Exit from Homeownership by Low-Income Households

NOVEMBER 2019 | JEFFREY ZABEL

JCHS JOINT CENTER FOR
HOUSING STUDIES
OF HARVARD UNIVERSITY

Exit from Homeownership by Low-Income Households

November 2019

Jeffrey Zabel
Economics Department
Tufts University

Abstract

One of the justifications for federal involvement in the homeownership market is that it provides one of the few ways that low-income households can accumulate wealth. But this did not happen over the past couple of decades (Wainer and Zabel 2019). This paper explores one explanation for this outcome, the relatively high likelihood of a change in tenure from owning to renting that was brought upon by the recent downturn in the housing market the precipitated the Great Recession. This problem was particularly relevant for low-income households that stretched their financial limits to take out a mortgage to purchase a home and who were more at risk of suffering a financial setback due to job loss, bad health condition, or family dissolution, particularly in economic downturns like the Great Recession. I investigate these reasons and others for the exit from homeownership for low-income households using the 1999-2015 waves of the PSID to estimate a model of homeownership exit.

It is found that a decline in real income and real wealth (both home equity and non-home equity wealth) is an important determinant of low-income homeowner exit. This is likely due to their relatively low level of wealth that allows them to cover their mortgage payments. The results provide little support the double trigger hypothesis such that a loss of income in conjunction with a state of negative equity has a large and significant impact on the transition to renting. Surprisingly, neither initial house price growth nor neighborhood quality is related to a lower likelihood of homeowner exit.

1. Introduction

One of the justifications for federal involvement in the homeownership market is that it provides one of the few ways for low-income households to accumulate wealth. In a recent paper (Wainer and Zabel 2019), we provide evidence, in a very broad sense, for the truism that "timing matters" when purchasing a home. We find that low-income households that were renters in 1984 and first purchased a home in 1989-1999, a period of relatively stable real house prices, experienced significant gains in wealth as of 2011 compared to households that remained as renters during this period. On the other hand, low-income households that were renters in 1999 and first purchased a home in 2001-2007, a period of growth followed by the Great Recession, experienced little or no gains in wealth as of 2013 compared to households that remained as renters during this period.

One reason for the lack of wealth accumulation, particularly during a period of housing instability, is the change in tenure from owning to renting due to financial difficulties related to mortgage distress. This problem is particularly relevant for low-income households that may have stretched their financial limits to take out a mortgage to purchase a home and who are more at risk of suffering a financial setback due to job loss, bad health condition, or family dissolution. In this paper, the shorter homeownership durations for low-income households is documented. Then I look for factors that can explain this differential by specifying and estimating a model of homeownership exit to renting using both random and fixed effects.

While there is an extensive literature that shows that financial factors such as LTV and negative equity impact mortgage default, there is little evidence on the role that so called "trigger" events such as job loss, marital dissolution, or the onset of poor health conditions play in this outcome. This is because household-level panel data that includes demographic, socio-economic, mortgage characteristics, and payment history that is needed to address this issue is hard to come by (Tian et al. 2016). I carry out such an investigation using household-level data in the 1999-2015 waves of the PSID. Studies that use aggregate data, use the county-level unemployment rate to proxy for these trigger events. I include the county-level unemployment rate to see how well this proxy performs.

The "double trigger" theory hypothesizes that necessary conditions for mortgage default, foreclosure, and the transition to renting are the presence of negative equity and a "trigger" event such as job loss, divorce, or the onset of poor health that leads to a loss of income. This theory is tested here by evaluating the significance of interactions between a decline in income (a proxy for these trigger events) with an indicator of negative equity

Newman and Holupka (2016) claim that one reason African Americans fared worse than whites in the homeownership market during the recent downturn was that they purchased homes in areas that were of lower quality and experienced lower house price appreciation. I see if this explanation also applies to low-income households. To obtain local neighborhood information, I obtain access to the proprietary version of the PSID that provides the census tract of residence. Data from the GeoLytics Neighborhood Change database that normalizes census tract boundaries

across Decennial Censuses are merged with the PSID data at the tract level. I also merge in data on house price growth rates at the zip code level from the Federal Housing Finance Association to see if low-income households tended to purchase houses in areas that exhibited lower house price appreciation and then whether this was related to turnover.

What is unique about this study is to combine all these aspects into one paper to be able to distinguish which among these rich set of factors are significant determinants of the transition from owning to renting for both low- and higher-income households. Given the panel nature of the data, I can estimate fixed effects models that can control for unobservable, time-invariant household characteristics that affect homeownership exit and hence get closer to being able to identify causal impacts of the exit to renting. This is important for developing effective policies to help low-income households stay in their homes to be able to accumulate wealth through home equity.

The paper is organized as follows. A brief literature survey in presented in Section 2. The data are described in Section 3 and basic summary statistics are provided.   model of homeownership exit behavior is developed in Section 4.   Section 5 includes the regression results and Section 6 concludes.

2. Literature Survey

There is a well-established literature on mortgage default that started with modeling default as an option (e.g. Foster and Van Order 1984). This literature showed that financial variables such as loan-to-value ratio (LTV) are important determinants of default. Quercia and Stegman (1992) provide a review of the early literature.

More recent literature provides evidence that adverse trigger events such as job loss, divorce, or health problems significantly affect mortgage default. But as Tian et al. (2016) point out, many studies use proxies for these individual outcomes such as the local unemployment rate. This is also likely to be a general indicator of local economic conditions that can lead to individual loss of income that can result in default, so it is not clear, a priori, what the unemployment rate proxy is capturing.

Tian et al. (2016) note that there is little direct evidence of the impact of trigger events on mortgage default because the panel data needed to carry out this research are hard to find. They use household-level information on a subsample of 2,311 Community Reinvestment Act (CRA) mortgages that were originated between1999 and 2003 to estimate the impact of unemployment on mortgage default. The Center for Community Capital at the University of North Carolina oversees an annual panel survey of these low-income and minority homeowners. The mortgages were observed for an average of 3.5 years to as late as the end of 2009. 54.5% were current as of the end of 2009, 7.5% entered default, and the rest were pre-payed.

The authors estimate a competing risk (default and pre-payment), proportional hazard model. They find that household income divided by AMI and FICO score have a negative and

significant impact and LTV has a positive and significant impact on the likelihood of default. Both household unemployment and the county-level unemployment rate have positive and significant impacts on the likelihood of default. Furthermore, the coefficient estimate for the local unemployment rate does not decrease by much when the household unemployment event is added to the model. This indicates that what the local unemployment rate is picking up most is factors other than the household unemployment event. Tian et al. also find that household savings in the previous year have a negative and significant impact on mortgage default.[1]

Boehm and Schlottman (2004) use the PSID from 1984 to 1992 to model and estimate multiple household tenure durations including renting to first-, second-, and third-time homeownership, and first- and second-time homeownership to renting. Conditional on socio-economic characteristics and regional indicators, they find that low-income and minority households are more likely to exit out of homeownership and are also less likely to transition to a second or third home from first-time homeownership.

Reid (2005) uses the PSID from 1976 to 1993 to investigate the experiences of low-income homeowners. Relevant to this study, Reid analyzes what factors affect exit from homeownership. She finds that divorce significantly increases the likelihood of the switch to renting, particularly for middle- and low-income households. Reid also finds that becoming unemployed significantly increases the likelihood of the switch to renting but the impact is larger for high-income households (though they are less likely to become unemployed).

Given that she has access to the proprietary version of the PSID, Reid merges in Decennial Census Data that allows her to look at neighborhood quality (at the census tract level). She finds that low-income minority households experience the largest increase in neighborhood quality upon purchasing a home. But the only groups that saw an increase in neighborhood quality as a homeowner were middle- and high-income white households.

Spader and Quercia (2008) address mobility and exit from homeownership using a sample of 2,199 households with 30-year, fixed-rate community reinvestment loans that were purchased through the Community Advantage Home Loan Secondary Market Program (CAP). They find that low-income and minority households are less likely to move and more likely to purchase a new home when the exit from homeownership is not due to a default or distressed move. This contrasts with most other studies that find that low-income and minority homeowners are more likely to exit to renting than high-income and white homeowners. This result might reflect the fact that this sample is not representative of all homeowners and/or is specific to the 30-year, fixed-rate community reinvestment mortgages in CAP.

One study that directly evaluates the impact of trigger events on exit from homeownership is by Sharp and Hall (2014). They use the PSID over four decades to investigate differences in the transition from ownership to rental status. They find that African Americans are more likely to

---

[1] Quercia, Pennington-Cross, and Yue (2012) use the same dataset and find similar results though they do not include household unemployment in their model. They also provide a comprehensive survey of the literature on low-income households and default.

exit from homeownership after controlling for socioeconomic and housing characteristics and that this disparity becomes larger over time. While trigger events such as marriage dissolution, job loss, and becoming disabled significantly affect homeownership exit, there does not appear to be a disparity by race.

Newman and Holupka (2016) mention three reasons that could explain why African Americans fared worse than whites in the housing market: 1) differences in mortgage financing, 2) differences in homeownership durations, and 3) differences in neighborhood characteristics. One advantage of their study is that the authors have access to the proprietary version of the PSID that provides the census tract of residence. They investigate the last explanation that African Americans purchased houses in lower quality areas that experienced lower house price appreciation. They find disparities in the means for African American and white new home buyers for median house values, percent African American, median household income, percent owner occupied, percent vacant, percent of poor families in the tract of residence, and the median house price at the zip code level using data from Zillow.

All three of these reasons for why low-income homeowners fared badly in terms of wealth accumulation over the last 15-20 years are addressed in this study in both an absolute sense and relative to higher-income homeowners. With access to the proprietary version of the PSID that provides the census tract of residence, the Newman and Holupka (2015) analysis is taken one step further by including census tract level characteristics and their changes over the previous decade in the model of homeownership exit for low- and higher-income households. Zip code-level house price growth rates in the years prior to purchase are also included. This will allow one to see if these neighborhood characteristics help to explain homeownership exit for low- and higher-income households. A comparison of the homeownership exit behavior of African Americans and whites will also be undertaken in this study.

While in this study the PSID data is used to dig deeper into homeownership exit as an explanation for lack of wealth accumulation in low-income households since the turn of the century, Gerardi et al. (2018) use this data to figure out how negative equity and the inability to make mortgage payments interact to result in default, particularly for high LTV mortgages. They find that negative income shocks increase the probability of default more for homeowners with low levels of equity than those with higher levels. Furthermore, low-income households are more likely to experience these negative income shocks. The authors also use the LTV ratio as an explanatory variable. There are numerous reasons why the LTV ratio is endogenous including the likelihood that it is related to the underlying savings ability of the homeowner. Furthermore, since home equity is self-reported, it is likely to be measured with error. Gerardi et al. create an instrument for the LTV ratio that is the cumulative growth in state-level house prices from the year of home purchase to the current survey year. The growth in state-level house prices is a valid instrument since it should not affect the mortgage default decision other than through its impact on the LTV ratio.

There is a similar problem in this paper that home equity is endogenous in the model of homeownership exit. Given the access to the proprietary version of the PSID, home equity is

instrumented using the growth rate in house prices as the zip code level rather than the state level. This should result in a more efficient IV estimator as the correlation between home equity growth rates at the zip code level should be higher than growth rates at the state level and hence will lead to better results in the model of homeownership exit.

3.   Initial Data Analysis

The main data used in this study are from the Panel Study of Income Dynamics (PSID), a survey that has collected information on the same families annually from 1968 until 1997 and biennially from 1997 onward. The survey asks questions related to demographics, housing, and income. This study uses data from 1999 to 2015. The initial sample includes heads of households in 1999 who also appear in the 2001 wave and were at least 25 years old, as most individuals have finished their education by that age, and no older than 54 in 1999.[2] All subsequent waves that they appear in the survey are included. Once a household is missing from the survey all future waves are excluded even if they reappear in later waves. This is referred to as the *1999 Sample*.

The start of 1999 for the sample period is used as this is seen as the beginning of a significant housing cycle that initiated a huge run-up in house prices that peaked around 2005-2007 and bottomed out in 2011-2012 (see Figure 1). Since this trough, house prices have been rising (though there are now signs of price moderation). Furthermore, this is the start of the second sample in Wainer and Zabel (2019) where the lack of wealth accumulation by low-income homeowners was evident. Finally, it is important for this analysis to have a measure of household wealth and starting in 1999, the PSID includes such information in every wave going forward (prior to 1999, wealth was included in the 1984, 1989, and 1994 waves). I will distinguish between low-income households and higher income households where the former group are in the bottom quartile of the household income distribution and the latter group is in the upper three quartiles.

To increase the sample size and to allow for new entrants, heads of households who first appeared in the PSID after 1999 and who also appeared in the following wave are included. And households where the head "aged in" to meet the age criterion are added (i..e a head who was 24 in 1999 and 26 in 2001). This is referred to as the *Extended Sample*. The 1999 Sample along with the Extended Sample is referred to as the *Full Sample*. Since the criteria for inclusion in the Extended Sample are different than for the 1999 Sample, the behavior of these two groups might differ. Hence, the models will be estimated using the 1999 Sample and the Full Sample to see if the results vary.

Wealth, income, and all other monetary variables are in 2013 dollars. The data are trimmed; the top ten highest and lowest values of wealth are dropped from the sample to limit the outliers' impact on the regression results and because these extreme values may be the result of reporting errors.

---

[2] This means that 54-year-olds will be 70 in 2015. The age range in 1999 could have been limited to be 25-48 so that the oldest anyone could be was 64 (and hence below the official retirement age) but this would reduce the sample size by 65 out of 572 in the renter group in 1999.

3.1 Cost of Living Control and Income Group Classification

It is important to control for variation in the cost of living so that wealth, income, and house prices are more comparable across locations. The IPUMS version of the 2000 Decennial Census is used to estimate a household income regression (in natural logs) that includes state fixed effects. Regressors include age and its square and indicators for female, white, African American, Hispanic, at most high school, some college, at most a BA, at least an MA, physical difficulties and veteran status. The index based on the state fixed effects is set to 100 for Alabama. This index is used to control for cost of living across states; it is assumed that higher income reflects higher costs of living.

I refer to *low-income households* for much of the analysis. They are defined to be those in the 1st quartile of the household income distribution in the first year in the sample. For the 1999 Sample, these households earned up to about $46,000 in 1999. Because of the way they are constructed, these samples are not representative of the U.S. population. The 1st quartile for the whole population is households with income less than $28,600 in 1999. The problem with using this latter cutoff is that there are then fewer low-income households making it more difficult to get precise estimates of the impact of observable factors on homeownership exit for low-income households. For this reason, the focus is on the more generous cutoff for the low-income group.[3] Households in the 2nd – 4th household income quartiles are referred to as *higher-income households*. For the Extended Sample, the low- and higher-income income households are based on the 1st and the 2nd – 4th quartiles of the household income distribution for the year each household entered this sample.

3.2   Sample Description

There is a total of 8,203 households and 43,513 household-year observations (4,089 and 4,114 households in the 1999 and Extended Samples, respectively). The 1999 sample includes 2,648 households (65%) that owned their homes and 1,441 households (35%) that were renting in 1999. The former group is referred to as the *Owner Group* and the latter group as the *Renter Group*. The Extended Sample includes 1,311 households (36%) that owned their homes and 2,803 households (64%) that were renting in the year they entered the sample. This lower rate of homeownership for the Extended Sample is not surprising given those households that "age in" to the sample are younger and less likely to own a home.

Given that interest lies in the transition from owning to renting, the Renter Group for the Full Sample is divided into 1,680 households that eventually became homeowners (R2O) and 2,564 households that were always renters (R2R). The Owner Group for the Full Sample is divided into the 3,213 households that were always owners (O2O) and the 746 households that became renters (O2R). Table 1 gives the summary statistics for these four groups. Interest is in the R2O group as they were those not able to build up home equity as those who were homeowners in the

---

[3] In Wainer and Zabel (2019), it is shown that using the stricter cutoff based on the whole U.S. population does not have a substantive impact on the results.

first sample year and hence were more susceptible to the downturn in the housing market starting in 2005-2007. The p-values for the comparison of means between this group and the other three groups are presented in columns (5) – (7) of Table 1. The R2O group is most like the O2R group though the latter group has significantly higher mean income and mean wealth excluding home equity.

The O2R and R2O groups are split by low-income and higher-income households. The mean non-equity wealth for the low-income households in the R2O and O2R groups are much closer than is the case for the higher-income households (Table 1).

One can see in the upper panel in Table 2 that higher-income households have longer durations of homeownership than the low-income households in the R2O group. For example, 21.1% of higher-income households owned for at least 12 years whereas only 15.8% of the low-income households owned for at least 12 years. Shorter duration of homeownership is a common reason for why low-income homeowners are less able to accumulate home equity as compared to higher-income homeowners (Galster and Santiago 2008). One explanation for the shorter durations for the low-income households is that they tended to purchase their house at a later year than the higher-income households and hence right-censoring is an issue. In fact, there is little difference in the timing of homeownership and, if anything, the low-income households in the R2O group purchased their houses earlier than the higher-income households (results available on request).

The homeownership durations for the low- and higher-income households for the O2R group are given in the bottom panel of Table 2. It is evident that the low-income households experienced shorter durations than the higher-income households (conditional on owning in the first year); 25.0% of low-income households owned for at least 12 years versus 32.3%of higher-income households owned for at least 12 years.

Possible reasons for homeownership exit are considered by looking at unfavorable changes in household circumstances such as job loss, marriage dissolution, and the onset of poor health. A change in employment status is defined as going from being employed to either unemployed or out of the labor force. A change in marital status is defined as transitioning from married to widowed or divorced. A change in health status is defined as either going from good or better health to poor health or by experiencing a disability that restricts work.

For the 141 lower-income households in the R2O group that switch to renting: 14 (9.9%), 19 (13.5%), and 5 (3.6%) of these switches coincide with a change in employment, marital status and health status, respectively. For the 249 higher-income households in the R2O group, these numbers are 29 (11.7%), 28 (11.2%). and 10 (4.0%), respectively. So, these transitions don't differ much between the low- and higher-income households in the R2O group. For a great majority of the households, the tenure transition from owning to renting does not coincide with any of these changes. As was discussed earlier, this is consistent with the double trigger theory

that not only is an adverse change in household circumstances required for transition to renting but this also requires a state of negative equity.[4]

One circumstance that can precipitate the move from owning to renting is a decline in income. Since income is observed every two years, two changes $\Delta Real\ Inome_t$ and $\Delta Real\ Income_{t-2}$ are considered and it is assumed the individual owns in period t-2 and rents in period t. The results are given in Table 3. Generally, the larger drop in income occurs in the two years between the change from owner to renter versus the two years before the change. The fact that declining income is more important in the period closer to the tenure switch implies that households rely on their income to meet mortgage payments, and thus may transition back to renting relatively quickly after an income shock.

3.3 Census Data

The census tract of residence for all survey members is observed with access to the proprietary PSID data. This allows the Decennial Census data to be merged with the PSID data at the census tract level. Data from the 1990 and 2000 Decennial Censuses from the GeoLytics Neighborhood Change Database (NCDB) are included. The major obstacle to using a census panel dataset at the tract level is the fact that census tracts vary in their geographical area from one decennial census to the next due to local population growth. The NCDB provides a solution by normalizing these boundaries, imposing the 2010 tract geographies on all the prior years, and weighting statistics and counts accordingly, allowing for consistent comparison of census tracts across time.

Many tract-level characteristics will be included to measure neighborhood quality. This will allow for the determination to what extent the quality of the neighborhood is related to homeownership exit.

3.4 Using the FHFA House Price Index to Calculate Home Equity

The Federal Housing Finance Association (FHFA) house price index that is measured at the 5-digit zip code level is used to capture changes in local house prices that can affect mortgage distress. The proprietary version of the PSID also provides the 5-digit zip code so the FHFA data is merged in at this geographic level. The biennial zip code-level house price growth rates are calculated from this data. One problem is that the data are missing for about 10% of the observations in the PSID data. The missing growth rates are replaced with county-level growth rates.

This information is used to calculate an exogenous measure of home equity that does not rely on individual responses to their home equity and/or house values. Starting with the house value and home equity given by the respondents in the year of purchase for the R2O and O2R groups, the zip code-level growth rates are applied to the initial house value and this change in value is

---

[4] For the 117 low-income households in the O2R group that switch to renting: 9 (7.7%), 5 (4.3%), and 10 (8.6)% of these switches coincide with a change in employment, marital status and health status, respectively. For the 613 higher-income households in the O2R group, these numbers are 47 (7.7%), 84 (13.7%). and 22 (3.6%), respectively.

added to the initial self-reported home equity. One useful aspect of this approach is that home equity can be calculated for the period that owners exit to renting as updating home equity only relies on the house price growth rate calculated using the FHFA house price index.

A version of home equity using only state-level house price growth rates is also generated since this is what Gerardi et al. (2018) use without access to the proprietary PSID data and this is compared to the preferred measure.

4. Model

In Section 3, it was showed that low-income homeowners tend to have shorter durations of homeownership than higher-income households. The next step is to determine what observable factors can explain this differential. To this end, a model of the transition from homeownership to renting is developed. This starts with a group of homeowners and their decision each period to continue owning or to exit to renting:

$$
\text{Rent}_t = \begin{cases} 1 \text{ if } U_t^R\left(H_t^R, Y_t - R_t, S_t | \text{Rent}_{t-1} = 0, E_{t-1}\right) - U_t^O\left(H_t^H, Y_t, S_t | \text{Rent}_{t-1} = 0, E_{t-1}\right) > 0 \\ 0 \text{ otherwise} \end{cases}
\tag{1}
$$

Thus, an owner in period t-1 will decide to rent in period t if the utility from renting is greater than the utility from owning. Here, H_t^J J = R, O includes house specific information given that the household is a renter or an owner in period t. For both H_t^R and H_t^O this includes the services provided by the unit in period t. These services derive from the structural characteristics and neighborhood attributes. For owners only, H_t^O includes home equity and mortgage characteristics. For renters only, H_t^R includes the costs of changing from renting to owning such as moving costs and the stigma attached to foreclosure. Y_t is income in period t. For renters, net income is $Y_t - R_t$, where R_t is the rent. If the household continues to own, H_t^O includes whether the household decides to make a mortgage payment, M_t, in period t. If it does, then net income is $Y_t - M_t$, if it does not, then net income is Y_t. S_t includes socioeconomic characteristics such as non-home equity wealth, employment, marital, and health status, race, gender, age, etc.

Utility is conditional on E_{t-1}; household experience up through period t-1. This includes house-specific information, income, and socioeconomic status in t-1 and earlier periods.

Given ownership in period t-1, and hence $U_{t-1}^R(\cdot) - U_{t-1}^R(\cdot) \leq 0$, the decision to rent in period t will be due to changes in household characteristics: $\Delta X_t = X_t - X_{t-1}$ for X = H, Y, S This includes changes in home equity, income, and the trigger events; changes in health, marital status and employment, and indirectly the loss of income that results from these events. The loss of home equity can lead to the decision to exit homeownership, particularly if this results in a state of negative equity. The double trigger hypothesis states that it is the combination of negative equity and a trigger event that leads to mortgage default, foreclosure, and ultimately the transition to

renting. The idea is that negative equity is a necessary but not sufficient condition for mortgage default and ultimately foreclosure and exit to renting. A household in a state of negative equity will continue to make mortgage payments if the expected gains from future house price increases outweigh the costs of the mortgage payment (and hence a decrease in consumption of other goods). Foote et al (2008) claim that the above trigger events can lead households to discount the future differently and hence arrive at different gains of future house prices that can lead some households to default and not others.

Based on this discussion, it is the changes in H, Y, and S that lead to the decision to exit homeownership. Hence, the following homeownership exit model is based on these (and other) changes:

$$
\begin{aligned}
\text{Rent}_{iczrt} = {} & \beta_0 + \beta_1 \text{Trigger}_{it} + \beta_2 \Delta \text{Income}_{it} + \beta_3 \Delta \text{Home Equity}_{izt} + \beta_4 I\left(\text{Home Equity}_{izt} < 0\right) \\
& + \beta_5 I\left(\Delta \text{Income}_{it} < 0\right) + \beta_6 I\left(\Delta \text{Income}_{it} < 0\right) \cdot I\left(\text{Home Equity}_{izt} < 0\right) \\
& + \beta_7 \Delta \text{Wealth}_{zt} + \beta_8 \Delta \text{Unemp}_{rt} + u_i + h_{t_0,t} + v_t + e_{iczrt}
\end{aligned}
\tag{1}
$$

where *Rent$_{iczrt}$* is an indicator of being a renter for household i in tract c, zip code z, county r, at time t. *Trigger* includes the following trigger events: $\Delta Health$, an indicator of a change to poor health or the onset of a disability, $\Delta Marital\_Status$, an indicator of a change from married to widowed or divorced, $\Delta Employment$, a transition from employment to non-employment, *Income* is household income, the construction of *Home Equity* is described in Section 3.4, *I(Home Equity$_{izt}$ < 0)* and $I\left(\Delta Income_{it} < 0\right)$ are indicators of negative home equity and a decline in income, *Wealth* is non-home equity wealth, *Unemp$_{rt}$* is the unemployment rate in county r in year t, u_i is a vector of unobserved, time-invariant household fixed effects, h is a set of binary indicators of years of homeownership starting in the first year of homeownership t_0 that captures duration dependence, v_t is a vector of year dummies, and e_{iczrt} is a standard stochastic error term. Equation (1) is referred to as the *Changes Model*.

The double trigger hypothesis can be tested by including interactions of the trigger events with the state of negative home equity. One problem is that there are few trigger events in the data when a household is in a state of negative equity; particulalrry since the model is estimated separately for low- and higher-income households in the R2O and O2R groups. Hence a loss of income is used as a proxy for trigger events. Then the key term in equation (1) is the interaction of *I(Home Equity$_{izt}$ < 0)* and $I\left(\Delta Income_{it} < 0\right)$. This captures the imapct of a loss of income in a period of negative equity. The interpretation of β_6 is the differential change in the likelihood of exiting to renting from experiencing a loss of income in a state of negative equity versus not being in a state of negative equity. It is expected that β_6 will the greater than zero.

The sample used to estimate equation (1) includes single spells of homeownership that end with an exit to renting. Renting in period t means an end of homeownership, hence the spell of homeownership continues when homeowners move to another house (without first renting). The exit to renting can come about through a (short) sale or a foreclosure. The former will occur if home equity is greater than or equal to zero, whereas the latter occurs when home equity is

negative. Only first homeownership spells are included. Those who remain owners through 2015 are dropped since this group will be excluded when using the fixed effects estimator as the ownership state never changes. So, for each household in this sample, Rent is 0 until the year when the household transitions to renting and then Rent is 1.

Given that the dependent variable is binary, equation (1) will be estimated using the fixed effects logit estimator developed by Chamberlain (1980).[5] This will capture unobserved time-invariant household-level characteristics and will mitigate the bias that results from the correlation between these fixed effects and the explanatory variables. For example, it is expected that households that that have a lower value of homeownership will be the first to exit homeownership (conditional on observables) and this is likely to be correlated with the explanatory variables in the model. Standard duration models do not control for unobserved heterogeneity. More advanced versions do include nonparametric finite-point unobserved heterogeneity but not a separate fixed effect for each individual/household (Heckman and Singer 1984, Ham and Lalonde 1996).

Importantly, equation (1) is separately estimated for low-income and higher-income households. This will allow one to see if different factors are related to the transition to renting for these two groups. Furthermore, one characteristic of the booming housing market in the early 2000s was the influx of low-income households into homeownership. So, the sample consists of renters in 1999 (or later for the *Extended Sample*) who then become homeowners. This group was subject to the extreme future volatility in the market and had a relatively high likelihood of experiencing negative equity and the potential for loss of home.

For comparison's sake, this model is run for the group of households that were homeowners in 1999 (or later for the *Extended Sample*) and transitioned to renting, the O2R group. This group started with significant home equity (median = $30.7 thousand) and larger amounts of real wealth (without home equity) and real income and hence will face fewer constraints on paying their mortgage when a negative income event happens. Again, only the first homeownership spell is included. These homeownership spells are clearly left censored though this is captured when using the fixed effects estimator.

The county-level unemployment rate is included to capture local economic conditions. Also, as noted in the literature review, the unemployment rate has been used as a proxy for individual transition of employment to unemployment. Given that this transition is included as a regressor, one can see to what extent the unemployment rate is picking up individual transitions to non-employment versus local economic conditions.

A model of homeownership exit will first be estimated using random effects so that the baseline covariates that include the census tract variables, can be included. This will determine to what extent neighborhood quality at the time of purchase is related to homeownership exit. If low-income households tend to buy houses in low-quality and declining neighborhoods and this

---

[5] This model is also referred to as the conditional logit model (as in Stata). But this can be confusing as the multinomial logit model is often referred to as the conditional logit model.

affects duration, then this is one explanation for why homeownership duration tends to be shorter for low-income households. Along these lines, the house price growth rate in the two years before first entering the sample is added to the model as a measure of recent neighborhood dynamics. If low-income households tend to buy in neighborhoods that are experiencing lower house price growth, and this leads to lower (and even negative) equity which is related to the switch to renting, this can help explain the lower homeownership durations of low-income households.

The second version of the homeownership exit model is specified as

$$\text{Rent}_{iczrt} = \beta_0 + \beta_1 \text{EMH}_{it} + \beta_2 \text{Income}_{it} + \beta_3 \text{Home Equity}_{izt} + \beta_4 \text{I}(\text{Home Equity}_{izt} < 0)$$
$$+ \beta_5 \text{Income}_{it} \cdot \text{I}(\text{Home Equity}_{izt} < 0) + \beta_6 \text{Unemp}_{rt} + \beta_7 S_{i,1999} + \beta_8 \text{CT}_{c,2000} \qquad (2)$$
$$+ \beta_8 \text{HPIgr}_{z,1999} + u_i + h_{t_0,t} + v_t + e_{iczrt}$$

where *EMH*$_{it}$ includes employment, marital, and health status for household i in period t, *S*$_{i,1999}$ is a vector of baseline individual-level covariates that includes age, gender, race, education, and (non-home equity) wealth, *CT*$_{c,2000}$ are tract characteristics from the 2000 Decennial Census, and *HPIgr*$_{z,1999}$ is the 2-year zip code-level house price growth rate in 1999 (note that house price growth rates after 1999 will be captured in *Home Equity*). Equation (2) is referred to as the *Levels Model*.[6]

The impact of income is allowed to vary depending on whether home equity is positive or negative. This is related to the double trigger hypothesis in that it allows for a decline in income to have a different effect depending on whether a household is in a state of positive or negative home equity.

The focus in this study is on the exit from homeownership and not the duration of homeownership. A duration model will allow for a calculation of expected duration that accounts for right-censored spells, but this is not the interest here. Furthermore, the homeownership exit model can be estimated using a fixed effects estimator (fixed effects logit), this is not something that is typically done with a duration model. Still, a standard Cox proportional hazard model will be estimated and compared to the results from the homeownership exit model.

Note that equation (1) is not just the first difference of equation (2) – it is akin to estimating a growth rate equation versus a levels equation (but the dependent variable is still the same). The trigger events are not the first difference of employment, marital, and health status as these would include the opposite outcomes (i.e. from unemployed to employed).

---

[6] For households that entered the sample after 1999 (i.e. the *Extended Sample*), *S*$_{i,1999}$ and *HPIgr*$_{z,1999}$ are for the first year they are in the sample.

5. Results

In this section, factors that lead to the transition from homeownership to renting for low- and higher-income homeowners are examined. Separate regressions are run for the low-income and higher income households in the R2O and O2R groups using the Full Sample.[7] The model is initially estimated using random effects (equation 2) to calculate the partial correlations between the explanatory variables and exiting to renting and then using fixed effects (equation 1) to ger (plausibly) causal effects. Summary statistics are given in Table 5.

As previously discussed, Decennial Census data are merged with the PSID data since access to the proprietary PSID data provides the census tract of residence. Forty variables from the 2000 Decennial Census were initially considered as potential measures of neighborhood quality in the census tract in which the house was purchased. They were included in the homeownership exit model. Given their high correlation, few, if any, are individually significant. Still, thirteen census variables with lower p-values were retained and their summary statistics are given in Table 4.[8] Given the general insignificance of even these thirteen variables, principle components analysis is used to extract one measure of neighborhood quality. The procedure selects positively on variables with higher values that are associated with higher quality (e.g. median rent) and negatively on variables with higher values that are associated with lower quality (e.g. percent poverty) so this is a measure of neighborhood quality. The mean/standard deviation for the low-income R2O group is -0.479/1.661 and the mean/standard deviation for the higher-income R2O group is -0.040/1.705. The values for the low- and higher-income households in the O2R groups are -0.589/1.266 and 0.465/1.875, respectively. So the higher income households reside in higher quality neighborhoods than the low-income households. Changes in these thirteen characteristics between 1990 and 2000 (and the first principle component) are also considered but they are not as good predictors of the switch to renter status as are the level values for 2000.[9]

5.1 Levels Model

The estimation results for the Levels Model of homeownership exit (equation 2) for the low and higher-income R2O groups are given in columns (1) and (2) and the results for the low and higher-income O2R groups are given in columns (3) and (4) of Table 6. Given that the dependent variable is binary, this model is estimated using probit. Coefficient estimates are not readily interpretable, so elasticities are given in Table 8. For binary variables (the trigger events and the indicators of negative equity, income loss, and their interaction), this is interpreted as the percent change in the probability of exit given a change from 0 to 1 in the explanatory variable. For continuous variables, the elasticity is interpreted as the percent change in the probability of

---

[7] Results using only the 1999 Sample are similar to those generated using the Full Sample but are generally not as significant given the sample size is about ½ of the Full Sample. These results are available on request.

[8] Another reason for dropping these 27 variables is to limit the number of variables included in the summary statistics in Table 4. The list of 27 census variables that are dropped is given in the Appendix.

[9] Using all forty variables to generate the principal component (versus the thirteen selected variables) has little impact on the results (the correlation between the two principal components is 0.95).

exit given a one standard deviation increase in the explanatory variable; the standard deviation is used rather than the mean since these variables can be negative and have small (and sometimes negative) mean values.

Since the R2O/O2R group is a non-random sub-sample from the set of all renters/owners in their first year in the sample, an estimate of the inverse Mills ratio is included to correct for possible sample selection bias. This is obtained from a probit regression where the dependent variable is 1 if a household is in the R2O/O2R group and 0 if in the R2R/O2O group. The sample is limited to the first year that each household appears in the data. Separate probit regressions are run for the low- and higher-income R2O/R2R groups. Results of the four probit regressions are available upon request. Note that the inverse Mills ratio is time invariant and hence cannot be included when the model is estimated by fixed effects (the fixed effect controls for the (non-random) selection into homeownership).

Of the three trigger characteristics (as opposed to trigger events which are changes in these characteristics), being married is negatively and significantly correlated with homeownership exit for all four random effects regressions (Table 6). Being employed is only (negatively) significantly correlated with homeownership exit for the higher-income R2O group and being in poor health is only (positively) correlated for the low-income O2R households. So, of the three trigger characteristics, only family composition, as expressed by marital status, is consistently related to homeownership exit.

Real income is negatively correlated with homeownership exit in all four samples and is statistically significant in two of these cases (though only at 20% for one). The interaction term between real income and negative equity is included to provide some evidence about the double trigger hypothesis. One would expect the impact of a decline in income in a state of negative equity to have a more significant impact on homeownership exit than such a decline in a state of positive equity (hence the coefficient on the interaction term should be negative). It is only significant for the low-income R2O group. If the double hurdle hypothesis is likely to hold, this group seems the most likely candidate as the combination of a relatively high likelihood of being in negative equity along with a low level of real wealth (see Table 5) would make them the most likely to be susceptible to exit upon a decline in income.

None of the baseline demographic characteristics; age, gender, race, education, appear to be consistently correlated with homeownership exit (though BA has a negative association in all four regressions). One baseline characteristic that does matter is real wealth; it is significantly negatively correlated with homeownership exit in three of the four regressions. This negative relationship for higher wealth along with the fact that the low-income households have lower levels of real wealth than the higher-income households (see Table 5), can help explain their shorter durations of ownership.

As a measure of neighborhood dynamics, the two-year house price growth rate at the first year in the sample is added to the model. If low-income households tend to buy in neighborhoods that are experiencing lower house price growth, and this leads to lower (and even negative) equity

14

which is related to the switch to renting, this can help explain the lower homeownership durations of low-income households. This does not appear to be the case in this sample as the mean of this two-year house price growth rate is greater for the low than for higher-income households in the R2O sample (6.1 versus 4.8) and in the O2R sample (8.0 versus 6.6). And while the coefficient estimate for this variable is negative in three of the four regressions and significant in two, the corresponding elasticities are all small (top panel of Table 8). This is, at best, minor evidence to support the result that households that reside in a neighborhood with lower house price growth are more likely to exit homeownership.[10]

As a measure of neighborhood quality, the first principal component of the thirteen 2000 Decennial Census variables is included in the model. This variable is not significant in any of the four regressions. It appears that factors related to local characteristics such as neighborhood quality and recent house price growth are weakly related with homeownership exit.[11]

5.2   Changes Model

The results for the Changes Model (equation 1) when estimated by fixed effects logit using the low- and higher-income households in the R2O and O2R groups are given in Table 7 and the corresponding elasticities are given in the bottom panel of Table 8.[12] Of the three trigger events, the employment to unemployment, married to widowed or divorced, and health transitions, the one that matters the most is marital dissolution. It is positive in all four regressions and significant in three (Table 7). Plus, the elasticities are economically large in all four regressions (bottom panel of Table 8).

Two variables that appear to have statistically significant and economically large (bottom panel of Table 8) impacts on homeownership exit are the change in home equity and being in a state of negative equity. Both point to the importance of home equity in decisions about continuing as a homeowner.   For the low- and higher-income households for the O2R group, the impact of a decline in real income has a positive and significant impact of homeownership exit. But the indicator of the double trigger outcome (the interaction of being in negative equity and experiencing a decline in income) has a negative impact which is the opposite of what we expect if this hypothesis holds. The impact of this interaction term is positive but also not significant for the low- and higher-income households for the R2O group. So overall, there is little support for the double trigger hypothesis in this study.

---

[10] A version of home equity and the two-year house price growth rate using only state-level house price growth rates is also generated since this is what Gerardi et al. (2018) use and this is compared to the preferred measure. The results are qualitatively smaller than when using the zip code-level house price growth rates but do show some differences for the parameter estimates for the key variables; house price growth rate and home equity. Results available on request.

[11] A Cox proportional hazard model is also estimated. The results are qualitatively similar to the results in Table 6. Results available on request.

[12] There is some ambiguity about calculating these elasticities when using the fixed effects logit estimator. I sued the default option in Stata. See Cameron and Trivedi (2009) for details.

The impact of the changes in real income and wealth are statistically significant and economically large for low-income households in the R2O group. This indicates the importance of these cushions when it comes to paying the mortgage for this group of households that has a relatively small wealth holding and little to fall back on when there is a loss of income.

Numerous papers have used the unemployment rate to proxy for the transition to non-employment. Of course, it can also capture the impact of local economic conditions on homeownership exit. The county-level unemployment rate is included in the Linear Model. One would expect that an increase in the unemployment rate would increase the likelihood of homeownership exit but this is only the case in one of the four regressions (low-income R2O). In fact, the impact is negative and significant for the low-income O2R group; this indicates that the unemployment rate is higher when households exit homeownership than when they do no do so (there is nothing causal here). The change in the county-level unemployment rate is included in the Change Model. This has a significant impact on homeownership exit in all four regressions. On the other hand, the individual characteristic of being employed and the trigger event of becoming non-employed are not consistently significantly related to homeownership exit. The correlation between *employed* and *unemployment rate* is low (all 4 less than -0.2) as is the correlation between Δ*Employment* and Δ*unemployment rate* (all 4 less than 0.10). So it is not surprising that the coefficient estimate for *employed*/Δ*Employment* does not change much when *unemployment rate*/Δ*unemployment rate* is excluded from the regression or vice versa. It does not appear that the unemployment rate is a good proxy for individual employment status. Rather, it is picking up the impact of the business cycle on homeownership exit; generally worse economic conditions coincide with higher likelihoods of homeownership exit.

5.3   Results by Race (African American/White)

Given that Newman and Holupka (2016) find significant differences in housing market outcomes for African American and White homeowners, separate homeownership exit models are estimated for these two groups. On average and over all four groups (low- and higher-income R20 and O2R), African Americans have shorter homeownership spells; 6.50 versus 7.13, and this difference is statistically significant at the 1% level (of course, the durations are right censored).

Given the small sample sizes if the low- and higher-income households for the R2O and O2R groups are split by race, the R2O and O2R groups are combined. Hence separate regressions are estimated for low- and higher-income African American and White homeowners. The results for the Level and Change Models are provided in Tables A1 and A2 in the Appendix. For the Level Model, differences are delineated along income lines rather than racial lines. There is a significant and negative relationship between initial real income and real wealth and homeownership exit for low-income African American and White households but not for higher-income African American and White households. This is the same as what was found for low-income households in the R2O group (column (1) of Table 6).

On the other hand, there is a significant negative relationship between the two-year house price growth rate, being female, and initial age and homeownership exit for higher-income African American and White households but not for low-income African American and White households.

For the Change Model, the change in real wealth has a positive and significant impact on homeownership exit for the low- and higher-income African American households but not for White households. And this holds given the same median change in real wealth for African American and White households; 0. Furthermore, the change in real income has a positive and significant impact on homeownership exit for the higher-income African American households whereas the impact is positive (but very small and not significant) for higher-income White households. This appears to be an anomalous result, but it points to the fact that there is complicated relationship between real income and real wealth and homeownership exits for African American hosueholds. This may not be so surprising given the lingering racial discrimination and continued residential segregation in the housing market.

6. Conclusions

The evidence from Wainer and Zabel (2019) supports the conclusion that low-income homeowners had a particularly hard time in building wealth holdings during the last two decades. One factor that affects wealth accumulation is homeownership duration. The initial data analysis makes it clear that a higher percentage of low-income than higher-income owners switch to renting and hence experience shorter spells of homeownership. Since renter households cannot acquire home equity, this is an important reason for the lack of wealth accumulation by low-income households. With this finding in mind, the focus in this study is on factors that are likely to result in the transition from owning to renting. These include job loss, marital dissolution, and the onset of bad health. The double trigger hypothesis is that one of these trigger events coupled with being in a state of negative equity can lead to homeownership exit. It is the loss of income that results from one of these trigger events and the lack of wealth to make up for this loss of income that can result in homeowners being unable to pay their mortgage that can result in foreclosure and loss of home when in a state of negative equity.

In this analysis, the one of these three triggers that is found to be negatively correlated with homeownership exit for both low- and higher-income households is marriage.[13] And it is the transition from being married to being widowed or divorced that can result in the transition to renting. There are not enough cases of a trigger event (job loss, marital dissolution, and the onset of bad health) when a household is also in a state of negative equity to provide the degrees of freedom to identify the impact of the double trigger on homeownership exit. Instead, these trigger events are proxied using a loss of real income. But the interaction term which is the product of being in negative equity and experiences a lot of income has no significant impact on homeownership exit in any of the four regressions.

---

[13] Reid (2005) also finds that divorce is related to the transition to renting for homeowners.

The only evidence of the double trigger hypothesis is the significance of the interaction term between real income and negative equity in the Linear Model for the low-income R2O group. If the double hurdle hypothesis is likely to hold, this group seems the most likely candidate as the combination of a relatively high likelihood of being in negative equity along with a low level of real wealth would make them the most likely to be susceptible to exit upon a decline in income.

The impact of the changes in real income and wealth are statistically significant and economically large for low-income households in the R2O group. This indicates the importance of these cushions when it comes to paying the mortgage for this group of households that has a relatively small wealth holding and little to fall back on when there is a loss of income. While it appears that higher-income households can rely on their greater wealth holdings to overcome the loss in income and still make their mortgage payments. Part of the rationale for supporting wealth accumulation through homeownership for low-income households is to build enough wealth to have a cushion when negative shocks, such as a loss in income, arise. Ironically, many low-income households are not able to build up enough wealth from homeownership to keep them from transitioning back to renting.

What is surprising in these results is that local effects such as initial neighborhood quality and the growth rate in house prices appear to have little effect on homeownership exit for either low-income or higher-income households. So, while it is the case that low-income households purchase houses in lower quality neighborhoods this doesn't seem to impact homeownership exit.

More recent house price appreciation is captured in the change in home equity during homeownership. The results show that an increase in the change in home equity leads to a lower likelihood of homeownership exit for all four groups. And low-income homeowners do have lower average home equity and lower average changes in home equity than do higher-income homeowners for both the O2R and R2O groups (in fact, the average change in home equity is negative for both the low- and higher-income households in the R2Ogroup). One might counter that home equity is likely to be correlated to initial neighborhood quality or the initial house price growth, yet these correlations are not particularly large; 0.19/0.03 between initial neighborhood quality and current home equity/the change in home equity and 0.09/0.02 between initial house price growth and current home equity/the change in home equity.

Note that while different regressions have been estimated for low- and higher-income households in the R2O and O2R groups, many of the coefficients across the difference groups are not statistically different from each other. This holds even though magnitudes of the estimates can be quite different. And the reason for this is the relatively small sample sizes for the regressions. This is the weakness of the PSID that it surveys many fewer households than, say, the Current Population Survey (CPS). But this weakness is easily outweighed by the ability to follow households over long periods of time, something that is not a characteristic of the CPS or other household surveys. Still, there are significant differences across the four groups that merit estimating separate regressions for each sub-group.

If the federal government wants to support homeownership as a means for low-income households to accumulate wealth, it is not enough to design policies to transition low-income households into homeownership. They must also design and implement policies that help low-income homeowners stay in their homes. Based on these results, one way to increase homeownership duration for low-income households is to provide support when a negative income shock or a decline in real wealth or home equity occurs. This could involve a restructuring of the mortgage structure to reduce current payments. Of course, Gerardi et al. (2018) show that these events are not that likely to result in mortgage default so that there is a windfall benefit to restructuring mortgages for those homeowners that suffer these negative events but that would continue to stay in their homes and pay their mortgages. From the government's standpoint, the costs are potentially high relative to benefits since only a fraction of households that receive payments are actually averted from defaulting.

One caveat of this analysis is that while a big step towards a causal interpretation of the results has been taken by including individual fixed effects in the models, even these estimates are not likely to be causal. Hence, it is important to look for exogenous changes in trigger events, home equity, and mortgage payments that can be used to identify the causal impacts of these factors on mortgage distress and the transition to renting.

References

Boehm, Thomas P., and Alan M. Schlottman. 2004. "The Dynamics of Race, Income, and Homeownership," *Journal of Urban Economics* 55:113–30.

Cameron, A. Colin, und Pravin K. Trivedi. 2009. *Microeconometrics: Methods and Applications*. Cambridge and New York NY: Cambridge University Press.

Chamberlain, Gary. 1980. "Analysis of covariance with qualitative data," *Review of Economic Studies* 57: 225–238.

Foote, Christopher L., Kristopher Gerardi, and Paul S.Willen. 2008. "Negative equity and foreclosure: Theory and evidence," *Journal of Urban Economics* 64: 234–245.

Foster, Chester and Van Order, Robert. 1984. "An Option Based Model of Mortgage Default," *Housing Finance Review* 3(4): 351-372.

Fuster, Andreas and Paul S. Willen. 2017. "Payment Size, Negative Equity, and Mortgage Default," *American Economic Journal: Economic Policy* 9(4): 167–191.

Galster, George C., and Anna M. Santiago. 2008. "Low-income homeownership as an asset-building tool: what can we tell policymakers?" *Urban and Regional Policy and Its Effects* 1: 60-108.

Gerardi, Kristopher, Kyle F. Herkenhoff, Lee E. Ohanian, and Paul S. Willen. 2018. "Can't Pay or Won't Pay? Unemployment, Negative Equity, and Strategic Default," *The Review of Financial Studies* 31(3): 1098-1131.

Gerardi, Kristopher, Adam Hale Shapiro, and Paul S. Willen. 2007. Subprime Outcomes: Risky Mortgages, Homeownership Experiences, and Foreclosures," Federal Reserve Bank of Boston Working Paper 07-15.

Ham, J.C., and R.J. Lalonde. 1996. "The effect of sample selection and initial conditions in duration models: evidence from experimental data on training," *Econometrica* 64: 175–205

Heckman, James and Burton Singer. 1984. "A Method for Minim12ing the Impact of Distributional Assumptions in Econometric Models for Duration Data," *Econometrica* 52: 271-320.

Newman, Sandra J. and C. Scott Holupka. 2016. "Is Timing Everything? Race, Homeownership and Net Worth in the Tumultuous 2000s," *Real Estate Economics* 44 2: 307–354

Quercia, Roberto G., Anthony Pennington-Cross, and Chao Tian Yue. 2012. "Mortgage Default and Prepayment Risks among Moderate and Low-Income Households," *Real Estate Economics* 40(S1): S159-S198.

Quercia, Roberto G. and Michael A. Stegman. 1992. "Residential Mortgage Default: A Review of the Literature," *Journal of Housing Research* 3(2): 341-379.

Reid, Carolina. 2005. "Achieving the American Dream? A Longitudinal Analysis of the Homeownership Experiences of Low-Income Households," Working Paper No. 05–20. Center for Social Development.

Sharp, Gregory and Matthew Hall. 2014. "Emerging Forms of Racial Inequality in Homeownership Exit, 1968–2009," *Social Problems* 61(3): 427-447.

Spader, Jonathan S. and Roberto G. Quercia. 2008. "Mobility and Exit from Homeownership: Implications for Community Reinvestment Lending." Housing Policy Debate 19:675–709.

Tian, Chao Yue, Roberto G. Quercia, and Sarah Riley. 2016. "Unemployment as an Adverse Trigger Event for Mortgage Default," *Journal of Real Estate Finance and Economics* 52:28-49.

Wainer, Allison and Jeffrey Zabel. 2019. "Homeownership and Wealth Accumulation for Low-Income Households," forthcoming *Journal of Housing Economics*.

Table 1 – Summary Statistics

Variable	Sub-Groups				p-values[+]		
	R2O (1)	R2R (2)	O2R (3)	O2O (4)	(1)v(2)	(1)v(3)	(1)v(4)
Age	34.39	34.44	37.93	40.46	0.85	0.00	0.00
	(8.16)	(8.22)	(8.33)	(8.54)			
Female	0.25	0.45	0.24	0.18	0.00	0.87	0.00
	(0.43)	(0.50)	(0.43)	(0.38)			
Family Size	2.69	2.74	3.26	3.21	0.39	0.00	0.00
	(1.44)	(1.58)	(1.55)	(1.40)			
Married	0.55	0.35	0.64	0.76	0.00	0.00	0.00
	(0.50)	(0.48)	(0.48)	(0.43)			
Divorced	0.14	0.14	0.13	0.10	0.93	0.89	0.00
	(0.34)	(0.34)	(0.34)	(0.31)			
Single	0.32	0.51	0.23	0.13	0.00	0.00	0.00
	(0.47)	(0.50)	(0.42)	(0.34)			
Children	0.50	0.57	0.65	0.62	0.00	0.00	0.00
	(0.50)	(0.50)	(0.48)	(0.49)			
White	0.57	0.34	0.54	0.69	0.00	0.29	0.00
	(0.50)	(0.48)	(0.50)	(0.46)			
African Amer	0.34	0.54	0.37	0.23	0.00	0.16	0.00
	(0.47)	(0.50)	(0.48)	(0.42)			
Asian	0.02	0.01	0.02	0.01	0.03	0.82	0.12
	(0.14)	(0.10)	(0.14)	(0.11)			
Hispanic	0.06	0.07	0.05	0.05	0.15	0.27	0.03
	(0.24)	(0.26)	(0.22)	(0.21)			
Northeast	0.15	0.13	0.11	0.15	0.22	0.01	0.69
	(0.35)	(0.34)	(0.31)	(0.36)			
Northcentral	0.22	0.24	0.23	0.26	0.44	0.82	0.01
	(0.42)	(0.42)	(0.42)	(0.44)			
South	0.43	0.44	0.49	0.41	0.62	0.01	0.22
	(0.50)	(0.50)	(0.50)	(0.49)			
West	0.20	0.19	0.16	0.17	0.71	0.08	0.06
	(0.40)	(0.39)	(0.37)	(0.38)			
Urban	0.71	0.77	0.66	0.65	0.00	0.02	0.00
	(0.45)	(0.42)	(0.47)	(0.48)			
Head Employed	0.87	0.76	0.88	0.93	0.00	0.69	0.00
	(0.33)	(0.43)	(0.33)	(0.26)			
College Graduate	0.38	0.22	0.31	0.38	0.00	0.00	0.93
	(0.49)	(0.42)	(0.46)	(0.49)			
High School Grad	0.22	0.27	0.26	0.24	0.00	0.03	0.08

	(0.41)	(0.44)	(0.44)	(0.43)			
Real Income ($1K)	62.46	41.68	84.45	103.42	0.00	0.00	0.00
	(50.00)	(34.36)	(78.64)	(108.23)			
Real Wealth ($1K)	38.67	16.02	138.76	182.06	0.00	0.00	0.00
w/o equity	(212.98)	(143.39)	(795.53)	(628.51)			
Number	1,680	2,564	746	3,213			
Low-Income							
Real Wealth ($1K)	12.64	2.42	5.18	32.74	0.01	0.35	0.02
w/o equity	(81.60)	(42.39)	(23.77)	(115.72)			
Number	444	1,065	120	273			
Higher-Income							
Real Wealth ($1K)	45.99	24.26	164.10	195.89	0.02	0.00	0.00
w/o equity	(236.68)	(178.20)	(865.45)	(654.32)			
Number	1,236	1,499	626	2,940			

Means and standard deviation in parentheses
+ p-value for the comparison of means with listed columns

Table 2 – Years Owned
Low- and Higher-Income Households in R2O and O2R Groups

Years Owned	1st Income Quartile			2nd - 4th Income Quartiles		
	Number	Pct	Cum pct	Number	Pct	Cum pct
R2O Group						
2	177	39.86	39.86	367	29.69	29.69
4	84	18.92	58.78	235	19.01	48.71
6	40	9.01	67.79	140	11.33	60.03
8	34	7.66	75.45	131	10.60	70.63
10	39	8.78	84.23	102	8.25	78.88
12	28	6.31	90.54	87	7.04	85.92
14	28	6.31	96.85	94	7.61	93.53
16	14	3.15	100.00	80	6.47	100.00
Number	444			1,236		
O2R Group						
2	29	24.17	24.17	95	15.18	15.18
4	24	20	44.17	99	15.81	30.99
6	20	16.67	60.83	80	12.78	43.77
8	12	10	70.83	87	13.90	57.67
10	5	4.17	75.00	63	10.06	67.73
12	10	8.33	83.33	71	11.34	79.07
14	11	9.17	92.50	76	12.14	91.21
16	9	7.50	100.00	55	8.79	100.00
	120			626		

Table 3 – Change in Income for Households that Change from Owners to Renters

	Number	Median	Mean	Std Dev	Maximum	Minimum
			Low-income R2O Group			
$\Delta real\_inome_{t-1}$	141	4.50	11.63	30.99	145.10	-52.03
$\Delta real\_inome_t$		0.00	-0.01	0.03	0.07	-0.14
			High-income R2O Group			
$\Delta real\_inome_{t-1}$	249	3.41	11.02	109.40	1380.45	-579.02
$\Delta real\_inome_t$		0.00	-0.01	0.10	0.18	-1.37
			Low-income O2R Group			
$\Delta real\_inome_{t-1}$	117	2.19	4.40	21.94	80.29	-53.85
$\Delta real\_inome_t$	.	0.00	0.00	0.03	0.15	-0.06
			High-income O2R Group			
$\Delta real\_inome_{t-1}$	613	-3.22	-9.37	54.23	179.76	-474.92
$\Delta real\_inome_t$	.	0.00	0.00	0.11	2.31	-0.86

Table 4: Summary Statistics for 2000 Decennial Census Variables

	Subgroups				P-values*		
					R2O vs R2R	R2O vs O2R	R2O vs O2O
Variable	R2O	R2R	O2R	O2O	R2R	O2R	O2O
total house holds	1678.4	1527.6	1639.8	1640.0	0.000	0.349	0.146
	(762.0)	(692.5)	(620.2)	(601.3)			
Pct Afr American	22.7	36.8	25.7	16.2	0.000	0.095	0.000
	(29.4)	(36.3)	(33.2)	(25.9)			
Pct Hispanic	11.6	13.4	9.4	8.0	0.064	0.040	0.000
	(18.8)	(21.1)	(18.1)	(16.5)			
Pct >=65 years	11.6	11.5	12.0	12.2	0.784	0.296	0.022
	(5.5)	(5.5)	(5.8)	(5.8)			
Pct Foreign	10.9	11.7	8.2	7.7	0.255	0.001	0.000
	(13.5)	(14.7)	(12.5)	(10.7)			
Pct Same House	50.6	52.7	55.7	56.8	0.001	0.000	0.000
	(13.3)	(12.5)	(11.1)	(11.4)			
Pct Some College	21.3	20.7	21.4	21.2	0.034	0.663	0.733
	(5.9)	(6.0)	(5.7)	(5.5)			
Pct BA degree	23.9	18.8	20.5	24.4	0.000	0.000	0.503
	(16.9)	(14.9)	(14.9)	(17.0)			
Poverty Rate	15.2	20.3	14.1	11.1	0.000	0.073	0.000
	(11.2)	(13.7)	(10.4)	(8.9)			
Avg HH Income	50.6	45.1	52.4	58.8	0.000	0.129	0.000
	(20.2)	(17.4)	(21.9)	(27.6)			
Pct Ownership	58.0	52.6	69.6	73.9	0.000	0.000	0.000
	(22.8)	(22.4)	(18.4)	(16.1)			
Pct SF Detached	59.9	54.5	74.0	77.0	0.000	0.000	0.000
	(29.6)	(30.5)	(24.1)	(22.6)			
Median Rent	585.3	545.5	570.6	597.0	0.000	0.249	0.222
	(209.2)	(195.7)	(235.8)	(245.3)			
Number	825	879	472	2232			

Means with Standard Deviations in Parentheses.

* P-values for comparison of means for two groups listed in column heading

Table 5: Summary Statistics for Samples used to Estimate the Homeownership Exit Equations

Variable	Low-Income R2O			Higher-Income R2O			Low-Income O2R			Higher-Income R2O		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
Rent = 1	274	0.515	0.501	531	0.469	0.5	287	0.408	0.492	1727	0.355	0.479
Employed	273	0.791	0.407	530	0.875	0.33	282	0.699	0.46	1722	0.869	0.337
Married	274	0.515	0.501	531	0.706	0.456	287	0.38	0.486	1727	0.697	0.46
Poor Health	274	0.142	0.38	531	0.122	0.391	286	0.36	0.74	1722	0.149	0.474
Real Income ($1,000s)	274	56.775	47.5	531	95.63	80.819	287	36.285	31.3	1727	97.324	128.658
Home equity ($1,000s)	250	33.080	88.41	496	53.701	104.70	261	36.750	52.316	1661	86.367	123.901
Negative equity = 1 (INE)	274	0.179	0.384	531	0.22	0.415	287	0.111	0.315	1727	0.09	0.287
Real Income*INE ($1,000s)	49	67.564	42.88	117	85.614	46.841	32	36.376	24.05	156	78.947	60.003
Unemployment Rate	274	6.998	2.653	531	7	2.817	287	7.123	3.157	1727	6.213	2.492
Age, First Year in sample (FYS)	274	31.000	7.744	531	32.213	7.829	287	36.686	7.953	1727	38.218	8.571
Female = 1	274	0.281	0.45	531	0.145	0.352	287	0.463	0.5	1727	0.157	0.364
African American = 1	273	0.425	0.495	517	0.282	0.451	279	0.602	0.49	1719	0.297	0.457
Graduated College = 1	274	0.358	0.48	531	0.403	0.491	287	0.084	0.277	1727	0.359	0.48
Real Wealth ($1000s) FYS	274	0.113	0.502	531	0.717	2.739	287	0.066	0.232	1727	1.514	6.414
Neighborhood Quality	274	-0.479	1.661	531	-0.04	1.705	287	-0.589	1.266	1727	0.465	1.875
House Price Growth FYS	274	6.107	8.406	531	4.816	10.566	287	8.092	8.047	1727	6.567	9.648
Inverse Mills Ratio	274	0.960	0.4	531	0.771	0.303	279	0.949	0.348	1727	1.451	0.219
ΔEmployed	274	0.095	0.294	531	0.083	0.276	287	0.087	0.282	1727	0.074	0.262
ΔMarried	274	0.080	0.272	531	0.07	0.255	287	0.021	0.143	1727	0.064	0.244
ΔHealth	274	0.142	0.38	531	0.122	0.391	287	0.359	0.739	1727	0.149	0.473
ΔReal Income ($1,000s)	274	0.000	0.03	531	-0.001	0.087	287	0.004	0.038	1727	-0.003	0.12
ΔHome Equity ($1,000s)	236	-4.438	31.61	482	-3.322	53.698	253	1.844	18.236	1617	4.517	44389
I(Home Equity<0) (INE)	274	0.179	0.384	531	0.22	0.415	287	0.111	0.315	1727	0.09	0.287
I(ΔReal Income<0) (IDRI<0)	274	0.493	0.501	531	0.467	0.499	287	0.446	0.498	1727	0.512	0.5
IDRI<0*INE	274	0.08	0.272	531	0.105	0.307	287	0.049	0.216	1727	0.047	0.211
ΔReal Wealth ($1000s)	274	-0.035	0.508	531	0.002	0.514	287	0.000	0.263	1727	-0.009	0.727
ΔUnemployment Rate	259	0.568	2.552	513	0.292	2.759	277	0.471	2.525	1678	0.500	2.083

Table 6: Probit Results for Linear Model of Homeownership Exit:
Low- and Higher-Income R2O and O2R Groups

Variable	R2O		O2R	
	Low-Income (1)	Higher Income (2)	Low-Income (1)	Higher Income (2)
Employed = 1	0.0178	-0.4002***	0.0123	0.0302
	(0.238)	(0.195)	(0.193)	(0.107)
Married = 1	-0.3658**	-0.5727****	-0.6136***	-0.7316****
	(0.208)	(0.166)	(0.255)	(0.089)
Poor Health = 1	-0.0263	0.1569	0.1986*	0.0683
	(0.236)	(0.152)	(0.124)	(0.082)
Real Income	-0.0059*	-0.0025***	-0.0055	-0.0003
	(0.004)	(0.001)	(0.005)	(0.000)
Home Equity	0.1598**	0.0193	-0.0473	-0.0449*
	(0.084)	(0.074)	(0.204)	(0.034)
I(Home Equity<0) (INE)	0.9562***	0.0590	0.0163	0.1301
	(0.417)	(0.324)	(0.452)	(0.213)
Real Income *INE	-0.0119***	0.0037	0.0026	-0.0018
	(0.005)	(0.003)	(0.012)	(0.002)
Unemployment Rate	0.0762**	-0.0262	-0.1040****	-0.0095
	(0.043)	(0.028)	(0.039)	(0.018)
Age; First year in sample (FYS)	0.3056	-0.1703	-0.2266	-0.4450****
	(0.240)	(0.232)	(0.231)	(0.115)
Female = 1	0.1414	0.3303***	-0.2958*	0.0180
	(0.240)	(0.157)	(0.211)	(0.097)
African American = 1	-0.5454***	-0.0687	-0.5088*	-0.0087
	(0.215)	(0.140)	(0.346)	(0.072)
BA Degree = 1	-0.0120	-0.0096	-0.0149	-0.0093*
	(0.011)	(0.008)	(0.012)	(0.007)
Real Wealth; FYS	-0.2688*	-0.0866****	-0.7074**	0.0032
	(0.209)	(0.032)	(0.383)	(0.004)
Neighborhood Quality Indicator+	0.0538	-0.0265	-0.0922	0.0028
	(0.061)	(0.035)	(0.077)	(0.020)
House price growth rate; FYS	-0.0093	-0.0089*	0.0002	-0.0097****
	(0.010)	(0.006)	(0.012)	(0.004)
Inverse Mills Ratio	-1.1170****	-0.0514	0.1190	-0.2479
	(0.372)	(0.325)	(0.284)	(0.290)
Observations	357	657	377	2,246

Standard errors in parentheses, **** p<0.01, *** p<0.05, ** p<0.10, * p<0.20
Annual indicators of duration dependence and year dummies are included.
+ First principal component of 13 variables from the 2000 Decennial Census (See Table 4)

Table 7: Fixed effects logit Results for Changes Model of Homeownership Exit: Low- and Higher-Income R2O and O2R Groups

Variable	R2O		O2R	
	Low-Income (1)	Higher Income (2)	Low-Income (1)	Higher Income (2)
ΔEmployment	-0.8607*	0.8461***	0.3286	0.2629
	(0.543)	(0.362)	(0.614)	(0.252)
ΔMarried	3.2721****	1.1863****	0.7891	1.9367****
	(0.845)	(0.412)	(1.293)	(0.267)
ΔHealth	-0.5806	0.6238	0.1170	0.0789
	(0.922)	(0.598)	(0.637)	(0.421)
ΔReal Income	-34.4139****	-0.8138	1.6747	0.9683*
	(10.937)	(1.402)	(4.368)	(0.616)
ΔHome Equity	-3.4255****	-0.9397****	-1.6080**	-0.8469****
	(0.872)	(0.230)	(0.876)	(0.199)
I(Home Equity<0) (INE)	1.8380**	2.6827****	0.9160	2.1802****
	(1.088)	(0.586)	(1.704)	(0.621)
I(ΔReal Income<0) (IDRI<0)	0.0790	0.1143	0.7381**	0.1926*
	(0.497)	(0.244)	(0.398)	(0.142)
IDRI<0*INE	0.0887	-0.2647	-0.4554	-0.4342
	(0.960)	(0.488)	(0.944)	(0.430)
ΔReal Wealth/1000	-1.3950*	-0.2639	0.0784	0.1227
	(0.971)	(0.223)	(0.462)	(0.096)
ΔUnemployment Rate	-0.2432****	-0.1822****	-0.3297****	-0.2538****
	(0.081)	(0.046)	(0.100)	(0.038)
Observations	391	755	390	2,264

Standard errors in parentheses, **** p<0.01, *** p<0.05, ** p<0.10, * p<0.20

Table 8: Semi-Elasticities for Random and Fixed Effects Models

Variable	R2O Low-Income (1)	R2O High-Income (2)	O2R Low-Income (3)	O2R High-Income (4)
Linear Model Results (Table 6)				
Employed	2.1	-51.9	2.5	5.9
Married	-43.7	-74.2	-124.9	-142.9
Poor Health	-3.1	20.3	40.4	13.3
Real Income	-31.3	-38.0	-32.5	-7.0
Home Equity	17.8	2.9	-4.7	-10.3
I(Home Equity<0) (INE)	114.1	7.6	3.3	25.4
Real Income *INE	-63.0	56.4	15.1	-41.5
Unemployment Rate	23.7	-8.6	-66.5	-4.7
1 if female	36.5	-22.1	-46.1	-86.9
1 if African American	16.9	42.8	-60.2	3.5
1 if BA Degree	-65.1	-8.9	-103.6	-1.7
Age	-1.4	-1.2	-3.0	-1.8
Real Wealth; First year in sample (FYS)	-16.7	-78.9	-33.6	4.4
Neighborhood Quality Indicator	10.8	-6.4	-24.5	1.0
House price growth rate; FYS	-9.2	-11.4	0.4	-18.8
Change Model Results (Table 7)				
ΔEmployed	-54.9	37.3	32.7	25.9
ΔMarried	208.9	52.3	78.6	191.1
ΔHealth	-37.1	27.5	11.6	7.8
ΔReal Income	-66.7	-3.4	5.5	10.0
ΔHome Equity	-156.8	-27.7	-29.2	-37.1
I(Home Equity<0) (INE)	117.3	118.4	91.2	215.1
I(ΔReal Income<0) (IDRI<0)	5.0	5.0	73.5	19.0
IDRI<0*INE	5.7	-11.7	-45.3	-42.8
ΔReal Wealth/1000	-55.8	-5.3	2.2	8.9
ΔUnemployment Rate	-37.7	-21.3	-83.5	-52.9

2

Figure 1

National House Price Index

data source: FHFA
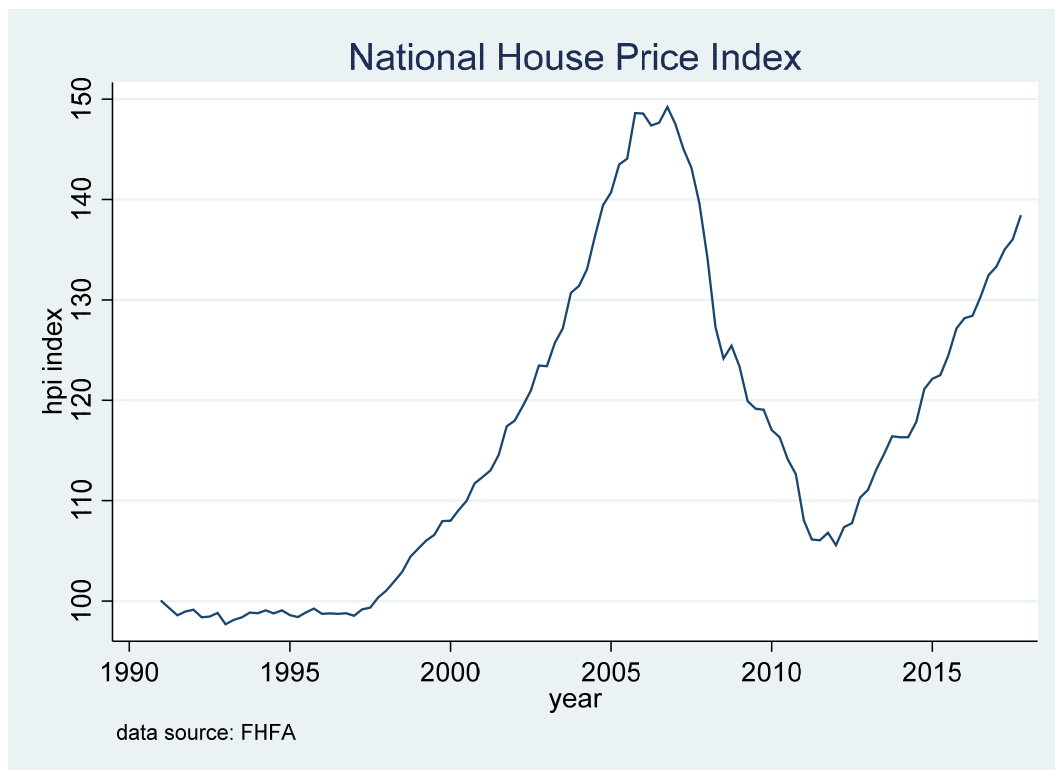
Appendix

Other Decennial Census variables that were initially considered for inclusion in the random effects regressions as measure of neighborhood quality but were later excluded since, conditional on the other census variables that were retained, their t-statistics were very small.

Total population, total number of families, total number of housing units, percent white, percent less than18 year old, percent of households that lived in a different house but in the same city as 5 years ago, percent with a high school degree, percent employed, welfare rate, average household income percent vacant units, percent of units with 1 bedroom, percent of units with 2 bedrooms, percent of units with 3 bedrooms, percent of units with 4 bedrooms, percent of single-family attached units, percent with 2 units, percent with 3 or 4 units, percent with 5plus units, percent of units aged less than or equal to 10 years old, percent of units aged 10 to 20 years old, percent of units aged 20 to 30 years old, percent of units aged 30 years or older, 10th., 25th, 50th, 75th and 90th percentiles of the household income distribution

Table A1: Probit Results for Linear Model of Homeownership Exit:
Low- and Higher-Income Groups by African American and White Races

Variable	African American		White	
	Low-Income (1)	Higher Income (2)	Low-Income (1)	Higher Income (2)
Employed = 1	0.0956	-0.0301	-0.0260	-0.0573
	(0.206)	(0.157)	(0.287)	(0.127)
Married = 1	-0.4714**	-0.7256****	-0.5970***	-0.8973****
	(0.266)	(0.157)	(0.247)	(0.097)
Poor Health = 1	0.2509**	0.2273*	-0.1102	0.0101
	(0.136)	(0.153)	(0.181)	(0.085)
Real Income	-0.0072*	-0.0034***	-0.0073***	-0.0004
	(0.005)	(0.002)	(0.004)	(0.000)
Home Equity	-0.1169	-0.0903	0.2785**	-0.0304
	(0.191)	(0.094)	(0.168)	(0.034)
I(Home Equity<0) (INE)	0.0757	-0.0552	-0.0680	0.1600
	(0.461)	(0.342)	(0.526)	(0.214)
Real Income *INE	0.0037	0.0006	-0.0034	-0.0014
	(0.011)	(0.004)	(0.006)	(0.002)
Unemployment Rate	-0.0445*	-0.0296	0.0698*	0.0036
	(0.034)	(0.033)	(0.052)	(0.018)
Female = 1	-0.2877	-0.4827****	0.0619	-0.4337****
	(0.257)	(0.173)	(0.305)	(0.143)
BA Degree = 1	-0.0382	-0.1161	-0.4628**	-0.0040
	(0.276)	(0.134)	(0.245)	(0.078)
Age; First Year in Sample (FYS)	-0.0164	-0.0154***	0.0344***	-0.0120*
	(0.013)	(0.008)	(0.017)	(0.008)
Real Wealth; FYS	-0.6407*	0.0053	-0.3132**	-0.0025
	(0.460)	(0.007)	(0.185)	(0.015)
Neighborhood Quality Indicator+	0.0273	-0.0212	0.0213	0.0094
	(0.066)	(0.033)	(0.079)	(0.022)
House price growth rate; FYS	-0.0128	-0.0137***	-0.0042	-0.0087***
	(0.010)	(0.006)	(0.012)	(0.004)
Inverse Mills Ratio	0.0987	0.1595	-1.8802****	0.1328
	(0.561)	(0.522)	(0.711)	(0.310)
Observations	272	627	256	1,523

Robust standard errors in parentheses, **** p<0.01, *** p<0.05, ** p<0.10, * p<0.20
+ First principal component of 13 variables from the 2000 Decennial Census

Table A2: Conditional Logit Results for Changes Model of Homeownership Exit:
Low- and Higher-Income Groups by African American and White Races

Variable	African American		White	
	Low-Income (1)	Higher Income (2)	Low-Income (1)	Higher Income (2)
ΔEmployment	-0.4176	0.3756	-0.2147	0.4752*
	(0.481)	(0.337)	(0.690)	(0.290)
ΔMarried	23.3394****	1.7349****	1.5144***	1.7460****
	(2.598)	(0.447)	(0.645)	(0.295)
ΔHealth	0.3646	0.6341	-1.6082*	0.0075
	(0.591)	(0.634)	(1.050)	(0.441)
ΔReal Income	-10.2744	5.5067**	-2.3412	0.2676
	(16.130)	(2.832)	(11.327)	(0.489)
ΔHome Equity	-6.6177****	-1.4158****	-1.0302***	-0.8748****
	(1.734)	(0.416)	(0.401)	(0.161)
I(Home Equity<0) (INE)	18.1565****	1.9353***	1.7197***	2.6982****
	(0.992)	(0.778)	(0.820)	(0.570)
I(ΔReal Income<0) (IDRI<0)	0.6507	0.1854	0.9042*	0.3099***
	(0.530)	(0.252)	(0.644)	(0.158)
IDRI<0*INE	0.0785	0.3143	-0.6835	-0.6574**
	(0.973)	(0.722)	(0.857)	(0.380)
ΔReal Wealth/1000	0.2280**	0.2897*	-0.4028	0.0230
	(0.127)	(0.190)	(0.637)	(0.062)
ΔUnemployment Rate	-0.2801***	-0.1726****	-0.1512*	-0.2654****
	(0.112)	(0.061)	(0.095)	(0.042)
Observations	396	907	374	2,081

Robust standard errors in parentheses, **** p<0.01, *** p<0.05, ** p<0.10, * p<0.20