Mobility and Mortgages: Evidence from the PSID*

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Abstract

We use the 1999-2009 Panel Survey of Income Dynamics to estimate household move probabilities as a function of, among other things, current housing equity. The lock-in effect supposes that mobility decreases with equity, particularly as equity becomes negative. We find that while owners do move less than renters, the move probability increases as homeowners become underwater. The propensity to move out of state in particular increases dramatically for sand state homeowners who have negative equity. There is no lock in effect from negative equity.

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1 Introduction

The decline in housing prices across the United States had the effect of pushing many homeowners "underwater"—owing more on the house than its market value. Many in the media (e.g. Timiraos and Casselman, 2011) have posited that underwater homeowners are less mobile than their homeowing peers, who already tend to be less mobile than renters. If lower household mobility makes a worker less likely to take a new job far away from his current house, labor market frictions are increased. We use data from the Panel Survey of Income Dynamics (PSID) to investigate the relationship between ownership and home equity and household mobility. While it is clear that homeowners are less mobile than renters, most likely due to higher transaction costs associated with selling a house, we find no evidence of "lock-in" among underwater homeowners. In fact, it appears that extremely underwater homeowners are somewhat more mobile than other homeowners, although still less mobile than renters. This may be due to the higher incentive to default when a homeowner is underwater. Moreover, our data allows us to compare the effects of equity status on local (in-state) and long-distance (out of state) moves separately. This is important, as long-distance household mobility induces more labor market frictions than mere local household mobility. We find that while the relative impact of equity status are similar between In-State and Out-of-State moves, the absolute impact on out of state moves is smaller, owing to the much lower probability of moving out of state. Moreover, we find that underwater households are more likely to move out of state than other homeowners—the opposite prediction of the lock-in hypothesis—and that extremely underwater homeowners have similar out-of-state mobility as renters.

There is abundant empirical evidence that owners are much less likely to move than comparable renters (Rohe and Stewart, 1996) and abundant intuition to suggest why this might be the case. The costs of moving out of a rental unit are relatively low, while owners are generally thought to incur high transactions cost when it comes time to sell or move. The consequences of this relative immobility can be positive or negative. For example, longer spells are hypothesized to be a primary reason why owners are more likely to invest in neighborhood social capital (DiPasquale and Glaeser, 1999) with the attendant positive spillovers. The spillovers in turn provide an efficiency rationale for the subsidization of homeownership by the federal government, and also local governments

(Coulson, 2002). On the other hand, with that stability comes potentially negative consequences for labor markets. Oswald (1997), for example, posited that high regional or national homeownership rates were likely to lead to higher unemployment rates because of the inability of individual owners to respond–i.e. migrate– to localized labor demand shocks. Other authors (e.g., Coulson and Fisher, 2002, 2009; Munch et al., 2006; Flatau et al., 2003) have investigated the connection between housing tenure and labor market experiences at the individual level, and while their empirical outcomes somewhat contradict the more aggregate studies of Oswald (see also Partridge and Rickman, 1997; Green and Hendershott, 2001) it is clear that homeownership has consequences for the labor market outcomes of households. Immobility across locations causes fewer matches to be made between employer and employee, and reduces the average quality of matches that are made. Fewer and lower quality matches can have negative external effects, and the lower mobility of homeowners becomes a matter of government policy.

A separate line of inquiry has focused on the role of house price changes on the willingness or ability of homeowners to become mobile. This inquiry has gained currency in light of dramatic price changes over the first decade of the 21st century in many housing markets across the US. It has focused in particular on the possibility of lock-in whereby homeowners become unwilling to sell their homes in the face of price declines, particularly declines that result in prices below the original purchase price. There are three aspects to this. First, Chan (2001) posits that homeowners are able to move if the sale of their home provides enough equity for the next home purchase. Localized price declines hamper the households ability to do that, causing lock-in. Second, Genesove and Mayer (2001) provide a behavioral explanation for lock-in, that nominal loss aversion can play a role in sellers decisions in housing transactions. Using data from Boston, they find that a nominal fall in housing prices manifests itself in above-market asking prices on the part of sellers, which, according to standard search-theoretic considerations should lead to longer time on the market, and longer spells in housing units in declining markets. These findings are corroborated by Annenberg (2011) using data from San Francisco. Other, perhaps more direct, evidence of nominal loss aversion is available in Engelhardt (2003) and Cunningham and Engelhardt (2008). Third, these effects are hypothesized to be exacerbated when homes become underwater—that is, when the value of the housing unit is not just less than the original purchase price, but less than the owners outstanding mortgage debt. This aspect has been the subject of intense interest in the aftermath of the housing downturn of 2006 and beyond.

However, this is somewhat contradictory to another line of inquiry, which links mobility and default. Three aspects are relevant. The first is that the default process is associated with mobility. The correlation is not perfect—households that enter the foreclosure process need not move for quite a while, and if they can lease the home back after a foreclosure sale they need not move at all. Nevertheless, Malloy and Shan (2012) find that even the initial notice of arrears does increase mobility, and quite substantially. Second, it may be the case that, with sufficient resources, households sell despite taking a loss on the property, precisely to avoid default. Third, as pointed out by Schulhofer-Wohl (2011) housholds may move and lease the property to another household as a way of forestalling default and foreclosure. At any rate, since there are reasons to believe that mobility could increase or decrease as loan-to-value ratios increase, the exact impact of equity on mobility is an empirical question.

The evidence is unclear. Ferreira et al. (2010, FGT hearafter) assemble a panel of housing units from the American Housing Survey that goes up to the year 2007 (and thus for some metropolitan areas, the beginnings of the house price declines). They find a pervasive lock-in effect from negative equity. Mobility rates decline by up to 35% when homes are underwater. Schulhofer-Kohl (2011) disputes this, finding that these authors do not use observations where an owner-occupied house (at the time of a survey) becomes vacant or occupied by renters (at the time of a subsequent survey). The purpose of this, according to Ferreira, Gyourko and Tracy's response (Ferreira et al., 2011) was that the latter two cases were potentially only temporary moves. Obviously treating these cases as moves, by that fact, raises mobility rates, and Schulhofer-Wohl (2011) finds that doing so removes the lock-in effect. There are two studies that attempt to use aggregated data to examine this issue. Donovan and Schnure (2011) use county level data to examine mobility rates in the face of (negative) price changes. They find that counties with large negative changes in house prices (which proxies for negative equity) experienced drops in within-county moves, but no drop in long distance moves. This is an important distinction, because long-distance moves are potentially associated with new job opportunities. As discussed in the opening paragraph, the relative immobility of homeowners can lead to labor market mismatch, so to the extent that this immobility is magnified by the lock-in from negative equity, it raises additional concerns. Donovan and Schnares finding minimizes those concerns. Nenov (2010) estimates the percentage of homeowners, by state, who are underwater, and estimates (separate) models of in- and out-migration with this underwater percentage as a covariate. The out-migration rate is negatively correlated with this percentage, suggesting lock-in, while the in-migration is uncorrelated with negative equity.

In this paper we re-examine the lock-in effect and the relative mobility of renters and homeowners, using a panel of household heads in the Panel Survey of Income Dynamics (PSID). There are two motivating factors behind the use of this data and which allow us to move beyond the facts established by previous research. First, like Donovan and Schnure (2011) we wish to examine the destination of those people that do move, in order to more fully understand the impact of negative equity on labor markets. Neither FGT nor Nenov are able to do this.

Second, because we have individual panel data, we can ask questions that the aggregate studies discussed above cannot. We have information on the particular circumstances of the household during multiple housing spells. Since we directly observe the outstanding mortgage levels of households as well as their self-reported house values, we are able to calculate households' expected equity position. While this may differ from the household's equity postition based on market-level house value, it is the relevant variable the household uses when deciding whether to move. FGT use an alternative strategy of inflating the previous reported sale price of the home with the FHFA metropolitan area price index. Clearly, this imputation does not account for neighborhood-level changes in housing prices or the effects of renovations on house value. In addition, the PSID allows us to follow households after the move. We observe their new destination, which FGT do not observe, so that we may distinguish the impact of equity levels on instate and out of state moves. Like FGT, we can also track changes in individual circumstances, such as change in marital status and household size, that are not available in aggregate data. Since these changes are frequent motivators for moving house, it is important that they be taken into account. Moreover, since the PSID follows households, rather than homes, there is no need to impute whether or not a move occurred as participants are asked this directly. However the survey does not ask whether or not a move is “temporary” or “permanent”. We take moving as *prima facie* evidence of mobility, since the ability to change locations is what is important for many labor market transactions. The fact that some moves might be temporary is even more evidence of labor market flexibility, even in the face of constraints arising from the housing market.[1]

Our results may be summarized as follows: We find, congruent with much recent literature, that owners generally are less likely to move than renters. However, contrary to the findings of FGT, but congruent with Schulhofer-Wohl (2011) we find that owners who are moderately underwater (i.e. with loan to value ratios between 1 and 1.2) have move probabilities that are not quantitatively all that different from owners with loan-to-value ratios less than one, and that homeowners who are deeply underwater (i.e. with loan to value ratios greater than 1.2) have a much higher move probability than those in any other category, and indeed are statistically indistinguishable from renters. We find this is the case for both in-state and out-of-state moves, but interestingly, the effect is more pronounced for out-of-state moves. Thus there is a qualitative similarity between our results and the aggregate data findings of Donovan and Schnure (2011).

2 Empirical Model

The dependent variable for our study is the migration decision of a household over a two-year period. The PSID survey is conducted on several thousand households every two years, including information on migration behavior. For any given household head in year t, we link the survey information in year t to location in year $t+2$ and mark whether the household indicated that they moved since the last survey.[2] We note the state of residence in $t+2$, and on the basis of these questions create a variable indicating which of the three choices above were made in the two-year

[1]We are able to check how frequently households return to states in which they previously lived, as would occur in temporary moves. For the survey years 2005-2009, we find that 13.7 percent of out of state movers are returning to a state they lived in two surveys prior. Of these, only 56.2 percent are homeowners upon their return.

[2]The question on location has changed slightly in 2003. Prior to 2003, household heads were asked whether or not they had moved since the previous survey, while in 2003 and later, they have been asked whether they moved since January 1 of the previous survey year. This introduces the possibility of double counting a move which occurs at the start of a survey year. However, since the month of move is also recorded in the PSID data, we are able to remove these instances of double-counting.

period t through $t+2$.[3] We posit a random utility function involving three choices: (a) don't move (the default), (b) move within state, and (c) move to a different state. We assume these utiltiies are a linear function of parameters. Thus, household head i chooses whether to stay, move in-state, or move out of state by choosing the highest of these utilities:[4]

$$U_{ai} = \epsilon_{ai}$$
$$U_{bi} = \gamma_b^{LTV_i} + X_i\beta_b + \epsilon_{bi}$$
$$U_{ci} = \gamma_c^{LTV_i} + X_i\beta_c + \epsilon_{ci}$$

where a, b, and c represent the three choices outlined above. We normalize the expected utility of staying in your current house to 0, and ϵ_i is a vector of household-specific shocks. The parameter of interest in our model is γ, the utility impact of residents' equity status on his mobility choice. We use renters as our base category, and divide homeowners into six categories based on their imputed loan-to-value ratio: less than 50 percent loan-to-value, 50 to 80 percent, 80 to 90 percent, 90 to 100 percent, 100 to 120, and over 120 percent. The final two categories represent underwater homeowners, while the final category could be considered deeply underwater. Thus, γ_b^{100}, is the additional utility (cost, if negative) a moderately underwater homeowner gets from an in-state move versus a renter.[5]

We would like to interpret our results on the impact of renting and the various loan-to-value categories as the impact of the household residency. However, there is the potential that households endogenously sort into a housing situation. For example, it may be that high mobility households are more likely to rent rather than own. To control for this, we must include a rich set of observable characteristics in X_i that determine a households mobility. After doing so, we assume that household unobservable characteristics, ϵ_i, are independent of the households current rental/equity status.[6]

[3]The state of residence is the finest level of geographic detail to which we have access.

[4]Although our data comes from a panel, we follow the literature in treating mobility decisions as independent over time. See Ferreira et al. (2010) for a discussion of the benefits of this method versus estimating a hazard function of moving.

[5]As is common for discrete choice models, the scale of utility is not identified, so we normalized the variance of ϵ to one.

[6]We must also consider the possibility of sample attrition affection our results if response rates differ between

Our use of the PSID allows our specification of X_i to be particularly rich, especially since the 1999 wave, which we therefore take as the initial year in our data. The X_i vector (generally) consists of data from year t of the survey, and includes the usual demographic information: log of household income, number of children in the household, age of the household head, the square and cube of age of the head, four categories of marital status, five categories of educational attainment by the head, and six categories of ethnicity of the household head. One of the primary unobservable differences in mobility is the likelihood of receiving new employment opportunities, our specification assumes that, controlling for income, age, educational attainment and other observed characteristics, renters and homeowners at different equity levels receive similar labor market opportunities. Year fixed effects are also included in our specification in order to control for changes in economic conditions which impact the likelihood of mobility over time.

Recent changes within the household can also drive mobility decisions; therefore we also allow mobility to be a function of changes (from $t-2$ to t) in the households circumstances. Because we include changes which are observed prior to the move decision between t and $t+2$, these changes are not likely to be endogenous to unobserved factors which drive the move decision (as would be the case if someone moved to take a well paying job). However, since we observe households only every two years, observed changes will have less explanatory power than they might if they were observed at higher frequency. We include separate controls for both positive and negative changes in income, positive and negative changes in the number of children, and two variables documenting changes in marital status.

Finally, geographic location can affect mobility. First, labor market differences across states may affect the propensity to move. Furthermore, since we are studying the difference between in-state and out-of-state moves, the state of residence is especially important in determining the likelihood of leaving the state. For example, a household may be less likely to move out of California or Texas, simply because they are very large states. For this reason, we include state fixed effects

movers and non-movers. Fortunately, while attrition does occur in the PSID, it is relatively low (Schonlau et al., 2011) and the representativeness of the sample does not seem to be greatly affected (Fitzgerald et al., 1998). Moreover, in order for selection to be the cause of our main findings, it would require non-moving, low LTV households to drop out of the sample at relatively high rates, which seems unlikely. We thank an anonymous referee for pointing this out.

in our preferred specification of X_i.

We assume that elements of ϵ_i are independent and distributed according to the Type-I extreme value, leading to a multinomial logit model. This assumption imposes the independence of irrelevant alternatives condition on the model. We have experimented with a nested logit framework where moving in-state and moving out of state are nested separately from the outside option of not moving. While the qualitative results using the nested logit model are unchanged, the dissimilarity parameter (i.e., nesting parameter) is not precisely estimated, nor is it stable across specifications we consider. This may be because we do not have choice-agent variation in the data. We fail to reject the null hypothesis if independence of irrelevant alternatives in 2 of 4 specifications, and we only narrowly reject the null hypothesis (p-value of .0497) in the richest specification we consider.

3 Data

We estimate the model using data collected by the Panel Survey of Income Dynamics. The unit of observation for this table is the household-year (over all years). The data indicate that about 23 percent of our observations at the time of a given survey had moved in the previous two years. According to the Census Bureau, about 14 percent of households move each year, so our sample frequency seems somewhat low, but reasonable given that some people are likely to move in consecutive years. Also, this may be due to the relatively older household heads in the survey (the mean age is 50 years old).[7] The split between interstate and intrastate moves is about right: interstate moves account for about 3.1 percent of the sample households. While there is some disagreement about mobility in more recent years (Kaplan and Schulhofer-Wohl, 2010) an annual interstate migration rate of 1.5-2.5 percent seems about right for the decade in question, suggesting that our two-year rate of 3.1 percent is within reasonable bounds.

Table 1 presents summary statistics for the variables used in the estimation conditioning on the equity status of the household. We break the sample up by whether the household rents,

[7]All our calculations apply sampling weights to the sample. This is particularly important because some groups are oversampled in the PSID. For example, African-Americans are over-sampled in the raw data (31 percent of the sample consists of this group), but applying the survey sampling weights indicates that they are 13 percent of the population.

is an above-water homeowner, or is an underwater homeowner. Relatively few homeowners are underwater in the sample, which is mostly but not exclusively drawn from pre-crisis years. About 53 percent of the sampled household-years have mortgages that are safely above water, about 10 percent are within 20 percentage points of being underwater and about 1.3 percent are, at the time of the survey, actually underwater. The remainder are renters. As might be expected, the raw move rates are much higher for renters than homeowners. However, renters also differ from homeowners on a number of other characteristics. For example, they tend to be younger, have less income, are more likely to be divorced, and have spent less time in their homes. We will see that controlling for these characteristics substantially reduces the difference in mobility for renters versus homeowners. Comparing underwater to above-water homeowners, we see that on average underwater homeowners are 50 percent more likely to undergo an in-state move than above-water homeowners. They are also more likely to move out of state, although the difference is less pronounced. Relative to the difference between renters and above-water homeowners, the difference in average characteristics of above- and underwater homeowners are small. In particular, the mean income and tenure in the house are very similar between above and underwater homeowners. However, some differences do exist: underwater homeowners are less likely to be married, and are more likely to be African-American, and are older on average. Our full model will control for flexibly control these differences as well as state and year fixed effects to determine the effect of equity levels on mobility.

4 Results

We begin with a presentation of coefficients and their z-scores from our multinomial logit model above with the full suite of conditioning variables in Table 2. This specification includes state fixed effects, which are suppressed in the table for brevity. We highlight this specification to provide a sense of the statistical importance of the background demographic variables. Following that, we will concentrate on the quantitative importance of equity for the moving decision, expressed as expected probability calculations as we vary rental status and the loan-to-value ratio of homeowners, not just in the specification of Table 2, but in a wide variety of models.

In Table 2 we present the coefficients that estimate the probability of moving in-state and out-of-state, relative to the omitted category of not moving at all. The background variables coefficients typically have the expected sign, if not always the hoped-for level of precision. Higher income households are more likely to move, and if the coefficients are any indication, higher incomes increase the out-of-state probability of moving more than the in-state probabilities. Since higher-skilled workers generally have geographically broader job markets, this is a sensible conclusion, although the z-scores for these variables do not give us complete confidence. Similarly, children appear to inhibit migration—out-of-state more than in-state, but again the precision of these estimates is low.

The coefficients for the age polynomial are, for numerical stability, based on standardized transformations of the original values. It can be seen that older households migrate less, up to a certain age, and then become more mobile as different living arrangements are contemplated after retirement or other lifestyle changes. Undoing the standardization, we find that the trough age for in-state moving probability is 69 years old. Note that the cubic term is small but negative. This would indicate that there is a local peak for moving probability, but this is well outside the range of the data and is immaterial. For out-of state moves the trough age falls to 62; again the local peak is outside the data range.

Married couples are generally the least likely to move. Every other marital category has a positive coefficient for in-state moves, though divorced and separated have much larger and more significant coefficients. None of the out-of-state coefficients in this category are precisely estimated; this is consistent with propensity to move out of state being determined more by job market conditions than social ties.

We also enter the spell length in the house as a polynomial. For both in and out-of-state moves, the coefficients are fairly precisely estimated, except for the cubic term in the out-of-state model. The fact that the cubic term is non-trivial indicates that mobility decreases in the spell length, then increases, and then decreases again, for both types of moves. Again, replacing the standardized data with actual polynomial values reveals that the local trough of the cubic is at about 13 years, while the local peak is at 29 years. For out-of-state moves the numbers are about 16 and 29 years.

The education indicators generally suggest that higher educated households are less likely to move instate and more likely to move out of state, which is somewhat congruent with the results on income, although the coefficients are in this case estimated somewhat more precisely. The only important variation in migration probabilities seen across ethnic groups in these estimates is that African-American headed households are much less likely to move out of state than the omitted category of white households. Among the change variables, the most notable results concern children, where an increase in the number of kids has a statistically significant effect on both in-state and especially out-of-state moves. Newly married couples also have a relatively low propensity to move out of state. It is also worth noting that both positive and negative changes in income are associated with increased mobility (although the coefficients are not significant in either case). This is weak evidence that moving may be associated in either a decline or improvement in labor market outcomes.

We turn now to an examination of the key variables of interest, those that describe the housing equity position of households in the sample. As is typical with discrete choice models, the magnitudes of the coefficient estimates are difficult to interpret directly. Instead, Table 3 presents the average counterfactual probability of moving in-state or out-of-state in each equity category as well as the rental category given that X_i is distributed according to the full population. Therefore, the differences between probabilities across categories represent the average marginal effect of a change in categories. Table 3 presents average moving probabilities for each loan-to-value category using four different specifications for the X_i vector of conditioning variables. Column I corresponds to a model with only the loan-to-value indicators in the model, Column II adds the demographic variables, Column III adds the trend variables, and column IV the state and time fixed effects. This last corresponds to the estimates in Table 2. As we add more controls, we are better able to control for household heads sorting into a particular LTV category due to other unobserved characteristics.

In Column I we observe that renters are, by a large degree, the category of household most likely to move, more than twice as likely than any other category of householder, and this corresponds to the bulk of research on this topic (e.g., Rohe and Stewart, 1996). Even here, however, note that move probability increases in a fairly uniform manner with homeowners' loan-to-value ratio. The probability of in-state moves increases from 7.4 percent for low LTV people up to 19 percent for high LTV households, and the increase is from 1.7 to 3.2 percent for out of state moves.

Adding the demographic variables lowers the conditional move probability for renters, quite substantially in the case of in-state moves. There is little in the way of major changes in the results for homeowners, but note that controlling for demographic characteristics raises the move probabilities for severely underwater households, and generally narrows the gap between owners and renters. This of course makes sense, since, as we saw in Table 1, renters have other attributes (i.e. they are younger and have fewer children) that make them more mobile, while homeownership tents to be correlated with attributes (i.e., married couples) that make households less mobile. Adding controls for the trend variables that track changes in household demographics has almost no effect on the move probabilities associated with above-water households, but increases the calculated probabilities of underwater and nearly underwater households by about one-half to three percentage points. Somewhat surprisingly, the addition of a full suite of state fixed effects in column IV has almost no effect on these calculations. Overall, the coefficients on a household heads equity status appear to be extremely robust to the inclusion on a large number of covariates in X_i. Of course, we are unable to control for all possible unobservables which could be correlated with equity status, but these results give us some confidence that our estimates reflect the causal impact of equity on household mobility.

While our specification contains a rich set of controls, we can still not entirely rule out the possibility that the impact of equity is biased by the presence of unobserved heterogeneity. As robustness checks, we offer four additional specifications to show that the basic result of *higher* mobility for underwater households remains. First, we augment specifications II and III from Table 3 with state level indices for housing prices and state level-unemployment rates.[8] The results remain essentially unchanged, which is to be expected since the state and year fixed effects of our preferred specification should capture a large degree of the variation in state level aggregates. Our next robustness check augments our preferred specification with characteristics of the employment status of the household head from the PSID. Specifically, we include whether the homeowner was

[8] We thank Paul Carrillo for providing state-level constant quality house price indexes. These indexes are built from county-level indexes that formed the basis for MSA indexes found in Carrillo et al. (2010). The unemployment rates are the annualized state-level rates available from Bureau of Labor Statistics.

unemployed, a member of a union, or employed in the manufacturing sector. Again, the results are essentially unchanged. Finally, since we know that our largest selection issue appears to be between renters and homeowners, we re-run the specification of Column IV focusing on homeowners alone. The results are again robust, as underwater homeowners are more mobile. While the overall mobility rates are lower, this is due to the exclusion of renters in the probability calculation, so these mobility rates represent the average counterfactual move rates of *homeowner* households rather than *all* households in the population. As we have already seen, homeowners tend to have other characteristics (e.g., age) which make them less mobile.

Our summary conclusion from these estimates is that there is no lock-in effect from underwater mortgages. Quite the opposite—those with underwater mortgages are more likely to move than above-water households, though not so likely as renters. Fears over the labor market impact of underwater lock-in appear to be even less well-grounded; severely underwater households are even more likely to move to a new labor market (to the extent that this can be defined as an out of state move) than renters. If there is a lock-in effect at all, it is the traditional one (Oswald, 1997) that centers on homeownership itself decreasing move probability. Interestingly, the proportionate decline in in-state and out-of-state mobility due to homeownership appear to be similar, although the absolute decline is much larger for in-state moves, which are much more common in general.

While our preferred specification controls for state fixed effects, it is possible that the impact of home equity varies by location within the United States. We are interested in the potential for a lock-in effect in areas which prices were particularly volatile in the housing boom and bust. In Table 5, we provide probability-of-move calculations from a multinomial logit model which allows the effect of loan-to-value ratio to differ by the location of the home. We specify a variable called *sand* if the home was located in one of the four states most hard hit by both the subprime crisis and the collapse of house prices, i.e. California, Nevada, Arizona, and Florida. We do not use state fixed effects (though we do still include time fixed effects) in this specification, thus the appropriate comparison is to Column III of Table 3, but it should be noted from Table 3's Columns III and IV that the coefficients for LTV variables are not substantively different when state fixed-effects are included. Also, in order to provide some increased precision to the estimates, we collapse both underwater categories into a single group, and also combine the 50-80, 80-90 and 90-100 groups into a single 50-100 LTV indicator. The similarity of the probabilities for these categories in Table 3 suggest that this is an acceptable reduction in parameterization.[9]

The probabilities associated with each loan-to-value category are basically the same as shown in Table 3, making allowances for the aggregation of categories. Also note that the probabilities of moving associated with sand and non-sand states are virtually the same, around 18-19 percent for in-state moves and 3-4 percent for out of state moves. The differences arise when we allow these probability calculations to be cross-tabulated. Note that for both in-state and out of state moves, sand-state households always have slightly higher mobility, except for the 50-100 loan-to-value category (where they are nearly identical anyway) and, importantly in the underwater category, where the differences are now quite large. The non-sand states' in-state move probability for underwater households is almost 6 percentage points higher than the sand states. The bigger difference comes with the out-of-state move probability, where underwater sand state homeowners have a 13.6 percent move probability, which is much higher than the out-of-state move probability of any other category of homeowner. It is these households who are the cause of Table 3 suggesting that underwater owners were more likely to move than everyone else, including renters. Note that the corresponding non-sand state probability is only 2.8 percent. However, this is not evidence for lock in, since this is still higher than the move probability for other sand state homeowners. Again, homeownership creates lock in effect, but underwater mortgages do not. This result seems to be true both in sand states and the country as a whole.

The rust belt is another region where the housing crisis has had a particularly deleterious effect. In Table 6 we repeat the exercise, replacing the sand category with the rust category, where rust refers to a trio of states whose housing markets appear to have been hit particularly hard by both the subprime crisis and the recession that was its immediate result. These states are Ohio, Michigan and Indiana. The top part of Table 6 is virtually the same as we found in Table 3, insuring that adding the rust variable has little effect on the baseline estimates of the model. The middle section

[9] Including the full set of LTV categories does not qualitatively affect the results, although the estimates are less precise. We have also estimated these specifications including job characteristics, state unemployment rates, and state housing price indices and the results are almost identical to those included in Tables 5 and 6.

demonstrates that the move probabilities for the two groups are roughly the same, although rustbelt residents appear to be slightly more likely to move in-state and slightly less likely to move out of state.

Again, interesting differences appear in the interactions between location and the loan-to-value categories. There is no systematic pattern when we compare the in-state move probabilities of the two locations across categories, although it should be noted that underwater households from both regions are more likely to move than anyone except renters. A similar pattern emerges when examining the non-rust households' out of state move probabilities, in that the underwater group is more likely to move than other owners, and in this case, are almost as likely to move as renters. However, a slightly different pattern emerges for the rust state owners. In this case, the 50-100 category are the least likely to more (1 percent probability), but the second least likely are the underwater households (1.7 percent). Thus there is a hint of lock in, if one compares underwater households to the 0-50 LTV group. This is not the natural comparison of course, since one is much more likely to move into the underwater category from the 50-100 group than from the 0-50. Becoming underwater is more likely to increase your move probability than otherwise. In any case, any lock in effect to be discerned here seems relatively minor, since the difference is only 1 percent of households in three states.

5 Conclusion

The role of housing debt as a determinant of household mobility is important to assessing how recent house price declines affect frictions in the labor market. In this paper, we investigated the role of housing equity on the propensity of households to move both in-state and out-of-state. Out-of-state moves are of particular interest since local moves are unlikely to significantly affect a households labor market prospects. We find that, for both local and non-local moves, home ownership tends to decrease housing mobility, but housing debt–and in particular being underwater—does not. If anything, we found that extreme levels of housing debt, tends to increase rather than decrease housing mobility. This suggests that the impact of house price declines on labor market frictions may be much smaller than previously supposed.

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Table 1: Summary Statistics.

	Renters		LTV<100		LTV≥100	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
In state move	0.376	0.484	0.090	0.286	0.150	0.357
Out of state move	0.059	0.235	0.021	0.142	0.023	0.151
Log income	10.080	1.006	10.933	0.887	10.959	0.939
Age	49.879	17.455	55.113	15.040	57.236	13.772
Number of kids	0.516	1.001	0.576	0.993	0.611	1.053
Single	0.299	0.458	0.075	0.263	0.081	0.273
Widowed	0.133	0.340	0.111	0.314	0.092	0.288
Divorced	0.283	0.450	0.135	0.342	0.157	0.364
Separated	0.066	0.248	0.014	0.118	0.016	0.127
High School Grad	0.312	0.463	0.303	0.459	0.290	0.454
Some College	0.215	0.411	0.211	0.408	0.223	0.416
College Graduate	0.108	0.310	0.177	0.382	0.175	0.380
Some Post-College	0.058	0.234	0.136	0.342	0.121	0.326
Unknown Education Level	0.041	0.199	0.028	0.165	0.033	0.178
African-American	0.235	0.424	0.075	0.263	0.110	0.313
Native American	0.008	0.090	0.004	0.066	0.005	0.072
Asian-American	0.018	0.133	0.016	0.125	0.017	0.129
Hawaiian/Pacific Islander	0.036	0.187	0.018	0.135	0.019	0.137
Other ethnicity	0.029	0.169	0.015	0.123	0.026	0.158
Unknown Ethnicity	0.007	0.081	0.004	0.065	0.005	0.071
Positive income change	0.189	0.460	0.149	0.326	0.172	0.366
Negative income change	0.189	0.496	0.130	0.350	0.155	0.464
Positive # children change	0.055	0.275	0.046	0.237	0.046	0.249
Negative # children change	0.128	0.455	0.104	0.348	0.102	0.335
Newly married	0.022	0.146	0.018	0.134	0.020	0.140
Newly single	0.052	0.221	0.032	0.177	0.023	0.150
Years in House	5.336	6.754	12.419	9.494	12.373	10.386
Manufacturing	0.096	0.294	0.125	0.331	0.121	0.326
Currently unemployed	0.048	0.213	0.013	0.115	0.025	0.155
Union member	0.084	0.277	0.100	0.299	0.095	0.293

Note: All calculations use PSID sampling weights.

Table 2: Results from Multinomial Logit Model.

	In-State		Out of State	
Independent variable	Coefficient	Z-ratio	Coefficient	Z-ratio
0-50 Loan-to-Value Ratio (LTV)	-1.378	-16.520	-1.154	-7.000
50-80 LTV	-1.300	-14.910	-1.290	-7.060
80-90 LTV	-1.177	-8.790	-1.072	-4.520
90-100 LTV	-1.337	-10.700	-1.360	-5.110
100-120 LTV	-0.670	-2.360	-0.600	-1.100
> 120 LTV	-0.318	-0.940	0.173	0.280
Log income	0.065	1.540	0.175	2.110
Number of kids	-0.047	-1.630	-0.099	-1.590
Age	-0.408	-6.450	-0.316	-2.740
Age squared	0.162	4.760	0.235	3.690
Age cubed	-0.001	-0.060	-0.012	-0.350
Single	0.150	1.600	-0.249	-1.340
Widowed	0.209	1.510	-0.062	-0.210
Divorced	0.367	4.520	0.093	0.550
Separated	0.469	3.080	0.161	0.500
Years in house	-0.192	-8.850	-0.176	-4.260
Years in house squared	0.009	5.010	0.005	1.390
Years in house cubed	0.000	3.320	0.000	-0.180
High School Graduate	-0.174	-2.140	-0.068	-0.340
Some College	-0.242	-2.680	0.409	2.000
College Graduate	-0.196	-1.920	0.480	2.070
Some post-graduate	-0.254	-2.140	0.521	2.100
unknown	-0.312	-2.050	0.484	1.600
African-American	0.070	0.870	-0.457	-2.580
Native American	0.230	0.710	0.563	1.060
Asian-American	-0.081	-0.370	-0.483	-1.020
Hawaiian or Pac. Island	0.053	0.260	-0.358	-0.660
Other	-0.166	-0.860	-0.461	-1.200
Unknown	-0.306	-0.930	0.235	0.470
2001	0.184	2.510	-0.131	-0.890
2005	0.098	1.270	-0.054	-0.370
2007	-0.161	-1.970	-0.324	-2.010
Positive change in income	0.107	1.670	-0.012	-0.090
Negative change in income	0.144	2.060	0.212	1.690
Increase in number of kids	0.134	1.690	0.307	2.080
Increase in number of kids	0.027	0.420	0.100	0.800
Newly married	0.243	1.450	-0.784	-2.160
Newly single, etc.	0.203	1.320	0.366	1.170

Note: Specification includes state fixed effects; N = 17,910.

Table 3: Average probability calculations.

	I	II	III	IV
In State				
Renters	0.376	0.289	0.290	0.292
	(0.007)	(0.007)	(0.009)	(0.009)
50 or Less	0.074	0.120	0.113	0.112
	(0.003)	(0.005)	(0.006)	(0.006)
50 to 80	0.116	0.123	0.119	0.119
	(0.005)	(0.006)	(0.007)	(0.007)
80 to 90	0.152	0.133	0.132	0.131
	(0.013)	(0.011)	(0.013)	(0.013)
90 to 100	0.142	0.112	0.117	0.116
	(0.012)	(0.010)	(0.011)	(0.011)
100 to 120	0.173	0.163	0.192	0.190
	(0.035)	(0.034)	(0.041)	(0.039)
over 120	0.190	0.218	0.239	0.234
	(0.043)	(0.046)	(0.057)	(0.054)
Out of State				
Renters	0.059	0.057	0.053	0.054
	(0.003)	(0.004)	(0.005)	(0.005)
50 or Less	0.017	0.027	0.027	0.026
	(0.002)	(0.003)	(0.003)	(0.003)
50 to 80	0.027	0.025	0.022	0.022
	(0.003)	(0.003)	(0.003)	(0.003)
80 to 90	0.034	0.025	0.026	0.027
	(0.006)	(0.004)	(0.005)	(0.005)
90 to 100	0.021	0.017	0.020	0.021
	(0.004)	(0.004)	(0.005)	(0.005)
100 to 120	0.031	0.031	0.038	0.038
	(0.018)	(0.017)	(0.020)	(0.019)
over 120	0.032	0.046	0.066	0.070
	(0.016)	(0.023)	(0.034)	(0.037)
Level Controls	No	Yes	Yes	Yes
Trend Controls	No	No	Yes	Yes
Year Effects	No	Yes	Yes	Yes
State Effects	No	No	No	Yes
N	23,303	23,303	17,910	17,910

Note: Standard errors in parentheses are calculated using the delta method.

Table 4: Robustness Checks.

	Indices Levels	Indices Trends	Job Chars.	Exclude Renters
In State				
Renters	0.290	0.291	0.292	
	(0.007)	(0.009)	(0.009)	
50 or Less	0.120	0.112	0.112	0.086
	(0.005)	(0.006)	(0.006)	(0.004)
50 to 80	0.123	0.118	0.120	0.102
	(0.006)	(0.007)	(0.007)	(0.006)
80 to 90	0.132	0.131	0.131	0.116
	(0.011)	(0.013)	(0.013)	(0.012)
90 to 100	0.111	0.115	0.116	0.103
	(0.009)	(0.011)	(0.011)	(0.010)
100 to 120	0.162	0.190	0.192	0.170
	(0.033)	(0.040)	(0.039)	(0.038)
over 120	0.217	0.237	0.234	0.208
	(0.046)	(0.057)	(0.055)	(0.052)
Out of State				
Renters	0.057	0.053	0.054	
	(0.004)	(0.005)	(0.005)	
50 or Less	0.026	0.026	0.026	0.022
	(0.003)	(0.003)	(0.003)	(0.002)
50 to 80	0.025	0.022	0.022	0.023
	(0.003)	(0.003)	(0.003)	(0.003)
80 to 90	0.025	0.026	0.027	0.029
	(0.004)	(0.005)	(0.005)	(0.006)
90 to 100	0.017	0.021	0.021	0.022
	(0.004)	(0.005)	(0.005)	(0.006)
100 to 120	0.030	0.037	0.038	0.040
	(0.016)	(0.020)	(0.019)	(0.022)
over 120	0.047	0.071	0.068	0.065
	(0.023)	(0.036)	(0.036)	(0.034)
Base Specification	II	III	IV	IV
N	23,303	17,910	17,910	12,234

Notes: Standard errors in parentheses are calculated using the delta method. The first two columns report the extension of specification II and III in Table 3 adding controls for state-level price and unemployment indices. The third column (Job Chars.) reports the extension of specification IV in Table 3 to include dummies for if the head of household was unemployed, worked in the manufacturing sector, or was a union member in the twelve months preceding his interview. The fourth and final column drops renters from specification IV in Table 3 to compare homeowners exclusively to other homeowners.

Table 5: Heterogeneous Effects for Sand States.

	In-State		Out of State	
	Prob.	Std. Err.	Prob.	Std. Err.
LTV category				
Renters	0.290	0.009	0.053	0.005
0-50 LTV	0.112	0.006	0.026	0.003
50-100 LTV	0.121	0.005	0.022	0.002
>100 LTV	0.210	0.033	0.047	0.016
State Category				
Non-Sand	0.177	0.004	0.031	0.002
Sand	0.191	0.008	0.037	0.004
LTV-State Interactions				
Renter*Non-Sand	0.285	0.009	0.051	0.005
Renter*Sand	0.309	0.019	0.061	0.011
0-50*Non-Sand	0.109	0.006	0.024	0.003
0-50*Sand	0.128	0.014	0.035	0.007
50-100*Non-Sand	0.120	0.006	0.023	0.003
50-100*Sand	0.124	0.014	0.019	0.005
>100*Non-Sand	0.219	0.037	0.028	0.013
>100*Sand	0.162	0.078	0.136	0.066

Note: Standard Errors calculated using delta method; N = 17,910.

Table 6: Heterogeneous Effects for Rust States.

	In-State		Out of State	
	Prob.	Std. Err.	Prob.	Std. Err.
LTV category				
Renters	0.290	0.009	0.053	0.005
0-50 LTV	0.113	0.006	0.026	0.003
50-100 LTV	0.120	0.005	0.023	0.002
>100 LTV	0.209	0.034	0.047	0.018
State Category				
Non-Rust	0.177	0.003	0.034	0.002
Rust	0.194	0.009	0.022	0.004
LTV-State Interactions				
Renter*Non-Rust	0.286	0.009	0.055	0.005
Renter*Rust	0.318	0.020	0.034	0.009
0-50*Non-Rust	0.113	0.006	0.027	0.003
0-50*Rust	0.112	0.014	0.025	0.008
50-100*Non-Rust	0.117	0.006	0.025	0.003
50-100*Rust	0.139	0.015	0.010	0.004
>100*Non-Rust	0.209	0.036	0.052	0.021
>100*Rust	0.209	0.085	0.017	0.017

Note: Standard Errors calculated using delta method; N = 17,910.