Does Credit Quality Matter for Homeownership?

Irina Barakova
Board of Governors of the Federal Reserve System

Raphael Bostic
University of Southern California

Paul Calem
Board of Governors of the Federal Reserve System

Susan Wachter
University of Pennsylvania

January 6, 2003

Preliminary: please do not quote without permission from the authors

The views expressed in this paper are those of the authors and do not necessarily reflect the views of the Board of Governors or other members of its staff. We thank Robert Avery, Glenn Canner, Tom Davidoff, and Arthur Kennickell for very helpful comments and Gerhard Fries for valuable research assistance

1. Introduction

While there has been considerable research empirically quantifying and simulating the role of borrowing constraints on homeownership rates, the primary focus of this work has been on measuring the relative importance of income and wealth constraints with respect to ownership outcomes. An important gap in the literature – the role of credit quality – has largely gone uninvestigated. Also missing from the literature is an assessment of recent trends; that is, of the degree to which the effects of borrowing constraints on homeownership may have changed over the past decade.

While micro-level household data on wealth and income are available for assessing income- and wealth-based constraints to homeownership, lack of data on household credit ratings has precluded evaluation of credit quality as a potential barrier to homeownership. Thus, questions of the importance of credit quality as a borrowing constraint, both alone and interacting with other financial constraints, and the importance of omitting a credit quality measure from assessments of the significance of other borrowing constraints have not been examined.

A key goal of this paper is to quantify the importance of credit quality as a factor in limiting access to homeownership. The data problem that has hampered previous research is overcome through the use of a special sample of individual credit records from which we develop a credit score imputation model. This credit score estimation technique allows for the derivation of a pseudo credit score for each respondent in our sample, which is drawn from the Survey of Consumer Finances. We then empirically estimate tenure outcome equations including these estimates of household credit quality along with other financial constraints to advance our

understanding of how and why such constraints matter in homeownership. This research thus allows for an important advancement in the understanding of how homeownership is achieved.

The role of financing constraints also is of interest to academic researchers and policy analysts seeking to understand recent homeownership trends and design policies that may influence future trends. Although homeownership rates increased over the 1990s (from 64% to an historic high of 67%), there is policy interest in further expanding access to homeownership, as evidenced by the American Dream initiative put forth by President Bush. There is also ongoing debate about the source of increasing homeownership rates. For example, Bostic and Surette (2001) find that demographic factors explain a substantial portion of the recent upswing in homeownership rates for higher income households but cannot account for increases among lower income households. They argue that this suggests that there is a potential explanatory role for recent changes in outreach by lending institutions, including the increased availability of "affordable" low down payment mortgages. Zorn (2002) points to a role for the increased use of automated underwriting using credit scoring models, which allow for better risk assessment and help to reduce origination costs. This paper also estimates the role of financial constraints over time to examine the possible impact of these institutional shifts.

The paper proceeds by summarizing the empirical literature in section 2. The description of data sources follows in section 3 and methodology is described in section 4. We present results in section 5 and briefly conclude in section 6.

2. Literature Review

Microdata studies of homeownership propensities have long demonstrated the importance of family income for determining the probability of homeownership, a finding interpreted as partially reflecting the greater ability of households with higher income to secure adequate mortgage financing. More recently, a literature has developed which documents and parameterizes the impact of mortgage lending constraints on the probability of homeownership. Feldman (2001) provides a comprehensive summary of the methodologies employed and the empirical findings in this literature as part of a review of the impact of mortgage interest rates on homeownership outcomes. Rosenthal (2002) also provides a review of the literature on the impact of borrowing constraints on homeownership, and relates these studies to the broader literature on credit rationing, using Stiglitz and Weiss (1981) as the theoretical foundation for why lenders would impose such constraints in the first place. Feldman and Rosenthal point to the distinction between studies that quantify the ability of households to purchase a home under different underwriting criteria and those that quantify the number of households that would choose to own a home under different underwriting criteria. Rosenthal notes that studies on the latter begin with papers by Linneman and Wachter (1989) and Zorn (1989), and more recently include Haurin, Hendershott, and Wachter (1997) and Quercia, McCarthy and Wachter (2003). These and subsequent studies stratify empirical samples into constrained and unconstrained households and examine the impact of a wide range of different underwriting criteria in tenure choice equations and tenure choice simulations.

The focus of these studies of the impact of borrowing constraints on tenure outcomes has been on modeling and separately and jointly quantifying income and wealth constraints imposed by lenders. Rosenthal notes an important finding of these studies: that wealth (down payment)

constraints appear to restrict access to homeownership with far greater frequency than income constraints. This is surprising, given that many lenders in the 1980s and continuing on into the 1990s had stated house payment-to-income limits of 28%. Wachter et al. (1996) and Quercia, McCarthy and Wachter (2003) further demonstrate that such constraints are a significant impediment to homeownership for "underserved" groups in the population, including younger families, low-income, and especially, minority households. While homeownership rates have increased significantly over the 1990s, the disparities across ethnic and racial groups have remained substantial.

The emphasis of these studies on income- and wealth-based constraints as barriers to homeownership leaves one important constraint--limits due to poor credit quality--largely unaccounted for. A key exception is Rosenthal (2002), which provides an assessment of the overall impact on homeownership of reduced access to credit from any cause, including a household's poor credit rating. Using the 1998 Survey of Consumer Finances, Rosenthal identifies those households that in the past five years sought credit but who were denied or received only a partial amount and those that refrained from applying for credit out of a concern of being turned down, and defines these households as being credit constrained. He then estimates a two-equation system of the probability of being credit constrained and the probability of being a homeowner using a bivariate probit technique to control for the possibility of sample selection bias in the homeownership equation. Rosenthal demonstrates that credit quality is indeed a barrier to homeownership for households, as bankruptcy and a history of delinquent loan repayment are positively related to the likelihood of being credit constrained but

unrelated to the probability of wanting to own a home. The key finding is that the removal of credit constraint barriers, as defined by Rosenthal, would increase the homeownership rate by about 4 percentage points, or about 6 percent. The effects are most pronounced among Hispanic households and lower-income households. Rosenthal concludes that the main effect of financing constraints is to delay entry into homeownership, a finding consistent with the results obtained by Goodman and Nichols (1997).

The present study contributes to this literature in several ways. First, like Rosenthal (2002), credit quality is incorporated into the analysis. However, the measure of credit quality used here is more direct and closely approximates the statistically based credit scores widely used by lenders to assign credit ratings to consumers based on the information in their credit reports. Second, unlike previous research, the current analysis distinguishes between the effects of income, wealth, and credit quality based constraints and quantifies the importance of each. In contrast, Rosenthal's methodology does not separately quantify the importance of constraints to homeownership due to impaired credit, lack of wealth to meet downpayment requirements, and lack of income to satisfy conditions required to receive mortgage credit.

Third, this study tracks the interesting and important issue of how the impact of each type of constraint has evolved over time, by estimating changes in their relative importance during the 1990s. The mortgage industry has expended a substantial effort to provide "affordable lending" products in recent years. The increased prevalence of these products, which are designed to be more accessible to households with relatively limited means in terms of income and wealth, could explain declines in the importance of income and wealth constraints. Further,

the widespread use of automated underwriting, based largely on credit scores established by national credit agencies, has migrated from consumer credit to mortgage credit markets only fairly recently, which suggests that credit-based constraints may have become more important over time. On the other hand, judgment of credit quality has always been a traditional part of mortgage underwriting.

3. Data

We use data from the Survey of Consumer Finances (SCF) from 1989, 1995, and 1998. The SCF is a triennial survey of U.S. households sponsored by the Board of Governors of the Federal Reserve System in cooperation with the U.S. Department of the Treasury, and conducted by the Survey Research Center at the University of Michigan. The survey provides detailed information on U.S. families' assets and liabilities, income, use of financial services, and housing and demographic characteristics. Household balance sheet and financial variables used in this study include liquid and semi-liquid financial assets; total non-housing assets; monthly mortgage payments and other monthly debt payments; and percent down payment at the time of purchase of the primary residence (for households with a home mortgage).[1] Housing-related variables employed include whether the household rents or owns; date of moving into the current residence (which, combined with the survey date, yields length of tenure); and the original purchase price and current house value (for owners). Demographic variables employed include age; years of education; marital status and number of dependents; and racial/ethnic classification.

1 Liquid and semi-liquid financial assets as defined by the SCF include all financial assets other than long-term savings instruments, such as pension plans, that cannot be borrowed against.

The SCF employs a dual-frame sample design that overlays a standard geographically based random sample with a special sample of relatively wealthy households.[2] Weights are provided for combining observations from the two samples to make estimates for the full population. Following Rosenthal (2002), we estimate regression models without weights but use sample weights when calculating summary statistics and predictions based on the estimated equations in order to generate summary statistics and predictions representative of the United States.

Beginning with the 1989 survey, missing data in the SCF have been imputed using a multiple imputation model.[3] Each missing value in the survey is imputed five times, resulting in five replicate data sets, referred to as "implicates." Here, we pool the five implicates and adjust regression standard error estimates for the multiple imputation, following the procedure described in Kennickell (2000).

In addition to the SCF, we rely on a special sample of credit records from a national consumer credit reporting agency to develop an imputation equation for assigning credit ratings to SCF households. These data were obtained by the Board of Governors of the Federal Reserve System and contain credit scores on a nationally representative sample of about 200,000 individuals, their dates of birth, and their full credit records exclusive of any personal identifying information, as of June 1999. These credit records consist primarily of information on an individual's current and past usage of credit accounts, along with any records of bankruptcy

2 See Kennickell (2000) for details.

3 See Kennickell (1991, 1998) for details.

filings; they do not contain information on household income and assets, for example. The records include information on number and types of credit accounts, the date each account was open and, if applicable the date closed, payment histories (especially, the timing and severity of episodes of delinquency), account balances, and credit limits (for open-end accounts).[4] Credit scores in these data range from 480 at the 1st percentile to 820 at the 99th percentile, with a median of 716 and mean of 696 (with a lower score indicating lower credit quality.)

We rely on two other data sources to construct variables used in this study. We utilize the state and metropolitan area weighted repeat sales house price indices published by the Office of Housing Enterprise Oversight to measure local house price appreciation rates. Finally, we rely on data on state and metropolitan area median house value and percent of housing units in a local area that are owner occupied, and metropolitan area population, from the 1990 U.S. Census.[5]

3.1 Sample restrictions

The issue of interest is the role that financing constraints may have in determining the outcome of a household's decision whether to own a home. In other words, we wish to determine the impact of several possible types of financing constraints on the marginal household that is poised between renting and owning. Ideally, one would analyze the impact of financing constraints using a sample of individuals that recently faced the choice of whether to buy a house. While the SCF does not explicitly offer such a sample, it does provide a reasonable proxy - "recent" movers. We define recent movers to be households that have been at their current address at most two years. Recent movers include both renters and homebuyers.

4 For a more complete description of these data, see Avery, Bostic, Calem and Canner (2003).
5 Geographic data in the SCF that are required for matching to these other databases are available only internally at

From this sample, we limit consideration to households headed by an individual aged 21-50, so as to reduce heterogeneity with respect to factors influencing the ownership decision.[6] For instance, factors that differentiate older and younger households, such as may be related to planning for retirement, also may systematically affect the nature of the ownership decision. Students and people living on farms are also excluded. After applying these restrictions, the SCF samples contain 575, 902 and 868 household observations for 1989, 1995 and 1998 respectively.

4. Method

Our analysis, which is conducted separately for each survey year, has two stages. At the first stage, we estimate who is financially constrained regarding entry into homeownership, separately identifying wealth, income, and credit quality constraints. In the second, we estimate the impact of the identified financial constraints on the probability of entering into homeownership.

4.1 Identifying households that are wealth or income constrained

We apply a modified version of a procedure developed by Linneman and Wachter (1989) to identify households likely to be wealth or income constrained in financing the purchase of a home. This is a two-step process. The first step estimates the value of each household's "preferred home" and the second step evaluates whether the household's income and wealth permit the purchase of that home.

---

the Federal Reserve Board.

6 As discussed below, results are robust to use of alternative sample restrictions.

In the first step, we model the value of a household's preferred house value (Value) as a function of household income and non-house assets (in logs), the median house value in the local geographic area (median value), age of the household head, and a vector of household demographic characteristics (**X**):

$$(1) \quad \text{Value} = a_0 + a_1\text{log\_income} + a_2\text{log\_assets} + a_3\text{median\_value} + a_4\text{pct\_owner\_occupied} + a_5\text{age} + \mathbf{b_1X}$$

Housing services are viewed as a normal consumption good and therefore that the preferred house value will increase with income. We expect that portfolio diversification motives will lead to a positive association between preferred house value and total non-house assets.[7] Median home value in the metropolitan area (MSA) or rural (non-MSA) county where the household resides is used as a proxy for differences in price across local geographic markets. It is based on 1990 median values from the U.S. Census, updated (in the case of the 1995 and 1998 samples) using the change in the OFHEO price index since 1990 for the local market.[8] We expect that otherwise identical households located in markets where prices differ will have a different preferred house value (with the direction of impact depending upon price elasticity of demand.) In addition, we control for potential systematic differences across local markets by including the percentage of housing units in the local area that are owner-occupied, also from the 1990 U.S. Census.

Demographic dummy variables in **X** identify education level of the household head (college or graduate degree, high school degree or some college), race of the household head

7 The results are robust to using total financial assets in place of total non-house assets.
8 If the household resides in an MSA for which an OFHEO price index is published, we use that index. Otherwise,

(African American, Hispanic, other non-white), and marital status of the household head (married or partnered with children, single with children, single without children.) Any of these, along with age, may be related to the quantity or types of housing services desired or the desired investment in housing assets.

The parameters for equation (1) are estimated using the sub-sample of recent homebuyers. We follow Linneman and Wachter (1989) by using the value of the house currently occupied as an indicator of the preferred house value for households that were not subject to wealth or income constraints when purchasing their home. Households are determined to have been wealth constrained when purchasing their home if their current equity (estimated to be original percent down payment multiplied by current house value) plus liquid and semi-liquid assets is less than 10 percent of their current house value. They are determined to have been income constrained if their total reported monthly debt payment obligations, including mortgage obligations, exceed 38 percent of monthly income. Wealth and income constrained households are treated as censored observations, since it is clear that their preferred house value will tend to be higher than the value of the home they purchased.[9] Because of the presence of these censored observations, (1) is estimated using a Tobit specification.[10] The estimated equation (1) is then applied to all households in the sample (including renters) to obtain an estimated preferred house value for each household.[11]

---

we use the state-level index.

9 The results are robust to treating credit quality constrained households (as defined below) as censored observations as well.

10 In this respect, we modify the procedure in Linneman and Wachter (1989), where households that purchased their home subject to wealth or income constraints when estimating an equation for preferred value are excluded from the estimation.

11 This approach assumes that otherwise similar renters have the same preferences for housing that owners do. If

The second step of the procedure is to identify households in the full sample of recent movers that are wealth or income constrained based on their estimated preferred house value. This is analogous to the determination made in the previous step in the context of identifying censored observations of preferred house value, but we now apply a common test for each constraint to both renters and owners in the sample. We assume that a household is wealth constrained if it cannot meet a minimum down payment requirement of 10 percent of its preferred house value, and is income constrained if (assuming a 10 percent down payment) its total monthly debt payment obligation after purchase of the preferred house exceeds 38 percent of monthly income. The wealth available for downpayment again is calculated as liquid plus semi-liquid assets plus (for owners) adjusted original downpayment. The monthly mortgage payment component of total debt obligations is calculated for a hypothetical 30-year fixed rate mortgage, with an interest rate equal to the average for the survey year and the prior year (with the loan amount equal to 90 percent of the preferred house value). Remaining monthly debt payment obligations are obtained directly from the SCF.

4.2 Identifying households facing credit quality constraints

Incorporation of credit quality constraints represents an important innovation and a key contribution of this work. Since a consumer credit rating is not included in the SCF data, we derive a pseudo credit score that approximates the statistically-based credit scores widely used by lenders to assign credit ratings to consumers based on the information in their credit

---

this is not the case, and renters have a different (lower) disposition toward housing size, this method may bias downwards to measured impact of borrowing constraints.

records.12 To do this, we use the credit records database described above to develop a score imputation model. We regress credit score on consumer characteristics in the credit records database that are also available in all three years of the SCF.

Because the data are proprietary, we are limited in the details we can provide. To give a flavor of this portion of the analysis, though, some key predictors are existence of delinquencies of 30 days and 60 days or longer in the past year, the aggregate balance and the utilization rate on bank credit cards, and the age of the individual.13 The R2 for the imputation regression model is .70, and predicted scores range from 561 at the first percentile to 818 at the 99th percentile, with a median score of 738 and a mean score of 724.

The score imputation model is then applied to the households in the SCF samples to obtain a pseudo credit score for each household, calculated as Zb, where Z is the vector of variables included in the model and b is the vector of estimated coefficients.14 Credit-constrained individuals are defined as those whose credit score falls below a minimum threshold level below which credit is unlikely to be extended. The mortgage industry generally views individuals with credit scores in the bottom 20 percent of the national credit score distribution as having relatively poor credit quality, and those in about the 20-25th percentile range as requiring "extra attention."15 Therefore, we adopt the 22nd percentile of the score distribution in our

12 For a more complete discussion of credit scoring, see Avery, Bostic, Calem, and Canner (2000).
13 Age was set equal to zero when missing, and a dummy variable was included in the regression to control for missing age. Presence of a mortgage account in the credit file was not used as an explanatory variable, to mitigate concerns about simultaneity in the homeownership analysis. Past bankruptcy was not considered.
14 The main limitation in attempting to predict scores and the main source of unexplained variation in scores in the imputation equation are lack of information in the SCF on episodes of delinquency more than one year old, accounts in collection, and derogatory public records (other than bankruptcy). Moreover, even delinquencies within the past year may be underreported in the SCF.
15 These ranges correspond to individuals with FICO scores below 620 and those with FICO scores between 620 and 660; see www.ficoguide.com.

credit records database (a score of 620) as our threshold for identifying a credit-constrained individual. About 20 percent of the full SCF sample for 1998 had imputed scores in this range, suggesting that the proportion of SCF respondents of with low credit quality is reasonably close to the proportion of such individuals in the general population.

4.3 Determining the impact of constraints

Once it is determined whether a household faces credit quality, wealth, and income constraints, the second stage of the analysis involves estimating the likelihood that an individual becomes a homeowner. The dependent variable for the analysis is a dummy variable (Owner) indicating whether the household recently purchased (Owner=1) or rents their current residence. We test for financing constraints affecting ownership by regressing homeownership on a vector **Z** of indicator variables for each of the three constraints via a logit model. We control for income (in logs); age of the household head; the same demographic characteristics **X** that were included in (1); and local market characteristics **Y**:

(2) $\text{Owner} = c_0 + c_1 \text{log\_income} + c_2 \text{age} + \mathbf{d_1 X} + \mathbf{d_2 Y} + \mathbf{d_3 Z}$

The wealth, income, and credit history constraint indicators are expected to have a negative effect on the probability of becoming an owner. We control for household income and demographic characteristics that we expect may affect the homeownership decision just as they may affect the desired price of the home. The house price appreciation rate, measured as the percent change in the OFHEO price index for the local market during the year of the survey, is

included in **Y** to capture the investment value of the home purchase.[16] We expect that the house appreciation rate in the local market will have a positive effect on the probability of homeownership. In addition, **Y** includes the MSA's population and a dummy variable that identifies households residing in a rural (non-MSA) county.[17] Table 1 provides additional details regarding to the definitions of some of the variables used in the study.

5. Results

Tables 2 and 3 report selected sample statistics for each survey year. Table 2 shows weighted means and standard deviations for selected variables. The mean homeownership rates shown in table 2 are significantly lower than homeownership rates for the full SCF, which are 60 percent for 1989 and 1995 and 63 percent for 1998.[18] This reflects restriction of the sample to "recent movers" in the age cohort 21-50, which, as noted, we view as appropriate for isolating the relationship between financial constraints and the decision to rent or own a house. Table 3 shows the percentage of income, wealth, and credit quality constrained households, respectively, in each of the other constraint categories. Note that high proportions of households that are income constrained or credit quality constrained are also wealth constrained.

Table 4 presents the results from estimation of equation (1) for the household's optimal

16 Again, if the household resides in an MSA for which an OFHEO price index is published, we use that index. Otherwise, we use the state-level index.

17 We experimented with additional explanatory variables in (1) and (2), including measures of employment and income stability (length of current employment; whether the household head is self-employed; and whether income is expected to increase or decrease), and additional demographic variables (whether the household head was previously married; total household size). These were found to contribute little explanatory power and had little impact on other estimated coefficients.

18 We exclude from our definition of homeowner households that own a mobile home but do not own the home site. With inclusion of these households, homeownership rates for the full SCF rise to 64 percent for 1989 and 1995 and 66 percent for 1990. By construction (via post-stratification), weighted mean homeownership rates in the

house price. The log of income and log of non-house assets both bear a statistically significant, positive relation to the preferred house value, as expected. The local area median value of the house price has a positive sign and is statistically significant. Other household characteristics generally are not statistically significant.

For our major findings, we turn to the results from estimation of equation (2), which tests the impact of financing constraints on likelihood of becoming an owner. These results are shown in table 5. Turning our attention first to the control variables, we observe consistently positive and statistically significant (except for 1995) estimated coefficients for log of income and for the indicator variables for married households. Thus, the results indicate that higher income households and married couples or partners with or without children are more likely to become owners, relative to lower income and single households. The house price appreciation rate for the MSA bears the expected, positive and statistically significant relationship to becoming an owner in 1989 and 1995; it is positive but not statistically significant in 1998. This is consistent with an investment motive for becoming an owner, which may have weakened by 1998 due to the high returns being earned on stocks and associated "irrational exuberance" of stock market investors during the latter part of the 1990s.

The results support the hypothesis that wealth and credit constraints are key barriers to homeownership; both the wealth and credit constraint indicator variables are estimated to have the expected negative and statistically significant coefficient. The income constraint variable is not statistically significant for any of the years. This finding is consistent with findings from previous studies that in general point to a far greater impact of the wealth constraint than the

full SCF sample coincide with those in the CPS.

income constraint since the late 1980s. The development of adjustable rate mortgages at that time may have been a factor helping to ease the impact of income constraints.

The results show a steady decline in the estimated coefficient on the wealth constraint indicator variable. In particular, it is about 25 percent smaller for the 1998 sample as compared to 1989, and this difference is statistically significant.[19] This finding indicates an increase in likelihood of homeownership among those households measured to be wealth constrained, possibly tied to the increasing flexibility of mortgage instruments that decreased the importance of wealth for obtaining financing (Avery, Bostic, Calem, and Canner 1996). In contrast, we observe a small (but not statistically significant) increase in the estimated coefficient on the credit constraint indicator variable between 1989 and 1998.

5.1 Predicted impact of the financing constraints

We use the estimated equation (2) to evaluate the impact of the financing constraints by comparing predicted likelihood of homeownership with and without the presence of such constraints. Specifically, we apply the estimated equation to each household in the sample of recent movers to obtain a predicted likelihood of homeownership based on its existing characteristics, including its status in regard to each of the three types of financing constraints. We then calculate the weighted-average predicted likelihood of homeownership for the sample using the weights provided by the survey. Next, we conduct analogous calculations making each household unconstrained (i.e. setting a constraint indicator variables to zero, holding other characteristics constant), first by lifting the financial constraints one at a time, and then lifting

19 The standard error for the estimated coefficient of the wealth constraint indicator variable is 0.246 for the 1998 sample and 0.309 for 1989.

them all at once. We then observe the corresponding changes in likelihood of homeownership, which quantify the impacts of the various combinations of constraints.

The results, shown in table 6, indicate a persistent, strong impact of both wealth and credit quality constraints on the potential for a household to transition from renting to owning. Wealth has been and remains the most substantial constraint to homeownership, but its impact appears to have diminished over time. The predicted homeownership rate for the 1998 sample increases by nearly 65 percent with removal of this constraint, whereas it doubles in the case of the 1989 sample. In part, the declining impact of wealth constraints is tied to a decline in the proportion of households that are measured to be wealth constrained (reflecting widespread increases in household wealth during the 1990s). Primarily, it reflects the increase in likelihood of homeownership among those households measured to be wealth constrained (the decline in the estimated coefficient on the wealth constraint indicator variable) between 1989 and 1998.

The second most important constraint is the credit quality constraint, which has a substantially smaller but still economically meaningful impact on the predicted homeownership rate. The predicted homeownership rate for the 1995 and 1998 samples increases by 12 and 10 percent, respectively, with removal of this constraint, and by only 5 percent in the case of the 1989 sample. Thus, the importance of this constraint appears to have increased since 1989. This increasing impact of credit quality constraints between 1989 and 1998 mostly reflects an increase in the proportion of households measured to be credit constrained (see table 2), since we observe only a small and increase in the estimated coefficient on the credit constraint indicator variable between 1989 and 1998. This increasing proportion of households with impaired credit

quality in the restricted sample is consistent with the trend observed in the full SCF and with the widely reported rise in personal bankruptcy filings and in credit card and consumer loan delinquency rates in the mid-1990s.[20]

The comparatively limited effect on the predicted homeownership rate from removing only the credit constraint understates the overall significance of this constraint, because this limited effect in part reflects the fact that most households that are credit constrained also are wealth constrained. Notably, when both constraints together are removed, the predicted homeownership rate for 1998, for example, increases by 84 percent and is 22 percentage points larger than the impact of removing the wealth constraint alone.

5.2 Robustness tests

Our analysis is based on a few threshold definitions that could be seen as arbitrary. In order to confirm the robustness of our results we have explored varying the sample restrictions and the defining limits for the financing constraints. The results have been found to be quite robust.

We explored robustness along a number of dimensions. The *age restrictions* of under-50 and above-21 years were chosen to balance concerns regarding sample heterogeneity against focusing the analysis to narrowly. To evaluate the sensitivity of the results to these choices, the equations were also estimated with upper age restrictions of 40, and 55 years, respectively, and a lower age restriction of 25. The *definition of recent movers* is necessary in order to ensure that the household's income, debt payment obligations, and assets as recorded in the SCF serve as a

20 In the full SCF samples, 15.9 percent of households were measured to be credit constrained in 1989, compared to 19.5 percent for 1995 and 19.9 percent for 1998. Among households in the 21 - 50 age category, 22.3 percent

reasonable proxy for the household's financial position as of the date of the household's ownership decision. In place of the 2 year or less at current address, we also used 3 years. Further, since renters implicitly might make periodic decisions (at the date of renewing their lease) whether to continue to rent or to own, we also ran tests using *an expanded sample* consisting of all renters along with recent homebuyers. (This is not our preferred specification because long-term renters might have made long-term decisions that they do not revisit.) Each of these variations yields findings similar to those reported above with respect to the impacts of the three types of financing constraints..

Our analysis also relies on the concept of a maximum affordable house price. In determining the maximum affordable house price and whether the household is wealth constrained, we varied the assumed required down payment (using 85 percent and 95 percent of the preferred house price, respectively) and components of household wealth that can be used for it. The alternative sources for down payment that we considered were total wealth, and liquid and semi-liquid assets plus (for owners, in place of adjusted down payment) home equity as computed from the reported loan balance and house value. The results were little changed under these alternative specifications. Finally, we found the results to be robust to varying the criteria for defining income-constrained (total monthly debt payments in excess of 35 percent and 40 percent of monthly income, respectively, and monthly mortgage payment in excess of 28 percent of monthly income) and credit constrained (scores below the 25th percentile of the national score distribution.)

---

were measured to be credit constrained in 1989, xx percent in 1995, and 28.8 percent in 1998.

6. Conclusions

Homeownership has been an important policy objective in the United States for many years. It has been long recognized that there are a number of financing barriers that limit access to homeownership for some households. This paper enriches the understanding of the nature of these barriers and, by extension, the possibility for policy to have a measurable impact. The study uses for the first time a measure of credit quality based constraints, and tracks the evolution of the relative importance of credit-, income-, and wealth-based constraints over time. As such, this work is an extension of Rosenthal (2002) and others who have examined this topic.

The results show that financing constraints continue to have an important impact on potential homebuyers. In particular, wealth and credit quality based constraints significantly reduce the likelihood of whether individuals and households opt to own a home. The wealth constraint has the largest impact, although its importance declined substantially during the 1990s. In recent years, the industry has responded to the need for mortgage products geared toward households with little accumulated wealth. Low down payment mortgages are increasingly available, with required down payments as low as zero percent in some cases; soft second programs have grown, and many entities (including the GSEs) are now offering down payment assistance. Nevertheless, our study shows that wealth barriers persist, so that this issue warrants continuing attention.

In contrast to the decline in influence of wealth-based constraints, credit quality based constraints have become more important barriers to homeownership during the 1990s, mostly reflecting an increase in the number of households with impaired credit quality. To some extent,

lenders are addressing the need for mortgage credit for households with impaired credit histories via flexible lending programs and subprime lending. More widespread implementation of credit scoring by mortgage lenders during this time may have further contributed to the increasing importance of credit constraints.

Promoting financial education and planning is one way to address the existence of credit quality based constraints. Such programs could help households re-establish a good credit record or, preferably, keep households from damaging their credit records in the first place. How to more fully address the increasing impact of credit quality constraints and the persistent impact of wealth-based constraints on homeownership is a challenge facing policymakers and the industry.

Table 1. Variable Definitions

Constraints	
Income constrained	1 if optimal house price > maximum affordable according to income
Wealth constrained	1 if optimal house price > maximum affordable according to wealth
Credit score constrained	1 if estimated credit score < 620
Financial variables	
Income	Total family income
Non-house wealth	(Total assets-home equity)-(liabilities-mortgage payments)
Liquid and semi liquid assets	Liquid assets include checking, savings, money market, and brokerage call accounts, and semi-liquid assets include CD's, mutual funds, stocks, bonds, and quasi-liquid retirement accounts (e.g., IRAs, thrift-type plans)
Adjusted down payment	Original down payment percentage times current home value
Market variables	
House prices	OFHEO median house price index (if in MSA the house price level is used, for rural areas the level is set to 0)
Appreciation rate	Percent change of the OFHEO house price index
Percent owned houses	Percent owned houses out of total housing in MSA or 0 if outside of an MSA

Table 2. Sample statistics, 1989, 1995 and 1998 SCF

Variable name	1998		1995		1989	
	Mean	Std.dev.	Mean	Std.dev.	Mean	Std. Dev.
homeowners	0.328		0.315		0.321	
years at current address	1.009	1.168	0.968	1.165	0.839	0.827
credit score	654	68	661	69	672	61
total income	40950	78941	34368	59370	31989	44047
non house assets	82862	516030	60242	544068	66138	395896
liquid and semi liquid assets	30079	151387	18642	186987	14720	91375
credit score constrained	0.359		0.336		0.211	
wealth constrained	0.652		0.659		0.670	
income constrained	0.295		0.364		0.493	
age of head of household	33.714	8.081	33.080	7.594	32.439	7.348
household head male	0.738		0.731		0.737	
high school not completed	0.170		0.142		0.165	
high school diploma	0.287		0.289		0.278	
some college	0.249		0.263		0.269	
college degree	0.184		0.196		0.149	
graduate school	0.110		0.109		0.139	
white	0.691		0.719		0.697	
African American	0.141		0.158		0.135	
Hispanic	0.122		0.075		0.102	
other non-white	0.046		0.048		0.065	
household head married with children	0.305		0.314		0.332	
household head single with children	0.215		0.199		0.170	
household head married without children	0.114		0.126		0.132	
household head single without children	0.366		0.361		0.364	
level of house prices	11.453	0.572	11.391	0.531	11.384	0.584
appreciation rate in MSA	0.057	0.022	0.045	0.021	0.067	0.065
percent houses owned in MSA	0.580	0.086	0.581	0.087	0.571	0.096
in rural area	0.112		0.120		0.150	
average 2 year interest rate	0.074		0.081		0.105	
number of observations	868		902		575	

NOTE: The statistics are weighted according to the weights assigned by the SCF. For means the standard deviations are in parenthesis.

Table 3. Cross-distribution of financing constraints

	1998		
	income constrained	wealth constrained	credit quality constrained
income constrained	100%	86%	45%
wealth constrained	39%	100%	50%
credit quality constrained	37%	90%	100%
	1995		
	income constrained	wealth constrained	credit quality constrained
income constrained	100%	81%	39%
wealth constrained	45%	100%	46%
credit quality constrained	42%	90%	100%
	1989		
	income constrained	wealth constrained	credit quality constrained
income constrained	100%	83%	20%
wealth constrained	61%	100%	26%
credit quality constrained	47%	82%	100%

Table 4. Estimates of preferred house value

Variable name	1998		1995		1989	
	beta	tstat	beta	tstat	beta	tstat
log of non house assets	0.138**	5.199	0.195**	9.668	0.065*	2.345
log of total family income	0.273**	5.465	0.087**	2.759	0.367**	7.112
African American	-0.046	-0.318	-0.356**	-2.821	0.178	1.036
Hispanic	-0.331*	-2.130	0.070	0.062	-0.126	-0.563
other non white	0.128	0.707	-0.109	-0.325	0.250	1.081
age of head of household	0.002	0.431	0.008	1.683	0.019**	3.332
Household head married with children	0.061	0.596	-0.001	-0.141	0.069	0.606
Household head married without children	0.081	0.512	-0.257**	-2.588	0.041	0.325
Household head single with children	0.151	1.017	-0.055	-0.543	-0.097	-0.529
college or graduate degree	0.248	1.480	0.692**	4.441	0.012	0.065
high school, some college	-0.004	-0.026	0.408**	2.785	-0.144	-0.804
percent owned houses	1.681	1.267	1.911	1.650	0.727	0.461
median house value for the MSA or state	0.462**	7.035	0.512**	7.310	0.794**	11.036
constant term	1.852*	2.478	2.053**	2.736	-2.649**	-3.272
Log likelihood	-183.098		-220.326		-173.871	
Pseudo R^2	0.431		0.387		0.455	

* Significant at 5%; ** significant at 1%
NOTE: Estimates are not weighted

Table 5. Estimates of homeownership likelihood

Variable name	1998		1995		1989	
	beta	tstat	beta	tstat	beta	tstat
income constrained	-0.372	-1.110	-0.279	-1.046	-0.265	-0.773
wealth constrained	-2.098**	-8.509	-2.210**	-10.627	-2.845**	-9.223
credit score constrained	-0.934**	-3.226	-1.061**	-4.045	-0.810*	-2.155
log of total family income	0.392**	2.697	0.184	1.763	0.549**	2.886
African American	0.094	0.276	0.143	0.484	-0.250	-0.509
Hispanic	-0.598	-1.504	-0.281	-0.615	-0.175	-0.292
other non white	-0.708	-1.275	-0.999	-1.783	-0.456	-0.764
age of head of household	0.046**	3.362	0.023	1.813	0.010	0.490
household head married with children	1.878**	7.051	1.231**	5.083	1.045**	3.064
household head married without children	1.299**	3.760	0.401	1.384	1.197**	2.720
household head single with children	0.607	1.778	0.439	1.442	0.462	0.986
college or graduate degree	-0.387	-0.950	0.101	0.263	-0.558	-1.153
high school, some college	-0.177	-0.493	-0.058	-0.170	-0.608	-1.389
house appreciation rate	8.020	1.468	10.036*	2.200	5.321*	2.387
log of population in MSA	0.533	1.552	0.103	0.376	-0.004	-0.010
1 if outside of MSAs	1.681	1.267	1.911	1.650	0.727	0.461
constant term	-7.265**	-3.900	-3.915**	-2.779	-5.741*	-2.376
Log likelihood	-304.313		-377.531		-192.236	
Pseudo R^2	0.445		0.356		0.507	

* Significant at 5%; ** significant at 1%
NOTE: estimates are not weighted

Table 6. The Impact of Financing Constraints

	1998	1995	1989
Predicted homeownership rate	0.29	0.32	0.30
Homeownership rate if constraint is lifted, by constraint lifted			
Wealth constraint	0.48	0.56	0.60
Income constraint	0.30	0.33	0.32
Credit quality constraint	0.32	0.36	0.32
Wealth and Income	0.50	0.57	0.64
Income and Credit	0.33	0.36	0.34
Credit and Wealth	0.54	0.64	0.64
All constraints	0.56	0.65	0.68
Change in homeownership from lifting constraint, by constraint lifted			
Wealth constraint	62%	74%	98%
Income constraint	3%	1%	6%
Credit quality constraint	10%	11%	6%
Wealth and Income	69%	76%	111%
Income and Credit	14%	13%	12%
Credit and Wealth	84%	99%	112%
All constraints	91%	102%	125%
MEMO: Actual homeownership rate in the sample	0.33	0.32	0.32

References

Avery, Robert B., Raphael W. Bostic, Paul S. Calem, and Glenn Canner, "Credit risk, credit scoring, and the performance of home mortgages," The Federal Reserve Bulletin, Vol. 82, No. 7, July 1996, pp. 621-648.

Bostic, Raphael W., and Surette, Brian J. 2001. Have the doors opened wider? Trends in homeownership rates by race and income. *Journal of Real Estate Finance and Economics* 23 (November): 411–34.

Federal National Mortgage Association (Fannie Mae). 1996. Fannie Mae review of the Wachter et al. paper. In *Studies on privatizing Fannie Mae and Freddie Mac*, pp. 383–94. Washington, D.C.: U.S. Department of Housing and Urban Development.

Feldman, Ron J. 2001. Mortgage Rates, Homeownership Rates, and Government-Sponsored Enterprises. Federal Reserve Bank of Minneapolis, Annual Report, pp.5-23.

Jappelli, T. 1990. Who is credit constrained in the U.S.? *Quarterly Journal of Economics* 105 (1): 219-34

Haurin, Donald R.; Hendershott, Patric H.; and Wachter, Susan M. 1997. Borrowing constraints and the tenure choice of young households. *Journal of Housing Research* 8 (2): 137–54.

Henderson, V., and Y. Ioannides. 1983. A model of housing tenure choice. *American Economic Review* 73(1): 98-113

Linneman, Peter; Megbolugbe, Isaac F.; Wachter, Susan M.; and Cho, Man. 1997. Do borrowing constraints change U.S. homeownership rates? *Journal of Housing Economics* 6 (December): 318–33.

Linneman, Peter, and Wachter, Susan. 1989. The impacts of borrowing constraints on homeownership. *AREUEA Journal* 17 (Winter): 389–402.

Quercia, Roberto G.; McCarthy, George W.; and Wachter, Susan M. 2003 . The impacts of affordable lending efforts on homeownership rates. *Journal of Housing Economics*, forthcoming.

Rosenthal, Stuart S. 2002. Eliminating credit barriers: how far can we go? In *Low-Income Homeownership*. pp111-145, Edited by Retsinas, Nicolas P.; Belsky, Eric S.

Stiglitz, J., and A. Weiss. 1981. Credit rationing in markets with imperfect information. *American Economic Review* 71 (3): 393-410.

Wachter, Susan; Follain, James; Linneman, Peter; Quercia, Roberto G.; and McCarthy, George. 1996a. Implications of privatization: The attainment of social goals. In *Studies on privatizing Fannie Mae and Freddie Mac*, pp. 338–77. Washington, D.C.: U.S. Department of Housing and Urban Development.

Wachter, Susan; Follain, James; Linneman, Peter; Quercia, Roberto G.; and McCarthy, George. 1996b. Response to Anthony M. Yezer's comments. In *Studies on privatizing Fannie Mae and Freddie Mac*, p. 382. Washington, D.C.: U.S. Department of Housing and Urban Development.

Zeldes, S. 1989. Consumption and Liquidity constrains an empirical investigation. *Journal of Political Economy* 97 (2): 305-46.

Zorn, Peter M. 1989. Mobility-tenure decisions and financial credit: Do mortgage qualification requirements constrain homeownership? *AREUEA Journal* 17 (Spring): 1–16.