The Effects of Home Ownership on Post-unemployment Wages *

Xi Yang†

November 4, 2015

Abstract

Homeownership can influence labor market outcomes in several ways. Previous papers mainly study whether homeowners are less mobile or whether homeowners experience longer unemployment duration with respect to renters. Little research, however, has been done to study the relationship between homeownership and the wages. This paper shows that unemployed homeowners, compared to unemployed renters, are more likely to accept lower wages. In particular, this negative effect is more evident in distressed labor markets where unemployment rates are higher than the national level. To illustrate why homeowners accept lowers wages, particular in the distressed labor market, this paper builds a two-markets job search model. The model predicts that homeowners tend to have lower reservation wages and put higher search efforts in the local market in order to be reemployed in this market. While the reservations wage effect lowers post-unemployment wages, the search effort offsets it. In a distressed labor market, the reservations wage effect is dominating, and therefore, unemployed homeowners are more likely to have lower wages.

Keywords: Job Search, Wage dynamics, Home Ownership

*I am grateful to Robert Moffitt for guidance and support. I thank Yuya Sasaki, Yingyao Hu, Hülya Eraslan, Richard Green, Gary Painter, Lynn Fisher, and participants at the JHU Applied Micro Seminar, the USC Lusk Center Seminar, and the AREUEA National Conference for helpful comments. I also thank Daniel Feenberg for NBER-generated tax data.

†Xi Yang, Lusk Center for Real Estate, University of Southern California. xiy@usc.edu

1 Introduction

The labor market consequences of home ownership have received increasing attention after the recent housing crisis. Many studies[1] discuss whether homeowners are less mobile and are suffering longer unemployment durations. Not much, however, is known about how homeownership affects post-unemployment wages. This paper contributes to the literature by investigating how and to what extent homeownership affects unemployment duration and post-unemployment wages.

The hypothesis that homeownership causes unemployment was first brought up in Oswald [1996, 1997], which finds that the high homeownership rate is associated with high unemployment rate at the country level. Oswald argues that high homeowenrship rate restricts labor mobility and therefore, leads to larger labor market friction and higher unemployment rate. Inspired by Oswald's hypothesis, several studies have attempted to estimate the effect of homeownership on unemployment using both aggregate and individual level data. So far, the aggregate level studies tend to support the positive correlation between homeownership rate and unemployment rate, though these conclusions are usually affected by omitted variable problem (Green and Hendershott [2001a]; Blanchflower and Oswald [2013]; Coulson and Fisher [2009]).

Results based on individual data are more ambiguous. On one hand, several findings support Oswald's hypothesis by showing that homeowners experience longer unemployment spells than renters(Green and Hendershott [2001b],Battu et al. [2008], Guler and Taskin [2011]; Taskın and Yaman [2013];Ringo [2014]). On the other hand, contrary to predictions from Oswald's hypothesis, several studies find that homeowners have more favorable labor market outcomes than renters. For example, owning one's home is found to be associated with lower unemployment probabilities, shorter unemployment durations, and higher wages (Goss and Phillips [1997];Coulson and Fisher [2002];Coulson and Fisher [2009];Flatau et al. [2003];Van Leuvensteijn and Koning [2004];Munch et al. [2006]); Munch et al. [2008];Laamanen [2013]).

In some papers on recent recession, Oswald's hypothesis has been related to the house-lock effect and led to heated debates on whether housing market collapse caused or exacerbated

[1]See Oswald [1996, 1997],Green and Hendershott [2001a], and Coulson and Fisher [2009] for examples.

unemployment. The house-lock effect can be think of a special case of Oswald's hypothesis, which argues that declining of housing price leads to negative home equity, which makes it even more costly for homeowners to move and match with job opportunities when unemployed. Empirical evidence on house-lock effect is mixed. Some studies[2] find house-lock effect is significantly large during the recent recession, while others[3] argue that the influence of this effect is limited.

Existing studies on labor market consequences of homeownership have three main limitations. First, most papers study only unemployment duration and unemployment rate. Post-unemployment wage, as an important dimension of job search outcomes, is largely neglected.[4] This paper fills this gap by estimating the effect of homeownership on post-unemployment wages. Based on a rich set of pre- and post-spell characteristics, this paper shows unemployed homeowners experience smaller wage increase and are more likely to accept wages that are lower than pre-unemployment ones when reemployed. Therefore, homeownership may not necessarily prolongs unemployment duration but lowers post-unemployment wages. This suggests the labor market friction caused by homeownership is more profound than what has been documented in the literature. [5]

Second, though many empirical attempts have been made to study the labor market consequences of homeownership, the economic theory based on which these empirical results can be interpreted is underdeveloped. The existing theories can be divided into two categories, depending on to what extent the unemployed is allowed to adjust job searching strategies. Oswald [1996] belongs to the first category, where homeowners are assumed to have a lower probability of reemploying in non-local labor market without any active adjustment of their search strategies. Neglecting these adjustments leads to a straightforward but biased conclusion that homeownership prolongs unemployment duration, which is disproved by many individual data studies. The second category of theory, based on a two-region partial job search model,

[2]For example, see Ferreira et al. [2010] and Karahan and Rhee [2012].

[3] See Schulhofer-Wohl [2011], Modestino and Dennett [2012],Abowd and Vilhuber [2012], Farber [2012], Demyanyk et al. [2013], and Valletta [2013].

[4]The post-unemployment wage is largely studied in the literature of unemployment benefits. For examples, see Ehrenberg and Oaxaca [1976], Belzil [2001], Lalive [2007], and Caliendo et al. [2013]).

[5] Ringo [2014] is the only other paper that discusses wage growth. It considers the annual wage growth instead of the post-unemployment wage growth.

allows homeowners to lower reservation wage for local offer to avoid moving cost and to increase reservation wage for non-local offer to compensate moving cost. Munch et al. [2006], uses this model and predicts that unemployed homeowners have a higher transition rate into employment in the local labor market, while a lower transition rate into jobs in non-local labor market. If job arrive rate in local market outweighs that in non-local market, one should expect shorter unemployment spell and lower wages for unemployed homeowners. Munch et al. [2006] confirms the empirical implication for unemployment spells, but conducts no estimation on wages. Also allowing the choices of reservation wage, Coulson and Fisher [2009] moves one step forward and includes the entry of firms into the job search.

Though allowing the adjustment of reservation wage alone can predict the shorter unemployment duration and the lower wages, it is not able to explain why the negative effect of homeownership on job matching quality is less significant in the region where labor market demand is strong. [6] To elaborate how unemployed homeowners change search strategy with respect to local demand, this paper extends the model in Munch et al. [2006] by allowing unemployed workers to choose not only the reservation wage but also the relative search effort they put in local and non-local labor markets. To avoid moving, unemployed owners are more willing to be reemployed in the local market than renters. To increase the probability of reemployment in the local market, they can either lower reservation wages or spend more time searching in the local market. The two strategies, however, have different implications in post-unemployment wages. Lower reservation wages imply lower post-unemployment wages. Higher search efforts, on the other hand, can increase the local reemployment probability without compromising wages.To what extent homeownership lowers wages depends on whether the search efforts can effectively boost the chance of receiving local job interviews. In a market where labor demand is strong, improving search effort can easily increase job opportunities. Homeowners, therefore, can increase the local reemployment probability by put more effort in this market without compromising wages. In a distressed labor market, job opportunities with matched skill requirement are few no matter how hard the unemployed workers search. In this

[6]Guler and Taskin [2011] and Head and Lloyd-Ellis [2012]) also study how labor market environment affect the effect of homeownership on unemployment, but both papers discuss unemployment duration and neglect other post unemployment outcomes.

case, homeowners are more likely to be forced to take low wage jobs in order to stay local. The relative effectiveness of search efforts in the distressed and the non-distressed labor market explains why the negative effect of home ownership on wages is more evident in the distressed market.

The lower wages in distressed labor market provides a potential explanation on why homeowners are observed to be more mobile than renters when housing price declines, [7] contrary to the prediction of Oswald's hypothesis or the house-lock effect; both argue that declining housing price raises moving cost and, therefore, makes homeowners even less mobile than renters. This prediction neglects the fact that housing price decline is usually accompanied by a distressed local demand. For unemployed homeowners living in those regions, the cost of moving is higher, the wage benefits of moving, however, are even higher. Therefore, homeowners may have higher mobility rate in regions where housing price declines, comparing with homeowners in other regions.

Besides the lack of theoretical guidance, the endogeneity of tenure choice is another reason that the literature produces mixed results. Homeownership is not randomly assigned in the population; the differences of labor market outcomes between owners and renters may reflect the different characteristics between the two groups, not the causality effect of homeownership. For example, homeownership usually involves longer financial commitment and larger financial burden, which implies that homeowners, compared to renters, are more likely to be steadily employed with high wages. This correlation could bias up the causal effect and leads to a spurious inference that ownership reduces unemployment and slows wage growth. To address this problem, the literature relies on the instrumental variable to identify the local causal effect. The dominant instruments are the regional level homeownership rate(Van Leuvensteijn and Koning [2004]) and housing policies, including mortgage interest deduction (Coulson and Fisher [2009]), rental housing market deregulation reform(Laamanen [2013]), and the strictness of local zoning ordinances (Taskın and Yaman [2013]).[8]

[7] See Schulhofer-Wohl [2011] and Demyanyk et al. [2013]

[8] Using regional level variable as an instrument might be invalid if individuals sort by regional characteristics that is correlated with the instrument. An individual level instrument is less vulnerable to this problem, but they are usually hard to get. So far, only two papers adopt individual level instruments. Coulson and Fisher [2009] employs the gender composition of first two children for a sample of households with two or more children; Ringo [2014]

The identification strategy of this paper relies on using state-level mortgage interest deductions as the instrumental variable. Following Hilber and Turner [2013], the variation of this tax policy is calculated as the additional tax caused by one percent increase of mortgage interest based on a large, fixed, representative sample provided by NBER. Using this measure of mortgage interest deduction as an instrumental variable has a number of desirable features. First, as one of the most important favorable tax treatment for homeowners[9], this tax policy predicts the propensity of being a homeowner in a certain state. Second, it varies only due to changes in the federal and state tax laws, not due to changes in income or other household level characteristics and provides an exogenous measure for the individual level analysis. Finally, it does not correlate with state-level unemployment rates and housing prices that are determining the local economy and therefore avoids the potential sorting problem.

This paper uses the Survey of Income and Program Participation (SIPP) 1996, 2001, 2004, and 2008 panels to test the predictions from the model. The rich set of pre- and post-unemployment characteristics make it possible to track unemployment transitions and to measure wage dynamics before and after unemployment. The estimation results show unemployed homeowners, compared with renters, stay in unemployment for a shorter time but experience about 10.8% lower reemployment wage gain and are about 10% more likely to accept displaced wages. By characterizing labor market at the state level and proxy distressed labor market as states that have higher unemployment rates than the national rate, this paper shows that the negative effect on wages is larger in distressed markets, while it is less significant in non-distressed markets. The empirical results are consistent with the model predictions. What is more, this negative effect is more evident among young homeowners and homeowners with limited liquid assets.

The paper is organized as follows: Section 2 outlines the theoretical framework and derives empirical implication. Section 3 describes the SIPP data and provides descriptive evidence regarding unemployment spells for both homeowners and renters. Section 4 presents the econometric model and discusses the endogeneity problem. The estimation results are

explores the childhood environment and uses the county level homeownership rate when and where the worker grew up as the instrument.

[9]See Rosen [1979],Rosen et al. [1983],Glaeser and Shapiro [2003],Poterba and Sinai [2008], and Hilber and Turner [2013]for more analysis on mortgage interest deduction

presented and discussed in Section 5 and Section 6 concludes.

2 Theoretical Model

I set up a partial equilibrium job search model in line with Munch et al. [2006], which distinguishes local and non-local job offers depending on whether the offer requires a geographic move and triggers moving costs. The local and non-local job arrive rate, $\lambda(s_l)$ and $\lambda(s_n)$[10], are determined by search effort s_l and s_n in the two markets. I normalize the total effort to be 1 unit, that is, $s_l + s_n \leq 1$. Let $\mu(s)$ denote the cost of searching effort s. $\lambda(\cdot)$ is assumed to be strictly increasing and concave, while $\mu(\cdot)$ is strictly increasing. That is, larger search effort is associated with more job opportunity, but also higher cost. The concavity of $\lambda(\cdot)$ means the return of searching is diminishing. The wages of offers from both markets are drawn from a known cumulative distribution function, $F(w)$. An accepted job offer (and its wage) is permanent.[11] Unemployed renters can move between the two markets freely, while unemployed owners have to pay a moving cost $c > 0$ if they decide to accept a non-local offer. The model predictions reply on the assumption that the moving costs for homeowners are larger than that for renters; the assumption of zero moving costs for renters is made for simplicity. While unemployed, renters and owners both receive unemployment benefit b.[12]

Based on the above setup, the unemployment transitions can be fully describes by Bellman equations. Suppose the discount rate is β, then for renter the discounted value of employment with wage w is

$$V_r^e(w) = w + \beta w + \beta^2 w + ... = \frac{w}{1-\beta}. \tag{1}$$

On the other hand, given the optimal choice of searching effort (s_{rl}, s_{rn}), the value of continuing searching, V_r^u, consists of the current period payoff, b, minus the cost of searching $\mu_(s_{rl} + s_{rn})$, plus the discounted expected value of waiting for another period. In that case, if an offer is received, with probability $\lambda(s_{rl}) + \lambda(s_{rn})$, the renter chooses between the maximum of the value

[10]For simplicity, the job arrive rate function is the same for local and non-local market. After relaxing this assumption, similar theoretical implications can be derived.

[11]I do not consider on the job search and layoff risk.

[12]I consider a normalized unemployment benefit which equals to real unemployment benefits net of the cost of search.

of working at a wage w, $V_r^e(w)$, or continuing to search and receive V_r^u. If no offer is received, which occurs with probability $1-\lambda(s_{rl})-\lambda(s_{rn})$, the renter must continue to search and receives V_r^u. Thus, the alternative-specific value function for the search choice is

$$\begin{aligned} V_r^u &= \max_{s_{rl},s_{rn}} b-\mu(s_{rl}+s_{rn}) \\ &+ \beta\{(\lambda(s_{rl})+\lambda(s_{rn}))Emax(V_r^e(w),V_r^u)+(1-\lambda(s_{rl})-\lambda(s_{rn}))V_r^u\}. \end{aligned} \tag{2}$$

Bellman equations (1) and (2) determines renter's job search behaviors, which are captured by the reservation wage w_{rl}^* and w_{rn}^*, and the optimal search effort s_{rl}^* and s_{rn}^* for local and non-local job offers. With a little algebra, it's easy to derive the following Lemma.

Lemma 1. *For renter, $w_{rl}^* = w_{rn}^*$ and $\lambda'(s_{rl}^*) = \lambda'(s_{rn}^*)$.*

Proof. See Appendix A1. □

Lemma 1 shows that unemployed renters are indifferent between local and non-local wage offers. They accept any offer that exceeds the reservation wage and decline any other offers. At the same time, renters search in both markets till the marginal benefits of searching in the two markets are equal. For simplicity, local and non-local job arrive rate function is assumed to be the same $\lambda(\cdot)$, so renters put equal search effort in the two markets.

For homeowner, the discounted value of employment with w is the same as that of renter,

$$V_h^e(w) = w+\beta w+\beta^2 w+... = \frac{w}{1-\beta}. \tag{3}$$

The Bellman equation of searching also has the same structure as that of renter. The only difference stem from the moving cost c. To be more precise, with probability $\lambda(s_{hl})$, the homeowner receives a local offer and chooses between the value of working at a wage w, $V_h^e(w)$, or continuing searching and receive V_h^u. With probability $\lambda(s_{hn})$, the homeowner receives non-local offer and chooses between the value of working at a wage w after paying the moving cost, $V_h^e(w)-c$, or continuing to search and receive V_h^u. This Bellman equation for the search choice of homeowner can be written as

$$\begin{aligned} V_h^u(w) &= \max_{s_{hl},s_{hn}} b-\mu(s_{hl}+s_{hn}) \\ &+ \beta\{\lambda(s_{hl})Emax(V_h^e(w),V_h^u)+\lambda(s_{hn})Emax(V_h^e(w)-c,V_h^u) \\ &+ (1-\lambda(s_{hl})-\lambda(s_{hn}))V_h^u\}. \end{aligned} \tag{4}$$

Similarly, the Bellman equation (3) and (4) determine the job search behaviors of the homeowner which are captured by the reservation wage w^*_{hl} and w^*_{hn}, and optimal search effort s^*_{hl} and s^*_{hn} for local and non-local job offers.

Lemma 2. *For homeowner,* $w^*_{hl} < w^*_{hn}$ *and* $s^*_{hl} > s^*_{hn}$.

Proof. See Appendix A1. □

Lemma 2 shows that unemployed homeowners accept lower wages and search more in local market, compared with that in non-local market, since they derive higher utility from local offers than from non-local offers with the same wage.

The difference in labor market outcomes between owners and renters can be decomposed into the causal effort and selection bias. The purpose of the model is to show the direction of the causal effect of homeownership on unemployment duration and job matching quality assuming selection bias is zero. Distinguishing the causal effect from selection bias is the purpose of the empirical work in the later section. Therefore, the model assumes owners and renters are identical in terms of observed and unobserved characteristics except how much moving cost they have to pay when accepting non-local job offers, which implies homeownership status is taken as exogenous.[13] Under this assumption, I compare search strategies between owners and renters and derive the following conclusions.

Theorem 1. *Compared with renters, unemployed homeowners search more in the local market and less in the non-local market,*

$$s^*_{rl} < s^*_{hl}, \quad s^*_{rn} > s^*_{hn};$$

Compared with renters, unemployed homeowners have lower reservation wages in the local market and higher reservation wages in the non-local market,

$$w^*_{hl} < w^*_{rl} = w^*_{rn} < w^*_{hn}$$

[14].

Proof. See Appendix A1. □

[13] A model allowing endogenous ownership choice, along the job search choice, is more realistic, but provides no more insight on how ownership status affects, not correlates with labor market outcomes.

[14] This results is similar with the Proposition 1 in Munch et al. [2006].

Theorem 1 illustrates that unemployed homeowners, comparing with renters, adjust search strategies in two ways when face additional moving cost. On the one hand, homeowners set lower reservation wages than renters for local offers to avoid moving cost, and higher reservation wages for non-local offers to compensate moving cost. On the other hand, homeowners tend to distribute more search effort in the local market and less in the non-local market to increase the probability of being employed in local market, which are more valuable to them.

To see how homeownership affects search outcomes, I show how the hazard rates out of unemployment (θ_l, θ_n) and the expected post-unemployment wages (w_l^p, w_n^p) in the local and non-local markets are determined for owners and renters. For renter,

$$\theta_{rl} = \lambda(s_{rl}^*)[1 - F(w_{rl}^*)], \quad \theta_{rn} = \lambda(s_{rn}^*)[1 - F(w_{rn}^*)]$$

$$w_{rl}^p = w_{rn}^p = E(w|w > w_{rl}^*) = E(w|w > w_{rn}^*)$$

The hazard rate out of unemployment is the product of the arrival rate of job offers s_{rl}^* (s_{rn}^*) and the probability that the offer is accepted, which is determined by reservation wage w_{rl}^* (w_{rn}^*). Post-unemployment wages are measured by the mean of the acceptable wages, that is, wages that are higher than reservation wage. Similarly, for homeowners,

$$\theta_{hl} = \lambda(s_{hl}^*)[1 - F(w_{hl}*)] \quad \theta_{hl} = \lambda(s_{hn}^*)[1 - F(w_{hn}*)]$$

$$w_{hl}^p = E(w|w > w_{hl}*) \quad w_{hl}^p = E(w|w > w_{hn}*)$$

The reservation wage and the search effort work on the same direction for the hazard rate into local labor market. Since $w_{hl}^* < w_{rl}^*$ and $s_{rl}^* < s_{hl}^*$, as in Theorems 1, homeowners are more willing to accept lower wages and put more efforts in local market, they have higher transition rates into employment in the local labor market.

Theorem 2. *Compared with renters, unemployed homeowners have higher transition rates into employment in the local labor market and lower transition rates into employment in the non-local market. That is,*

$$\theta_{rl} \leq \theta_{hl}, \quad \theta_{rn} \geq \theta_{hn}$$

Proof. See Appendix A1. □

For a unemployed homeowner, both lower reservation wage and higher search effort in local market lead to higher transition rate and shorter unemployment spells into employment in the local market. However, the implications on overall hazard rate and the length of unemployment spells are more complicated, which depends on the relative size of local and non-local job offers. If the size of local offers is larger than the non-local offers, one should expect to see shorter unemployment spells for homeowners than renters, holding other conditions equal.

Though working on the same direction for unemployment duration for reemployment in local and non-local markets, reservation wage and search effort affect post-unemployment wages in different ways. A lower reservation wage decreases the mean of accepted wages, which leads to lower job matching quality in the local market, while a higher search intensity is not associated with such labor market friction. As long as $w^*_{hl} < w^*_{rl} = w^*_{rn} < w^*_{hn}$, as in Theorem 1, one should expect a negative effect of homeownership on post-unemployment wages in local market and positive effect on post-unemployment wages in non-local market. I summarize the difference of post-unemployment wages for owners and renters in the following theorem.

Theorem 3. *Compared with renters, unemployed homeowners have lower expected wages when reemployed in the local labor market and higher expected wages when reemployed in the non-local market. That is,*

$$w^p_{rl} \geq w^p_{hl}, \quad w^p_{rn} \leq w^p_{hn}$$

Proof. See Appendix A1. □

Taking own or rent status as exogenous decision, the directions of how homeownership affects hazard rates and post-unemployment wages in local and non-local markets are illustrated in Theorems 2 and 3. The sign of the overall effect, however, is not clear from a theoretical point of view. The endogeneity problem makes it even harder to quantify the causal effect of homeownership on unemployment and post unemployment outcomes. And these are the main reasons that the literature is providing mixed empirical results. Nevertheless, the model produces testable implications to recover a larger part of the story.

First, the model highlights that it is necessary to distinguish local and non-local job matches because homeownership leads to opposite implications in the two markets. The opposite implications make it possible to test whether local market or non-local market matching is

dominating. Oswald's hypothesis, for example, emphasizes only the non-local matching. Many micro level empirical evidence, including this paper, however, finds that local market matching is more important to explain how homeownership affects unemployment.

Second, a lower reservation wage and higher search intensity have different implications on post-unemployment wage. This difference provides an opportunity to test which search strategy is playing a bigger role in determining homeowners' job search outcomes. If an unemployed homeowner reemployed with a lower wage, it means improving search effort cannot fully offset the wage mismatch caused by being a homeowner. This is especially true when the local labor market demand is weak and search effort, therefore, can not effectively increase the probability of receiving high quality local job offers. On the other hand, if an unemployed homeowner reemployed with a similar or high wage, then search effort plays a larger role. Therefore, the negative effect of homeownership on job matching quality is expected to be more profound in a distressed labor market.

Suppose the labor market can be characterize into distressed (D) and non-distressed markets (N), with the search effort to be less effective in the former than in the latter. One should expect to see owners search less and accept even lower wages in the distressed market. This feature is summarized in the following theorem.

Theorem 4. *Suppose w_{hl}^N and w_{hl}^D are expected post-unemployment wages corresponding to the two job arrive rate functions $\lambda_l^D(s)$ and $\lambda_l^N(s)$. If $\lambda_l^{D'}(\cdot) < \lambda_l^{N'}(\cdot) = \lambda_n^{D'}(\cdot) = \lambda_n^{N'}(\cdot)$, we have*

$$w_{hl}^N > w_{hl}^D, \quad \textit{and} \quad s_{hl}^N > s_{hl}^D.$$

Proof. See Appendix A1. □

A smaller $\lambda_l(\cdot)$ means the job arrive rate is lower with the same level of search effort. Theorem 4 illustrates the job matching quality is even lower and homeowners tend to search less in a distressed market. On one hand, unemployed worker search less in a distressed local market because the marginal benefit of searching in is relatively smaller than in non-distressed market. On the other hand, reservation wage is lower in the distressed market because the expectation for future wages is lower and increasing search effort can not efficiently increase the job arrive rate in the local market. This theorem can help to explain why homeowners are more mobile when housing price declines. Based on Oswald's hypothesis, the recent decline

of housing price leaves a growing number of homeowners "underwater". With negative home equity, unemployed homeowners are facing higher moving cost, which further harm their ability to be matched with job vacancies outside of local market. However, rare empirical evidence has been found to support this seemingly possible argument. The model with both reservation wage and search effort mechanisms provides a theoretical explanation of why such negative effect of homeownership (negative home equity) is hard to be found in the data. The prediction based on Oswald's hypothesis neglects the fact that decline in housing price mostly happens in distressed labor markets. For homeowners located in those regions, the cost of moving is higher, the wage benefits of moving, however, are even higher. As showed in Theorem 4, homeowners tend to search more in non-local areas and may have higher probability of moving away from current locations. The implication on empirical work is that the local market economy should be considered when estimating the effect of housing price or negative home equality on labor market outcomes.

3 Data and Empirical Overview

3.1 the Survey of Income and Program Participation

I use the Survey of Income and Program Participation (SIPP) 1996, 2001, 2004, and 2008 panels. In each panel, SIPP follows around 40,000 households over three to four years and surveys them every four months, creating 9 to 12 waves.[15] Each wave provides comprehensive information not only on demographic characteristics, but also on monthly labor force activities, including earnings, number of weeks worked or unemployed. This longitudinal design allows the tracking of unemployment transitions. Unlike the CPS, it provides complete unemployment spells and a rich set of pre- and post-spell characteristics, which are proved to be essential for understanding unemployment transitions.[16] In addition, the SIPP has a relatively large sample size, which provides enough numbers of unemployment spells for the purpose of this research. Finally, the four panels cover the years between 1996 and 2013, which witness the booms and

[15]SIPP is comprised of core and topical module data. The core questions are asked every wave, while topical module questions are only asked during certain waves.

[16]Other literature that also take advantage of this feature of SIPP including Chetty [2008] and Low et al. [2010].

busts in the housing market and make it possible to test the linkage between housing and labor markets. All monetary variables are converted to 1996 dollars.

In the SIPP, homeowners can be further divided into out-right homeowners and mortgagors, where mortgagors are defined as homeowners who hold positive mortgage loans. At the same time, renters can be further divided into private market renters, public housing renters and free renters, depending on the type of the rental unit they lived in. The labor market incentive is different for highly leveraged homeowners and outright homeowners; it is also different for renters who pay market rent and those who pay subsidized rent. Since outright homeowners are more likely to be seniors who have already retired from the labor market and usually have lower incentive to get reemployed, I'm reluctant to put outright homeowners and mortgagors into the same category. Similarity, renters in subsidized and public housing may worry about losing their below-market rents when moving for job opportunities. Therefore, it's unwise to treat them the same as other households who live in private rental units. To identify the causal effect of housing tenure, it's essential to rely on comparable groups of owners and renters who are paying their fair share of housing cost, through mortgage or rent. Therefore, this study focus only on mortgagors and private market renters. Appendix table A1 reports the statistical descriptions for all the four categories[17] of housing tenure states: (1) owners with mortgages, (2) private market renters,(3) outright owners,and (4) subsidized renters. It shows that 78% owner-occupiers are owners with mortgages, and private renters comprise close to 93% of total renters.

The sample is restricted to include working age males[18](from 18 to 64 years old) whose residential status are either mortgagors or private renters. The effects of housing tenure on unemployment-employment transition are estimated by comparing unemployment spells and post-unemployment outcomes between owners and renters using instrumental variable to correct the selection bias.[19] To reduce measurement errors of unemployment spells and wages, several

[17]Flatau et al. [2003] has considered how different states of ownership (degrees of leverage) affects unemployment.

[18]I focus exclusively on males for two reasons. First, it avoids the complications caused by fertility decision and various benefit that available for females. Second, job search models are more relevant for modeling the labor force activities of males with high-frequency data, while females labor force participation is better described by labor supply models.

[19]The implicit assumption of using unemployment spells is that ownership status is not correlated with unemployment shock.

restrictions are applied to the data. First, I keep individuals who have information for at least three months. Second, to focus on active job seekers, I eliminate individuals who have ever been out of labor force. [20] Therefore, unemployment spells that end with out of labor force are eliminated. Third, to eliminate gaps in the employment history, I drop individuals who are enrolled in school or the Armed Forces and those who are self-employed, disabled, or retired. More details of the construction of unemployment spells and the post-unemployment wages are provided in Appendix A2. Lastly, I exclude states Maine, North Dakota, South Dakota, Vermont and Wyoming because these states are not be able to separately identified in panels 1996 and 2001. The final sample contains containing 15,394 unemployment spells of 11,828 unique individuals.

Table 1 compares unemployed homeowners and renters as two groups for their individual characteristics. Homeowners, who have ever experience unemployment, as compared to unemployed renters, are older, more likely to be married with child(ren). On average, homeowners receive more education and are in a better financial position. They have higher total wealth and higher liquid asset even though they are holding part of asset as mortgage. Their spouses are more likely to work and have higher earnings. Despite that homeowners compose a larger proportion of the whole sample (61%), unemployed homeowners compose a smaller proportion of unemployed individuals (41.5%). This suggests homeowners are less likely to be unemployed.

Table 2 provides statistic descriptive of unemployment spells for owners and renters. Spells are categorized into two types: 12,353 spell ends with employment and 3,039 are right censored. For each unemployment spell, I collect the information of the length of duration, the pre and post-unemployment wages whenever it is available. Hourly wage instead of monthly wage is used in order to tease out the changes in hours worked rather than changes in wages. The average length of unemployment spells for owners is 12.64 weeks, about one week longer than that for renters. The mean pre and post-unemployment hourly wages for homeowners are \$15.48 per hour and \$19.09 per hour, both are higher than wages of renters. I pay special

[20] A transition to out of labor force can have different explanation. For some, this transition reflects a discouraged job seeker effect, i.e., the individual is losing the desire and attachment to work to continue the search process. For others, however, it can represent a period of investing in human capital through full-time education and training or a decision to undertake full-time care for dependent children or aged parents.

attention to a sub-sample of the unemployment spells that begin and end with employment and wages, based on which the measurements of job matching quality are constructed. This leaves 11,048 unemployment spells, with about 26% spells experience decrease in wages.[21] Suppose pre-unemployment wage measures the workers productivity, the deviation of post-unemployment wage compared with the pre-unemployment wage, therefore, measures how well the unemployed workers are matched with job offers. The average wage changes is $3.62 per hour before and after unemployment for homeowner, and $5.25 per hour before and after unemployment for renter. Besides, homeowners, compared with renters, experience 15% higher probability to be displaced accepting wages that are lower than the pre-unemployment ones. Wage gains and displacement probability show homeownership is associated with lower job matching quality.

To test whether the job matching quality is even lower for owners than for renters in a distressed labor market, as predicted in the model, I divided samples into distress and non-distressed states. Distressed states are defined as those with unemployment rates higher than the national level in that year, while non-distressed are states with lower rates. State level unemployment rates between 1995 and 2013 come from the Bureau of Labor Statistics (BLS). Table 3 shows that both renters and owners experienced longer unemployment duration in distressed states. Owners, however, experience even smaller wage gains and are even more likely to be displaced when local economy is struggling. These results suggest that the local labor market environment is a critical factor that needs to be take into consideration when comparing the post-unemployment outcomes between owners and renters.

Reducing geographic mobility is one of the most important channels, claimed in the literature, of how owning a house would affect individual's ability to match with a job. It would be ideal if one could distinguish unemployment spells that end with a local job and those end with a non-local job that involves moving. To do this, one first needs to define mobility. As mentioned in Taskın and Yaman [2013], the SIPP data allows three measurements of mobility:

[21] One concern of this wage measurement is it dose not normalize living cost in different locations, which, I argue would not contribute much to the wage dynamics of unemployed workers in the sample since the mobility rate is only about 1% for owners and about 6% for renter. Besides, the estimate includes state and year dummies which more or less control the living cost among different locations.

MSA change, State change and address change. However, none of the measurements is perfect. The MSA code in SIPP only identifies 97 largest metro areas which make it impossible to track mobility across smaller sized metro areas.[22] The state mobility would underestimate inter-state mobility. Finally, address change gives the highest mobility rate, but the measurement error is considerably large. In table 4, I report the characteristics of the unemployment spells for those end with local and non-local jobs, where non-local job is defined by comparing addresses before and after unemployment spells. The results certainly indicate the homeowners are much less likely to accept and move for a non-local job. It's worth mentioning, however, that the number of unemployment spells end with a non-local job[23] is not large enough to provide reliable results.

4 Estimation

To investigate how homeownership affects the unemployment-employment transition, I consider three dependent variables: unemployment duration, the difference between the (logarithm) wages of pre- and post-unemployment jobs, and a binary variable indicating whether the post-unemployment wage is lower than the pre-unemployment wage, that is, whether the unemployed worker is displaced when reemployed.[24] Unemployment duration measures how long it takes unemployed worker to be matched with a job, while the last two variables measure the quality of the post-unemployment job matches. I first conduct OLS estimation with the following estimation equations

$$Y_{ji} = \beta_{j1} H_i + \beta_{j2} X_i + \epsilon_{ji}. \tag{5}$$

where i is the individual index, $Y_j, j = 1, 2, 3$ stands for the three dependent variables, H_i is the binary variable of homeownership that equals 1 for owner and 0 for renter. Therefore, the

[22] Due to confidential reason, MSA information is not provided in 2004 and 2008 panels.

[23] The number of unemployment spells end with a non-local job is even smaller when non-local job is defined by MSA mobility or state mobility.

[24] Unemployed owners and renters are not randomly selected from the population, therefore, the estimations based on unemployed population may introduce bias. The common solution for this selection bias is Heckman correction method. This method, however, depends on a exclusion restriction that affect probability of unemployed, but not job matching quality. This exclusion restriction is hard to obtain. An alternative estimation method is to put more structure behind both the ownership choice and the determination of unemployment and job matching quality before structurally estimating such a model. I leave this topic for future work.

primary objective is to get consistent estimates of the parameter $\beta_{j1}, j = 1, 2, 3$, which measure the effects of homeownership on unemployment duration and job matching quality.

The X_{it} is a vector of variables that are correlated with unemployment-employment transitions. As mentioned in Classen [1977], the X_{it} variables are proxies for worker's distribution of job offers and the cost of job searching. The same variables should enter all three estimation equations above, because $Y_j, j = 1, 2, 3$ are simultaneously determined endogenous variables that represent the outcomes of an unobserved search strategy. For those proxy variables, I consider the pre-unemployment wage. For demographic variables, I include age, race, education, marital status, number of young(0-6) and old(7-15) children live in the household, and whether the household is located in metro area. Age is measured at the time of entrance into unemployment to approximate the year of work experience which can not be observed in the data. For education, I use three dummy variables: high school or less, college graduate or dropout, graduate education, with high school or less as the reference group. Besides, financial status can also influence job search strategy [25] by affecting job seeker's ability of smoothing consumptions while unemployed. For example, if individual is receiving unemployment benefits or a wage earing spouse is present in the household, this may relieve financial stress of the unemployed who may reduce search intensity and wait longer time for a better job match. To control the influence of financial status, I include the level of unemployment benefits, spouse employment status and total household wealth as controls. Finally, as illustrated in the model, the effect of homeownership on unemployment depends on the local market environment, so I also include state level unemployment rate, state level housing price, state and year dummies.

4.1 Identification

The key concern with OLS estimation of β_{j1} is that homeownership can be correlated with the unobserved characteristics that are determining an individual's job search strategy and labor market outcomes at the same time. For example, homeownership usually involve longer financial commitment and larger financial burden, which implies that homeowners, compared with renters, are more likely to be steadily employed and have sufficiently high wages. This correlation between labor market outcomes and homeownership could lead to a spurious inference that

[25] Both Rendon [2006] and Lentz and Tranaes [2005] illustrate the wealth effect on job search.

ownership reduces unemployment and slows wage growth. To deal with this problem, I conduct two-stage least-squares (2SLS) estimations where the state-level mortgage interest deduction is used as the instrumental variable. As one of the most important favorable tax treatment for homeowners, this policy affects individual's homeownership decision but is no direct correlated with labor market factors, which makes it a good instrument.

To measure this deduction, I follow Hilber and Turner [2013] and calculate the tax saving based on publicly available data of tax rates using NEBR program TAXSIM.[26] To be more specific, I first calculate the state income tax liabilities owed by a large, fixed, nationally representative sample of 1995 individual tax returns for each state and year, provided by the Statistics of Income Division of the U.S. Internal Revenue Service. Then, I increase the mortgage interest by 1% for each taxpayer and recalculate the state taxes. Mortgage tax subsidies at state-year level are generated by averaging the additional tax over taxpayers by state and by year. This subsidy variable is used to measure mortgage interest deduction in different states. States with a higher subsidy indicate a more favorable tax code for homeowners.

Table 5 presents the average mortgage tax subsidy of different states in the period 1996-2013 [27]. The mortgage tax subsidy varies across different states with the maximum rate reach 4.72% per dollar in California. This variation reflects different state tax structure. For example, some states use federal adjusted gross income as a starting point for developing their tax base, some use federal taxable income, and other states may compute the taxable income independently of the federal formula. The heterogeneity in tax structure can be caused by mimic neighboring state's policies or by the variation in state's efforts to exporting tax burdens to nonresidents (Fisher [1996]) For example, some states, such as Florida, Nevada and Texas, collect no personal income tax at all, while others, such as California, Delaware, Maine, Massachusetts and North Carolina, rely heavily on personal income taxes to raise revenue, and permit the deduction of mortgage interest. Moreover, within a state, mortgage tax subsidy can change over time, mainly caused by the change of federal tax code, especially the marginal tax rates at the federal level. From 1996 to 2013, the sample period, the federal tax law has experienced 1997,

[26] See details in Feenberg and Coutts [1993] and at http://www.nber.org/taxsim.

[27] Maine, North Dakota, South Dakota, Vermont and Wyoming are excluded from the sample because they can not be separately identified in SIPP

2001 and 2003, three main changes. The 1997 tax law change increased marginal taxes rates, while the other two tax cuts reduce marginal taxes rate. On one hand, federal tax law is directly related with state mortgage interest deduction, since some states have reciprocal deductibility whereby federal taxes are also deductible from state taxable income (Fisher [1996]). On the other hand, the change in federal marginal tax rates can indirectly affect the state level tax instrument since state tend to depend on the tax revenue that are federal deductible. (Hilber and Turner [2013];**?**).

The NBER measure of mortgage interest deduction has a number of desirable features to instrument homeownership status. First, it varies due to changes in the federal and state tax laws, not due to changes in income or other household level characteristics, and, therefore, provides an exogenous measure for the individual-level analysis. Second, it does not correlate with other state-level characteristics that determining the local economy and labor market prospects of local unemployed. As presented in Table 6, no significant correlation is found between state-level tax variation and other state-level variables, including unemployment rates and housing prices, though the last two variables are significantly correlated.

4.2 Estimation results

Table 7 shows the OLS estimate of β from equation (5). The dependent variables are unemployment duration, the post-unemployment wage gain, and the probability of wage displacement. For each dependent, I estimate four different specifications. The first column does not consider state level variables. The second and third columns include state and year dummies and state level unemployment rate and housing prices. The second column considers only unemployment spells that end with local jobs. The third column considers both unemployment spells end with local or non-local jobs. The empirical results are similar in the three specifications. Especially, the similarity of the last two columns indicates labor market outcomes in local market reflects the overall effect of homeownership. In general, the results show that unemployment spells for homeowners are shorter and come along with lower wage increase and higher probability of displacement, which are consistent with the model predictions that homeownership may not necessarily prolong unemployment duration, but affects labor market outcomes by reducing job matching quality.

Given the concern about potential bias in the OLS estimate, I conduct two-stage least squares estimation. Let Z_i denote the state-level mortgage tax subsidy, the first stage estimates the following probit homeownership equation:

$$H_i = \alpha_1 Z_i + \alpha_2 X_i + \epsilon_{hi}. \tag{6}$$

Table 8 presents the first-stage results. The first column shows 1 % increase in state-level mortgage tax subsidy is associated with a 4.5% percentage point increase in the likelihood that an individual becomes homeowner in that state. Columns 2 and 3 of table 5 illustrate the robustness of the first-stage estimates to the different specification of control variables and different regression models. In column 2, I add the state and year dummies and state level unemployment rate and housing prices. In column 3, I consider a linear probability model instead of a probit model. The mortgage tax subsidy is significantly correlated with the ownership indicator in all three models, suggesting that individuals are more likely to own in the states where tax policies are more favorable to owners. In all three specifications I estimate the F-statistic to be greater than 10, indicative of a strong first-stage relationship. [28]

Table 9 shows the IV estimate of β from (5). Columns 1 reports 2SLS results when the dependent variable is unemployment duration. Columns 2 and columns 3 report the 2SLS results for wage gain and the probability of wage displacement. The sign of causal effect parameters in 2SLS are consistent with those in OLS estimation, but the size become smaller. Unemployed homeowners, compared with renters, stay unemployed for about two weeks shorter, experience 10.8% less wage gain, and with 10.5% probability more likely to be displaced. The results confirm the negative effect of homeownership on job matching quality. This negative effect can only be caused by reservation wage effect, indicating search effort is not large enough to mitigate this market friction.

Many of the other estimated parameters are as expected. Higher pre-unemployment

[28] The literature has concern about whether the mortgage interest deduction is an effective tax policy for promoting homeownership, for example Glaeser and Shapiro [2003] and Hilber and Turner [2013] find that home mortgage deduction disproportionately benefits the wealthy because they claim most of the deductions, therefore boost homeownership only of higher-income households in less tightly regulated housing markets. The concern is less severe in this paper because it uses the sample of male household heads, who are more likely than other demographic groups to be beneficiaries of this tax policy.

wage is associated with shorter unemployment duration, smaller wage increase and higher probability of displacement, which is consistent with a life-cycle wage growth pattern. Education has a positive effect on wages growth and negative effect on displacement, though the effect on displacement is not significant. Unemployment insurance is associated with longer unemployment duration and higher wage increase. The unemployed with more wealth or higher spouse income tends to have longer unemployment duration, larger wage increase and lower probability of displacement. White unemployed are associated positive labor market outcomes, shorter unemployment duration, larger wage increase and lower probability of displacement.

4.3 Robustness Check

To investigate the robustness of our results, I perform a set of sensitivity analysis. First, I adopt alternative instrumental variables to check whether the negative effect of homeownership depends on my choice of instrument. Second, I consider the sample of young unemployed to check the concern of the proxy bias caused by including pre-unemployment wage. Finally, I conduct hazard model estimation for unemployment spells and probit model estimation for displacement probability to illustrate the baseline estimation results do not depend on functional assumptions.

4.3.1 Alternative Instrumental Variable

While the state level mortgage deduction has desirable features, it remain somewhat unsatisfactory because it is an aggregate measurement and it is possible to be correlated with unobservable shocks in the local area that are not captured by state-level unemployment rates or housing prices. An ideal instrumental variable should correlated with the propensity of becoming a homeowner at individual level (Coulson and Fisher [2009]). A few previous papers use individual level variable as instrument. For example, Ringo [2014] adopts county level homeownership rate when and where the worker grew up. This variable, however, is not available for the observations in the SIPP. On the other hand, Coulson and Fisher [2009] provides another individual level instrumental variable: the gender composition of the first two children. The idea is based on Angrjst and Evans [1998], which shows that households whose two first-born children are the same sex are more likely to have a third child, therefore a larger family

size. Family size is showed in literature to be correlated with higher propensity of becoming homeowner. One should expect that among households with two children, those with the first-born children being the same sex are more likely to become homeowner. As in Coulson and Fisher [2009], I restrict the sample to individuals with two or more children and construct two indicators for male and female same-sex first-born children to specify the sex composition(two first-born children with different sexes is the omitted category). I repeat the baseline 2SLS estimation with these two indicators as instrumental variables.

The estimation results are presented in Table 10. The first stage results show that households with two male first-born children are about 23.8% more likely to be homeowners than other households with more than two children, while households with two female first-born children are about 13.3% more likely to be homeowners. The F-statistic is 15.1, indicating the sex composition variables are not weak instruments. The second stage results are consistent with those in baseline estimation; homeownership reduces unemployment duration with a cost of poor job matches which are reflected as smaller wage gains and higher probability of wage displacement.

4.3.2 Among the Young

To directly proxy for the mean of the wage offer distribution and avoid omitted variable bias, pre-unemployment wage is commonly used in the regression based estimation of job search model as long as this variable is observed in the data. However, Wolpin [2013] raises concern about this inclusion and argues that pre-unemployment wage can lead to "proxy variable bias." Wolpin's main argument is that pre-unemployment wage is an outcome for previous job search, and therefore, is correlated with the unobserved characteristics that affect job search strategy. Based on the theoretical model, he also shows that, given perfect measure of job arrival rate and wage distribution, the pre-unemployment wage should have no impact on search outcomes. In this paper, I assume that for young job seekers, the previous job searches are less likely to be associated with homeownership decision, and therefore, the "proxy variable bias" is relatively small. I conduct a robustness check using the sample of young unemployed to show the baseline results are not severely contaminated by the proxy variable bias.

The estimation results for the sample of young are presented in Table 11. The results

show that the effect of homeownership on unemployment duration is similar among the sample of young with that among the full sample, and the negative effect of homeownership on job matching quality is larger among the young (0.333) than that among the full sample (0.108). Despite "proxy variable bias," this result is intuitive since young people tend to experience larger wage increase and the variance of job matching quality should be larger. This result suggests a potential disadvantage of being a homeowner at the younger age.

4.3.3 Alterative Estimation Models

The baseline models for unemployment duration and the wage displacement dummy are chosen to be linear for two reasons. First, instrumental variable method works well for linear models, but not for non-linear models, eg. hazard model, because the orthogonality conditions required to justify the method do not necessarily extend to nonlinear transformations. Second, comparing with the alternative full-information maximum likelihood estimation, 2SLS estimation does not require functional assumptions on the correlation between first and second stages. However, it should be admitted that the nonlinear models also have their own advantages. For example, hazard model is commonly used for data of unemployment spell for its advantage of easy incorporation of censored cases. Probit or logit models, on the other hand, are usually used for binary dependent variable because they fit the outcome probability better than linear probability model.

To ensure the baseline results are not artifact of model specification, I estimate a hazard model for unemployment duration and a probit model for the wage displacement, while the first stage of homeowner status is modeled as a probit model as in equation (6). The estimation results for the two models are reported in Table 12. It shows that the homeownership has a significant negative effect on unemployment duration and a positive effect on the probability of being displaced, just as in the baseline estimation results. Finally, though not conducted in this paper, it is worth mentioning that the under-going development of nonparametric estimation[29] might be a better solution for nonlinear model with endogeneity problem and this method is worth exploring for future studies.

[29]See Heckman and Vytlacil [2005].

5 Discussion

The baseline estimation shows, contrary to Oswald's hypothesis, homeownership shortens the unemployment duration. However, the postive job search outcomes come along with a cost, poor job matching. This suggests, on average, reservation wage effect is dominating search effort effect. As suggested in the model, the relative magnitudes of the two effects, and, in turn, the overall effects of homeownership are varying with labor market environment, the size of moving cost, and the financial position of job seekers. This section discusses how the effects of homeownership are changing with those factors.

5.1 The role of the labor market environment

The net effect of homeownership on unemployment depends on the empirical magnitudes of effects on local and non-local labor markets. This section studies the role of local labor market environment by dividing sample into those in distressed markets and those in non-distressed markets, where distressed market is defined defined if state unemployment rate is higher than the national level in that year. Between the year 1996 and 2013, the most distressed three states are DC, Michigan, and Mississippi, while the least distressed three states are Nebraska, Iowa, and Virginia.

Table 13 shows the effects of homeownership on job search outcomes are quite different in distressed and non-distressed markets. Though homeowners stay unemployed for shorter time period in both distressed and non-distressed markets, they are more likely to experience a wage decrease when the local labor market demand is weak. To be more specific, when located in a distressed market, unemployed homeowners experience 1.333 smaller wage gain than renters, and are 17.4 % more likely to accept wages that are lower than their pre-unemployment wage. On the contrary, located in a non-distressed market, homeowners experience 0.09 smaller wage gain and they are also 11.6% less likely to have a wage decrease, though these effects are not significant.

The different effects of homeownership in distressed and non-distressed states reflect the relative magnitudes of reservation wage effect and search effort effect. Different with reservation wage effect, the later can only be effective if local labor market has enough high quality job

opportunities. Otherwise, the job arrival rate cannot be increased even if the unemployed person puts more effort for searching. Therefore, homeowners are more likely to get out of unemployment in local market through accepting a less satisfied job then through searching more in the local market. On the other hand, when the market is full of high quality jobs, increased search effort can easily lead to a much higher job arrival rate, which means homeowners do not need to take a lower wage job in order to be reemployed in local market. These results suggest that labor market environment is a crucial factor that needs to be considered when discussing the effects of homeownership on labor market outcomes.

5.2 The Role of Declining Housing Price

As illustrated in the model, the magnitude of moving cost plays a crucial role determining the different search strategies for homeowners and renters. If the additional moving cost is zero for homeowners, there should be no difference in job search outcomes between the two groups when all other conditions are equal. Following the same logic, if moving cost increases, the difference between owners and renters in terms of unemployment duration or job matching quality should be larger. One challenge for testing this hypothesis is that moving cost usually cannot be directly observed in the data, and therefore it is hard to be measured.

Recent housing crisis, however, provides a chance to explore this hypothesis. The dramatic declining in housing price during recent recession leaves many homeowners "underwater." Their negative housing equity requires the owner to put up additional cash beyond standard closing costs to be able to move (Ferreira et al. [2010], Chan [2001], Abowd and Vilhuber [2012], Farber [2012]). Therefore, those homeowners are facing an even larger moving cost unless they choose to default. The literature is interested in whether this higher moving cost caused by the decline in housing price leads to an even lower mobility rate and a persistently high unemployment rate. One category of papers compare homeowners holding negative housing equity with those holding positive equity(Ferreira et al. [2010], Schulhofer-Wohl [2011], Demyanyk et al. [2013]); The other category of papers compare homeowners located in regions with different level of housing price decline (Abowd and Vilhuber [2012], Farber [2012]). Though still controversial, the literature tends to agree that a negative home equity or a decline in housing price is not an important barrier to labor mobility.

To check whether homeownership reduce mobility and hurt the economy even more when housing price is declining, that is, when moving cost is larger, I divide unemployment spells into two samples: those experience housing price declining and those do not. The 2SLS estimations are then repeated for both samples with an extra dependent variable indicating whether the unemployment spell is ended with an address change. Table 14 summarizes the estimation results. Similar with the results in distressed markets, in regions where housing price is declining, unemployed homeowners have an even shorter unemployment duration, lower job matching quality, and higher probability to be reemployed with a non-local job offer..

These results, though contrary to the prediction of Oswald's hypothesis, are consistent with the model prediction in section 2. The model illustrates the mechanisms behind these empirical results and shows the adjustment of search effort plays a crucial role. Declining in housing price is highly correlated with high unemployment rate. As discussed in the last section, a high local unemployment rate means job seekers would put more effort to search outside of the local labor market, which leads to a chance of receiving job opportunities that require moving. Therefore, homeowners in regions with declining housing price are not likely to be locked-in, because their search effort in non-local labor market beats the barrier caused by higher moving cost.

5.3 The Role of Liquidity Constraints

Liquidity constraints matter when unemployed worker choose search strategies. Lacking of other options to smooth consumption, individuals with limited liquid assets are more eager to get reemployed locally, they are, therefore, more likely to accept lower wage offers or search more intensively in the local market. Liquidity constraints cannot be directly observed in the data. I use the level liquid assets at the time of job loss to proxy liquidity constraints, where liquid assets are defined as total wealth minus home, business, and vehicle equity. After controlling spousal work status and the level of unemployment benefits, those with less liquid asset are then more likely to be constrained.

To test whether the effect of homeownership is larger when liquidity constraint is binding, I divide the sample into two, with the first sample composed of individuals whose liquid assets are higher than the median level, while the second sample liquid assets are lower than the median

level. Table 15 summarizes the estimation results, which shows, with limited liquid assets, unemployed homeowners, compared with unemployed renters, stay unemployed for about two and half weeks shorter, experience 1.53 smaller wage gain, and are 18.3 % more likely to accept wages that are lower than their pre-unemployment wage.

6 Conclusion

This paper studies the labor market consequences of being a homeowner. It finds owning a home increases unemployed worker's probability of being reemployed, but this positive labor market outcome comes with a cost of job matching quality. Compared with their pre-unemployment wage, unemployed homeowners who are reemployed experience smaller wage gains and are more likely to be displaced. Especially, this negative effect on job matching quality is more profound among young people, people live in the distressed labor market, or people with limited liquid assets. Studying post-unemployment wages along with unemployment duration extends the effect of homeownership in a new dimension and gives a more complete description of the labor market friction caused by homeownership.

If data are made possible, empirical results in this paper can be extended in two directions. First, majority of unemployment spells end with local jobs. This explains why the overall effect of homeownership on unemployment is consistent with the theoretical prediction for local job market matching. More unemployment spells, however, are need to draw reliable conclusion about whether the job matching quality in non-local market is higher than that in local market. Second, since the SIPP are short panels, which follow individuals for only about three or four years, it is not possible to estimate the long term effect of the wage displacement caused by owning a house. Longer panels are needed to estimate the long term or lifetime mismatch caused by homeownership.

Table 1: Summary Statistics of Individuals in SIPP Sample (1996-2013)

	Total		Mortgagor		Renter	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Age	36.05	(11.76)	40.12	(12.03)	33.13	(10.65)
White	0.80	(0.40)	0.85	(0.36)	0.76	(0.43)
Black	0.13	(0.34)	0.09	(0.29)	0.16	(0.37)
High school	0.57	(0.50)	0.47	(0.50)	0.64	(0.48)
College	0.39	(0.49)	0.46	(0.50)	0.34	(0.47)
Graduate school	0.05	(0.21)	0.07	(0.26)	0.03	(0.16)
Married	0.48	(0.50)	0.64	(0.48)	0.37	(0.48)
N.of children (0-6)	0.35	(0.71)	0.34	(0.70)	0.35	(0.72)
N.of children (7-15)	0.51	(0.91)	0.64	(0.97)	0.42	(0.84)
Live in metro	0.81	(0.39)	0.80	(0.40)	0.81	(0.39)
Spouse employed	0.30	(0.46)	0.45	(0.50)	0.18	(0.39)
Spouse income (1000)	0.95	(2.01)	1.63	(2.56)	0.46	(1.29)
Total wealth (1000)	145.59	(211.79)	213.79	(278.68)	96.85	(125.36)
Liquid asset(1000)	76.42	(149.63)	104.01	(204.21)	56.71	(87.51)
Observations	11828		4930		6898	

Source: SIPP 1996,2001,2004, and 2008 Panels
Note: Homeowners are individuals who hold positive mortgage debt excluding outright homeowners and mobile homeowners; Renters are individuals who live in rental units excluding public house renters; Spouse income is measured monthly.

Table 2: Summary Statistics of Unemployment Spells: Homeowners and Renters(1996-2013)

	Total		Mortgagor		Renter	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Unemployment duration (weeks)	12.01	(16.06)	12.64	(17.56)	11.54	(14.80)
Pre-unemp wage	12.19	(11.74)	15.48	(12.90)	9.23	(9.66)
Post-unemp wage	16.66	(10.61)	19.09	(12.13)	14.48	(8.46)
Wage change	4.47	(11.05)	3.61	(12.33)	5.25	(9.68)
Probability of wage increase	0.67	(0.47)	0.59	(0.49)	0.73	(0.44)
Probability of wage decrease	0.26	(0.44)	0.34	(0.47)	0.19	(0.39)
Wage change ratio (percent)	0.04	(0.61)	-0.01	(0.62)	0.09	(0.59)
Number of spells	15394		6660		8734	
Spells end with a job	12353		5814		6539	
Spells censored	3039		845		2194	
Spells with Pre- and Post-wages	11048		5240		5808	

Source: SIPP 1996,2001,2004, and 2008 Panels
Note: Pre- and post-unemployment wages are hourly rates; Wage change= Post-unemployment wage- Pre-unemployment wage; Probability of wage increase=Prob(Wage change>0);Probability of wage decrease=Prob(Wage change<0); Wage change ratio=(Post-unemployment wage-Pre-unemployment wage)/ Pre-unemployment wage.

Table 3: Summary Statistics of Unemployment Spells: Distressed and Non-distressed labor markets(1996-2013)

	Mortgagor Total	Distress	Non-distress	Renter Total	Distress	Non-distress
Unemployment duration (weeks)	12.636	13.361	11.517	11.537	12.034	10.632
Pre-unemp wage	15.479	14.959	14.753	9.226	9.380	8.941
Post-unemp wage	19.088	18.399	19.618	14.476	14.675	14.114
Wage change	3.608	3.440	4.865	5.250	5.295	5.174
Probability of wage increase	0.587	0.484	0.591	0.731	0.732	0.730
Probability of wage decrease	0.336	0.435	0.329	0.192	0.188	0.198
Wage change ratio (percent)	-0.008	-0.021	-0.001	0.087	0.096	0.071
Number of spells	6660	4034	2625	8734	5645	3087

Source: SIPP 1996,2001,2004, and 2008 Panels.
Note: Pre- and post-unemployment wages are hourly rates; Wage change= Post-unemployment wage- Pre-unemployment wage; Probability of wage increase=Prob(Wage change>0);Probability of wage decrease=Prob(Wage change<0); Wage change ratio=(Post-unemployment wage- Pre-unemployment wage)/ Pre-unemployment wage.

Table 4: Summary Statistics of Unemployment Spells Ending with Local and Non-local Jobs(1996-2013)

	Mortgagor Total	Local	Non-local	Renter Total	Local	Non-local
Unemployment duration (weeks)	12.64	12.55	21.01	11.54	11.03	18.88
Pre-unemp wage	15.48	15.47	16.44	9.23	9.06	11.95
Post-unemp wage	19.09	19.09	18.61	14.48	14.43	15.25
Wage change	3.61	3.62	2.17	5.25	5.37	3.29
Probability of wage increase	0.59	0.59	0.63	0.73	0.73	0.73
Probability of wage decrease	0.34	0.34	0.38	0.19	0.19	0.29
Wage change ratio (percent)	-0.01	-0.01	-0.04	0.09	0.08	0.11
Number of spells	6660	6590	70	8734	8167	567

Source: SIPP 1996,2001,2004, and 2008 Panels
Note: Pre- and post-unemployment wages are hourly rates; Wage change= Post-unemployment wage- Pre-unemployment wage; Probability of wage increase=Prob(Wage change>0);Probability of wage decrease=Prob(Wage change<0); Wage change ratio=(Post-unemployment wage- Pre-unemployment wage)/ Pre-unemployment wage.

Table 5: NBER Mortgage Interest Subsidy Rate by US state in %, 1996-2013

	Mean	S.D.	Min	Max
Alabama	3.52	(0.10)	3.37	3.64
Alaska	0.00	(0.00)	0.00	0.00
Arizona	2.60	(0.19)	2.38	2.97
Arkansas	4.47	(0.05)	4.41	4.58
California	4.72	(0.20)	4.47	5.35
Colorado	3.06	(0.24)	2.61	3.46
Connecticut	1.00	(0.52)	0.55	1.57
Delaware	2.47	(0.30)	2.16	3.07
DC	2.25	(0.23)	1.94	2.51
Florida	0.00	(0.00)	0.00	0.00
Georgia	3.44	(0.27)	3.11	3.96
Hawaii	4.53	(0.44)	4.20	5.25
Idaho	0.82	(0.20)	0.53	1.10
Illinois	0.00	(0.00)	0.00	0.00
Indiana	0.00	(0.00)	0.00	0.00
Iowa	0.66	(0.03)	0.62	0.72
Kansas	3.11	(0.11)	2.88	3.27
Kentucky	3.24	(0.23)	3.02	3.55
Louisiana	0.33	(0.45)	-0.40	0.83
Maryland	3.87	(0.41)	3.47	4.55
Massachusetts	0.00	(0.00)	0.00	0.00
Michigan	0.00	(0.00)	0.00	0.00
Minnesota	2.76	(0.31)	2.33	3.20
Mississippi	3.02	(0.20)	2.87	3.38
Missouri	2.01	(0.12)	1.86	2.21
Montana	0.55	(0.04)	0.49	0.61
Nebraska	0.62	(0.09)	0.49	0.76
Nevada	0.00	(0.00)	0.00	0.00
New_Hampshire	0.00	(0.00)	0.00	0.00
New_Jersey	0.00	(0.00)	0.00	0.00
New_Mexico	0.93	(0.26)	0.59	1.22
New_York	2.60	(0.14)	2.42	3.00
North_Carolina	3.64	(0.31)	3.28	4.35
Ohio	0.00	(0.00)	0.00	0.00
Oklahoma	3.96	(0.44)	3.29	5.00
Oregon	2.83	(0.03)	2.76	2.87
Pennsylvania	0.00	(0.00)	0.00	0.00
Rhode_Island	3.66	(1.21)	1.91	4.88
South_Carolina	3.97	(0.12)	3.76	4.18
Tennessee	0.00	(0.00)	0.00	0.00
Texas	0.00	(0.00)	0.00	0.00
Utah	1.72	(0.44)	0.96	2.32
Virginia	4.17	(0.11)	4.05	4.38
Washington	0.00	(0.00)	0.00	0.00
West_Virginia	0.00	(0.00)	0.00	0.00
Wisconsin	1.87	(0.08)	1.73	1.98

Note: Mortgage Interest Subsidy Rate is calculated by TAXSIM provided by NBER; Maine, North Dakota, South Dakota, Vermont and Wyoming are excluded from the sample because they can not be separately identified in SIPP

Table 6: Correlation of State-level MRS, Unemployment Rate and Housing Price, 1996-2013

	MSR	Housing Price	Unemployment Rate
MSR	1		
Housing Price	0.0364	1	
Unemployment Rate	-0.0353	0.166***	1

Note: Mortgage Interest Subsidy Rate is calculated by TAXSIM provided by NBER; State level unemployment rates between 1995 and 2013 come from the Bureau of Labor Statistics;State level housing price between 1995 and 2013 come from Federal Housing Finance Agency.

Table 7: The Effects of Home Ownership on Unemployment Duration and Job Matching Quality: OLS

	Duration			Wage Gain			Displaced		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Homeowner	-0.036	0.128	-0.108	-0.154***	-0.158***	-0.155***	0.205***	0.210***	0.206***
	(0.331)	(0.335)	(0.331)	(0.012)	(0.012)	(0.012)	(0.013)	(0.013)	(0.013)
log(Pre-unemp wage)	-1.420***	-1.295***	-1.429***	-0.326***	-0.322***	-0.326***	0.205***	0.200***	0.205***
	(0.298)	(0.301)	(0.298)	(0.010)	(0.011)	(0.010)	(0.012)	(0.012)	(0.012)
log(Amount of UI)	1.436***	1.388***	1.430***	0.005***	0.005***	0.005***	0.001	0.001	0.001
	(0.041)	(0.041)	(0.040)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Age	0.006	0.004	0.005	0.007***	0.008***	0.007***	-0.009***	-0.009***	-0.009***
	(0.014)	(0.014)	(0.014)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
White	-1.494**	-1.852***	-1.550***	0.016	0.022	0.015	-0.031	-0.038	-0.031
	(0.594)	(0.602)	(0.594)	(0.021)	(0.021)	(0.021)	(0.024)	(0.024)	(0.024)
Black	0.758	0.364	0.694	-0.015	-0.004	-0.016	0.002	-0.006	0.002
	(0.732)	(0.740)	(0.731)	(0.026)	(0.026)	(0.026)	(0.029)	(0.030)	(0.029)
Married	-1.539***	-1.548***	-1.569***	0.029**	0.030**	0.028**	-0.049***	-0.045***	-0.049***
	(0.405)	(0.410)	(0.404)	(0.014)	(0.015)	(0.014)	(0.016)	(0.017)	(0.016)
College	-0.030	-0.116	-0.065	0.064***	0.065***	0.063***	-0.019	-0.026**	-0.019
	(0.297)	(0.300)	(0.296)	(0.010)	(0.011)	(0.010)	(0.012)	(0.012)	(0.012)
Graduate school	1.463*	1.385*	1.421*	0.197***	0.187***	0.197***	-0.055*	-0.057*	-0.054*
	(0.747)	(0.753)	(0.746)	(0.027)	(0.027)	(0.027)	(0.030)	(0.031)	(0.030)
N.of children (0-6)	0.221	0.128	0.237	0.006	0.007	0.006	0.011	0.012	0.011
	(0.204)	(0.206)	(0.204)	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)
N.of children (7-15)	0.078	0.092	0.072	0.005	0.004	0.004	-0.012**	-0.011*	-0.012*
	(0.151)	(0.151)	(0.150)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
Wealth quantile	-0.267*	-0.195	-0.226	0.055***	0.057***	0.056***	-0.057***	-0.055***	-0.057***
	(0.156)	(0.158)	(0.156)	(0.005)	(0.006)	(0.005)	(0.006)	(0.006)	(0.006)
Spouse employed	0.361	0.588	0.426	-0.012	-0.014	-0.011	0.031*	0.029*	0.030*
	(0.434)	(0.439)	(0.434)	(0.015)	(0.015)	(0.015)	(0.017)	(0.018)	(0.017)
Spouse income (1000)	0.162*	0.112	0.162*	0.010***	0.010***	0.010***	-0.004	-0.004	-0.004
	(0.095)	(0.097)	(0.095)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
Live in metro	0.773**	0.797**	0.853**	0.003	0.004	0.004	-0.019	-0.020	-0.020
	(0.371)	(0.375)	(0.372)	(0.013)	(0.013)	(0.013)	(0.015)	(0.015)	(0.015)
Constant	10.762***	7.560*	7.475*	0.362***	0.282**	0.315**	0.214	0.311**	0.254
	(3.684)	(4.106)	(4.124)	(0.126)	(0.143)	(0.143)	(0.143)	(0.152)	(0.162)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-level variables	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Observations	8254	7907	8254	7422	7119	7422	7432	7129	7432
R^2	0.223	0.220	0.225	0.170	0.169	0.171	0.126	0.128	0.126

Source: SIPP 1996,2001,2004, and 2008 Panels
*Note: Dependent variables are: length of unemployment duration; wage gain= Post-unemployment wage-pre-unemployment wage; Displacement dummy which equals 1 if post-unemployment wage is smaller than pre-unemployment wage. Column (1) does not include state level unemployment rate and housing price as control variables; Column (2) uses unemployment spells ending with local job offers; Column (3) uses unemployment spells ending with local and non-local job offers. State level variables include unemployment rate and housing price; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.*

Table 8: The Effects of Homeownership on Unemployment Duration and Job Matching Quality: Instrumental Variable (First Stage)

	First-stage (1)	(2)	(3)
MSR	0.045***	0.241***	0.061**
	(0.009)	(0.093)	(0.026)
log(Pre-unemp wage)	0.403***	0.391***	0.113***
	(0.035)	(0.036)	(0.010)
log(Amount of UI)	0.021***	0.018***	0.006***
	(0.005)	(0.005)	(0.001)
Age	0.013***	0.013***	0.003***
	(0.002)	(0.002)	(0.000)
White	0.270***	0.182**	0.049**
	(0.068)	(0.072)	(0.020)
Black	0.094	-0.027	-0.010
	(0.083)	(0.088)	(0.024)
Married	0.029	0.062	0.020
	(0.047)	(0.048)	(0.014)
College	0.086**	0.098***	0.023**
	(0.034)	(0.035)	(0.010)
Graduate school	-0.205**	-0.215**	-0.060**
	(0.097)	(0.099)	(0.025)
N.of children (0-6)	-0.023	-0.008	-0.001
	(0.024)	(0.024)	(0.007)
N.of children (7-15)	0.128***	0.140***	0.039***
	(0.018)	(0.018)	(0.005)
Wealth quantile	0.634***	0.657***	0.190***
	(0.018)	(0.019)	(0.005)
Spouse employed	0.310***	0.277***	0.092***
	(0.052)	(0.053)	(0.014)
Spouse income (1000)	0.061***	0.058***	0.010***
	(0.013)	(0.013)	(0.003)
Live in metro	-0.172***	-0.161***	-0.053***
	(0.040)	(0.045)	(0.012)
Constant	-3.373***	-4.563***	-1.194***
	(0.154)	(0.698)	(0.215)
Year dummies	No	Yes	Yes
State dummies	No	Yes	Yes
State-level variables	Yes	Yes	Yes
Observations	8254	8218	8254
R^2			0.348
pseudo-R^2	0.279	0.300	

Source: SIPP 1996,2001,2004, and 2008 Panels
*Note: Column (1) estimates probit model and does not include state and year dummies as control variables; Column (2) estimates probit model; Column (3) estimate linear probability model. State level variables include unemployment rate and housing price; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.*

Table 9: The Effects of Homeownership on Unemployment Duration and Job Matching Quality: Instrumental Variable (Second Stage)

	Second-stage Duration	Wage Gain	Displaced
Homeowner	-2.168	-0.108***	0.105**
	(1.911)	(0.031)	(0.055)
log(Pre-unemp wage)	-1.206***	-0.349***	0.225***
	(0.347)	(0.016)	(0.014)
log(Amount of UI)	1.443***	0.004***	0.002
	(0.052)	(0.001)	(0.002)
Age	0.013	0.007***	-0.008***
	(0.015)	(0.001)	(0.001)
White	-1.470**	0.005	-0.023
	(0.652)	(0.020)	(0.024)
Black	0.652	-0.014	-0.002
	(0.830)	(0.025)	(0.030)
Married	-1.547***	0.023	-0.046***
	(0.396)	(0.014)	(0.016)
College	-0.008	0.059***	-0.015
	(0.300)	(0.011)	(0.012)
Graduate school	1.304*	0.208***	-0.063**
	(0.680)	(0.030)	(0.030)
N.of children (0-6)	0.235	0.007	0.011
	(0.206)	(0.008)	(0.008)
N.of children (7-15)	0.154	-0.003	-0.005
	(0.163)	(0.005)	(0.007)
Wealth quantile	0.165	0.019	-0.025
	(0.396)	(0.012)	(0.016)
Spouse employed	0.631	-0.029*	0.047**
	(0.474)	(0.016)	(0.018)
Spouse income (1000)	0.184*	0.008**	-0.003
	(0.101)	(0.004)	(0.004)
Live in metro	0.745**	0.015	-0.028*
	(0.356)	(0.013)	(0.016)
Constant	10.740***	0.472***	0.239**
	(3.203)	(0.104)	(0.121)
Year dummies	Yes	Yes	Yes
State dummies	Yes	Yes	Yes
State-level variables	Yes	Yes	Yes
Observations	8218	7391	7401
R^2	0.221	0.140	0.106

Source: SIPP 1996,2001,2004, and 2008 Panels
*Note: Dependent variables are: (1)length of unemployment duration;(2)wage gain= Post-unemployment wage-pre-unemployment wage; (3)Displacement dummy which equals 1 if post-unemployment wage is smaller than pre-unemployment wage. State level variables include unemployment rate and housing price; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.*

Table 10: Robustness (1): Alternative Instrumental Variable

	First-stage Homeowner	Second-stage Duration	Wage Gain	Displaced
Same sex children(male)	0.238***			
	(0.086)			
Same sex children(female)	0.133			
	(0.084)			
Homeowner		-3.279	-0.158*	0.164
		(2.491)	(0.090)	(0.113)
log(Pre-unemp wage)	0.516***	-1.667**	-0.310***	0.229***
	(0.071)	(0.733)	(0.030)	(0.027)
log(Amount of UI)	0.015	1.384***	0.002	0.003
	(0.010)	(0.097)	(0.003)	(0.003)
Age	0.019***	0.017	0.009***	-0.011***
	(0.005)	(0.043)	(0.001)	(0.002)
White	0.225	-0.545	0.012	-0.040
	(0.140)	(0.996)	(0.036)	(0.043)
Black	-0.224	2.493	-0.034	-0.012
	(0.174)	(1.639)	(0.045)	(0.055)
Married	-0.214**	-2.879***	0.089***	-0.067*
	(0.105)	(0.938)	(0.029)	(0.035)
College	0.199***	0.380	0.084***	-0.049**
	(0.072)	(0.652)	(0.020)	(0.024)
Graduate school	0.167	3.139**	0.188***	-0.022
	(0.242)	(1.406)	(0.060)	(0.062)
N.of children (0-6)	-0.050	-0.147	0.007	0.016
	(0.040)	(0.305)	(0.012)	(0.012)
N.of children (7-15)	0.055*	-0.407	-0.005	0.000
	(0.033)	(0.250)	(0.009)	(0.011)
Wealth quantile	0.678***	0.383	0.058***	-0.063***
	(0.040)	(0.512)	(0.017)	(0.022)
Spouse employed	0.295***	1.043	0.003	0.042
	(0.086)	(0.686)	(0.026)	(0.029)
Spouse income (1000)	0.089***	0.128	0.011	-0.007
	(0.025)	(0.154)	(0.009)	(0.007)
Live in metro	0.053	-0.153	-0.018	-0.013
	(0.088)	(0.717)	(0.024)	(0.029)
Constant	-2.998***	19.403***	0.492***	0.069
	(0.712)	(6.758)	(0.191)	(0.216)
Year dummies	Yes	Yes	Yes	Yes
State dummies	Yes	Yes	Yes	Yes
State-level variables	Yes	Yes	Yes	Yes
Observations	2370	2370	2144	2149
R^2		0.217	0.191	0.152
pseudo-R^2	0.333			

Source: SIPP 1996,2001,2004, and 2008 Panels
*Note: Dependent variables are: (1)length of unemployment duration;(2)wage gain= Post-unemployment wage-pre-unemployment wage; (3)Displacement dummy which equals 1 if post-unemployment wage is smaller than pre-unemployment wage. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.*

Table 11: Robustness (2): Among the Young (Age 18-35)

	First-stage Homeowner	Second-stage Duration	Wage Gain	Displaced
MSR	0.252***			
	(0.061)			
Homeowner		-1.746	-0.333*	0.297
		(4.243)	(0.174)	(0.186)
log(Pre-unemp wage)	0.365***	-0.612	-0.377***	0.258***
	(0.061)	(0.591)	(0.032)	(0.027)
log(Amount of UI)	0.015*	1.242***	0.007***	-0.001
	(0.009)	(0.088)	(0.003)	(0.003)
Age	0.001	-0.049	0.016***	-0.012***
	(0.006)	(0.048)	(0.002)	(0.002)
White	0.382***	-0.685	0.056	-0.020
	(0.126)	(1.045)	(0.039)	(0.044)
Black	0.291*	0.686	0.046	-0.051
	(0.153)	(1.206)	(0.045)	(0.050)
Married	-0.045	-1.924***	-0.007	0.010
	(0.083)	(0.639)	(0.025)	(0.027)
College	0.057	-0.256	0.096***	-0.065***
	(0.060)	(0.470)	(0.020)	(0.020)
Graduate school	-0.507**	0.219	0.306***	-0.161**
	(0.212)	(1.238)	(0.082)	(0.073)
N.of children (0-6)	-0.056	0.203	0.010	-0.000
	(0.035)	(0.334)	(0.011)	(0.011)
N.of children (7-15)	0.236***	0.009	-0.011	0.019
	(0.034)	(0.370)	(0.015)	(0.016)
Wealth quantile	0.684***	-0.542	0.103**	-0.078*
	(0.030)	(0.946)	(0.040)	(0.042)
Spouse employed	0.259**	-0.257	-0.033	0.051
	(0.107)	(0.884)	(0.035)	(0.037)
Spouse income (1000)	0.076**	0.371	0.024***	-0.018*
	(0.030)	(0.260)	(0.009)	(0.009)
Live in metro	-0.226***	0.254	-0.027	0.014
	(0.072)	(0.607)	(0.024)	(0.026)
Constant	-1.359	11.295***	0.103	0.302
	(0.837)	(4.085)	(0.216)	(0.212)
Year dummies	Yes	Yes	Yes	Yes
State dummies	Yes	Yes	Yes	Yes
State-level variables	Yes	Yes	Yes	Yes
Observations	3117	3117	2762	2771
R^2		0.164	0.222	0.195
pseudo-R^2	0.225			

Source: SIPP 1996,2001,2004, and 2008 Panels
*Note: Dependent variables are: (1)length of unemployment duration;(2)wage gain= Post-unemployment wage-pre-unemployment wage; (3)Displacement dummy which equals 1 if post-unemployment wage is smaller than pre-unemployment wage. Sample of young includes individuals who are 35 or younger. State level variables include unemployment rate and housing price; Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.*

Table 12: Robustness (3): Alternative Estimation Models

	Hazard model Unemployment Duration	Probit model Displaced
Homeowner	-5.216*** (1.827)	0.133 (0.208)
log(Pre-unemp wage)	-0.479 (0.342)	0.643*** (0.040)
log(Amount of UI)	1.506*** (0.055)	0.007 (0.005)
Age	0.027* (0.015)	-0.021*** (0.002)
White	-0.828 (0.744)	-0.080 (0.078)
Black	0.032 (0.896)	-0.057 (0.094)
Married	-1.209*** (0.441)	-0.116** (0.051)
College	0.143 (0.314)	-0.062* (0.037)
Graduate school	0.758 (0.693)	-0.219** (0.095)
N.of children (0-6)	0.033 (0.230)	0.013 (0.025)
N.of children (7-15)	0.314* (0.183)	-0.004 (0.021)
Wealth quantile	0.513 (0.419)	-0.101** (0.047)
Spouse employed	0.654 (0.521)	0.147** (0.057)
Spouse income (1000)	0.172 (0.108)	-0.013 (0.012)
Live in metro	0.720* (0.369)	-0.032 (0.048)
Constant	5.296* (2.836)	-0.918** (0.395)
Year dummies	Yes	Yes
State dummies	Yes	Yes
State-level variables	Yes	Yes
Observations	8268	7455
pseudo-R^2	0.173	0.144

Source: SIPP 1996,2001,2004, and 2008 Panels
*Note: Dependent variables are: (1)length of unemployment duration;(2)Displacement dummy which equals 1 if post-unemployment wage is smaller than pre-unemployment wage. State level variables include unemployment rate and housing price. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.*

Table 13: The Effects of Homeownership on Unemployment Duration and Job Matching Quality: Distressed and Non-distress States

	Distress			Non-distress		
	1	2	3	1	2	3
Homeowner	-5.580**	-0.133***	0.174*	-5.188*	0.090	-0.116
	(2.528)	(0.032)	(0.094)	(2.800)	(0.101)	(0.116)
log(Pre-unemp wage)	-0.321	-0.314***	0.205***	-0.518	-0.389***	0.242***
	(0.510)	(0.017)	(0.019)	(0.609)	(0.022)	(0.025)
log(Amount of UI)	1.598***	0.003	0.003	1.397***	0.005**	0.002
	(0.059)	(0.002)	(0.002)	(0.073)	(0.003)	(0.003)
Age	-0.001	0.007***	-0.007***	0.072***	0.007***	-0.007***
	(0.022)	(0.001)	(0.001)	(0.026)	(0.001)	(0.001)
White	-0.848	0.009	-0.058*	-1.567	0.012	0.032
	(0.898)	(0.029)	(0.033)	(1.165)	(0.042)	(0.048)
Black	-1.179	-0.003	-0.053	-0.143	-0.054	0.044
	(1.102)	(0.036)	(0.041)	(1.351)	(0.048)	(0.056)
Married	-1.287**	0.028	-0.034	-1.432*	0.011	-0.053*
	(0.582)	(0.019)	(0.022)	(0.762)	(0.027)	(0.032)
College	-0.185	0.079***	-0.034**	0.438	0.042**	0.005
	(0.446)	(0.015)	(0.017)	(0.511)	(0.018)	(0.021)
Graduate school	0.202	0.248***	-0.123***	0.966	0.174***	-0.001
	(1.111)	(0.036)	(0.041)	(1.333)	(0.048)	(0.055)
N.of children (0-6)	-0.131	0.009	0.009	0.431	0.013	-0.015
	(0.284)	(0.009)	(0.011)	(0.410)	(0.015)	(0.017)
N.of children (7-15)	0.454*	0.002	-0.008	-0.031	-0.006	0.009
	(0.238)	(0.008)	(0.009)	(0.298)	(0.011)	(0.012)
Wealth quantile	0.639	0.058***	-0.061***	0.762	0.008	0.002
	(0.548)	(0.018)	(0.020)	(0.637)	(0.023)	(0.026)
Spouse employed	1.502**	-0.018	0.042*	0.180	-0.027	0.063*
	(0.686)	(0.022)	(0.025)	(0.813)	(0.029)	(0.034)
Spouse income (1000)	0.097	0.009*	-0.007	0.128	0.007	-0.001
	(0.152)	(0.005)	(0.006)	(0.162)	(0.006)	(0.007)
Live in metro	0.954	0.010	-0.021	0.784	-0.004	0.015
	(0.588)	(0.019)	(0.022)	(0.657)	(0.024)	(0.027)
Constant	3.980	0.226	0.495**	3.808	0.740***	-0.460**
	(6.059)	(0.197)	(0.224)	(5.607)	(0.201)	(0.233)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
State dummies	Yes	Yes	Yes	Yes	Yes	Yes
State-level variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5137	4652	4658	3078	2736	2740
R^2	0.225	0.161	0.116	0.234	0.112	0.111

Source: SIPP 1996,2001,2004, and 2008 Panels
*Note: Dependent variables are: (1)length of unemployment duration;(2)wage gain= Post-unemployment wage-pre-unemployment wage; (3)Displacement dummy which equals 1 if post-unemployment wage is smaller than pre-unemployment wage. Distressed states are defined as states with unemployment rate lower than the national level. State level variables include unemployment rate and housing price. * $p < 0.1$, ** $p< 0.05$, *** $p < 0.01$. Standard errors in parentheses.*

Table 14: The Effects of Homeownership on Unemployment Duration and Job Matching Quality: States with Declined and Non-declined Housing Price

	HP Decline				HP Not-decline			
	1	2	3	4	1	2	3	4
Homeowner	-6.147***	-0.063***	0.159*	0.497	-5.239	-0.025	-0.086	-0.232
	(1.959)	(0.025)	(0.096)	(3.686)	(0.094)	(0.110)	(0.762)	(0.599)
log(Pre-unemp wage)	-1.886**	-0.332***	0.200***	-0.057	0.163	-0.342***	0.222***	0.009
	(0.853)	(0.022)	(0.025)	(0.091)	(0.375)	(0.016)	(0.018)	(0.058)
log(Amount of UI)	2.146***	-0.000	0.010***	-0.006	1.100***	0.006***	-0.003	0.001
	(0.097)	(0.002)	(0.003)	(0.006)	(0.045)	(0.002)	(0.002)	(0.002)
Age	0.070*	0.005***	-0.007***	-0.003	0.008	0.008***	-0.008***	-0.000
	(0.038)	(0.001)	(0.001)	(0.003)	(0.016)	(0.001)	(0.001)	(0.001)
White	-0.291	-0.068*	0.059	-0.075	-1.479**	0.070**	-0.084**	-0.008
	(1.430)	(0.037)	(0.043)	(0.074)	(0.725)	(0.031)	(0.036)	(0.023)
Black	-0.162	-0.101**	0.051	-0.044	-1.374	0.041	-0.073*	-0.016
	(1.848)	(0.047)	(0.055)	(0.031)	(0.843)	(0.037)	(0.042)	(0.022)
Married	-2.372**	0.042	-0.055*	0.028	-0.468	0.009	-0.039*	0.019
	(0.995)	(0.026)	(0.030)	(0.024)	(0.457)	(0.020)	(0.022)	(0.031)
College	0.534	0.067***	-0.017	-0.019	-0.087	0.064***	-0.017	0.007
	(0.751)	(0.019)	(0.022)	(0.036)	(0.327)	(0.014)	(0.016)	(0.013)
Graduate school	-0.466	0.195***	-0.048	0.018	0.931	0.233***	-0.080*	-0.011
	(1.828)	(0.047)	(0.054)	(0.029)	(0.841)	(0.036)	(0.041)	(0.056)
N.of children (0-6)	0.319	-0.003	-0.013	0.003	-0.166	0.015	0.014	-0.001
	(0.480)	(0.013)	(0.014)	(0.012)	(0.227)	(0.010)	(0.011)	(0.006)
N.of children (7-15)	0.202	-0.005	0.010	-0.026	0.392**	0.001	-0.009	0.006
	(0.407)	(0.010)	(0.012)	(0.035)	(0.180)	(0.008)	(0.009)	(0.026)
Wealth quantile	0.494	0.042**	-0.015	-0.090	0.886*	0.039*	-0.058**	0.047
	(0.722)	(0.018)	(0.021)	(0.132)	(0.458)	(0.020)	(0.023)	(0.132)
Spouse employed	2.239**	-0.020	0.068**	-0.073	0.299	-0.027	0.044*	0.013
	(1.135)	(0.029)	(0.034)	(0.088)	(0.506)	(0.022)	(0.025)	(0.043)
Spouse income (1000)	0.216	0.005	-0.000	-0.005	0.078	0.011**	-0.007	0.002
	(0.230)	(0.006)	(0.007)	(0.008)	(0.111)	(0.005)	(0.005)	(0.005)
Live in metro	3.117***	-0.000	0.002	0.054	0.050	0.010	-0.004	-0.013
	(0.998)	(0.026)	(0.030)	(0.063)	(0.423)	(0.018)	(0.021)	(0.031)
Constant	-2.777	0.320	0.010	0.252	9.601***	0.351**	0.144	0.052
	(14.799)	(0.380)	(0.441)	(0.534)	(3.527)	(0.153)	(0.174)	(0.083)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-level variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2880	2599	2601	2891	5338	4792	4800	5363
R^2	0.261	0.143	0.089	0.74	0.173	0.131	0.135	0.031

Source: SIPP 1996,2001,2004, and 2008 Panels
*Note: Dependent variables are: (1)length of unemployment duration;(2)wage gain= Post-unemployment wage-pre-unemployment wage; (3)Displacement dummy which equals 1 if post-unemployment wage is smaller than pre-unemployment wage; (4) Mobility dummy which equals 1 if unemployment ends with a non-local job offer. State level variables include unemployment rate and housing price. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.*

Table 15: The Effects of Homeownership on Unemployment Duration and Job Matching Quality: Constrained and Non-Constrained Individuals

	Constrained			Non-constrained		
	1	2	3	1	2	3
Homeowner	-2.687	-0.153**	0.183**	-4.018*	-0.270	0.112
	(2.095)	(0.069)	(0.077)	(2.021)	(0.185)	(0.218)
log(Pre-unemp wage)	-1.106**	-0.327***	0.212***	0.225	-0.336***	0.189***
	(0.490)	(0.016)	(0.018)	(0.691)	(0.024)	(0.028)
log(Amount of UI)	1.559***	0.004**	-0.001	1.449***	0.005*	0.003
	(0.059)	(0.002)	(0.002)	(0.077)	(0.003)	(0.003)
Age	0.002	0.010***	-0.011***	0.044	0.003***	-0.004***
	(0.021)	(0.001)	(0.001)	(0.032)	(0.001)	(0.001)
White	-1.604*	0.030	-0.068**	-0.457	0.013	-0.009
	(0.909)	(0.030)	(0.034)	(1.155)	(0.039)	(0.046)
Black	-0.515	0.009	-0.048	-1.536	-0.094**	0.031
	(1.082)	(0.036)	(0.040)	(1.390)	(0.047)	(0.056)
Married	-1.586***	0.033*	-0.055**	-1.095	0.042	-0.075**
	(0.582)	(0.019)	(0.021)	(0.797)	(0.027)	(0.032)
College	-0.407	0.064***	-0.012	1.286**	0.082***	-0.052**
	(0.433)	(0.014)	(0.016)	(0.633)	(0.022)	(0.025)
Graduate school	-0.347	0.258***	-0.116**	1.847*	0.214***	-0.071*
	(1.497)	(0.050)	(0.055)	(1.051)	(0.036)	(0.042)
N.of children (0-6)	0.029	0.009	0.013	0.048	0.002	-0.008
	(0.290)	(0.010)	(0.011)	(0.381)	(0.013)	(0.015)
N.of children (7-15)	0.163	-0.008	-0.005	0.383	0.022*	-0.014
	(0.227)	(0.008)	(0.008)	(0.369)	(0.013)	(0.015)
Wealth quantile	1.133	-0.005	-0.007	1.674**	0.057**	-0.049
	(0.835)	(0.028)	(0.031)	(0.777)	(0.026)	(0.031)
Spouse employed	0.324	-0.018	0.020	1.992**	-0.017	0.068*
	(0.679)	(0.022)	(0.025)	(0.913)	(0.031)	(0.037)
Spouse income (1000)	0.251	0.010	0.000	0.043	0.010**	-0.010*
	(0.214)	(0.007)	(0.008)	(0.137)	(0.005)	(0.006)
Live in metro	0.368	-0.016	-0.005	1.131	0.013	0.019
	(0.552)	(0.018)	(0.020)	(0.798)	(0.027)	(0.032)
Constant	5.501	0.181	0.401**	11.268*	0.932***	-0.291
	(4.743)	(0.157)	(0.175)	(6.255)	(0.213)	(0.252)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
State dummies	Yes	Yes	Yes	Yes	Yes	Yes
State-level variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5703	5121	5131	2551	2301	2301
R^2	0.214	0.147	0.134	0.246	0.171	0.051

Source: SIPP 1996,2001,2004, and 2008 Panels
*Note: Dependent variables are: (1)length of unemployment duration;(2)wage gain= Post-unemployment wage-pre-unemployment wage; (3)Displacement dummy which equals 1 if post-unemployment wage is smaller than pre-unemployment wage. Constrained individuals are defined as individuals whose liquid asset is lower than the sample median. State level variables include unemployment rate and housing price. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.*

References

J. M. Abowd and L. Vilhuber. Did the housing price bubble clobber local labor market job and worker flows when it burst? *The American Economic Review*, 102(3):589–593, 2012.

J. D. Angrjst and W. N. Evans. Children and their parents' labor supply: Evidence from exogenous variation in family size. *The American Economic Review*, 88(3):450–477, 1998.

H. Battu, A. Ma, and E. Phimister. Housing tenure, job mobility and unemployment in the uk. *Economic Journal*, 118(527):311–328, 2008.

C. Belzil. Unemployment insurance and subsequent job duration: Job matching versus unobserved heterogeneity. *Journal of Applied Econometrics*, 16(5):619–636, 2001.

D. G. Blanchflower and A. J. Oswald. Does high home-ownership impair the labor market? *NBER Working paper*, 2013.

K. Burdett and D. T. Mortensen. Search, layoffs, and labor market equilibrium. *The Journal of Political Economy*, pages 652–672, 1980.

M. Caliendo, K. Tatsiramos, and A. Uhlendorff. Benefit duration, unemployment duration and job match quality: A regression-discontinuity approach. *Journal of Applied Econometrics*, 28(4): 604–627, 2013.

J. Y. Campbell and J. F. Cocco. How do house prices affect consumption? evidence from micro data. *Journal of Monetary Economics*, 54(3):591–621, 2007.

S. Chan. Spatial lock-in: Do falling house prices constrain residential mobility? *Journal of urban Economics*, 49(3):567–586, 2001.

R. Chetty. Moral hazard versus liquidity and optimal unemployment insurance. *Journal of Political Economy*, 116(2):173–234, 2008.

K. P. Classen. The effect of unemployment insurance on the duration of unemployment and subsequent earnings. *Industrial and Labor Relations Review*, pages 438–444, 1977.

N. Coulson and L. Fisher. Tenure choice and labour market outcomes. *Housing Studies*, 17(1): 35–49, 2002.

N. Coulson and L. Fisher. Housing tenure and labor market impacts: The search goes on. *Journal of Urban Economics*, 65(3):252–264, 2009.

Y. S. Demyanyk, D. Hryshko, M. J. Luengo-Prado, and B. E. Sorensen. Moving to a job: The role of home equity, debt, and access to credit. 2013.

R. D. Dietz and D. R. Haurin. The social and private micro-level consequences of homeownership. *Journal of urban Economics*, 54(3):401–450, 2003.

D. DiPasquale and E. L. Glaeser. Incentives and social capital: are homeowners better citizens? *Journal of urban Economics*, 45(2):354–384, 1999.

Z. Eckstein and G. Van den Berg. Empirical labor search: A survey. *Journal of Econometrics*, 136 (2):531–564, 2007.

R. G. Ehrenberg and R. L. Oaxaca. Unemployment insurance, duration of unemployment, and subsequent wage gain. *The American Economic Review*, pages 754–766, 1976.

H. S. Farber. Unemployment in the great recession: Did the housing market crisis prevent the unemployed from moving to take jobs? *The American Economic Review*, 102(3):520–525, 2012.

D. Feenberg and E. Coutts. An introduction to the taxsim model. *Journal of Policy Analysis and Management*, 12(1):189–194, 1993.

F. Ferreira, J. Gyourko, and J. Tracy. Housing busts and household mobility. *Journal of Urban Economics*, 68(1):34–45, 2010.

R. C. Fisher. *State and local public finance*. Irwin Chicago, 1996.

P. Flatau, M. Forbes, and P. Hendershott. Homeownership and unemployment: the roles of leverage and public housing. *NBER Working paper*, 2003.

C. Flinn and J. Heckman. New methods for analyzing structural models of labor force dynamics. *Journal of Econometrics*, 18(1):115–168, 1982.

E. L. Glaeser and J. M. Shapiro. The benefits of the home mortgage interest deduction. *Tax Policy and the Economy*, pages 37–82, 2003.

E. P. Goss and J. M. Phillips. The impact of home ownership on the duration of unemployment. *The Review of Regional Studies*, 27(1):9–27, 1997.

R. Green and P. Hendershott. Home-ownership and unemployment in the u.s. *Urban Studies*, 38 (9):1509, 2001a.

R. K. Green and P. Hendershott. Home-ownership and the duration of unemployment: a test of the oswald hypothesis. *NBER Working paper*, 2001b.

R. K. Green and K. D. Vandell. Giving households credit: How changes in the us tax code could promote homeownership. *Regional Science and Urban Economics*, 29(4):419–444, 1999.

B. Guler and A. A. Taskin. Homeownership and unemployment: The effect of market size. Technical report, Working Paper, 2011.

T. Hastie, R. Tibshirani, and J. J. H. Friedman. *The elements of statistical learning*, volume 1. Springer New York, 2001.

A. Head and H. Lloyd-Ellis. Housing liquidity, mobility, and the labour market. *The Review of Economic Studies*, 79(4):1559–1589, 2012.

J. Heckman and E. Vytlacil. Structural equatiosn, treatment effects, and econometric policy evaluation. *Econometrica*, 73(3):669–738, 2005.

J. J. Heckman and S. Urzua. Comparing iv with structural models: What simple iv can and cannot identify. *Journal of Econometrics*, 156(1):27–37, 2010.

J. J. Heckman and E. J. Vytlacil. Econometric evaluation of social programs, part i: Causal models, structural models and econometric policy evaluation. *Handbook of econometrics*, 6:4779–4874, 2007.

C. A. Hilber. Neighborhood externality risk and the homeownership status of properties. *Journal of Urban Economics*, 57(2):213–241, 2005.

C. A. Hilber and T. M. Turner. The mortgage interest deduction and its impact on homeownership decisions. *The review of economics and statistics*, 2013.

K. Hoff and A. Sen. Homeownership, community interactions, and segregation. *American Economic Review*, pages 1167–1189, 2005.

G. W. Imbens and J. D. Angrist. Identification and estimation of local average treatment effects. *Econometrica*, 62(2):467–475, 1994.

B. A. Jacob and J. Ludwig. The effects of housing assistance on labor supply: Evidence from a voucher lottery. *The American Economic Review*, 102(1):272–304, 2012.

F. Karahan and S. Rhee. Housing and the labor market: The role of migration on aggregate unemployment. *University of Pennsylvania, mimeo*, 2011.

F. Karahan and S. Rhee. Geographical relocation and unemployment duration. *Working paper*, 2012.

J.-P. Laamanen. Home-ownership and the labour market: evidence from rental housing market deregulation. 2013.

R. Lalive. Unemployment benefits, unemployment duration, and post-unemployment jobs: A regression discontinuity approach. *The American economic review*, pages 108–112, 2007.

R. Lentz and T. Tranaes. Job search and savings: Wealth effects and duration dependence. *Journal of labor Economics*, 23(3):467–489, 2005.

H. Low, C. Meghir, and L. Pistaferri. Wage risk and employment risk over the life cycle. *The American economic review*, 100(4):1432–1467, 2010.

G. E. Metcalf. Assessing the federal deduction for state and local tax payments. Technical report, National Bureau of Economic Research, 2008.

A. S. Modestino and J. Dennett. Are american homeowners locked into their houses? the impact of housing market conditions on state-to-state migration. *Regional Science and Urban Economics*, 2012.

J. R. Munch, M. Rosholm, and M. Svarer. Are homeowners really more unemployed? *The Economic Journal*, pages 991–1013, 2006.

J. R. Munch, M. Rosholm, and M. Svarer. Home ownership, job duration, and wages. *Journal of Urban Economics*, 63(1):130–145, 2008.

A. Oswald. A conjecture on the explanation for high unemployment in the industrialised nations. *Warwick Economic Research Papers*, 1996.

A. Oswald. The missing piece of the unemployment puzzle. *Working paper*, 1997.

J. Poterba and T. Sinai. Tax expenditures for owner-occupied housing: Deductions for property taxes and mortgage interest and the exclusion of imputed rental income. *The American Economic Review*, pages 84–89, 2008.

J. M. Poterba. Tax subsidies to owner-occupied housing: an asset-market approach. *The quarterly journal of economics*, pages 729–752, 1984.

J. M. Poterba. Taxation and housing: old questions, new answers. Technical report, National Bureau of Economic Research, 1992.

S. Rendon. Job search and asset accumulation under borrowing constraints. *International Economic Review*, 47(1):233–263, 2006.

D. Ringo. Home ownership as a labor market friction. *working paper*, 2014.

R. Rogerson, R. Shimer, and R. Wright. Search-theoretic models of the labor market: A survey. *Journal of Economic Literature*, 43(4):959–988, 2005.

H. S. Rosen. Housing decisions and the us income tax: An econometric analysis. *Journal of Public Economics*, 11(1):1–23, 1979.

H. S. Rosen, K. T. Rosen, and D. Holtz-Eakin. Housing tenure, uncertainty, and taxation, 1983.

S. Schulhofer-Wohl. Negative equity does not reduce homeowners' mobility. *NBER Working Paper*, 2011.

T. Sinai and J. Gyourko. The (un) changing geographical distribution of housing tax benefits: 1980-2000. *Tax Policy and the Economy*, pages 175–208, 2004.

A. A. Taskın and F. Yaman. Does homeownership prolong the duration of unemployment? 2013.

R. G. Valletta. House lock and structural unemployment. *Labour Economics*, 2013.

M. Van Leuvensteijn and P. Koning. The effect of home-ownership on labor mobility in the netherlands. *Journal of Urban Economics*, 55(3):580–596, 2004.

H. Winkler. The effect of homeownership on geographic mobility and labor market outcomes. *Working paper*, 2010.

K. Wolpin. *Empirical Methods for the Study of Labour Force Dynamics*. Routledge, 2013.

J. M. Wooldridge. *Econometric analysis of cross section and panel data*. MIT press, 2010.

R. Yao and H. Zhang. Optimal consumption and portfolio choices with risky housing and borrowing constraints. *Review of Financial Studies*, 18(1):197, 2005.

Appendix

A1. Proofs

Lemma 1. *For renter,* $w^*_{rl} = w^*_{rn}$ *and* $\lambda'(s^*_{rl}) = \lambda'(s^*_{rn})$.

Proof. For renters, the reservation wages w^*_{rl} is defined as the wage that equates the value of search in the local market and the value of accepting the job; The reservation wages w^*_{rn} is defined as the wage that equates the value of search in the non-local market and the value of accepting the job. The value of accepting a local job and a non-local job is the same with the same level of wage, that is,

$$V^u_r = V^e_r(w^*_{rl}) = V^e_r(w^*_{rn}).$$

Therefore, it follows $w^*_{rl} = w^*_{rn}$.

Suppose $w^*_{rl} = w^*_{rn} = w^*$. Since $V^u_r = V^e_r(w^*_{rl})$, we have

$$Emax(V^e_r(w), V^u_r) = \int_{w^*_{rl}}^{\infty} V^e_r(w)dF(w) + V^u_r.$$

Plugging the above equation into Bellman equation (2), with a little further algebra, we obtain the following implicit equation for the reservation wage (which must have a unique solution given that V does):

$$\begin{aligned} w^* &= \max_{s_{rl}, s_{rn}} b - \mu(s_{rl} + s_{rn}) \\ &+ \frac{\beta}{1-\beta}\{(\lambda(s_{rl}) + \lambda(s_{rn})) \int_{w^*}^{\infty} (w - w^*)dF(w)\}. \end{aligned} \tag{7}$$

Given the value of w^*, the first order conditions for the optimal choice of (s_{rl}, s_{rn}) in equation (8) are

$$\mu'(s^*_{rl} + s^*_{rn}) = \lambda'(s^*_{rl}) \frac{\beta}{1-\beta} \int_{w^*}^{\infty} (w - w^*)dF(w) \tag{8}$$

$$\mu'(s^*_{rl} + s^*_{rn}) = \lambda'(s^*_{rn}) \frac{\beta}{1-\beta} \int_{w^*}^{\infty} (w - w^*)dF(w) \tag{9}$$

It follows from (9) and (10) that $\lambda'(s^*_{rl}) = \lambda'(s^*_{rn})$. That is, the unemployed distributes the search efforts making sure the marginal benefits of searching in the two markets are the same. □

Lemma 2. *For homeowner,* $w^*_{hl} < w^*_{hn}$ *and* $s^*_{hl} < s^*_{hn}$.

Proof. For homeowner, $V_h^u = V_h^e(w_{hl}^*) = V_h^e(w_{hn}^*) - c$, it follows

$$w_{hl}^* < w_{hn}^*.$$

Using $V_h^u = V_h^e(w_{hl}^*)$, Bellmen equation (4) can be rewritten as

$$\begin{aligned} w_{hl}^* &= \max_{s_{hl}, s_{hn}} b - \mu(s_{hl} + s_{hn}) \\ &+ \frac{\beta}{1-\beta}\{\lambda(s_{hl}) \int_{w_{hl}^*}^{\infty} (w - w_{hl}^*) dF(w) + \lambda(s_{hn}) \int_{w_{hn}^*}^{\infty} (w - w_{hl}^* - (1-\beta)c)) dF(w)\}. \quad (10) \end{aligned}$$

Given the value of w^*, the first order conditions for the optimal choice of (s_{hl}, s_{hn}) in equation (11) are

$$\mu'(s_{hl}^* + s_{hn}^*) = \lambda'(s_{hl}^*) \frac{\beta}{1-\beta} \int_{w_{hl}^*}^{\infty} (w - w_{hl}^*) dF(w) \quad (11)$$

$$\mu'(s_{hl}^* + s_{hn}^*) = \lambda'(s_{hn}^*) \frac{\beta}{1-\beta} \int_{w_{hn}^*}^{\infty} (w - w_{hl}^* - (1-\beta)c) dF(w) \quad (12)$$

It follows from (11) and (12) that $\lambda'(s_{hl}^*) < \lambda'(s_{hn}^*)$ since $\int_{w_{hl}^*}^{\infty} (w - w_{hl}^*) dF(w) > \int_{w_{hn}^*}^{\infty} (w - w_{hl}^* - (1-\beta)c) dF(w)$. That is, the unemployed distributes the search efforts making sure the marginal benefits of searching in the non-local market is higher to compensate the moving cost. □

Theorem 1. *Compared with renters, unemployed homeowners search more in the local market and less in the non-local market,*

$$s_{rl}^* \leq s_{hl}^*, \quad s_{rn}^* \geq s_{hn}^*;$$

Compared with renters, unemployed homeowners have lower reservation wages in local market and higher reservation wages in the non-local market,

$$w_{hl}^* \leq w_{rl}^* = w_{rn}^* \leq w_{hn}^*.$$

[30]

Proof. From lemma 1 and lemma 2, the optimal level of search effort for owners and renters can be summaries as following

$$\frac{\lambda'(s_{hl}^*)}{\lambda'(s_{hn}^*)} \leq \frac{\lambda'(s_{rl}^*)}{\lambda'(s_{rn}^*)} = 1 \quad (13)$$

[30] This results is similar with the Proposition 1 in Munch et al. [2006].

By the assumption that $\lambda(\cdot)$ is concave functions and $s^*_{hl} + s^*_{hn} = 1$, one has

$$s^*_{rl} \leq s^*_{hl}, \quad s^*_{rn} \geq s^*_{hn}.$$

Since $\lambda'_l(s^*_{hl}) \leq \lambda'_l(s^*_{rl})$, comparing equation (8) and (11), one obtains

$$\int_{w^*_{hl}}^{\infty}(w - w^*_{hl})dF(w) \geq \int_{w^*_{rl}}^{\infty}(w - w^*_{rl})dF(w),$$

it follows

$$w^*_{hl} \leq w^*_{rl}.$$

Similar to equation (10), w^*_{hn} can be written as

$$\begin{aligned} w^*_{hn} &= \max_{s_{hl}, s_{hn}} b - \mu(s_{hl} + s_{hn}) + (1-\beta)c \\ &+ \frac{\beta}{1-\beta}\{\lambda(s_{hl})\int_{w^*_{hl}}^{\infty}(w - w^*_{hn} - (1-\beta)c)dF(w) + \lambda(s_{hn})\int_{w^*_{hn}}^{\infty}(w - w^*_{hn}))dF(w)\}. \quad (14) \end{aligned}$$

The first order conation for s_{hn} in equation (14) is

$$\mu'(s^*_{hl} + s^*_{hn}) = \lambda'(s^*_{hn})\frac{\beta}{1-\beta}\int_{w^*_{hn}}^{\infty}(w - w^*_{hn})dF(w) \quad (15)$$

comparing equation (9) and (15), one obtains

$$\int_{w^*_{hn}}^{\infty}(w - w^*_{hn})dF(w) \leq \int_{w^*_{rn}}^{\infty}(w - w^*_{rn})dF(w),$$

it follows

$$w^*_{hn} \geq w^*_{rn}.$$

□

Theorem 2. *Compared with renters, unemployed homeowners have have higher transition rates into employment in the local labor market and lower transition rates into employment in the non-local market. That is,*

$$\theta_{rl} \leq \theta_{hl}, \quad \theta_{rn} \geq \theta_{hn}$$

Proof. The transition rates into local and non-local markets for renters are

$$\theta_{rl} = \lambda(s^*_{rl})[1 - F(w*)], \quad \theta_{rn} = \lambda(s^*_{rn})[1 - F(w*)].$$

The transition rates into local and non-local markets for renters are

$$\theta_{hl} = \lambda(s^*_{hl})[1 - F(w_{hl}*)] \quad \theta_{hl} = \lambda(s^*_{hn})[1 - F(w_{hn}*)].$$

Since $s^*_{rl} \leq s^*_{hl}, s^*_{rn} \geq s^*_{hn}$, and $w^*_{hl} \leq w^*_{rl} = w^*_{rn} \leq w^*_{hn}$ by Theorem 1, we have $\theta_{rl} \leq \theta_{hl}$. and $\theta_{rn} \geq \theta_{hn}$. □

Theorem 3. *Compared with renters, unemployed homeowners have have lower expected wages when reemployed in the local labor market and higher expected wages when reemployed in the non-local market. That is,*

$$w^p_{rl} \geq w^p_{hl}, \quad w^p_{rn} \leq w^p_{hn}$$

Proof. The expected wage when reemployed in local and non-local markets for renters are

$$w^p_{rl} = w^p_{rn} = E(w|w > w^*_{rl}) = E(w|w > w^*_{rn})$$

The expected wage when reemployed in local and non-local markets for homeowners are

$$w^p_{hl} = E(w|w > w_{hl}*) \quad w^p_{hn} = E(w|w > w_{hn}*)$$

By $w^*_{hl} \leq w^*_{rl}$, we have $w^p_{rl} \geq w^p_{hl}$; By $w^*_{hn} \geq w^*_{rn}$, we have $w^p_{rn} \leq w^p_{hn}$. □

Theorem 4. *Suppose w^N_{hl} and w^D_{hl} are expected post-unemployment wages corresponding the two job arrive rate functions $\lambda^D_l(s)$ and $\lambda^N_l(s)$. If $\lambda^{D'}_l(\cdot) < \lambda^{N'}_l(\cdot) = \lambda^{D'}_n(\cdot) = \lambda^{N'}_n(\cdot)$, we have*

$$w^N_{hl} > w^D_{hl}, \quad \textit{and} \quad s^N_{hl} < s^D_{hl}.$$

Proof. Rewrite equations (11) and (12) for different local and non-local job arrive rates λ_n and λ_l

$$\mu'(s^*_{hl} + s^*_{hn}) = \lambda'_l(s^*_{hl}) \frac{\beta}{1-\beta} \int_{w^*_{hl}}^{\infty} (w - w^*_{hl}) dF(w) \tag{16}$$

$$\mu'(s^*_{hl} + s^*_{hn}) = \lambda'_n(s^*_{hn}) \frac{\beta}{1-\beta} \int_{w^*_{hn}}^{\infty} (w - w^*_{hl} - (1-\beta)c) dF(w) \tag{17}$$

Equations (16) and (17) holds for both distressed and non-distressed market. Let's assume $w^N_{hl} < w^D_{hl}$, then $\int_{w^*_{hn}}^{\infty} (w - w^N_{hl} - (1-\beta)c) dF(w) > \int_{w^*_{hn}}^{\infty} (w - w^D_{hl} - (1-\beta)c) dF(w)$. According to equation (17), we must have $\lambda'_n(s^N_{hn}) < \lambda'_n(s^D_{hn})$, and, therefore, $s^N_{hn} > s^D_{hn}$. Since $s^*_{hl} + s^*_{hn} = 1$, it follows that $s^N_{hl} < s^D_{hl}$. According to equation (16), this means $w^N_{hl} > w^D_{hl}$, which is a contradiction. So we must have $w^N_{hl} > w^D_{hl}$. And $s^N_{hl} < s^D_{hl}$ is followed from equation (11). □

A2. Construction of variables

- Homeownership status: the SIPP asks questions on the ownership status of the living quarters. Homeowners are further asked about their mortgage status. Renters are further asked whether they are paying any rent or live in public housing unit and receiving government subsidized rent. The sample, therefore, are divided into four more detailed categories depending on tenure status: (1) owners with mortgages, (2) private market renters, (3) outright owners, and (4) subsidized renters. Table A1 summarizes the demographic characteristics and information of unemployment spells for the four groups. It highlight the difference between owners and outright owners, and the difference between private market renters and subsidized renters. For the two groups of owners, outright owners are older, experience longer unemployment duration and smaller wage gain. For the two groups of renters, subsided renters are poorer, experience longer unemployment duration and smaller wage gain.

- Labor market Variables: The SIPP contains data on monthly employment status[31] and labor income, which makes it possible to construct an individual's complete work history throughout the survey period. Three labor market variables are considered in this paper:

  (1) Employment status (being employed,being unemployed and being out of the labor force): The individual is defined as unemployed as long as he/she is unemployed for part of the interview period.[32] To avoid mis-coding non-participation as unemployment, I dropped those who are out of the labor market from the sample.[33]

  (2) Unemployment duration: Unemployment duration measures how long people remaine

[31] In SIPP, the basic labor force information has been recoded into eight employment status recodes (ESR's). These ESR's are defined as follows:
ESR 1 –With job entire month, worked all weeks.
ESR 2 –With job entire month, missed 1 or more weeks, but not because of a layoff.
ESR 3 –With job entire month, missed 1 or more weeks because of a layoff.
ESR 4 –With job part of month, but not because of a layoff or looking for work.
ESR 5 –With job part of month, some time spent on layoff or looking for work.
ESR 6 –No job in month, spent entire month on layoff or looking for work.
ESR 7 –No job in month, spent part of month on layoff or looking for work.
ESR 8 –No job in month, no time spent on layoff or looking for work.

[32] This definition is consistent with that of the Bureau of Census. That is, unemployment consists of ESR=3 or ESR=5 or ESR=6 or ESR=7.

[33] I define those whose ESR=8 as non-participating. According to this definition, 32.3% of individuals are out of the labor market, 82% of whom were older than 65 and, therefore, retired.

Table A1: Summary Statistic: Four Housing Tenure Categories (1996-2013)

	Total	Mortgagor	Renter	Outright owner	Public
Age	36.57	40.12	33.13	43.04	31.07
White	0.79	0.85	0.76	0.80	0.55
Black	0.14	0.09	0.16	0.14	0.35
High school	0.58	0.47	0.64	0.58	0.78
College	0.38	0.46	0.34	0.38	0.21
Graduate school	0.04	0.07	0.03	0.04	0.00
Married	0.47	0.64	0.37	0.49	0.32
N.of children (0-6)	0.32	0.34	0.35	0.19	0.42
N.of children (7-15)	0.50	0.64	0.42	0.37	0.69
Live in metro	0.77	0.80	0.81	0.71	0.77
Spouse employed	0.28	0.45	0.18	0.28	0.11
Spouse income (1000)	0.88	1.63	0.46	0.86	0.27
Total wealth (1000)	164.11	213.79	96.85	312.85	94.90
Liquid asset(1000)	84.40	104.01	56.71	130.00	53.36
Unemployment duration (weeks)	12.26	12.64	11.54	14.51	14.91
Pre-unemp wage	11.52	15.48	9.23	12.27	6.66
Post-unemp wage	16.13	19.09	14.48	16.08	11.30
Wage change	4.61	3.61	5.25	3.81	4.64
Probability of wage increase	0.69	0.59	0.73	0.64	0.79
Probability of wage decrease	0.26	0.34	0.19	0.28	0.17
Wage change ratio (percent)	0.03	-0.01	0.09	-0.01	0.11
Number of spells	22891	6660	8734	2094	674
Spells end with a job	17467	5814	6539	1749	458
Spells censored	5419	845	2194	343	216
Spells with Pre- and Post-wages	15581	5240	5808	1571	410

Source: SIPP 1996,2001,2004, and 2008 Panels

unemployed during each of the times (spells) they experienced unemployment. It's defined as an uninterrupted period of time in which an individual was unemployed. I use week as the time unit for unemployment spells since employment status is defined every week. The unemployment spells that begin and end with employment are defined if employment lasts at least four weeks before and after the spell.

(3) Hourly wage: In the SIPP, workers are allowed to report their wages in two ways, one is monthly wage and one is hourly wage depending whether they are paid by hourly rate. For those who are paid hourly, I use the hourly wage directly. For those who are not paid hourly, I calculate their hourly wage by dividing monthly earnings with hours they worked at that month. Hourly wage data is trimmed by throwing out observations in which hourly wages below $1.00 or above $1000.00. I calculate the wage change as the different of hourly wage before and after the unemployment duration. For the wage change, I excluded any observation which wages were reported to increase or decrease by more than 5 times.