0659**	0.6298	0.0040	0.0380
20th < Household Income < 40th	0.1077	0.1235**	0.2176	0.0133	0.0234
40th < Household Income < 60th	0.0939	0.0200	1.44	0.0019	0.1352
60th < Household Income < 80th	0.0731	-0.3298**	-0.3945	-0.0241	-0.0288
Household Income > 80th	0.0068	-0.0137	0.6257	-0.0001	0.0043

Table 8- Difference between FHA and Conventional Affordability at 90th Percentile, Results from Separate Regressions, and Implied Effects of FHA on Homeownership (continued)

Race	*Affordability Difference at 90th Pctile*	*OLS Coefficient*	*IV Coefficient*	*OLS Effect*	*IV Effect*
White	0.0810	0.0458	0.2039**	0.0037	0.0165
Black	0.0835	0.1739**	0.4384**	0.0145	0.0366
Asian	0.0477	-0.1865**	-0.9921**	-0.0089	-0.0473
Native American	0.0871	0.0015	0.5344*	0.0001	0.0465

Education	*Affordability Difference at 90th Pctile*	*OLS Coefficient*	*IV Coefficient*	*OLS Effect*	*IV Effect*
High School Dropout	0.0982	0.0387	0.4283**	0.0038	0.0421
High School Graduate	0.0845	0.0862**	0.5038**	0.0073	0.0426
Some College	0.0706	0.0501	0.1341	0.0035	0.0095
College Graduate	0.0538	0.0611	0.0894	0.0032	0.0048

Age of Household Head	*Affordability Difference at 90th Pctile*	*OLS Coefficient*	*IV Coefficient*	*OLS Effect*	*IV Effect*
Age < 25	0.0754	0.0211	0.6493**	0.0016	0.0490
25 <= Age <= 34	0.0695	0.0055	-0.0221	0.0004	-0.0015
35 <= Age <= 44	0.0692	0.1438**	0.0580	0.0100	0.0040
45 <= Age <= 54	0.0737	0.1539**	0.3729**	0.0113	0.0113
55 <= Age <= 64	0.0834	0.0340	0.3518**	0.0028	0.0293
65 <= Age <= 74	0.1072	0.0457	0.3615**	0.0049	0.0388
Age > 74	0.0977	0.0233	0.2712**	0.0023	0.0265

Birthplace of Household Head	*Affordability Difference at 90th pctile*	*OLS Coefficient*	*IV Coefficient*	*OLS Effect*	*IV Effect*
United States	0.0705	0.0558**	0.3149**	0.0039	0.0222
Foreign Country	0.0819	0.0894	-0.8043**	0.0073	-0.0659

Table 8- Difference between FHA and Conventional Affordability at 90th Percentile, Results from Separate Regressions, and Implied Effects of FHA on Homeownership (continued)

Family Structure	*Affordability Difference at 90th pctile*	*OLS Coefficient*	*IV Coefficient*	*OLS Effect*	*IV Effect*
Non-Family Household	0.0495	0.0102	-0.0937	-0.0046	-0.0046
Married Couple w/Children	0.0844	0.1506**	0.6128**	0.0127	0.0517
Married Couple w/o Children	0.0911	0.0738*	-0.1263	0.0067	-0.0115
Male head w/Children	0.1062	0.0981*	-0.0998	0.0104	-0.0106
Male head w/o Children	0.0709	0.3295**	0.2727	0.0233	0.0193
Female head w/Children	0.1141	0.1360**	0.1721	0.0155	0.0196
Female head w/o Children	0.0887	0.0585	0.4970*	0.0052	0.0441

Notes: Income percentiles are calculated within years. Non-family households are one-person households or households in which no member of the household is related to any other household member. Affordability difference refers to the mean fraction of homes in the metropolitan area that can be purchased with FHA underwriting criteria minus the fraction of homes that can be purchased with conventional underwriting criteria. Male-headed of female-headed households are those in which the household head is unmarried, but at least two of the household members are related. The coefficient is the coefficient on the FHA-conventional affordability difference variable in a regression of all observations that belong to the relevant category in the first column. Total effect is the product of coefficient and affordability difference. Control variables are the same as the regression in Table 5.

Appendix – Construction of the FHA and conventional affordability and down payment variables

This section details in-depth how the FHA and conventional affordability and down payment variables were constructed. In creating these variables, I had to make certain assumptions and imputations, all of which I would like to make clear in this appendix.

All data on persons and households is taken from the IPUMS and uses IPUMS notation. This notation is most important in its choice of assignment of metropolitan areas, which changes some over time. All observations not in a metropolitan area were thrown out.

Information on FHA underwriting characteristics was taken from FHA underwriting manuals, written in 1972, 1982, 1988, and 1990, as well as information from Vandell (1995). There were one or two conflicts between the two sources; in such cases I went with my interpretation of the manuals where it was appropriate, and with Vandell for 1970 data.

More specifically, both conventional and FHA underwriting criteria include criteria concerning down payments (amount and source), maximum amount of loan (FHA only), credit criteria, necessity and cost of mortgage insurance, front-end ratios (maximum amount of housing costs/income), closing costs (amount and financing), and back-end ratios (maximum amount of total long-term debt/income). My work in creating FHA and conventional down payment and affordability variables was, using IPUMS data, to translate these criteria into numbers that could be used in a regression.

Because the Census lacks data on wealth and personal debt, it is impossible to simulate the effects of back-end ratios. Conceivably, one could use data with wealth information and impute the effects of such back-end ratios, but it is unclear how much additional information that would provide. The same is true for credit criteria. FHA has looser credit criteria than conventional lenders, and that has remained true over time, although it may be less true today than it once was. Due to these considerations, in this paper I concentrate on the effects of front-end ratios, closing costs, mortgage insurance, and down payments.

Front-end ratios include what are called PITI costs (principal, interest, real estate taxes, and insurance). Interest rates were assumed to be either the dominant HUD rate for that census year (for FHA loans) or the going 30-year conventional rate at the beginning of that year (for conventional loans). Both figures were taken from the Mortgage Bankers Association of America (MBAA) web page (www.mbaa.org). The earliest interest rate was taken in cases where the relevant figure was not available for January 1970. Estimates for real estate taxes were taken from the American Housing Survey (AHS). Real estate tax data is by region, house value, and by year. Data for 1973 was used in place of 1970 data because that was the earliest available. Data from 1973 and 1980 was available in book form and gave the average property tax mill rate by Census region for the ranges of house values given in the AHS. Data for the 1990 census year was taken from the 1989 version of the American Housing Survey. I used the same four regions as before and for each region, ran a regression with property tax mill rate on the LHS and a quartic in house value on the RHS. I used this regression to calculate property tax rates for all households in the 1990 census. I ran a similar regression (quartic in value) with fire and hazard insurance costs (divided by house value) in the

1989 AHS (also by region) and assumed that the values were the same in all three Census years. In addition, I assumed that closing costs were 2.3% of total house value, and that FHA allowed these costs to be financed, while conventional lenders wanted these costs as part of the down payment.

In coming up with total payments allowed, I assumed that interest was compounded monthly and all mortgage loans were for 30 years. Private mortgage insurance (PMI) was assumed to be 1% of the total loan for conventional loans and 0.5% of the total value of the loan in 1970. Mortgage insurance cost varies for FHA loans, being 0.5% annually of the total value of the loan in 1970 and 1980, moving to 3.8% upfront of the total value of the loan in 1990.

I assumed that conventional down payments were five percent of total house value in 1980 and 1990, and ten percent in 1970. As mentioned before, conventional down payments also include PMI and closing costs in all years. FHA down payments change over the 1970-1990 period. As mentioned before, FHA allows closing costs and upfront mortgage insurance (1990) to be financed. This creates much smaller down payments for FHA loans than for conventional loans.

In 1970, FHA down payments were 3% of all housing costs under $25,000 and 90% of all costs above that. In 1980, FHA down payments were 3% of all housing costs if the total housing cost was under $25,000. Otherwise, the down payment was 3% of the first $25,000 and 5% of all the housing cost above that up to the mortgage limit. By 1990, FHA down payments were 3% of total housing cost if the house value was under $50,000. Otherwise, the down payment was 3% of the first $25,000 and 5% of the rest.

The FHA and down payment variables were calculated as down payment divided by yearly household income as given in the IPUMS. FHA and conventional down payments were calculated as given above, and the down payment variables were constrained to be zero if negative, and ten if greater than ten in order to reduce the effect of outliers.

FHA and conventional affordability variables created using FHA and secondary market criteria (for conventional loans). The use of secondary market criteria for conventional criteria is justified because many mortgage lenders resell mortgages to the GSEs (Fannie Mae and Freddie Mac), and so their criteria become the modal criteria for the secondary market. Here I will concentrate on front-end ratios because I do not have detailed information on credit ratings and other debt. As mentioned before, front-end ratios determine the amount of income that can be spent on main housing costs (principal, interest, taxes, and insurance). These ratios were determined by using GSE underwriting standards because many lenders wish to resell mortgages to the GSEs, and therefore must follow GSE guidelines to do so.

FHA front-end guidelines for 1970 and 1980 state that no more than 35 percent of after-tax income can be spent on housing costs, as defined before. After-tax income was computed using the NBER TaxSim program (Feenberg 1993) and Social Security tax rates for the appropriate year. Since income on the census is given for the year before the census, I used that tax year for computing tax liability. The only exception to this rule was 1970, in which I used 1977 tax laws to compute state tax liability (TaxSim doesn't have state tax simulations before that year). I used the CPI to convert 1969 income into 1977 dollars to compute the liability and then to reconvert the liability into 1969 dollars. In 1990, the front-end limit was 38% of after-tax income. Strictly speaking, the front-end

guidelines were computed as percentage of before-tax income that year, but I used 1989 regulations because they were more representative of the decade 1980-1990.

GSE underwriting guidelines stated that total housing costs (as computed before) could equal up to 25% of before-tax income in 1970. This was increased to 28% in 1980 and 1990.

The conventional and FHA affordability ratios were constructed to figure out what fraction of homes in a particular MSA during a particular year a household could afford. In order to calculate this, I took all the listed values for homes in a particular MSA by year. I then assumed that all topcoded domiciles had a value 20% larger than the topcode. After this, I took the log of all house values, took the mean and standard deviation of this log for each MSA, and then I assumed that the distribution of house values within a MSA was lognormal. Using the front-end ratios and appropriate interest rates, I then calculated what fraction of homes the household could afford under FHA and conventional guidelines, assuming the lognormality of the house value distribution within any metropolitan areas as just stated.

Gini coefficients for income and house values were computed by taking twenty equidistant points in the percentile distribution of household income and house values (5^{th} percentile, 10^{th}, and so on), and computing the area under the Lorenz curve calculated with such 20 points. House values were only taken from owner-occupied homes and income was restricted to be non-negative (those who reported negative incomes had incomes truncated to zero). Median house value was also computed only using owner-occupied homes.

Appendix Table 1 – Logit Regression Results

Dependent Variable: Owner = 1	*Coefficient*	*Std. Err*	*t*	*P>|t|*
Additional Fraction of Homes Affordable w/FHA	0.212	0.165	1.29	0.198
Additional Down Payment w/Conventional	-0.429	0.527	-0.81	0.416
Conventional Down Payment/Income	-0.294	0.596	-0.49	0.622
Fraction of Homes Affordable w/Conventional	-0.076	0.109	-0.7	0.485
Fraction of Homes Affordable at FHA Cap	0.564	0.235	2.4	0.016
Age < 25	-2.25	0.0187	-120.65	0
25< Age < 34	-1.23	0.0142	-86.41	0
35 < Age < 44	-0.454	0.0112	-40.52	0
55 < Age < 64	0.448	0.020	22.27	0
65 < Age < 74	0.825	0.025	33.07	0
Age > 74	0.823	0.021	38.74	0
Real Total Household Income (1989 dollars)	-1.3E-05	7.20E-06	-1.83	0.068
Real Total Household Income^2	1.72E-10	6.05E-11	2.84	0.005
Real Total Household Income^3	-7.43E-16	2.27E-16	-3.27	0.001
Real Total Household Income^4	9.88E-22	3.16E-22	3.12	0.002
MSA Median House Price	3.15E-05	8.23E-06	3.83	0
Income Centile in MSA	2.65	0.306	8.67	0
Race = Black	-0.583	0.026	-22.08	0
Race = Native American	-0.508	0.040	-12.85	0
Race = Asian	-0.117	0.056	-2.1	0.036
Race = Other	-0.445	0.061	-7.26	0
U.S. Native	0.379	0.025	15.01	0
Married w/Children	1.50	0.025	60.84	0
Married w/o Children	0.994	0.015	68.34	0
Male Head w/Children	0.508	0.026	19.19	0
Male Head w/o Children	0.603	0.026	23.31	0
Female Head w/Children	0.524	0.019	27.62	0
Female Head w/o Children	0.567	0.020	28.46	0
High School Dropout	-0.219	0.009	-23.53	0
Some College	0.0008	0.0104	0.07	0.942
College Graduate	0.0179	0.0164	1.09	0.276
Veteran	0.0531	0.0104	5.1	0
MSA Income Gini Coefficient	-9.67	2.00	-4.84	0
MSA Median House Price	-1.31E-06	1.24E-06	-1.06	0.289
MSA House Value Gini Coefficient	5.78	1.11	5.19	0
Fraction Black in MSA	-1.08	0.32	-3.34	0.001
Fraction Asian in MSA	-0.931	0.249	-3.74	0
Fraction Native American in MSA	2.57	2.78	0.92	0.356
Fraction Other Race in MSA	-10.2	6.62	-1.53	0.125
Year = 1980	0.305	0.126	2.43	0.015
Year = 1990	0.362	0.132	2.74	0.006

Notes: All variables are household-level and pertain to the head of household unless otherwise specified. Included years are 1970, 1980, and 1990. All observations are inside of an MSA, as defined by the IPUMS. The dependent variable equals one if the home is owner-occupied. The above regression was run by logit with clustering by MSA by year. Down payment is expressed as required down payment divided by total household income. Affordability refers to the fraction of homes in the metropolitan area that can be purchased given the appropriate (FHA or conventional) underwriting criteria and income of the household. There are 1,606,433 observations. A full set of indicator variables for the metropolitan areas is included and the adjusted R-squared is 0.249.