Housing Price Shocks, Leverage, and Mobility

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Abstract

This paper assesses the impact of housing leverage on the mobility of homeowners. For identification, I exploit a policy innovation in the form of Tax Reform Act, 1986 (TRA) to address an increase in housing leverage. The TRA eliminated the tax deductibility on all personal loans except for interest payments on mortgage debt. This tax-shield encouraged homeowners to increase housing leverage by switching from unsecured to secured loans (mortgage debt). Higher housing leverage brought about by the TRA implies that a given change in housing prices has a bigger impact on homeowners' net worth. In particular, in falling markets, fewer funds are available (after sale of the existing house) for downpayment to buy a comparable new house. Using PSID data for the period, 1983-1997, I find that the higher housing leverage due to the TRA constrains the mobility of homeowners. However, the TRA has no impact on the mobility of renters.

1 Introduction

In this study, I investigate the role of housing leverage on the mobility of homeowners. The housing market crash during the recent financial crisis eliminated a significant amount of housing equity. Many homeowners with escalated housing leverage found themselves, subsequent to the housing market crash, with negative equity. An ongoing debate among academics and policymakers is whether negative equity, due to housing leverage, affects the mobility of homeowners.[1] The debate seems to ignore the impact of housing leverage on the mobility of those homeowners with positive equity. This paper documents some striking evidence on the effects of the housing leverage on the mobility of homeowners with positive or negative equity.

Figure 1 shows a decline in mobility of households during the period, 1983-1997.[2] A natural question is what caused this decline in mobility. Stein (1995) offers an explanation where housing leverage can play a critical role. Housing prices tend to be locally correlated. In the presence of higher housing leverage, a negative price shock in the housing market can eliminate a substantial amount of net worth in the form of housing equity for many homeowners simultaneously. Assuming that net worth on the existing house largely determines the downpayment on a new house, homeowners with reduced housing equity might choose not to sell since they would have lower funds left for down payment on a new house. This paper documents evidence that higher housing leverage constrains homeowners' mobility. The question has important public policy implications, for evidence that housing leverage decreases mobility would suggest substantial impediment to the adjustment process that sees workers in employment-poor areas relocate to those with more plentiful employment opportunities.

For identification, I address a policy innovation, the Tax Reform Act, 1986 (TRA) that resulted in higher housing leverage. A key change this reform brought into effect was the elimination of tax deductibility on all personal loans except for interest payments on mortgage financing. This provision limited the tax-shield only for mortgage financing. The policy change generated a substitution effect where existing homeowners switched from unsecured loans (such

[1] See Ferreira, Gyourko, and Tracy (2010, 2011), Schulhofer-Wohl (2011), and Coulson and Grieco (2013) among many.

[2] The data on mobility are from the Panel Study of Income Dynamics (PSID).

as auto loans or credit card balances) to secured loans (mortgage financing). This policy innovation provided homeowners an incentive to increase their borrowing against their home equity. Higher housing leverage brought about by the TRA implies that a given change in housing prices has a bigger impact on homeowners' net worth. In particular, in falling markets, fewer funds are available (after the sale of an existing house) for down-payment to buy a comparable new house elsewhere with better economic prospects. Hence, housing leverage can adversely affect homeowners' mobility.

In the first set of tests, I estimate the sensitivity of mobility to changes in net worth in the presence of the higher housing leverage due to the TRA. For a 1%, 5%, and 10% fall in housing prices, there is a corresponding 1%, 3%, and 4% additional decline in mobility of homeowners who moved from an owned house to another owned house. Second, I find that the housing leverage increases more in higher-tax vs. lower-tax states. Next, due to the higher leverage, the sensitivity of mobility to changes in net worth in the presence of the higher housing leverage due to the TRA is more pronounced in higher-tax vs. lower-tax states. Further, sensitivity of mobility to changes in net worth in the presence of the higher housing leverage is not due to the falling mortgage rates. Finally, higher housing leverage due to the TRA has no impact on the mobility of those households who move between rental housing.

This study makes two major contributions. The first contribution is to document the evidence that housing leverage affects the mobility of homeowners (with both negative and positive equity). The second contribution is to exploit, for the first time in literature, a policy innovation in the form of the TRA to address an increase in housing leverage.

The rest of the paper is organized as follows: Section 2 reviews the literature. Section 3 provides the hypothesis development. Section 4 describes the data. Section 5 discusses the identification strategy. Section 6 presents empirical analyses. Section 7 concludes.

2 Literature Review

This paper is related to several strands of the literature. The first strand is housing and life cycle consumption. A household faces two objectives simultaneously: smoothing the life-

time housing consumption and optimizing the investment portfolio (Henderson and Ioannides (1983)). A house may also be conceived of as an asset with housing services coming from it as dividends, in the spirit of Lucas (1978). Housing as an investment can be an important channel for many households through which to acquire and accumulate wealth, during their life cycle, for retirement (Modigliani and Brumberg (1954)). Consider a negative price shock that eliminates a considerable amount of housing equity. For those homeowners with higher housing leverage, the shock can even trigger a negative equity. A major distortion of debt overhang is that it can potentially spark a lock-in effect where a homeowner cannot move. As a result, the homeowner, if locked-in, might not be able to take up a potentially better employment opportunity elsewhere which, in turn, may adversely affect their retirement wealth or life cycle consumption.

The second strand is the literature on negative equity and mobility. Ferreira, Gyourko, and Tracy (2010, 2011) use American Housing Survey owner-occupied housing data from 1985 to 2009 to show that negative equity lowers mobility. Coulson and Grieco (2013) document similar results, but also conclude that negative equity has no lock-in effect on mobility. However, Schulhofer-Wohl (2011) claims that negative equity has no impact on mobility. The claim also understates the impact of housing price shocks on the mobility of those homeowners with positive equity. Stein (1995) and Shleifer and Vishny (1992) predict reduced mobility rates due to housing price shocks even for those households with positive equity. Behavioral literature also has similar implications. Genesove and Mayer (2001)) and Engelhardt (2003) document that loss aversion can have an adverse impact on mobility for those homeowners even with positive equity. This study attempts to assess the effects of housing price shocks on the mobility of those homeowners with positive equity as well.

The third strand is the emerging literature that explores the link between the credit supply and housing markets. A significant finding, in this strand of literature, is that with an increased supply of credit, there has been a persistent increase in both household debt (Mian and Sufi (2009)) and mortgage debt (Campbell (2006)). An oft-made explanation is that easy access to cheaper credit in mortgage financing (figure 2) fueled housing prices by boosting housing demand. Rice and Strahan (2010) document the role of the banking deregulation that resulted

in a higher mortgage supply (Favara and Imbs (2014)). Higher liquidity due to increased securitization, for conforming loans (Adelino, Schoar, and Severino (2012)) and non-jumbo loans (Loutskina and Strahan (2009)), also helped mortgage lending. However, the easy credit policy only explains the supply side of the issuance of credit and the increased mortgage levels; it does not unambiguously explain the incentive for the increased demand for the higher leverage ratios. Glaeser, Gottlieb, and Gyourko (2013) argue that cheap credit alone can not explain such an increase in housing leverage. Thus, the question as to, what prompted homeowners to increase their leverage ratios, remains to be answered. This paper provides a demand side identification, in the policy innovation (Tax Reform Act, 1986), that generated a substitution effect that provided homeowners an incentive to switch from non-housing leverage to housing leverage.

The fourth strand is the extant literature on the leverage-related issues in housing markets, which several studies have investigated. Keys, Mukherjee, Seru, and Vig (2010) show that the agency issues within the securitization process led to the suboptimal mortgage lending that had a higher likelihood of default right from the beginning. Foote, Gerardi, and Willen (2008) show the impact of debt overhang (negative equity) on mortgage defaults. Another study by Guiso, Sapienza, and Zingales (2013) presents the impact of debt overhang on strategic defaults. Different states have different law-enforcement regimes for mortgage defaults. Ghent and Kudlyak (2011) show that the likelihood of mortgage default is higher in recourse vs. non-recourse states. [3] Debt overhang that can lead to a potential mortgage defaults has not only economic but also significant social costs. Li and White (2009) document the increased incidence of personal bankruptcies due to mortgage defaults. Campbell, Giglio, and Pathak (2011) document evidence that shows the discount due to fire sales on the prices of already foreclosed houses. These studies and several others have documented the impact of debt overhang when homeowners with negative equity cannot manage to make their mortgage payments. Melzer (2010) shows the impact of debt overhang on the underinvestment in house remodeling by homeowners that stay in their homes. However, the question, as to how housing

[3] However, Kuchler and Stroebel (2009) show that, in the short run, a switch from non-recourse- to recourse-mortgage contracts has little impact on foreclosures and bankruptcies.

leverage affects those homeowners with positive equity, who, would have moved in the absence of the housing price shocks, remains an open question.

Finally, this paper is closely related to Stein (1995) and Lamont and Stein (1999). Stein (1995) presents a theoretical model that explains why the trading volume or liquidity in the housing markets is higher in rising markets than in falling ones. Lamont and Stein (1999) empirically test the liquidity effect of Stein (1995). Their main result is that in cities with higher housing leverage, housing prices are more sensitive to local economic shocks. In other words, leverage amplifies the sensitivity of the housing-price risk to (local) economic shocks. This paper extends the work of Stein (1995) and Lamont and Stein (1999) by focusing on mobility.

3 Hypothesis Development

A mortgage loan can be viewed as a long-term loan that consists of several short-term ones. To buy a house, a potential homeowner needs to make at least a minimum downpayment as a proportion of the value of the house. This practice is akin to the concept of posting collateral for an investment in another financial asset such as a security. After the acquisition of the house, a typical homeowner (mortgagee) makes regular, often monthly, mortgage payments to lender (mortgagor). A typical mortgage payment is made up of two parts: one part that covers part of principal, which can be viewed as a short-term loan and the second part that covers the interest on the outstanding mortgage balance. Hence, a typical mortgage payment includes debt servicing (interest on the long-term loan) and the repayment of a short-term loan (amortization). Although a homeowner needs to satisfy a minimum collateral requirement (downpayment) to buy a house, after the acquisition, he is not obligated to keep up this collateral ratio. In contrast, in other financial asset markets, margin requirements can be strictly followed. The minimum down-payment is more like a onetime barrier to buying a house than a dynamic constraint. Myers (1977) models debt overhang for corporate firms in a partial equilibrium setting where excessive leverage can impede firm investment. Quigley (1987) argues that households adjust their housing consumption to the equilibrium level by

moving. If, in the spirit of Myers (1977), moving is considered a positive NPV project then immobility, due to housing leverage including negative equity, is similar to underinvestment.

What is the mechanism for housing leverage to constrain mobility? I follow Stein (1995) that offers a rational explanation. In a theoretical model, he addresses two related questions into the housing market - one, what accounts for fluctuations in house prices, and two, why trading volume is higher in rising markets than in falling markets. Lamont and Stein (1999) document empirical evidence for the first question that the impact of an economic shock on house prices is more intense in those cities with higher vs. lower leverage. This study picks up on the second question. The key idea is quite intuitive. For a given change in housing price level, higher housing leverage results in more pronounced fluctuations in homeowners net worth (housing equity). If housing equity on the previous house largely determines the downpayment on the next house then, in falling housing markets, homeowners with substantial housing leverage might be left with fewer funds (housing equity). He argues that the reason leverage can play an important role in housing market is that the potential for stabilizing arbitrage is limited (Shleifer and Vishny (1997)), since, in contrast to other financial markets such as equity markets, a small set of arbitrageurs in housing market might have diminishing returns to owning more than one house.

In his model of repeat buyers, households own house with leverage, and derive positive gains if they move for reasons such as better jobs and better schools among many. Stein (1995) divides homeowners into three groups - unconstrained movers, constrained movers, and constrained non-movers. Consider a negative price shock in the housing market. In response to the shock, the unconstrained movers in his model are sufficiently wealthy that financial constraints have no effect on their moving behavior. The constrained movers in his model face binding financial constraints, so in falling markets, they trade down if they move. Finally, homeowners in the third group (constrained non- movers) in the model are so financially constrained that, in spite of the potential gains from moving, they choose not to move. For our purposes, Stein (1995) implies that if housing leverage were to increase then the proportion of the third group constrained non-movers would rise, hence higher housing leverage will result in a larger drop in mobility. This may impede the adjustment process in the labor market that

sees that homeowners are locked-in due to housing leverage in employment-poor locations and not being able to move to employment-rich locations. Thus, our hypothesis is:

Hypothesis: Ceteris paribus, for a given fall in housing prices (leading to a fall in housing equity), the probability of moving will be lower for the homeowner with higher vs. lower housing leverage.

4 Data and Summary Statistics

4.1 Data

The empirical analysis in this paper is based on the Panel Study of Income Dynamics (PSID) household data from the University of Michigan. Survey data have been collected since 1968. The sample selected in this study spans the period 1983 to 1997 because this is the only horizon where all the variables of interest are available on an annual basis. The information on outstanding mortgage balances in the PSID files is missing for the year, 1982, which confines us to starting our sample from 1983. The end year of our study horizon, 1997, was the last wave during which the PSID data were collected annually; afterward, the PSID has been collecting its data, biennially. The data are structured into two types of files: individual and family. While the family files have only one observation per family for each wave, the individual files could contain information that pertains to many members in a family in a given wave. This study uses family-level information. However, it uses some information from individual files, such as employment status and education. I conduct my analysis at the state level since the PSID data in the public domain are available only at this level. Each wave inducts some new families into the sample and some families from the past also stop responding. This study considers only the responding families. The data collected encompasses almost all states in the US. The data include various socio-economic-demographic features across these states and, by and large, they do a good job in representing the population. For our purposes, the most important feature of the data is that they are panel, which allows us to compute the leverage ratio by using the information on the outstanding mortgage balance on the last-owned house in the year prior to a move. Also, the observed changes in household-specific economic and

social characteristics are nicely tractable with the panel.

Examination of such data has at least three advantages. First, assuming household behavior is similar across states, a negative price shock in some state provides a setting where the differential impact of the shock in that state can be compared with other states. Second, state-level price shocks identified in this study are of rather moderate intensity. It is interesting to observe how even these moderate price shocks affect mobility. Third, the absence of other economic shock(s) (unlike during the recent crisis) allows us to focus solely on housing markets.

The following selection criteria were used before analyzing the data. Two PSID variables, ER30001 and ER30002, uniquely identify an individual household head. The PSID tracks all individuals in a family unit. It also provides a variable, sequence number, that describes the relationship of an individual to the head in the family. This variable always takes the value one for the household head. I set the sequence number equal to one to uniquely identify a family. In the data, there are 9981 families that span 15-year period 1983 to 1997. The panel is unbalanced as only 12.5% of these household units are observed for all these years. Among homeowners, the sample is restricted to only those households that moved from an owned house to another owned or rental house. Since the sample is annual, I consider those homeowners who moved between the two (annual) interview waves. A household could have a spell that ranges from one to several years. A household's spell is computed as the number of years between move-in and move-out of an owned house.

4.2 Variable Construction

Household moving decisions are dynamic and could remain empirically unobservable. I construct several controls that might affect the moving decision. Employment status, tenure in a current job, income, gender, and racial status are included in order to capture household socio-economic differences. Employment status is a binary variable that takes the value one if a homeowner is employed; otherwise, it is zero. Tenure is measured as the number of years in an existing job. Income is measured in logs. I also include education, which is a measure of future income potential as argued by Gyourko and Linneman (1996). Education is a variable

that takes discrete values from in an ascending order 0 to 17 that denote the number of years of education. Zero means no education, while 17 means some post-graduate work. Gender is a binary variable that takes the value one if a homeowner is male; otherwise the value is zero. Ethnicity is also a binary variable that takes the value one if the homeowner is white; otherwise, it is zero. To capture the tastes and preferences of the household, I include marital status, family size, and the age of the household head. Marital status is a binary variable that takes the value one if the homeowner is married; otherwise the value is zero. Family size is the number of members in the household unit. Age is the age in number of years for each household member, as reported by these households. A move can also be influenced if there are young children in the household. Households with young children may move less. I include a binary variable that takes the value one if there is child less than six years old in a family unit; otherwise the value is zero. To control for housing supply, I include a housing-elasticity measure developed by Saiz (2010). This measure is based on geographical topography. Saiz (2010) shows that cities with higher supply elasticities have slower growth in housing prices compared to cities with lower housing-supply elasticities. Since local housing supply can potentially influence moving decisions, a proxy is needed to control for such a possibility. The loan-to-value ratio (LtV) is employed as the ratio of outstanding mortgage balance to the reported value of the house, i at time, t in the year prior to a move. For those households that do not have mortgage financing, the ratio is zero. This paper focuses on the financial effect, but moving decisions could also be affected by wealth effect. To ensure that our results are not biased, due to the omission of the wealth effect, I construct a measure of wealth by summing up the income data of each homeowner over the horizon of the study. To normalize, I take the logs of the summed variable. The information on the decision to move is provided by the PSID, which asks whether an interviewed homeowner had moved into a new house since the last wave of the survey. "Move" is a binary variable that takes the value of one if there is a move; otherwise, it is zero. To account for the cost of capital for homeownership, I include user costs as suggested in Poterba (1984). However, an issue with this measure is that it is not risk-adjusted. To address this concern, I compute the house-price risk separately. The computation of user costs and housing-price risk is described in next two subsections.

4.2.1 Risk

The literature has documented some stylized facts about housing returns and volatility. One of the stylized facts of housing markets is that they follow local economic dynamics. To capture local economic cycles, I employ two state-level variables: per capita income and the unemployment rate. I use lagged per capita income in logs and lagged unemployment rates. Case and Shiller (1989) document that housing markets are inefficient in the short run (11 months), I include lagged returns up to the tenth order to capture any possible dependence. To compute the house-price risk, I set up a GARCH (1,1) process (Bollerslev (1987)). GARCH (1,1) is a parsimonious process used to capture volatility clustering, which might be relevant for housing markets. Thus, an AR (10)-GARCH (1,1) process simultaneously addresses the house-price adjustment dynamics and the local market conditions. The resulting returns and volatility processes are as follows:

$$R_{s,t} = \mu + \sum_{i=1}^{10} \rho_i R_{s,(t-i)} + \gamma_1 log(PCSGDP)_{s,(t-1)} + \gamma_2 Unemp_{s,(t-1)} + u_{s,t} \tag{1}$$

$$u_{s,t} = \epsilon_{s,t}\sqrt{\sigma_{s,t}} \tag{2}$$

$$\epsilon_{s,t} \sim N(0,1) \tag{3}$$

$$\sigma_{s,t} = \alpha_0 + \alpha_1 u^2_{s,(t-1)} + \beta_1 \sigma_{s,(t-1)} \tag{4}$$

The house-price index data come from Freddie Mac, the per capita state gross domestic product (PCSGDP) information is derived from the Bureau of Economic Analysis, and the unemployment rates come from the Bureau of Labor Statistics. The house-price index data are available from 1975 to 2013, and the unemployment rates are available from 1976 to 2013, but the PCSGDP data are only available to 2012. Thus, I use data from 1976 to 2012 to estimate the above GARCH process. I take the monthly state-wise house-price index data from Freddie Mac and convert them into returns for each state. There are at least two benefits to this extended and monthly computation of house-price risk. First, it exploits the full information about house prices, unemployment, and the PCSGDP available until recently to

compute housing price risk. Second, the GARCH performs better with more (monthly vs. annual) observations.

At exploratory levels, I find (in unreported results) that the house-price processes, for most of the states, are (positive) trend stationary. And the computed returns are mean reverting with varying levels of clustering for different states. Some state series, such as California, are more volatile than the others. As expected, the coefficient on per capita income (in logs) is positive, and the coefficient on the unemployment rate is negative in the unreported results. For several states, the coefficients on the lagged returns are statistically significant up to the tenth order.

This setup provided us with conditional returns and volatilities on a monthly basis. Conditional monthly series are mapped into annual returns. "Conditional volatility" is our proxy for house-price risk, and "conditional return" is our proxy for expected capital gains to be used next to compute user cost.

4.2.2 User Cost

As suggested in Poterba (1984), user cost for households is calculated analytically for each household i in the sample for each time t.

$$UC_{it} = (1 - t_{st})[LtV_{it} * r_{mt} + (1 - LtV_{it}) * r_{ft} + proptax_{it}] + dep_{it} - E_t(ret_{st}) \tag{5}$$

User cost, UC_{it}, is simply the sum of the cost of the outstanding mortgage, the opportunity cost of the (housing) equity, property tax, and depreciation minus the expected capital gains for each household i at time t. The mortgage cost of debt, the opportunity cost of equity, and the property tax payments are tax deductible. Depreciation is assumed to be a flat 6%. The expected capital gains at the state level are computed, as expected, conditional returns from the AR(10)-GARCH (1,1) process from the preceding section. The personal federal and state marginal tax rates are obtained from the TAXSIM model at the National Bureau of Economic Research (NBER) (Feenberg (2010)), the risk-free rates from the Federal Reserve,

and the 30-year mortgage rates from Freddie Mac. The PSID provides the individual property tax payments for each household, i at time, t except in 1988 and 1989. Moreover, some states (mainly New England states) have differential estimation method for the property tax. I follow Flavin and Yamashita (2002) to compute property tax for the missing years. All variables are on an annual basis.

4.3 Summary Statistics

Table 1 presents summary statistics of the variables that we employ in the subsequent regressions and tests. The sample contains 37,267 observations for 9,631 homeowners who moved from an owned house to another owned house. In our sample, some homeowners move, while others do not. Both types of moves, with or without mortgage financing, are included in our analyses. In our sample, a homeowner has an average of nearly 13 years of education (EDUCATION) with a standard deviation of nearly three years. The mean age (AGE) of a homeowner who decides to move is almost 47 years with a standard deviation of nearly 15 years. Nearly 74% of the homeowners who move are married (MARRIED) with an average family size (FAMILY SIZE) of three members. 25% of the homeowners who move have a child less than six years old (YOUNG CHILD). 72% of the homeowners who move are employed (EMPLOYMENT), and have an average of nearly six years of experience (TENURE) in their current job. 80% of the homeowners who move are males (GENDER), and approximately 70% are Caucasian (ETHNICITY). Homeowners live an average of ten years in the last-owned house (SPELL) before moving into the next one. INCOME is the natural logarithm of total nominal annual income of the household. WEALTH is the natural logarithm of the aggregation of the incomes of the homeowner over the sample period. HOUSING SUPPLY is the Saiz's housing-elasticity measure ((Saiz (2010)). Broadly speaking, it can be inferred that, a typical homeowner who decides to move is more likely to be a white male in his forties with a family and a job.

5 Identification

The PSID collects household-level data from annual surveys. The potential issues regarding measurement error and omitted variable biases are rampant. A major concern is endogeneity of housing leverage. For identification, this paper employs a strategy that addresses a policy innovation.

The Tax Reform Act, 1986 (TRA) came into effect in 1987. The TRA was an overhaul of the personal income taxation system [4] in the US. For our purposes, a key change that the TRA brought into effect was the elimination of tax deductions on all personal loans except for interest payments on mortgage financing. This favored tax deduction provision for interest payments on mortgage financing limited the tax-shield only for mortgage financing that generated a substitution effect in which the existing homeowners had an incentive to switch from unsecured loans (such as credit card balances and auto loans) to secured loans (mortgage financing). The purpose of this exclusive tax-shield for mortgage financing only was to encourage home ownership, but existing homeowners could also exploit this tax-shield by obtaining more mortgage financing on their home equity to pay off their expensive personal loans. This policy innovation allowed homeowners an incentive to borrow more against their home equity. In Stein (1995) model, higher housing leverage adds to financial constraints. Therefore, for a given change in housing prices, higher housing leverage will entail greater fluctuations in homeowners net worth. In particular, in falling markets, after the policy change that led to higher housing leverage the proportion of constrained non-movers is likely to go up. Thus, according to our hypothesis, the policy innovation, the TRA, led to higher housing leverage potentially resulting in reduced mobility.

6 Empirical Methodology and Results

In this section, we present the results of the effect of debt overhang mediated by the policy innovation and the state-level housing price shocks on mobility. We first present the results of

[4] Personal marginal taxation rates were drastically slashed, however, an oft-made argument is that the effective taxation rate was largely unchanged.

our univariate tests, and then we move on to the multivariate analyses.

6.1 Univariate Tests of Relation between Mobility, State-level Housing Price Shocks, and the Policy Innovation

First, we ask whether the TRA resulted in higher housing leverage. Panel B of Table 1 presents the univariate statistics for LtV before and after the TRA. The median LtV increased from 26% during the pre-TRA period to 31% during the post-TRA period. Next, we turn to the mobility rates. Table 1 also presents the univariate (means) tests of differences in the mobility before and after the TRA. Panel B presents the changes in the mobility before and after the TRA. Mobility declined from 10.7% during the pre-TRA period to 9.6% during the post-TRA period. The differences in mobility and housing leverage (LtVs) are statistically significant at all conventional levels.

6.2 Multivariate Analysis of Relation between Mobility, Housing Leverage, and the Policy Innovation

The standard approach in the literature is to use loan-to-value ratios to proxy housing leverage. However, a major concern is that LtV can be endogenous. Different households may have different tastes and preferences towards loans. Lower-income homeowners may have a higher preference or a need for higher loans. Higher-income people may also go for higher leverage in order to exploit the tax benefits as suggested by Poterba (1991). People who are more careful tend to have less leverage. Also, it is possible that the loan amounts and terms might be selected by the lenders. Mortgage lending might also be correlated with social (racial), economic (net worth and income), financial (idiosyncratic risk factors), geographic (neighborhood factors), market conditions (liquidity of the financial markets especially the mortgage-backed securities markets), agency issues (lenient loan approval standards, especially during the recent period (Keys, Mukherjee, Seru, and Vig (2010))), and personal background (education, nationality, and employment status among others). Even after including a host of controls, many relevant factors for leverage remain unobservable, and, therefore, the relevant nested restrictions go untested. A common approach used in the literature to deal with endogeneity

problems is to employ the instrumental variable methodology, and make use of instrumental variables to generate exogenous variation in the endogenous variables. However, instrumental variable estimation presents several challenges. Finding good instruments is rather difficult since they should have a relatively high correlation with endogenous variables and be uncorrelated with household characteristics that we study.[5] The strategy I follow is as follows. The TRA generated an incentive for homeowners to escalate their housing leverage, and hence, the policy change is highly correlated with the housing leverage. Thus, the policy change variable can be employed to address the increase in housing leverage to investigate its impact on mobility. This strategy not only alleviates the endogeneity issue with mortgage financing but also takes care of the measurement error issue associated with self-reported house values (that we use to compute LtVs). To measure the changes in housing price, I follow Lamont and Stein (1999), and compute annual growth rate of state-level housing price indices.

The TRA affected every household in every state, hence identifying a control group is problematic. The methodology I employ is widely known as treatment effect or BA (before-after) methodology (Marcantonio and Cook (1994)).[6] The specification is as follows:

$$\begin{aligned} Pr(Mobilty)_{i,t} = \quad & \beta_1 AnnPriceGrowth_{s,t} \cdot Policy\Delta Dum_t + \beta_2 Policy\Delta Dum_t \\ & + \beta_3 AnnPriceGrowth_{s,t} + \gamma X_{i,t} + State_s + Year_t + \epsilon_{i,t} \end{aligned} \tag{6}$$

Next, I interact the annual (state-level) housing-price changes with the dummy variable for the policy innovation to assess the average impact of a house-price change on the mobility of all homeowners due to the increased housing leverage from the policy change. Stein (1995) implies that, higher housing leverage following the TRA, a change in housing price will result in a greater fluctuations in net worth (home equity) of homeowners. Net worth on the existing house largely determines the downpayment on the next house. In particular, in falling housing market, in the presence of the increased housing leverage following the TRA, fewer funds are available after sale to make a downpayment on a comparable house elsewhere with better

[5] See Lamont and Stein (1999) for a discussion on the lack of good instrumental variables.

[6] See Roberts and Whited (2012) for discussion and Nini, Smith, and Sufi (2009) for application.

economic prospects. Thus, a positive and significant coefficient on the interaction variable implies that, after the TRA that resulted in higher leverage, the sensitivity of mobility to housing-price changes for homeowners considering a move has increased. The impact of the TRA, θ_2, is expected to be negative since the TRA created a tax-shield that favored higher mortgage financing. θ_3 denotes the impact of change in net worth on mobility. We expect a negative coefficient on θ_3 for a fall in net worth to induce mobility to make up for economic losses.

$X_{i,t}$ is the set of other control variables: total income in logs, wealth in logs, family size, race, gender, marital status, age, education in years, tenure in the present job, spell (number of years resided) in the last owned house, employment status, a binary variable for the age of the youngest child to be equal to or less than six, house-price volatility, user cost, and a geographical elasticity measure to control the housing supply. Even after employing a host of these control variables, there still might be some differences across states, such as culture and local tastes, that may remain unobserved. To address such concerns, state dummies are included to capture state-specific unobserved heterogeneity. Finally, year dummies that capture macroeconomic effects are also included. Since the data are state-specific, state shocks have a potentially time-varying component. The residuals are clustered by state. Favara and Imbs (2014) point out the advantage that clustering by state is more general than state-year clustering that does not allow for serial correlation.

Table 2 reports the results of the above specification. Columns 1 and 2 report the marginal effects of the above specification from probit regressions without and with control variables, respectively. We find that the interaction term, sensitivity of mobility to house-price movements from the higher leverage due to the TRA, even after controlling for their direct effects, is positive and significant indicating that after the policy change that resulted in higher housing leverage, a negative (positive) growth in housing prices led to lower (higher) mobility. In other words, after the policy change, the sensitivity of mobility to housing-price changes for homeowners escalated. Next, we interpret the control variables. An additional year of education has a positive impact on mobility. An additional year of age lowers the probability of moving. A negative and statistically significant coefficient on marital status implies that, for two hypo-

thetical homeowners with all else being equal, the probability of moving is lower for a married homeowner than for an unmarried one. The mobility is significantly higher for male homeowners vs. female homeowners. The mobility is significantly higher for white homeowners than for non-whites. The mobility significantly decreases as the family size increases by an additional member. The marginal effect of Saiz's housing-elasticity measure is positive and statistically significant, suggesting that homeowners tend to move more as the housing supply (wider or better options) increases. The probability of moving declines as the tenure (number of years in a job) increases by one year. Mobility decreases as the spell (number of years residing in the existing home) goes up by one year all else being equal. This suggests that the lumpy transaction costs associated with the move or that psychological factors (Genesove and Mayer (2001)) may be relevant. To address any bias associated with probit regressions, in column 3, results from ordinary least squares (OLS) regressions are reported.

Subsequent to housing pricing shocks, job options might be poor, and, therefore, it may be optimal to move elsewhere with better economic prospects. For a 1% fall in housing price, the mobility decreases by 1.1% from 10.7% during the pre-TRA period to 9.6% during the post-TRA period. Similarly, for a five percent fall in housing price, the mobility declines by 2.8% from 11.7% during the pre-TRA period to 8.9% during the post-TRA period. And, for a ten percent fall in housing price, the mobility falls by 3.7% from 12.2% during the pre-TRA period to 8.5% during the post-TRA period. To alleviate any skepticism, I run the above specification with state-level unemployment growth rates instead of housing-price changes, and obtain similar (unreported) results. In summary, the results in this section, that the effect of the higher housing leverage following the TRA on mobility was negative, support our hypothesis.

6.2.1 Validity of the TRA for the Increased Housing Leverage

Based on univariate and multivariate results in previous sections, we found that the increased leverage, due to the TRA, resulted in lowered mobility. One may argue that the TRA variable might be merely picking up some time-variation effect. In this section, we address this concern. The best way to test the validity of the relevance of the TRA is to investigate the mobility in

higher- vs. lower-tax states. Differential tax rates across can cause a substantial variation in tax savings.

According to our argument, that the TRA created a tax-shield, the tax savings should be greater in higher- vs. lower-tax states. If the TRA variable is picking up some time-variation effect then we expect to observe no differential effects of the increased housing leverage (due to the TRA) on the mobility of the homeowners in higher- vs. lower-tax states. First, I test the effect of the TRA on housing leverage in higher- vs. lower-tax states. The specification is as follows:

$$\begin{aligned} LtV_{i,t} = \quad & \beta_1 HIGHERTAXSTATES_{s,t} \cdot Policy\Delta Dum_t + \beta_2 Policy\Delta Dum_t \\ & + \beta_3 HIGHERTAXSTATES_{s,t} + \gamma X_{i,t} + State_s + Year_t + \epsilon_{i,t} \end{aligned} \tag{7}$$

The dependent variable, LtV, is a proxy for housing leverage for each homeowner on an annual basis. I create a dummy variable, HIGHERTAXSTATES, that takes value one for a state where the marginal tax rate is greater than its median across all states for a given year, else zero.[7] Policy change variable is defined the same as before. We expect a positive coefficient on β_1 for the TRA to have a differential (positive) impact on housing leverage in higher-tax states. Table 3 reports the results of the effect of the TRA on housing leverage from ordinary least squares regression. As hypothesized, the coefficient on the interaction term is positive and significant. Hence, the results suggest that tax savings on mortgage financing due to the TRA led to higher housing leverage in higher-tax states.

Next, I test the effect of the increased higher housing leverage due to the TRA on mobility in higher- vs. lower-tax states. If the policy change led to higher housing leverage then we expect to observe a higher sensitivity on the interaction term due to the higher housing leverage following the TRA for homeowners in higher- vs. lower-tax states. The specification is the same as in the preceding section. Table 4 reports the results of the effect of the increased leverage due to the TRA on the mobility of homeowners in higher- vs. lower-tax states. In column 1 of Table 4, we find that, in higher-tax states, the interaction term, sensitivity of

[7] I also tried average tax rates and the (unreported) results were similar.

mobility to house-price movements in combined with the higher leverage due to the TRA, even after controlling for their direct effects, is still positive and significant (at less than 1% significance level). In contrast, in column 2 of Table 4, we find that, for lower-tax states, the interaction term, sensitivity of mobility to house-price movements from the higher leverage, due to the TRA, is, in fact, insignificant indicating that the policy innovation that resulted in a tax-shield that encouraged higher housing leverage has no effect on the sensitivity of mobility in lower-tax states. Therefore, the results in this section imply that the TRA variable is picking up the correct variation due to the increased housing leverage.

6.2.2 Relation between Mobility and the Housing Leverage due to the Policy Innovation vs. Falling Mortgage Rates

The result in column 2 of Table 4, that sensitivity of mobility to changes in net worth in the presence of the higher housing leverage due to the TRA is insignificant in lower-tax states, is particularly interesting. An argument, based on the emerging literature that explores the link between the credit supply and housing markets, can be made that easy access to cheaper credit in mortgage financing (figure 2) boosted housing demand.[8] If this is the case, a potential concern is that our policy change variable might be murky, in the sense, that it captures both effects, due to the policy innovation and falling mortgage rates, and hence, our estimates may be upward biased. Falling mortgage rates should affect the higher- and lower-tax states uniformly, but we find that the effect of our instrument for the homeowners in lower-tax states is insignificant. It may ease the concern since, if our policy change variable is a murky then it should, at least, pick up the effect due to falling mortgage rates in the lower-tax states.

To further rule out such possibility owing to a potential sub-sample bias, I conduct the following test. Figure 2 shows that the rates are falling during the period, 1983-1986, and they cease falling during the period, 1986-1990. If falling mortgage rates result in higher housing leverage, and consequently lower mobility then we should not observe lower mobility during

[8]The pricing equation is: $P_t = \sum_{i=1}^{\infty} \frac{E_t(CF_{t+i})}{SDF_t}$. We know that $\frac{dP_t}{dSDF_t} < 0$. Thus, the first order effect of falling mortgage rates (SDF) is that P_t goes up. For a given level of mortgage financing, increase in P_t (due to falling mortgage rates) implies leverage ratio goes down. The second order effect of falling mortgage rates (SDF), for a given P_t, is that leverage ratio should go up. However, the net effect (of the two effects) is indeterminate, and, therefore, presents a theoretical ambiguity.

the post-TRA period, 1987-1990. Columns 3 and 4 of Table 4 present the results, and we find that the sensitivity of mobility to housing-price movements combined with the higher housing leverage, due to the TRA, is still positive and significant for higher-tax states. However, the interaction term continues to remain insignificant for lower-tax states. Based on the results in this section, we can infer that the reduced mobility is not due to the falling mortgage rates.

6.2.3 Relation between Mobility, Housing Leverage, and the Policy Innovation in Recourse vs. Non-recourse States

Ghent and Kudlyak (2011) document that a potential threat of recourse acts as a deterrent for homeowners with negative equity to just "walk away", and show that the likelihood of mortgage default is lower in recourse vs. non-recourse states. In our case, it will imply that the effect of the increased housing leverage (due to the TRA), which might have resulted in negative equity for some homeowners, will result in a lower mobility in recourse vs. non-recourse states, since the threat of recourse will deter those homeowners with negative equity from defaulting and keep them making mortgage payments. I identify the recourse states as in Ghent and Kudlyak (2011).

Table 5 reports the results of the effect of the increased housing leverage due to the TRA on the mobility of homeowners in recourse vs. non-recourse states. In column 1 of Table 5, we find that, in recourse states, the interaction term, sensitivity of mobility to house-price movements from the higher housing leverage due to the TRA, even after controlling for their direct effects, is positive and significant. On the other hand, in column 2 of Table 5, we find that, for non-recourse states, the interaction term, sensitivity of mobility to house-price movements from the higher leverage, due to the TRA, even after controlling for their direct effects, is, in fact, insignificant indicating that the policy innovation that resulted in higher housing leverage ratios has no effect on the sensitivity of mobility to house-price changes for homeowners in non-recourse states. Thus, the results in this section support Ghent and Kudlyak (2011), and we find that the sensitivity of mobility to house-price movements after the TRA came into effect, is significantly higher in recourse states suggesting that the recourse deters mobility for homeowners with potential negative equity.

6.2.4 Relation between Mobility, Housing Leverage, and the Policy Innovation within State vs. out-of-state

One of the central assumptions of our analysis is that housing prices are locally correlated. Higher housing leverage brought about by the TRA implies that a given change in housing prices has a bigger impact on homeowners net worth. Stein (1995) implies that, in falling markets, fewer funds are available after the sale of the existing house for downpayment to buy a comparable new house elsewhere with better economic prospects. Therefore, in falling markets, there should not be any obstacle to mobility within the state since the downpayment on a new house in the same state will be lower, too. Stein (1995) argument is valid only for out-of-state moves.

In this section, we test the effect of changes in net worth on mobility in the presence of higher housing leverage brought about by the TRA within state vs. out-of-state. Table 6 reports the results of the effect of the increased housing leverage due to the TRA on the mobility of homeowners within state vs. out-of-state. In column 1 of Table 6, we find that the interaction term, sensitivity of mobility to house-price movements from the higher housing leverage due to the TRA, even after controlling for their direct effects, is positive and significant for out-of-state moves. However, in column 2 of Table 6, we find that the interaction term, sensitivity of mobility to house-price movements from the higher leverage, due to the TRA, even after controlling for their direct effects, is, in fact, insignificant indicating that the policy innovation that resulted in higher housing leverage ratios has no effect on the sensitivity of mobility to house-price changes for homeowners for within state moves. Therefore, the results in this section support Stein (1995), and we find that the sensitivity of mobility to house-price movements (change in net worth) after the TRA came into effect is significant only for out-of-state states.

6.2.5 Relation between Mobility, Housing Leverage, the Policy Innovation and State-level Housing-price Shocks

Since the TRA affected every household in every state, there is no control group. However, I identify (negative) housing price shocks in 13 states in the US for the period under review.[9] I define a housing-price shock to be negative if a state-level housing-price index experiences negative growth for two or more years. The states hit with negative housing-price shocks are California (1991-1996), Connecticut (1990-1996), the District of Columbia (1993-1995), Hawaii (1992-1997), Louisiana (1985-1989), Maine (1990-1994), Massachusetts (1990-1993), New Jersey (1990-1991), New Hampshire (1990-1993), Oklahoma (1984-1988), Rhode Island (1990-1996), Texas (1986-1989), and Wyoming (1984-1988). The housing price shocks in those states represent economic adversity. Subsequent to a shock, local job options might be poor, and, therefore, it is optimal for homeowners in those states to move elsewhere with better economic prospects in order to make up for the economic losses (housing equity). Another way of observing the impact of higher housing leverage on mobility is to observe the mobility subsequent to the shocks in those 13 states. The shocks in those 13 states provide an accounting effect i.e. an increase in the housing leverage ratios. Consequently, it is expected that, in these 13 states, the shocks must have escalated financial constraints (including negative equity) for some homeowners. Thus, subsequent to the shocks, we expect reduced mobility in those states.

Table 8 reports the marginal effects of probit regression of the sensitivity of mobility to changes in net worth in the presence of the higher housing leverage due to the TRA in those 13 shock-hit states during their downturns. In column 1 of Table 8, we find that the interaction term, sensitivity of mobility to house-price movements in the presence of the higher leverage due to the TRA in those 13 shock-hit states during their downturns, even after controlling for their direct effects, is positive and significant. Column 2 of Table 8 reports the results for non-shock-hit states to rule out the possibility that our results, in preceding sections, could be driven by those shock-hit states during their downturns. It can be seen that the interaction

[9] Housing-price shocks might not provide us a clean identification for the fact that housing prices are endogenous. Another concern is that the size of shocks can be correlated with the TRA. Nevertheless, it is interesting to observe the mobility patterns in these states.

term, sensitivity of mobility to house-price movements in the presence of the higher housing leverage due to the TRA in those non-shock-hit states is positive and significant. Thus, the result, that the effect of the increased housing leverage due to the TRA, subsequent to the shocks, on mobility is negative, supports our hypothesis.

6.2.6 Relation between Mobility, Housing Leverage, and the Policy Innovation for Lower-income Homeowners

A potential concern is that the TRA may have increased the housing leverage of homeowners, but the overall household leverage may still remain unaffected. To ease this concern, in this section, I look at the homeowners with lower income. Homeowners with lower income may be close to their debt capacity limits. In that case, the TRA does not offer much gain to these homeowners by switching from unsecured to secured debt. Stein (1995) implies that the homeowners with the most severe financial constraints choose not to move. Higher housing leverage following the TRA may leave lower-income homeowners to be the most financially constrained. I create a dummy variable taking the value of one if the income of a homeowner is above the median income in a particular state for a given year; otherwise the value of the dummy variable is zero. I employ the same specifications as used in preceding sections to assess the effect of increased housing leverage due to the TRA on the mobility of homeowners with lower income.

Table 7 reports the marginal effects of probit regression of the sensitivity of mobility to changes in net worth in the presence of the higher housing leverage due to the TRA. Columns 1 and 2 of Table 7 report the results for lower-income and higher-income homeowners, respectively. The interaction term in column 1 is positive and significant for homeowners with lower income, whereas the interaction term remains insignificant for the higher-income homeowners. Thus, the higher housing leverage due to the TRA adversely affected the mobility of lower-income homeowners.

6.3 Relation between Mobility, Housing Leverage, and the Policy Innovation for those Homeowners who move from an Owned House to Rental Housing

Next, in this section, I move on to investigate the impact of housing leverage on the mobility of those homeowners who move from an owned to rental housing. This group is most likely to contain homeowners with negative equity. Since, in falling markets, their net worth can be too low to buy a new house. Unless they are forced, homeowners might not want to move into rental housing except for retirement purposes. Those homeowners may decide to stay put.

Column 1 of Table 9 reports the results for the mobility of those homeowners who moved from an owned to rental housing. It can be seen that the interaction term, sensitivity of mobility to housing price movements (or changes in net worth) in the presence of the higher leverage due to the TRA even after controlling for their direct effects, is positive and significant. The direct effect of the increased housing leverage due to the TRA is negative and significant denoting that the higher leverage following the TRA resulted in reduced mobility for those homeowners who moved from an owned to rental housing. Columns 2 and 3 of Table 9 report the results for those homeowners who moved from an owned to rental housing in higher-tax states and recourse states, respectively. In columns 2 and 3 of Table 9, the interaction term, sensitivity of mobility to changes in net worth in the presence of the higher leverage due to the TRA, continues to be positive and significant implying that the higher leverage following the TRA resulted in reduced mobility of those homeowners who moved from an owned to rental housing in higher-tax states and recourse states, respectively. Lastly, column 4 of Table 9 reports the results of the effect of the increased housing leverage following the TRA, on the mobility of homeowners who moved from an owned to rental housing in those 13 shock-hit states during the downturns, and, again, we find that the interaction term, sensitivity of mobility to house-price movements after the TRA came into effect, is positive and significant. The direct impact of the increased housing leverage due to the TRA is negative and significant denoting that the higher leverage following the TRA resulted in reduced mobility for those homeowners who moved from an owned to rental housing in those 13 shock-hit states during

the downturns. Thus, based on the results in this section, we can conclude that the higher housing leverage due to the TRA adversely affected the mobility of those homeowners who moved from an owned house to rental housing.

6.4 Relation between Mobility, Housing Leverage, and the Policy Innovation for those Households who move between Rental Housing

Finally, in this section, I investigate the impact of the policy change that led the higher housing leverage on the mobility of those homeowners who move between rental housing. Being renters, these households have no housing leverage, and, therefore, the higher housing leverage due to the TRA should not affect their mobility. If we find that the mobility of households who moved between rental housing is also affected by the policy change that led to the higher leverage then our empirical design is flawed, since our tax-shield based explanation does not hold for the households who live in rental units. However, if our tax-shield based explanation for mobility is valid then we should not observe any effect due to the policy change on the mobility of those households who move between rental housing.

Table 10 reports the results for the mobility of households who move between rental units. Column 1 of Table 10 shows that the interaction term, sensitivity of mobility to housing price movements after the TRA came into effect, is insignificant indicating that the effect of the increased housing leverage due to the TRA, on the mobility of households who moved between rental housing is zero. In columns 2 and 3 of Table 10 report the results for those homeowners who move between rental units in higher-tax states and recourse states, respectively. We find that the interaction term, sensitivity of mobility to housing price movements after the TRA came into effect, remains insignificant. Column 4 of Table 11 reports the results of the effect of the increased leverage (due to the TRA), on the mobility of households who move between rental housing in those 13 shock-hit states during the downturns. Again, we find that the interaction term, sensitivity of mobility to house-price movements after the TRA came into effect, is insignificant. Hence, based on the results in this section, we conclude that the increased housing leverage due to the TRA has no effect on the mobility of households who moved between rental housing.

6.5 Relation between Probability of Moving, Housing Leverage (LtV), and the Policy Innovation

For completeness, in this section, I also conduct analyses with loan-to-value ratios (LtVs) as housing leverage measure to test the effect of the higher housing leverage triggered by the policy innovation, (TRA, 1986), on the probability of moving of the homeowner. The specification is as follows:

$$\begin{aligned} Pr(Move)_{i,t} = \quad & \theta_1 Policy\Delta Dum_t \cdot LtVDum_{i,t-1} + \theta_2 Policy\Delta Dum_t \\ & + \theta_3 LtVDum_{i,t-1} + \gamma X_{i,t} + State_s + Year_t + \nu_{i,t} \end{aligned} \tag{8}$$

As earlier, the dependent variable, mobility, is a binary variable that takes the value one if there was a move during the last calendar year; otherwise it is zero. $Policy\Delta Dum$ is a dummy variable that takes the value one after 1986, the year of the policy innovation, the TRA; otherwise the value is zero. For negative equity, I create a dummy variable for the LtV ratio that takes the value one if the LtV on previously owned house exceeds 100%; otherwise the value is zero. In the US, underwriting guidelines for conforming loans (those that meet government-sponsored enterprises (GSEs)) are limited to an LtV ratio that is less than or equal to 80% (Manuel, Schoar, and Severino (2012)). Homeowners with LtVs below 80% are usually considered as lower-risk borrowers, whereas homeowners with LtVs above 80% are commonly considered as higher-risk borrowers. Lamont and Stein (1999) also used an 80% LtV ratio in their analyses. I follow the literature and create a dummy variable for the LtV ratio that takes the value one if the LtV exceeds 80%; otherwise the value is zero. I also create three additional subgroups, for three different thresholds 50%, 60%, and 70% LtVs. The four different thresholds, 50% - 80%, represent positive equity homeowners. The set of control variables, X, continues to remain the same as in preceding sections.

Table 11 reports the marginal effects from probit regressions for the policy innovation. Columns 1 to 5 present the results for four LtV dummy variables for the LtV thresholds, 50%, 60%, 70%, 80%, and 100% and higher, respectively. In column 5 of Table 11, θ_1, the marginal

effect of the higher leverage due to the policy innovation, the TRA, even after controlling for their direct effects separately, is negative and significant at a 1% level. This indicates that the probability of moving after the policy change drops by 18.1% for homeowners with a 100% and higher LtV. The direct effect of the higher leverage that results from the TRA, θ_2, on the mobility of the homeowners across the states is also negative and significant. The effect of higher leverage, θ_3, is, positive and statistically significant, implying that negative equity helped homeowners move. This result is counter-intuitive most likely due to endogeneity or measurement error of LtV. In columns one to four, I repeat the same regression for other housing leverage thresholds - 50%, 60%, 70%, and 80% LtVs. A consistently interesting pattern emerges. The effect of the increased housing leverage ratios, due to the TRA, on the mobility of homeowners even with positive equity is negative. Thus, the results in this section, that the TRA affected the mobility of homeowners with mortgage financing (both positive and negative equity), support our hypothesis.

7 Concluding Remarks

The goal of this study is to assess the impact of housing leverage on the mobility of homeowners. A big stumbling block for studies like ours is endogeneity of loan-to-value ratio (LtV) as a measure of housing leverage. For identification, this study exploits a policy innovation in the form of the TRA (1986) to document an increase in housing leverage. This study shows a decline in mobility of homeowners. In particular, mobility declined not only for the homeowners with negative equity but also for those with positive equity. A limitation of this study is that it is moot on the issue of defaults or strategic defaults mainly due to non-availability the data.

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Table 1: Summary Statistics and Univariate Tests

Panel A: Summary Statistics

This table reports the summary statistics of the control variables used in subsequent regressions for the sample of homeowners from the PSID (Panel Study of Income Dynamics) for the period 1983-1997. EDUCATION is the number of years of education of the homeowner. AGE is the age of the homeowner in years. MARITAL STATUS is a dummy variable that takes the value one if the homeowner is married, else zero. GENDER takes the value one if the homeowner is male, else zero. ETHNICITY takes the value one if the homeowner is White, else zero. FAMILY SIZE is the number of members in the household unit. YOUNG CHILD takes the value one if a household unit has a child with age equal to or less than 6, else zero. HOUSING SUPPLY is the Saiz "geo-topological" measure for housing supply elasticity. EMPLOYMENT STATUS takes the value one if the homeowner has an employment, else zero. TENURE is the experience (in years) in current job of the homeowner. SPELL is the number of years the homeowner resided in the last owned house prior to a move. INCOME is the natural logarithm of total nominal annual income of the household. WEALTH is the natural logarithm of the aggregation of the incomes of the homeowner over the sample period.

Variables	N	Mean	SD	Min	Max
EDUCATION	37267	12.600	3.193	0	17
AGE	37267	47.316	14.942	16	99
MARITAL STATUS	37267	0.736	0.441	0	1
GENDER	37267	0.803	0.397	0	1
ETHNICITY	37267	0.698	0.459	0	1
FAMILY SIZE	37267	3.076	1.482	1	17
YOUNG CHILD (< 6 YRS OLD)	37267	0.254	0.435	0	1
HOUSING SUPPLY ("SAIZ" MEASURE)	37267	1.828	1.021	0.595	12.148
EMPLOYMENT STATUS	37267	0.726	0.446	0	1
TENURE (YEARS)	37267	5.863	5.469	0	19
SPELL (YEARS)	37267	10.221	6.877	0	25
INCOME (LOGS)	37267	10.422	0.691	8.314	11.082
WEALTH (LOGS)	37267	12.926	0.673	11.138	13.467

Panel B: Univariate tests

This table reports the univariate tests of the relation between mobility and the policy innovation (TRA). MOBILITY is a binary variable that takes the value one if there is a move for the homeowner, else zero. Policy innovation (TRA) is a binary variable that takes the value one 1987 onwards after the policy innovation (TRA, 1986) was introduced, else zero. LtV (loan-to-value) is computed as the ratio of outstanding mortgage balance to self-reported house value.

	Before	After	% Difference	*p*-value
MOBILITY	10.66%	9.55%	-10.47%	0.000
LtV (median)	26%	31%	20.83%	0.000

Table 2: Relation between Mobility, Housing Leverage, and Policy Innovation

This table reports the marginal effects from the multivariate probit regressions on the probability of a move (a binary variable that takes the value one for a move else zero) of the homeowner. ANNGROWTH_HOUSEPXINDEX*POLICYCHANGEDUMMY is the interaction of ANNGROWTH_HOUSEPXINDEX and POLICYCHANGEDUMMY. POLICYCHANGEDUMMY is a binary variable that takes the value one after the policy innovation (TRA, 1986) was introduced, else zero. ANNGROWTH_HOUSEPXINDEX is the annual growth rate of the state-level housing price-index. EDUCATION is the number of years of education of the homeowner. AGE is the age of the homeowner in years. MARITAL_STATUS is a dummy variable that takes the value one if the homeowner is married, else zero. GENDER takes the value one if the homeowner is male, else zero. ETHNICITY takes the value one if the homeowner is White, else zero. FAMILY_SIZE is the number of members in the household unit. YOUNG_CHILD_AGED6 takes the value one if a household unit has a child with age equal to or less than 6, else zero. HOUSING_SUPPLY is the Saiz "geo-topological" measure for housing supply elasticity. EMPLOYMENT takes the value one if the homeowner has an employment, else zero. TENURE is the experience (in years) in current job of the homeowner. USER_COST is computed as suggested by Poterba (1984). HOUSING_PRICE_VOLATILITY is a state-level conditional volatility estimate derived from AR(10)-GARCH(1,1) processes. SPELL is the number of years the homeowner resided in the last owned house prior to a move. INCOME is the natural logarithm of total nominal annual income of the household. WEALTH is the natural logarithm of the aggregation of the incomes of the homeowner over the sample period. All regressions include state and year dummies. Standard errors are clustered at state-level. Standard errors are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.

	Probit	Probit	OLS
DEPENDENT VARIABLE	MOVE	MOVE	MOVE
POLICYCHANGEDUMMY* HIGHER-TAXSTATE_DUMMY	0.221***	0.194*	0.204*
	(0.075)	(0.115)	(0.115)
POLICYCHANGEDUMMY	-0.020***	-0.011	0.007
	(0.005)	(0.011)	(0.010)
HIGHER-TAXSTATE_DUMMY	-0.067	-0.101	-0.090
	(0.060)	(0.100)	(0.100)
EDUCATION		0.003***	0.003***
		(0.001)	(0.001)
AGE		-0.003***	-0.003***
		(0.000)	(0.000)
MARITAL_STATUS		-0.012*	-0.012
		(0.007)	(0.008)
GENDER		0.013**	0.019**
		(0.006)	(0.009)
ETHNICITY		0.026***	0.026***
		(0.004)	(0.004)
FAMILY_SIZE		-0.012***	-0.017***
		(0.001)	(0.001)
YOUNG_CHILD_AGED6		-0.001	0.000
		(0.003)	(0.004)
HOUSING_SUPPLY		0.006*	0.005
		(0.004)	(0.004)
EMPLOYMENT		-0.004	-0.002
		(0.006)	(0.006)
TENURE (YEARS)		-0.002***	-0.003***
		(0.001)	(0.001)
USER_COST		-0.002	-0.001
		(0.005)	(0.005)
HOUSING_PRICE_VOLATILITY		0.001	0.001
		(0.002)	(0.002)
SPELL (YEARS)		-0.009***	-0.008***
		(0.001)	(0.000)
INCOME (LOGS)		0.003	0.004***
		(0.003)	(0.001)
WEALTH (LOGS)		0.005	-0.009***
		(0.003)	(0.002)
YEAR EFFECTS	No	Yes	Yes
STATE EFFECTS	No	Yes	Yes
OBSERVATIONS	65706	37265	37090

Table 3: Relation between Housing Leverage and Policy Innovation in Higher- vs. Lower-Tax States

This table reports the impact of the policy innovation on the housing leverage in higher- vs. lower-tax states. We employ OLS regressions. Housing leverage is the ratio of outstanding mortgage balance to the house value. HIGHER-TAX STATE is the state, where the marginal tax rate is greater than its median across all states for a given year, else LOWER-TAX STATE. ANNGROWTH_HOUSEPXINDEX*POLICYCHANGEDUMMY is the interaction of ANNGROWTH_HOUSEPXINDEX and POLICYCHANGEDUMMY. POLICYCHANGEDUMMY is a binary variable that takes the value one after the policy innovation (TRA, 1986) was introduced, else zero. ANNGROWTH_HOUSEPXINDEX is the annual growth rate of the state-level housing price-index. EDUCATION is the number of years of education of the homeowner. AGE is the age of the homeowner in years. MARITAL_STATUS is a dummy variable that takes the value one if the homeowner is married, else zero. GENDER takes the value one if the homeowner is male, else zero. ETHNICITY takes the value one if the homeowner is White, else zero. FAMILY_SIZE is the number of members in the household unit. YOUNG_CHILD_AGED6 takes the value one if a household unit has a child with age equal to or less than 6, else zero. HOUSING_SUPPLY is the Saiz "geo-topological" measure for housing supply elasticity. EMPLOYMENT takes the value one if the homeowner has an employment, else zero. TENURE is the experience (in years) in current job of the homeowner. USER_COST is computed as suggested by Poterba (1984). HOUSING_PRICE_VOLATILITY is a state-level conditional volatility estimate derived from AR(10)-GARCH(1,1) processes. SPELL is the number of years the homeowner resided in the last owned house prior to a move. INCOME is the natural logarithm of total nominal annual income of the household. WEALTH is the natural logarithm of the aggregation of the incomes of the homeowner over the sample period. All regressions include state and year dummies. Standard errors are clustered at state-level. Standard errors are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.

Dependent Variable	LtV
POLICYCHANGEDUMMY* HIGHER-TAXSTATE_DUMMY	0.699*
	(0.397)
POLICYCHANGEDUMMY	0.035
	(0.213)
HIGHER-TAXSTATE_DUMMY	-0.022
	(0.342)
EDUCATION	0.008
	(0.033)
AGE	-0.005
	(0.003)
MARITAL_STATUS	0.151
	(0.150)
GENDER	-0.020
	(0.035)
ETHNICITY	0.061
	(0.155)
FAMILY_SIZE	0.147*
	(0.075)
YOUNG_CHILD_AGED6	-0.210
	(0.247)
HOUSING_SUPPLY	-0.169*
	(0.093)
EMPLOYMENT	0.047
	(0.193)
TENURE (YEARS)	0.023
	(0.020)
USER_COST	1.532**
	(0.631)
HOUSING_PRICE_VOLATILITY	0.102
	(0.083)
SPELL (YEARS)	-0.040***
	(0.012)
INCOME (LOGS)	-0.052
	(0.088)
WEALTH (LOGS)	-0.106*
	(0.058)
YEAR FIXED EFFECTS	Yes
STATE FIXED EFFECTS	Yes
OBSERVATIONS	37090

Table 4: Relation between Mobility, Housing Leverage, and Policy Innovation in Higher- vs. Lower-tax States
This table reports the marginal effects from the multivariate probit regressions on the probability of a move (a binary variable that takes the value one for a move else zero) of the homeowner. HIGHER-TAX STATE is the state, where the marginal tax rate is greater than its median across all states for a given year, else LOWER-TAX STATE. ANNGROWTH_HOUSEPXINDEX*POLICYCHANGEDUMMY is the interaction of ANNGROWTH_HOUSEPXINDEX and POLICYCHANGEDUMMY. POLICYCHANGEDUMMY is a binary variable that takes the value one after the policy innovation (TRA, 1986) was introduced, else zero. ANNGROWTH_HOUSEPXINDEX is the annual growth rate of the state-level housing price-index. EDUCATION is the number of years of education of the homeowner. AGE is the age of the homeowner in years. MARITAL_STATUS is a dummy variable that takes the value one if the homeowner is married, else zero. GENDER takes the value one if the homeowner is male, else zero. ETHNICITY takes the value one if the homeowner is White, else zero. FAMILY_SIZE is the number of members in the household unit. YOUNG_CHILD_AGED6 takes the value one if a household unit has a child with age equal to or less than 6, else zero. HOUSING_SUPPLY is the Saiz "geo-topological" measure for housing supply elasticity. EMPLOYMENT takes the value one if the homeowner has an employment, else zero. TENURE is the experience (in years) in current job of the homeowner. USER_COST is computed as suggested by Poterba (1984). HOUSING_PRICE_VOLATILITY is a state-level conditional volatility estimate derived from AR(10)-GARCH(1,1) processes. SPELL is the number of years the homeowner resided in the last owned house prior to a move. INCOME is the natural logarithm of total nominal annual income of the household. WEALTH is the natural logarithm of the aggregation of the incomes of the homeowner over the sample period. All regressions include state and year dummies. Standard errors are clustered at state-level. Standard errors are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.

	1983-1997		1983-1990	
	HIGHER-TAX	LOWER-TAX	HIGHER-TAX	LOWER-TAX
DEPENDENT VARIABLE	MOVE	MOVE	MOVE	MOVE
ANNGROWTH_HOUSEPXINDEX*POLICYCHANGEDUMMY	0.279***	0.120	0.247*	0.022
	(0.091)	(0.315)	(0.141)	(0.300)
POLICYCHANGEDUMMY	-0.008	-0.015	0.019	-0.019
	(0.013)	(0.032)	(0.014)	(0.026)
ANNGROWTH_HOUSEPXINDEX	-0.121	-0.044	-0.165*	0.060
	(0.088)	(0.250)	(0.099)	(0.252)
EDUCATION	0.003***	0.003***	0.003***	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)
AGE	-0.003***	-0.003***	-0.003***	-0.003***
	(0.000)	(0.000)	(0.000)	(0.000)
MARITAL_STATUS	-0.017**	-0.006	-0.031***	-0.022**
	(0.007)	(0.008)	(0.010)	(0.011)
GENDER	0.013*	0.011	0.022**	0.036***
	(0.007)	(0.008)	(0.011)	(0.011)
ETHNICITY	0.025***	0.028***	0.038***	0.029***
	(0.005)	(0.007)	(0.006)	(0.010)
FAMILY_SIZE	-0.013***	-0.011***	-0.011***	-0.010***
	(0.001)	(0.002)	(0.002)	(0.003)
YOUNG_CHILD_AGED6	0.003	-0.005	-0.003	-0.013**
	(0.005)	(0.004)	(0.007)	(0.006)
HOUSING_SUPPLY	0.008***	0.004	0.015***	0.005
	(0.003)	(0.006)	(0.004)	(0.007)
EMPLOYMENT	-0.008	-0.001	0.004	0.001
	(0.008)	(0.007)	(0.012)	(0.009)
TENURE (YEARS)	-0.002***	-0.001	-0.005***	-0.005***
	(0.001)	(0.001)	(0.002)	(0.001)
USER_COST	0.005	-0.013	0.007	-0.008
	(0.003)	(0.009)	(0.009)	(0.014)
HOUSING_PRICE_VOLATILITY	0.004***	0.002	0.006***	0.002
	(0.001)	(0.006)	(0.002)	(0.005)
SPELL (YEARS)	-0.008***	-0.010***	-0.012***	-0.014***
	(0.001)	(0.001)	(0.001)	(0.001)
INCOME (LOGS)	0.005	0.001	0.016***	0.012*
	(0.004)	(0.005)	(0.004)	(0.007)
WEALTH (LOGS)	0.014***	-0.003	-0.007**	-0.014***
	(0.004)	(0.003)	(0.003)	(0.002)
YEAR FIXED EFFECTS	Yes	Yes	Yes	Yes
STATE FIXED EFFECTS	Yes	Yes	Yes	Yes
OBSERVATIONS	21228	16038	10401	8965

Table 5: Relation between Mobility, Housing Leverage, and Policy Innovation in Recourse vs. Non-recourse States
This table reports the marginal effects from the multivariate probit regressions on the probability of a move (a binary variable that takes the value one for a move else zero) of the homeowner. RECOURSE is the state where the lender may be able to collect on the mortgage debt not covered by the proceedings from a foreclosure sale by obtaining a deficiency judgment, else non-recourse state. ANNGROWTH_HOUSEPXINDEX*POLICYCHANGEDUMMY is the interaction of ANNGROWTH_HOUSEPXINDEX and POLICYCHANGEDUMMY. POLICYCHANGEDUMMY is a binary variable that takes the value one after the policy innovation (TRA, 1986) was introduced, else zero. ANNGROWTH_HOUSEPXINDEX is the annual growth rate of the state-level housing price-index. EDUCATION is the number of years of education of the homeowner. AGE is the age of the homeowner in years. MARITAL_STATUS is a dummy variable that takes the value one if the homeowner is married, else zero. GENDER takes the value one if the homeowner is male, else zero. ETHNICITY takes the value one if the homeowner is White, else zero. FAMILY_SIZE is the number of members in the household unit. YOUNG_CHILD_AGED6 takes the value one if a household unit has a child with age equal to or less than 6, else zero. HOUSING_SUPPLY is the Saiz "geo-topological" measure for housing supply elasticity. EMPLOYMENT takes the value one if the homeowner has an employment, else zero. TENURE is the experience (in years) in current job of the homeowner. USER_COST is computed as suggested by Poterba (1984). HOUSING_PRICE_VOLATILITY is a state-level conditional volatility estimate derived from AR(10)-GARCH(1,1) processes. SPELL is the number of years the homeowner resided in the last owned house prior to a move. INCOME is the natural logarithm of total nominal annual income of the household. WEALTH is the natural logarithm of the aggregation of the incomes of the homeowner over the sample period. All regressions include state and year dummies. Standard errors are clustered at state-level. Standard errors are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.

	Recourse States	Non-recourse States
DEPENDENT VARIABLE	MOVE	MOVE
ANNGROWTH_HOUSEPXINDEX*POLICYCHANGEDUMMY	0.246*	-0.240
	(0.139)	(0.242)
POLICYCHANGEDUMMY	-0.015	0.019
	(0.011)	(0.018)
ANNGROWTH_HOUSEPXINDEX	-0.146	0.378*
	(0.091)	(0.205)
EDUCATION	0.003***	0.005***
	(0.001)	(0.001)
AGE	-0.003***	-0.003***
	(0.000)	(0.000)
MARITAL_STATUS	-0.005	-0.029**
	(0.007)	(0.012)
GENDER	0.009	0.030***
	(0.007)	(0.005)
ETHNICITY	0.030***	0.028***
	(0.005)	(0.009)
FAMILY_SIZE	-0.012***	-0.012***
	(0.001)	(0.002)
YOUNG_CHILD_AGED6	-0.001	-0.000
	(0.003)	(0.009)
HOUSING_SUPPLY	0.005	0.019***
	(0.004)	(0.006)
EMPLOYMENT	0.001	-0.015
	(0.006)	(0.009)
TENURE (YEARS)	-0.002**	-0.003***
	(0.001)	(0.001)
USER_COST	-0.002	0.001
	(0.004)	(0.007)
HOUSING_PRICE_VOLATILITY	0.001	0.008
	(0.002)	(0.009)
SPELL (YEARS)	-0.009***	-0.009***
	(0.001)	(0.001)
INCOME (LOGS)	0.004*	0.009***
	(0.002)	(0.003)
WEALTH (LOGS)	-0.008***	-0.002
	(0.002)	(0.003)
YEAR FIXED EFFECTS	Yes	Yes
STATE FIXED EFFECTS	Yes	Yes
OBSERVATIONS	28110	8980

Table 6: Relation between Mobility, Housing Leverage, and Policy Innovation within State vs. out-of-state

This table reports the marginal effects from the multivariate probit regressions on the probability of a move (a binary variable that takes the value one for a move else zero) of the homeowner. Within States is a binary variable that takes the value one for a move within state else zero. ANNGROWTH_HOUSEPXINDEX*POLICYCHANGEDUMMY is the interaction of ANNGROWTH_HOUSEPXINDEX and POLICYCHANGEDUMMY. POLICYCHANGEDUMMY is a binary variable that takes the value one after the policy innovation (TRA, 1986) was introduced, else zero. ANNGROWTH_HOUSEPXINDEX is the annual growth rate of the state-level housing price-index. EDUCATION is the number of years of education of the homeowner. AGE is the age of the homeowner in years. MARITAL_STATUS is a dummy variable that takes the value one if the homeowner is married, else zero. GENDER takes the value one if the homeowner is male, else zero. ETHNICITY takes the value one if the homeowner is White, else zero. FAMILY_SIZE is the number of members in the household unit. YOUNG_CHILD_AGED6 takes the value one if a household unit has a child with age equal to or less than 6, else zero. HOUSING_SUPPLY is the Saiz "geo-topological" measure for housing supply elasticity. EMPLOYMENT takes the value one if the homeowner has an employment, else zero. TENURE is the experience (in years) in current job of the homeowner. USER_COST is computed as suggested by Poterba (1984). HOUSING_PRICE_VOLATILITY is a state-level conditional volatility estimate derived from AR(10)-GARCH(1,1) processes. SPELL is the number of years the homeowner resided in the last owned house prior to a move. INCOME is the natural logarithm of total nominal annual income of the household. WEALTH is the natural logarithm of the aggregation of the incomes of the homeowner over the sample period. All regressions include state and year dummies. Standard errors are clustered at state-level. Standard errors are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.

DEPENDENT VARIABLE	MOVE	MOVE
	Out-of-state	Within state
ANNGROWTH_HOUSEPXINDEX*POLICYCHANGEDUMMY	0.068**	0.141
	(0.032)	(0.103)
POLICYCHANGEDUMMY	-0.004	-0.004
	(0.005)	(0.008)
ANNGROWTH_HOUSEPXINDEX	-0.025	-0.080
	(0.028)	(0.088)
EDUCATION	0.001***	0.002***
	(0.000)	(0.001)
AGE	-0.000***	-0.003***
	(0.000)	(0.000)
MARITAL_STATUS	0.000	-0.011*
	(0.002)	(0.006)
GENDER	0.002	0.012**
	(0.002)	(0.006)
ETHNICITY	0.007***	0.023***
	(0.001)	(0.004)
FAMILY_SIZE	-0.001***	-0.011***
	(0.000)	(0.001)
YOUNG_CHILD_AGED6	-0.000	-0.002
	(0.002)	(0.003)
HOUSING_SUPPLY	0.001*	0.005
	(0.001)	(0.003)
EMPLOYMENT	-0.001	-0.003
	(0.002)	(0.007)
TENURE (YEARS)	-0.001***	-0.001**
	(0.000)	(0.001)
USER_COST	-0.003	0.001
	(0.002)	(0.004)
HOUSING_PRICE_VOLATILITY	0.000	0.001
	(0.001)	(0.002)
SPELL (YEARS)	-0.001***	-0.008***
	(0.000)	(0.001)
INCOME (LOGS)	0.001	0.005***
	(0.001)	(0.002)
WEALTH (LOGS)	0.000	-0.008***
	(0.000)	(0.002)
YEAR FIXED EFFECTS	Yes	Yes
STATE FIXED EFFECTS	Yes	Yes
OBSERVATIONS	33697	36703

Table 7: Relation between Mobility, Housing Leverage, and Policy Innovation for Lower-income Homeowners

This table reports the marginal effects from the multivariate probit regressions on the probability of a move (a binary variable that takes the value one for a move else zero) of the homeowner. Lower income status is determined if the income of the homeowner is less than its median in a state-year, else higher income. ANNGROWTH_HOUSEPXINDEX*POLICYCHANGEDUMMY is the interaction of ANNGROWTH_HOUSEPXINDEX and POLICYCHANGEDUMMY. POLICYCHANGEDUMMY is a binary variable that takes the value one after the policy innovation (TRA, 1986) was introduced, else zero. ANNGROWTH_HOUSEPXINDEX is the annual growth rate of the state-level housing price-index. EDUCATION is the number of years of education of the homeowner. AGE is the age of the homeowner in years. MARITAL_STATUS is a dummy variable that takes the value one if the homeowner is married, else zero. GENDER takes the value one if the homeowner is male, else zero. ETHNICITY takes the value one if the homeowner is White, else zero. FAMILY_SIZE is the number of members in the household unit. YOUNG_CHILD_AGED6 takes the value one if a household unit has a child with age equal to or less than 6, else zero. HOUSING_SUPPLY is the Saiz "geo-topological" measure for housing supply elasticity. EMPLOYMENT takes the value one if the homeowner has an employment, else zero. TENURE is the experience (in years) in current job of the homeowner. USER_COST is computed as suggested by Poterba (1984). HOUSING_PRICE_VOLATILITY is a state-level conditional volatility estimate derived from AR(10)-GARCH(1,1) processes. SPELL is the number of years the homeowner resided in the last owned house prior to a move. INCOME is the natural logarithm of total nominal annual income of the household. WEALTH is the natural logarithm of the aggregation of the incomes of the homeowner over the sample period. All regressions include state and year dummies. Standard errors are clustered at state-level. Standard errors are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.

	LOWER-INCOME	HIGHER-INCOME
DEPENDENT VARIABLE	MOVE	MOVE
ANNGROWTH_HOUSEPXINDEX * POLICYCHANGEDUMMY	0.232**	0.135
	(0.108)	(0.145)
POLICYCHANGEDUMMY	-0.023	-0.006
	(0.016)	(0.012)
ANNGROWTH_HOUSEPXINDEX	-0.184*	-0.021
	(0.096)	(0.126)
EDUCATION	0.002**	0.004***
	(0.001)	(0.001)
AGE	-0.003***	-0.004***
	(0.000)	(0.000)
MARITAL_STATUS	-0.028***	-0.003
	(0.008)	(0.009)
GENDER	0.021***	0.005
	(0.007)	(0.010)
ETHNICITY	0.032***	0.023***
	(0.008)	(0.005)
FAMILY_SIZE	-0.006***	-0.015***
	(0.002)	(0.002)
YOUNG_CHILD_AGED6	0.014**	-0.007
	(0.006)	(0.005)
HOUSING_SUPPLY	0.008*	0.005
	(0.004)	(0.004)
EMPLOYMENT	-0.001	-0.003
	(0.008)	(0.009)
TENURE (YEARS)	-0.003***	-0.002**
	(0.001)	(0.001)
USER_COST	-0.001	-0.001
	(0.006)	(0.005)
HOUSING_PRICE_VOLATILITY	0.000	0.002
	(0.002)	(0.003)
SPELL (YEARS)	-0.007***	-0.010***
	(0.001)	(0.001)
INCOME (LOGS)	0.002	0.010**
	(0.006)	(0.005)
WEALTH (LOGS)	0.012***	-0.010***
	(0.004)	(0.002)
YEAR FIXED EFFECTS	Yes	Yes
STATE FIXED EFFECTS	Yes	Yes
OBSERVATIONS	12182	25001

Table 8: Relation between Mobility, Housing Leverage, and Policy Innovation for Homeowners in Housing Price Shock-hit States
This table reports the marginal effects from the multivariate probit regressions on the probability of a move (a binary variable that takes the value one for a move else zero) of the homeowner. Lower income status is determined if the income of the homeowner is less than its median in a state-year. SHOCKDUMMY is a binary variable that takes the value one if state-level housing price index has a negative growth for three or more consecutive years, else zero. POLICYCHANGEDUMMY is a binary variable that takes the value one after the policy innovation (TRA, 1986) was introduced, else zero. ANNGROWTH_HOUSEPXINDEX is the annual growth rate of the state-level housing price-index. ANNGROWTH_HOUSEPXINDEX*POLICYCHANGEDUMMY is the interaction of ANNGROWTH_HOUSEPXINDEX and POLICYCHANGEDUMMY. EDUCATION is the number of years of education of the homeowner. AGE is the age of the homeowner in years. MARITAL_STATUS is a dummy variable that takes the value one if the homeowner is married, else zero. GENDER takes the value one if the homeowner is male, else zero. ETHNICITY takes the value one if the homeowner is White, else zero. FAMILY_SIZE is the number of members in the household unit. YOUNG_CHILD_AGED6 takes the value one if a household unit has a child with age equal to or less than 6, else zero. HOUSING_SUPPLY is the Saiz "geo-topological" measure for housing supply elasticity. EMPLOYMENT takes the value one if the homeowner has an employment, else zero. TENURE is the experience (in years) in current job of the homeowner. USER_COST is computed as suggested by Poterba (1984). HOUSING_PRICE_VOLATILITY is a state-level conditional volatility estimate derived from AR(10)-GARCH(1,1) processes. SPELL is the number of years the homeowner resided in the last owned house prior to a move. INCOME is the natural logarithm of total nominal annual income of the household. WEALTH is the natural logarithm of the aggregation of the incomes of the homeowner over the sample period. All regressions include state and year dummies. Standard errors are clustered at state-level. Standard errors are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.

	Shock-hit States	Non-shock-hit States
DEPENDENT VARIABLE	MOVE	MOVE
ANNGROWTH_HOUSEPXINDEX * POLICYCHANGEDUMMY	7.269***	0.234*
	(2.504)	(0.131)
POLICYCHANGEDUMMY	0.122	-0.012
	(0.093)	(0.012)
ANNGROWTH_HOUSEPXINDEX	-7.386	-0.142
	(6.455)	(0.097)
EDUCATION	0.003**	0.003***
	(0.001)	(0.001)
AGE	-0.003***	-0.003***
	(0.001)	(0.000)
MARITAL_STATUS	-0.023	-0.010
	(0.019)	(0.007)
GENDER	0.035*	0.013*
	(0.021)	(0.007)
ETHNICITY	-0.003	0.031***
	(0.005)	(0.004)
FAMILY_SIZE	-0.009***	-0.012***
	(0.002)	(0.001)
YOUNG_CHILD_AGED6	-0.013	-0.000
	(0.021)	(0.003)
HOUSING_SUPPLY	-0.011**	0.007*
	(0.005)	(0.004)
EMPLOYMENT	-0.028***	-0.000
	(0.008)	(0.005)
TENURE (YEARS)	-0.004***	-0.002***
	(0.001)	(0.001)
USER_COST	0.177	-0.002
	(0.120)	(0.005)
HOUSING_PRICE_VOLATILITY	-0.120	0.001
	(0.088)	(0.002)
SPELL (YEARS)	-0.005	-0.009***
	(0.003)	(0.001)
INCOME (LOGS)	0.007***	0.005***
	(0.002)	(0.002)
WEALTH (LOGS)	-0.008	-0.007***
	(0.005)	(0.002)
YEAR FIXED EFFECTS	Yes	Yes
STATE FIXED EFFECTS	Yes	Yes
OBSERVATIONS	2642	34448

Table 9: Relation between Mobility and Policy Innovation for those Homeowners who moved from an Owned to Rental Housing
This table reports the marginal effects from the multivariate probit regressions on the probability of a move (a binary variable that takes the value one for a move, else zero) of the renter. HIGHER-TAX STATE is the state, where the marginal tax rate is greater than its median across all states for a given year, else LOWER_TAX STATE. RECOURSE is the state where the lender may be able to collect on the mortgage debt not covered by the proceedings from a foreclosure sale by obtaining a deficiency judgment, else non-recourse state. SHOCKDUMMY is a binary variable that takes the value one if state-level housing price index has a negative growth for three or more consecutive years, else zero. ANNGROWTH_HOUSEPXINDEX*POLICYCHANGEDUMMY is the interaction of ANNGROWTH_HOUSEPXINDEX and POLICYCHANGEDUMMY. POLICYCHANGEDUMMY is a binary variable that takes the value one after the policy innovation (TRA, 1986) was introduced, else zero. ANNGROWTH_HOUSEPXINDEX is the annual growth rate of the state-level housing price-index. EDUCATION is the number of years of education of the homeowner. AGE is the age of the homeowner in years. MARITAL_STATUS is a dummy variable that takes the value one if the homeowner is married, else zero. GENDER takes the value one if the homeowner is male, else zero. ETHNICITY takes the value one if the homeowner is White, else zero. FAMILY_SIZE is the number of members in the household unit. YOUNG_CHILD_AGED6 takes the value one if a household unit has a child with age equal to or less than 6, else zero. HOUSING_SUPPLY is the Saiz "geo-topological" measure for housing supply elasticity. EMPLOYMENT takes the value one if the homeowner has an employment, else zero. TENURE is the experience (in years) in current job of the homeowner. HOUSING_PRICE_VOLATILITY is a state-level conditional volatility estimate derived from AR(10)-GARCH(1,1) processes. SPELL is the number of years the homeowner resided in the last owned house prior to a move. INCOME is the natural logarithm of total nominal annual income of the household. WEALTH is the natural logarithm of the aggregation of the incomes of the homeowner over the sample period. All regressions include state and year dummies. Standard errors are clustered at state-level. Standard errors are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.

	ALL	HIGHER-TAX	RECOURSE	SHOCK-HIT
DEPENDENT VARIABLE	MOVE	MOVE	MOVE	MOVE
ANNGROWTH_HOUSEPXINDEX * POLICYCHANGEDUMMY	0.137*	0.245*	0.263***	1.791*
	(0.082)	(0.139)	(0.086)	(0.964)
POLICYCHANGEDUMMY	-0.020**	-0.015	-0.005	-0.056**
	(0.010)	(0.011)	(0.012)	(0.023)
ANNGROWTH_HOUSEPXINDEX	-0.073	-0.145	-0.111	-0.775
	(0.072)	(0.091)	(0.085)	(0.610)
EDUCATION	0.001***	0.003***	0.003***	0.000
	(0.000)	(0.001)	(0.001)	(0.001)
AGE	-0.002***	-0.003***	-0.004***	-0.003***
	(0.000)	(0.000)	(0.000)	(0.000)
MARITAL_STATUS	-0.011**	-0.005	-0.015**	-0.011
	(0.005)	(0.007)	(0.007)	(0.009)
GENDER	0.018***	0.009	0.014**	0.011
	(0.005)	(0.007)	(0.007)	(0.022)
ETHNICITY	0.024***	0.030***	0.027***	-0.008***
	(0.004)	(0.005)	(0.005)	(0.003)
FAMILY_SIZE	-0.007***	-0.012***	-0.012***	-0.002*
	(0.001)	(0.001)	(0.001)	(0.001)
YOUNG_CHILD_AGED6	0.011***	-0.001	0.003	0.011
	(0.003)	(0.003)	(0.005)	(0.009)
HOUSING_SUPPLY	0.004	0.005	0.008***	-0.004
	(0.002)	(0.004)	(0.003)	(0.004)
EMPLOYMENT	-0.001	0.001	-0.006	-0.027***
	(0.005)	(0.006)	(0.007)	(0.010)
TENURE (YEARS)	-0.002***	-0.002**	-0.002***	-0.002*
	(0.000)	(0.001)	(0.001)	(0.001)
USER_COST	-0.001	-0.002	0.006	-0.037
	(0.003)	(0.004)	(0.004)	(0.024)
HOUSING_PRICE_VOLATILITY	0.002	0.001	0.004***	0.009**
	(0.001)	(0.002)	(0.001)	(0.003)
SPELL (YEARS)	0.001**	-0.009***	-0.008***	0.002**
	(0.000)	(0.001)	(0.001)	(0.001)
INCOME (LOGS)	0.012***	0.004*	0.006***	0.012***
	(0.003)	(0.002)	(0.002)	(0.003)
WEALTH (LOGS)	0.002	-0.008***	-0.002	0.001
	(0.002)	(0.002)	(0.003)	(0.010)
YEAR FIXED EFFECTS	Yes	Yes	Yes	Yes
STATE FIXED EFFECTS	Yes	Yes	Yes	Yes
OBSERVATIONS	35329	28112	21145	2536

Table 10: Relation between Mobility and Policy Innovation for Households who moved between Rental Housing

This table reports the marginal effects from the multivariate probit regressions on the probability of a move (a binary variable that takes the value one for a move, else zero) of the renter. HIGHER-TAX STATE is the state, where the marginal tax rate is greater than its median across all states for a given year, else LOWER_TAX STATE. RECOURSE is the state where the lender may be able to collect on the mortgage debt not covered by the proceedings from a foreclosure sale by obtaining a deficiency judgment, else non-recourse state. SHOCKDUMMY is a binary variable that takes the value one if state-level housing price index has a negative growth for three or more consecutive years, else zero. ANNGROWTH_HOUSEPXINDEX*POLICYCHANGEDUMMY is the interaction of ANNGROWTH_HOUSEPXINDEX and POLICYCHANGEDUMMY. POLICYCHANGEDUMMY is a binary variable that takes the value one after the policy innovation (TRA, 1986) was introduced, else zero. ANNGROWTH_HOUSEPXINDEX is the annual growth rate of the state-level housing price-index. EDUCATION is the number of years of education of the homeowner. AGE is the age of the homeowner in years. MARITAL_STATUS is a dummy variable that takes the value one if the homeowner is married, else zero. GENDER takes the value one if the homeowner is male, else zero. ETHNICITY takes the value one if the homeowner is White, else zero. FAMILY_SIZE is the number of members in the household unit. YOUNG_CHILD_AGED6 takes the value one if a household unit has a child with age equal to or less than 6, else zero. HOUSING_SUPPLY is the Saiz "geo-topological" measure for housing supply elasticity. EMPLOYMENT takes the value one if the homeowner has an employment, else zero. TENURE is the experience (in years) in current job of the homeowner. HOUSING_PRICE_VOLATILITY is a state-level conditional volatility estimate derived from AR(10)-GARCH(1,1) processes. SPELL is the number of years the homeowner resided in the last owned house prior to a move. INCOME is the natural logarithm of total nominal annual income of the household. WEALTH is the natural logarithm of the aggregation of the incomes of the homeowner over the sample period. All regressions include state and year dummies. Standard errors are clustered at state-level. Standard errors are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.

	ALL	HIGHER-TAX	RECOURSE	SHOCK-HIT
DEPENDENT VARIABLE	MOVE	MOVE	MOVE	MOVE
ANNGROWTH_HOUSEPXINDEX*POLICYCHANGEDUMMY	0.085	0.098	0.034	1.947
	(0.092)	(0.086)	(0.099)	(2.254)
POLICYCHANGEDUMMY	-0.015	-0.001	-0.013	0.007
	(0.012)	(0.016)	(0.014)	(0.040)
ANNGROWTH_HOUSEPXINDEX	-0.076	-0.052	-0.050	-1.591
	(0.090)	(0.097)	(0.092)	(1.717)
EDUCATION	0.003***	0.003**	0.002	0.007***
	(0.001)	(0.001)	(0.001)	(0.001)
AGE	-0.005***	-0.005***	-0.005***	-0.004***
	(0.000)	(0.000)	(0.000)	(0.000)
MARITAL_STATUS	-0.034***	-0.039***	-0.036***	-0.059**
	(0.007)	(0.008)	(0.008)	(0.027)
GENDER	0.024***	0.026***	0.024***	0.049***
	(0.005)	(0.006)	(0.005)	(0.017)
ETHNICITY	0.039***	0.036***	0.041***	0.036
	(0.005)	(0.008)	(0.005)	(0.022)
FAMILY_SIZE	-0.012***	-0.013***	-0.011***	-0.010**
	(0.002)	(0.002)	(0.002)	(0.005)
YOUNG_CHILD_AGED6	0.006	0.007	0.006	0.007
	(0.005)	(0.006)	(0.006)	(0.014)
HOUSING_SUPPLY	0.014***	0.022**	0.013**	0.000
	(0.005)	(0.009)	(0.006)	(0.015)
EMPLOYMENT	0.002	0.001	0.005	-0.017**
	(0.005)	(0.007)	(0.005)	(0.007)
TENURE (YEARS)	-0.003***	-0.004***	-0.004***	-0.003
	(0.001)	(0.001)	(0.001)	(0.003)
HOUSING_PRICE_VOLATILITY	-0.001	0.000	-0.001	-0.003
	(0.002)	(0.003)	(0.002)	(0.006)
INCOME (LOGS)	0.007**	0.004	0.010**	0.005
	(0.003)	(0.005)	(0.004)	(0.006)
WEALTH (LOGS)	0.001	0.006	-0.002	0.002
	(0.003)	(0.004)	(0.003)	(0.007)
YEAR FIXED EFFECTS	Yes	Yes	Yes	Yes
STATE FIXED EFFECTS	Yes	Yes	Yes	Yes
OBSERVATIONS	78505	46362	60738	6568

Table 11: Relation between Mobility, Housing leverage (LtV), and Policy Innovation

This table reports the marginal effects from the multivariate probit regressions on the probability of a move (a binary variable that takes the value one for a move else zero) of the homeowner. POLICYCHANGEDUMMY*LEVERAGE(LTV>100%DUMMY) is the interaction term of POLICYCHANGEDUMMY and LEVERAGE(LTV>100%DUMMY). Similar interaction terms are created for LtV exceeding 50%, 60%, 70%, and 80% respectively. POLICYCHANGEDUMMY is a binary variable that takes the value one after the policy innovation (TRA, 1986) was introduced, else zero. LEVERAGE(LTV>100%DUMMY) is a binary variable that take the value one if the loan-to-value ratio of the homeowner exceeds 100%, else zero. Similar binary variables are created for LtV exceeding 50%, 60%, 70%, and 80% respectively. EDUCATION is the number of years of education of the homeowner. AGE is the age of the homeowner in years. MARITAL_STATUS is a dummy variable that takes the value one if the homeowner is married, else zero. GENDER takes the value one if the homeowner is male, else zero. ETHNICITY takes the value one if the homeowner is White, else zero. FAMILY_SIZE is the number of members in the household unit. YOUNG_CHILD_AGED6 takes the value one if a household unit has a child with age equal to or less than 6, else zero. HOUSING_SUPPLY is the Saiz "geo-topological" measure for housing supply elasticity. EMPLOYMENT takes the value one if the homeowner has an employment, else zero. TENURE is the experience (in years) in current job of the homeowner. USER_COST is computed as suggested by Poterba (1984). HOUSING_PRICE_VOLATILITY is a state-level conditional volatility estimate derived from AR(10)-GARCH(1,1) processes. SPELL is the number of years the homeowner resided in the last owned house prior to a move. INCOME is the natural logarithm of total nominal annual income of the household. WEALTH is the natural logarithm of the aggregation of the incomes of the homeowner over the sample period. All regressions include state and year dummies. Standard errors are clustered at state-level. Standard errors are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.

DEPENDENT VARIABLE	MOVE	MOVE	MOVE	MOVE	MOVE
POLICYCHANGEDUMMY*LEVERAGE(LTV>50%DUMMY)	-0.024***				
	(0.008)				
POLICYCHANGEDUMMY*LEVERAGE(LTV>60%DUMMY)		-0.029***			
		(0.010)			
POLICYCHANGEDUMMY*LEVERAGE(LTV>70%DUMMY)			-0.049***		
			(0.012)		
POLICYCHANGEDUMMY*LEVERAGE(LTV>80%DUMMY)				-0.079***	
				(0.017)	
POLICYCHANGEDUMMY*LEVERAGE(LTV>100%DUMMY)					-0.181***
					(0.026)
POLICYCHANGEDUMMY	0.002	-0.002	-0.003	-0.012	-0.044*
	(0.013)	(0.013)	(0.015)	(0.018)	(0.026)
LEVERAGE(LTV>50%DUMMY)	0.059***				
	(0.008)				
LEVERAGE(LTV>60%DUMMY)		0.082***			
		(0.012)			
LEVERAGE(LTV>70%DUMMY)			0.142***		
			(0.015)		
LEVERAGE(LTV>80%DUMMY)				0.235***	
				(0.025)	
LEVERAGE(LTV>100%DUMMY)					0.622***
					(0.025)
EDUCATION	0.003***	0.004***	0.004***	0.005***	0.008***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
AGE	-0.004***	-0.004***	-0.004***	-0.005***	-0.007***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MARITAL_STATUS	-0.014*	-0.015*	-0.019**	-0.022*	-0.019
	(0.008)	(0.008)	(0.009)	(0.011)	(0.016)
GENDER	0.014**	0.015**	0.019**	0.023**	0.031**
	(0.007)	(0.007)	(0.009)	(0.011)	(0.013)
ETHNICITY	0.031***	0.034***	0.043***	0.055***	0.086***
	(0.004)	(0.005)	(0.006)	(0.007)	(0.011)
FAMILY_SIZE	-0.014***	-0.015***	-0.017***	-0.020***	-0.030***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.003)
SPELL (YEARS)	-0.009***	-0.009***	-0.010***	-0.010***	-0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
INCOME (LOGS)	0.003	0.004	0.005	0.010*	0.033***
	(0.004)	(0.004)	(0.004)	(0.006)	(0.008)
OTHER CONTROLS	Yes	Yes	Yes	Yes	Yes
YEAR FIXED EFFECTS	Yes	Yes	Yes	Yes	Yes
STATE FIXED EFFECTS	Yes	Yes	Yes	Yes	Yes
OBSERVATIONS	37256	37256	37256	37256	37256

Figure 1: Mobility (%) 1983-1997

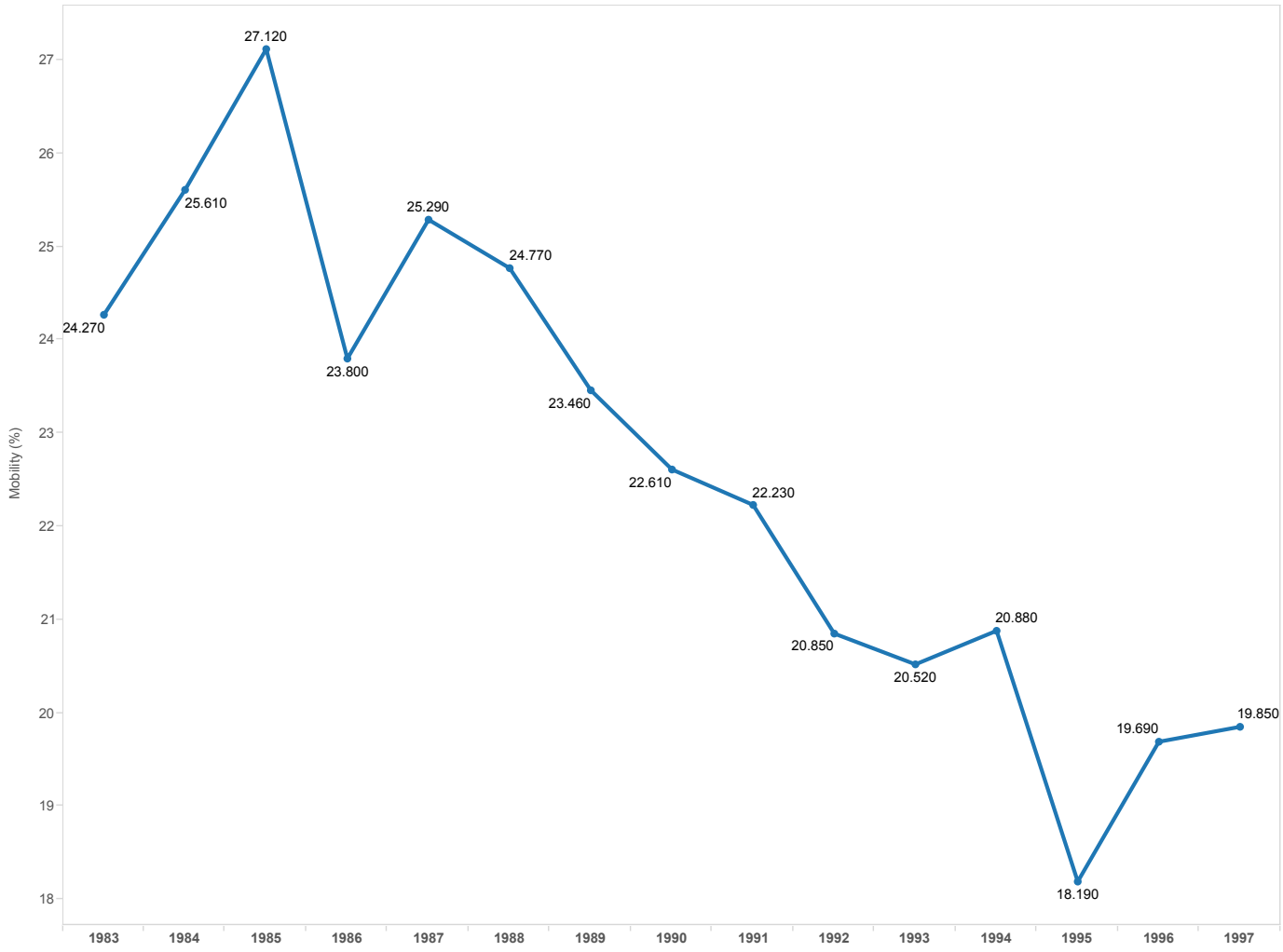

Figure 2: 30-year (long term) Mortgage Rates (Freddie Mac)

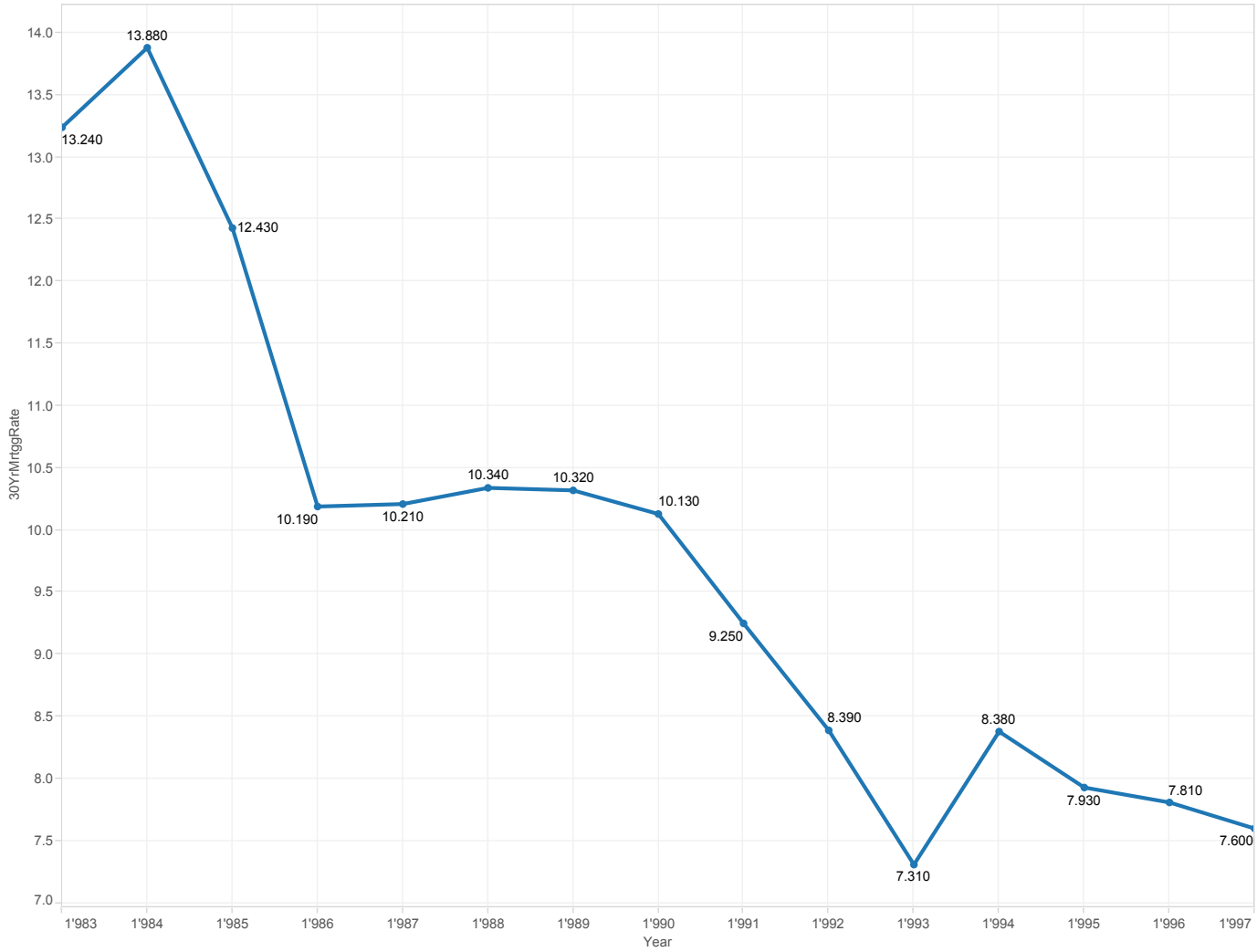

Figure 3: State-level Housing Price Shocks: 1983-1997