Housing and Unemployment: The Search for the "American Dream"

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Abstract

This paper constructs a model of search and bargaining across two different markets: the labor market and the housing market. Interestingly, the model highlights that housing prices and frictions in the housing market have a profound impact on labor market activity through the desire of workers to eventually purchase a home, the "American Dream." In particular, higher housing prices adversely affect workers' incentives in the labor market as employment can eventually lead to access to housing through the ability to purchase a home. Similarly, labor market frictions can impact housing market activity. Notably, tighter housing markets are associated with higher unemployment rates and less job creation. Consequently, our work suggests that policymakers should be very careful in implementing policies targeted towards housing – housing markets are likely to generate significant external effects to other sectors of the economy, especially the labor market.

Keywords: Housing, Unemployment, Search Frictions

JEL Codes: R21, J64, J31, E24, E60

1 Introduction

The recent financial crisis in the United States demonstrates that there are significant linkages between housing market conditions and labor market performance. Therefore, it is critically important to start taking a look at the deep connections between labor market and housing market activity. For example, how does labor market activity affect housing market behavior? Alternatively, how do housing market conditions impact the performance of the labor market? These are important, but complicated questions – activity in each sector feeds into the other sector. Consequently, ignoring such connections almost certainly would lead to ineffective policymaking. Yet – that appears to be the modus operandi in policy discussions – for example, current policy debates aimed at promoting housing market activity virtually omit any discussion of the role of labor market conditions such as wages or the duration of unemployment spells.

In addition to ignoring the linkages between both markets, much existing research ignores that there are significant information frictions within each market. To begin, workers generally engage in a relatively long period of job search before finding employment. In 2005, workers were unemployed for an average of 18.5 weeks. Therefore, even in a strong labor

market, workers generally needed around 4.5 months to locate a successful job match. By comparison, in 2011, the average duration of unemployment was much higher – nearly 10 months. It also takes a relatively long amount of time to sell a home – a process that has become noticeably more difficult since the housing recession began. In 2005, only 22% of homes were vacant for more than 6 months. By comparison, in the fourth quarter of 2011, around 35% were vacant – nearly 60% more. In particular, Genesove and Han (2011) using data from the National Association of Realtors find that seller time significantly depends on the level of market demand. Given these observations of pronounced delay, there are clearly appreciable transactions costs in each market. It takes time to find a job. It also takes time to find a home-buyer. Consequently, the standard Walrasian market-clearing paradigm does not apply to either market. Since the Walrasian clearing mechanism does not apply, the standard price-taking mechanism is not appropriate to study the determination of wages or home prices. Moreover, the effects of policy depend on the time involved in the search process and the price-determination mechanism in each market. Notably, Henley (1998) observes: "UK economists have been concerned for some time that the housing and labour markets may not operate together in a frictionless manner."

How does activity in the labor market and housing market depend on the information frictions and non-competitive price determination in each market? Moreover, how should policymakers account for the connections between housing and labor market conditions? Finally, is it possible to account for the level of housing price appreciation witnessed during the recent housing boom in a general equilibrium model with search frictions and bargaining?

To adequately address these important concerns, a model that clearly analyzes market fundamentals with *endogenous* transactions costs is required. Consequently, the objective of this paper is to develop a general equilibrium, search-theoretic model that is able to address the significant connections between housing and labor market outcomes. In our framework, unemployed individuals spend time searching to find job vacancies. Once a worker contacts a vacancy, workers engage in bargaining over their wage rate. Upon earning labor market income, workers can begin searching for a home to purchase so that they can enjoy the benefits of home ownership. Thus, our model introduces an important connection between housing market conditions and labor market activity – *the value of finding a job extends beyond labor income, it also includes the discounted benefit of access to housing.* In this manner, we are able to demonstrate that *housing market conditions* are an important component of *labor market incentives.* Therefore, policies designed to affect home ownership such as the mortgage interest deduction are highly likely to affect labor market activity. By comparison, adverse housing market conditions (i.e., higher property taxes or rationing of mortgage credit) would also generate an external effect beyond the housing market.

We turn to determination of housing market activity. While demand for housing comes into the market as workers find jobs, the supply of homes is also tied to demographic patterns. That is, the lifecycle plays an important role in the demand and supply of housing. Alternatively, turnover in the labor market also affects housing supply.[1] Upon finding a suitable home, the buyer and seller bargain over housing prices. A worker's surplus from home ownership depends on wages, the expected length of time that they will remain in the home, and the utility from home ownership. The seller's surplus from finding a buyer depends on the sale price of the home and the amount of time it would take to find an alternative buyer. Thus, labor market conditions through wages and labor force participation rates may also affect prices and tightness in the housing market. Therefore,

[1] Ai et. al. (2003) study the lifecycle components of housing demand.

policies targeted towards the labor market would also transmit to housing market activity.

Our work contributes to a growing literature that emphasizes the connections between housing and labor markets. To begin, Coulson and Fisher (2009) study the consequences of home ownership for unemployment rates.[2] In their empirical analysis, they find that homeowners have a lower incidence of unemployment, but also receive lower wages than renters. By comparison, Cunningham and Reed (2012a) study the consequences of housing equity for wages among homeowners in the American Housing Survey. In particular, they find that individuals in a negative equity position earn wages that are almost 7% lower than other homeowners. In addition, Cunningham and Reed (2012b) demonstrate that workers' equity positions affect wages and the extent of involuntary unemployment in a model with moral hazard in the labor market.

As we emphasize, Coulson and Fisher argue that the Walrasian price-taking mechanism is inappropriate for wage determination in the labor market. If wages are determined through bargaining, higher levels of home ownership are associated with lower unemployment rates. However, Coulson and Fisher do not include a real estate market in their analysis. Consequently, in contrast to our setting, they are unable to look at the impact of labor market activity on housing conditions. Moreover, in contrast to our framework, the desire to purchase a home cannot influence worker incentives or labor market performance. That is, in contrast to Cunningham and Reed (2012a,b) we study how housing prices affect wages among individuals who do *not* own a home.[3] Yet, housing prices affect labor market outcomes. Therefore, we pay little attention to "wealth effects" from homeownership in our framework. Instead, it is the desire of individuals to eventually purchase a home (the "American Dream") that affects workers' incentives.

In other recent work, Head and Lloyd-Ellis (2012) study an economy with two sectors: the housing sector and the labor market. Both sectors are plagued by search frictions. However, Head and Lloyd-Ellis assume that workers are price-takers in the labor market. Again, by ignoring the desire for homeownership in workers' incentives, externalities from the housing sector are omitted. Nevertheless, we contend that the "American Dream" leads to a crucial role for housing market activity to affect labor market outcomes.

The paper is organized as follows. Section 2 describes the physical environment. The economy is made up of two markets: a housing market and a labor market. Section 3 describes the matching process and introduces the bellman equations that guide our analysis. Within both sectors of the economy, matches are formed according to a matching technology. Section 4 derives the steady-state analysis for a partial equilibrium model with exogenous housing prices.[4] Section 5 formulates the steady-state properties for a partial equilibrium model with exogenous wages. Section 6 introduces a general equilibrium model with wages and housing prices endogenously determined. We calibrate the model and present the results of our calibration analysis. In Section 7 we conclude and discuss policy implications.

[2] See also Dohmen (2005).

[3] Interestingly, Campbell and Cocco (2007) observe that housing prices affect consumption levels among *both* homeowners and renters in the United Kingdom.

[4] In this manner, our work follows the approach of Laing, Palivos, and Wang (1995) who study human capital investment in the presence of search frictions in the labor market. Taking the level of human capital accumulation as given, they show how labor market frictions and wages interact with an exogenous level of schooling to impact steady-state activity. After this benchmark setting, they endogenize the level of schooling. We study interactions between two different markets: the labor market and the housing market. Consequently, we begin by studying activity in each market taking the price in the other sector as given. We conclude with analysis in general equilibrium.

2 Environment

We construct a continuous time dual search economy. There are two decentralized markets, a housing market and a labor market. Due to frictions in each market, time is required until matches in each sector of the economy occur. The economy is populated by risk-neutral workers and firms who discount the future at rate $\rho > 0$. At the beginning of each period, new workers are born at a constant rate of $\eta > 0$. Workers do not differ in terms of skills or preferences. Moreover, the productivity of each job match is the same. As we explain below, once a worker-firm match is formed the match produces a non-storable consumption good. In addition to labor market activity, there is an active housing market. In this market, a stock of homes is traded across generations of individuals. Once individuals reach old age, they retire, sell their homes, and exit the economy. Houses do not depreciate.

The Labor Market

As a result of frictions in the labor market, it takes time for firms to contact unemployed workers. Likewise, workers spend time searching, collecting information, and applying for jobs. We assume that contact between the worker and firm is random. More specifically, a random subset of unemployed workers and vacant jobs are brought together via a matching technology. Unemployed workers meet job vacancies with arrival rate $\alpha > 0$. By comparison, vacancies contact unemployed workers with arrival rate $\beta > 0$. Once a match is formed, the worker and firm bargain bilaterally over wages. Job destruction does not occur. Instead, matches in the labor market remain in tact until the worker reaches old age and retires from the economy.[5]

The Housing Market

Similar to the labor market, finding a match within the housing market takes time. In addition to the time spent searching, home buyers view and inspect potential homes. It also takes time for a seller to contact a potential home buyer. In contrast to the labor market, we abstract from costs of posting housing vacancies. Consequently, buyers and sellers are randomly matched, and this match is generated from a realization of the matching function in the housing market. Potential buyers meet potential sellers with arrival rate $\lambda > 0$. Sellers make contact with buyers at a rate of $\sigma > 0$. Provided that a buyer-seller meeting takes place, the price of the home is determined by Nash bargaining. As the stock of homes does not depreciate and the size of the population is constant, residential construction is not necessary.

2.1 Firms

There is a continuum of firms in the economy at any point in time. Each firm has access to a constant returns to scale production technology in which labor is the only input. To be specific, the productivity of each match is equal to y each period. Net revenue over time is income in excess of wages (w), $y - w$.

[5] As job separation does not occur until the worker exits the labor market, wages are independent of wealth effects from housing prices. In contrast, Cunningham and Reed (2012b) study the implications of housing equity for worker incentives and labor market activity but they do not model the process by which individuals become homeowners.

2.2 Workers

Upon entering the economy, workers immediately begin searching for job opportunities. Each worker has the same level of ability in terms of labor productivity and there is no disutility from labor effort. After gaining employment, a worker is eligible to participate in the housing market and search for a home to purchase. In this manner, our model reflects the strong degree of labor market attachment that is generally required in order to get access to mortgage credit.[6]

Owning a home not only serves as an investment, but it also provides utility in terms of psychological satisfaction – one of the central tenets of the housing literature. The utility value of homeownership is represented by z. There are a number of factors which contribute to the utility from owning a home. For example, individuals are likely to develop social capital through interactions in their neighborhood. In addition, individuals often cite the emotional stability resulting from homeownership. They also have access to local public goods. Such factors do not appear in models of labor market activity. Interestingly, as we show below, the value of home ownership can have a significant impact on labor market activity through workers' incentives to find a job and eventually gain access to the housing market.

With flow probability ω, workers age, retire from the labor market, and no longer receive utility from owning a home. One can interpret that ω represents a type of negative health shock in which individuals become physically unable to work and care for their homes. In this manner, our framework captures the lifecycle component of housing demand. As a result, buyers in the housing market are composed of young workers who have found stable employment. Sellers in the housing market are determined by the number of individuals seeking to sell their existing homes.

3 Matching and Bellman Equations

In this section, we further elaborate on the matching process within both markets. We begin with the labor market and follow with the housing market. As we describe below, the total number of matches in each market over time results from a matching technology in each segment of the economy.

3.1 Labor Market Matching

Unemployed workers meet vacancies at the rate αU, where U represents the number of unemployed workers. Additionally, vacancies meet unemployed workers at the rate βV, where V signifies the measure of vacancies. The total number of matches on each side of the market must be the same. Therefore:

$$\alpha U = \beta V \tag{1}$$

The total number of matches over time is governed by the matching function in the labor market, $m_o M(U, V)$. The parameter m_o reflects the productivity of matching in the market. As a result, we have:

[6] By comparison, unemployed workers can purchase homes in the study of housing and mobility by Head and Lloyd-Ellis (2012).

$$\alpha U = m_o M(U, V) = \beta V \tag{2}$$

Assumption 1. The matching function, $M(U, V)$, is continuous, strictly increasing, concave in each argument, twice differentiable and exhibits constant returns to scale. Following the literature, we assume it has the Cobb-Douglas form.

3.2 Housing Market Matching

Due to imperfect information, buyers and sellers are both required to search. As workers discount the future, the delay required to find a buyer or seller is costly. Buyers make contact with sellers at the rate λ_0., Likewise, sellers find home buyers at the rate σ. As E_0 indicates the number of home buyers and R represents the measure of retired individuals in the economy, matches on both sides of the market must be equal:

$$\lambda E_0 = \sigma R \tag{3}$$

As agents confront search frictions in the housing market, we assume the matching rate is determined by a Poisson process with parameter h_o representing the ease or difficulty of creating matches. The matching function, $h_o H(E_0, R)$, has the same properties as the matching function in the labor market:

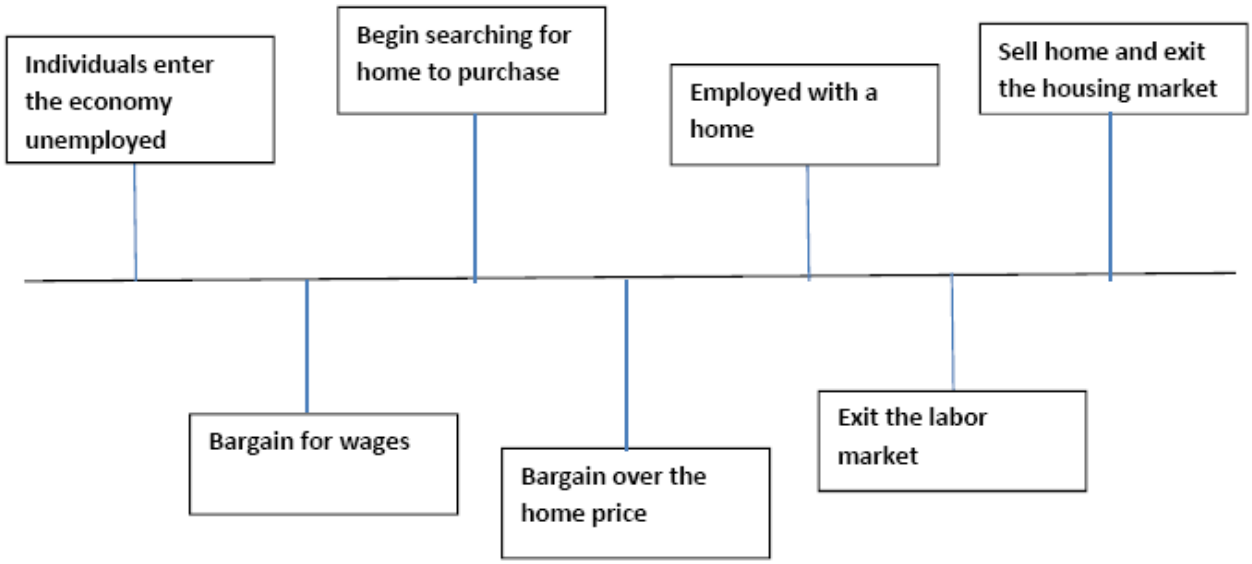
$$\lambda E_0 = h_o H(E_0, R) = \sigma R \tag{4}$$

Assumption 2. The matching technology, $H(E_0, R)$, has the same properties as the matching technology, $M(U, V)$.

3.3 Bellman Equations

Over time, workers transition through four different states. Upon birth, workers are unemployed. They remain so until they find a match with a vacancy. After finding a job, workers become eligible to buy a home.[7] After their working careers, workers sell their homes and exit the economy. Vacancies are either filled or unfilled. The timeline of actions for each individual is presented in the following timeline:

[7] For tractability, rental costs are normalized to zero.



The values associated with these transitions are illustrated with the Bellman equations below:

Bellman Equations for Workers:

$$\rho J_u = \alpha(J_e^0 - J_u) \tag{5}$$

$$\rho J_e^0 = w - \lambda P + \lambda(J_e^1 - J_e^0) \tag{6}$$

$$\rho J_e^1 = w + z + \omega(J_r - J_e^1) \tag{7}$$

$$\rho J_r = z + \sigma(P - J_r) \tag{8}$$

Bellman Equations for Firms:

$$\rho \Pi_v = \beta(\Pi_f^0 - \Pi_v) \tag{9}$$

$$\rho \Pi_f^0 = (y - w) + \lambda(\Pi_f^1 - \Pi_f^0) \tag{10}$$

$$\rho \Pi_f^1 = (y - w) + \omega(\Pi_v - \Pi_f^1) \tag{11}$$

As an example, we describe the Bellman equation for an employed worker without a home (J_e^0), equation (6). While the individual is employed and does not have a home, he earns income from employment and searches for a home to purchase. With flow probability λ, the individual finds a home to purchase and incurs the price of the home, P. Upon purchase, the individual experiences the capital gains from becoming a home-owner. Thus, in equation (7), the individual derives utility from wage income and the value of homeownership, z. This continues until the individual experiences a health shock, retires, sells the home, and exits the economy.[8] The Bellman equations for firms follow analogously.

4 Steady-State I (Exogenous Price of Housing)

We first take a look at a one-sided partial equilibrium model of the labor market. That is, we analyze labor market activity taking the price of housing as exogenous. The tractability of the model allows us to analytically determine how frictions in both the labor market and housing market affect labor market outcomes. Interestingly, the model highlights new mechanisms in which housing market conditions feed into labor market activity.

4.1 Bargaining

Once a match is created between a worker and firm, Nash bargaining is used to determine the wage paid to the worker. The wage agreement does not change throughout the duration of the match. Furthermore, workers and firms both generate surplus from the match. From the perspective of the worker, his surplus is the gain in utility from becoming employed. A firm's surplus is the gain in present discounted income from filling the vacancy. The gain in utility from becoming employed is $J_e^0 - J_u$. A worker will accept any wage such that $J_e^0 \geq J_u$. A firm's gain in income from filling a vacancy is $\Pi_f^0 - \Pi_v$. Similarly, a firm will agree to pay any wage such that the $\Pi_f^0 \geq \Pi_v$. Under symmetric Nash bargaining, the match surplus is split evenly between both agents:

$$J_e^0 - J_u = \Pi_f^0 - \Pi_v \tag{12}$$

It is important to consider the value of a job and how it relates to the wage offer function. The value of a job has two elements: labor income and the benefit associated with having access to housing. Going forward, consider the following definitions: $\hat{\beta} = \frac{\beta}{\rho+\beta}$, $\hat{\alpha} = \frac{\alpha}{\rho+\alpha}$, $\hat{\lambda} = \frac{\lambda}{\rho+\lambda}$, $\hat{\omega} = \frac{\omega}{\rho+\omega}$, and $\hat{\sigma} = \frac{\sigma}{\rho+\sigma}$. The gains from finding a job vacancy are:

$$J_e^0 - J_u = (1-\hat{\alpha})\{[\frac{1}{(\rho+\lambda)} + \frac{\hat{\lambda}}{(\rho+\omega)}]w + \hat{\lambda}[\frac{1}{(\rho+\omega)} + \frac{\hat{\omega}}{(\rho+\sigma)}]z - \hat{\lambda}[1-\hat{\omega}\hat{\sigma}]P\} \tag{13}$$

The value of a job reveals that housing market conditions have an important external effect on labor market activity. Notably, higher housing prices lower employment incentives because higher prices make it more difficult to attain the American Dream and enjoy the benefits of home-ownership.

[8] For tractability, retirement from the labor force and withdrawal from homeownership occur simultaneously. Alternatively, a health or 'retirement' shock and a shock to the utility from homeownership could be separate events. However, this would result in an additional worker state and Bellman equation in the model. Given that search takes place across two different markets (the labor market and the housing market) and wages and housing prices are endogenously determined, we pursue the strategy here in order to maintain analytical tractability.

Proposition 1 below demonstrates how overall market conditions affect wages:

Proposition 1 (The Wage Function). Under symmetric Nash bargaining, the wage function is:

$$
\begin{aligned}
w \quad = \quad & \frac{(1-\hat{\beta})}{(1-\hat{\alpha})(1-\hat{\lambda}\hat{\omega}\hat{\beta})+(1-\hat{\beta})}y \\
& + \left(\frac{\hat{\lambda}(\rho+\lambda)}{[(\rho+\omega)+\hat{\lambda}(\rho+\lambda)]}\right)\left(\frac{(1-\hat{\alpha})(1-\hat{\lambda}\hat{\omega}\hat{\beta})}{\left[(1-\hat{\alpha})(1-\hat{\lambda}\hat{\omega}\hat{\beta})+(1-\hat{\beta})\right]}\right)(\rho+\omega)(1-\hat{\omega}\hat{\sigma})P \\
& - \left(\frac{\hat{\lambda}(\rho+\lambda)}{[(\rho+\omega)+\hat{\lambda}(\rho+\lambda)]}\right)\left(\frac{(1-\hat{\alpha})(1-\hat{\lambda}\hat{\omega}\hat{\beta})}{[(1-\hat{\alpha})(1-\hat{\lambda}\hat{\omega}\hat{\beta})+(1-\hat{\beta})]}\right)\left(\frac{(\rho+\sigma)+\hat{\omega}(\rho+\omega)}{(\rho+\sigma)}\right)z
\end{aligned}
\tag{14}
$$

The wage equation illustrates that there are multiple components of the wage function. The wage function responds to labor productivity, utility from homeownership, and home prices. Furthermore, each component has a slightly different effect on the wage function. The following three Lemmas describe the three components of the wage function.

Lemma 1 *(Labor Productivity Effect on Wages). The labor productivity effect on the wage function is given by the following term:*

$$
\frac{(1-\hat{\beta})}{(1-\hat{\alpha})(1-\hat{\lambda}\hat{\omega}\hat{\beta})+(1-\hat{\beta})}y \tag{15}
$$

The labor productivity effect is stronger if frictions facing home buyers are lower (λ higher). The labor productivity effect is independent of frictions facing sellers of homes.

The labor productivity component of the wage function is the standard component of wages in search and matching models of the labor market. As is typically the case, workers earn higher wages if they contact vacancies more easily. Similarly, they earn lower wages if it takes less time for vacancies to find unemployed workers in the labor market.

The contribution of our work comes from incorporating housing market activity into a model of the labor market. Notably, the model includes the motivation to search and buy a home. Consequently, in contrast to standard search models of the labor market, search frictions in the housing sector can also spill over to affect labor market activity. Interestingly, the labor productivity effect on wages is stronger when the frictions facing home buyers are lower.

Increasing the contact rate for home buyers reduces the average length of time it takes for an individual to buy a home. As a result, the amount of time from unemployment to home ownership is lower. This weakens the need for a worker to find employment in order to eventually become a homeowner. In turn, labor productivity has a stronger impact on wages. *That is, the worker will be able to extract a larger amount of revenue from their employer when it is easier to find a home.* Alternatively, wages will respond more to firm income when housing conditions are not as 'tight.' Therefore, our framework illustrates

that policies directed towards the labor market cannot ignore the impact of conditions in the housing market.

For a given housing price, the labor productivity effect in the labor market is independent of the frictions facing sellers in the housing market. That is, the importance of labor productivity for wages does not depend on the ability of individuals to eventually sell their homes.

In order to put our results into perspective, it may help to consider the implications of recent activity within the context of our model. Estimates for 2012 put the growth rate of real GDP around a sluggish 2%. However, housing market conditions have improved. Consequently, the slight increase in tightness in the housing market implies that wages may not respond as much to the increase in GDP. That is, tighter frictions in the housing market would be associated with limited growth in wages. Alternatively, during the housing boom which preceded the Great Recession, the model implies that wages would become less responsive to macroeconomic conditions. *Instead, as we explain below, labor market conditions would be likely to depend much more on activity in the housing market.*

As is clear from (13), higher housing prices are a work disincentive. Consequently, firms must compensate workers for the loss of surplus in order to fill their job vacancies. In this manner, our work is clearly distinct from previous research emphasizing the implications of individuals' housing equity on labor market incentives. Additional insights are summarized in the following Lemma:

Lemma 2 *(Home Price Effect on Wages).*

$$\left(\frac{\hat{\lambda}(\rho+\lambda)}{[(\rho+\omega)+\hat{\lambda}(\rho+\lambda)]}\right)\left(\frac{(1-\hat{\alpha})(1-\hat{\lambda}\hat{\omega}\hat{\beta})}{\left[(1-\hat{\alpha})(1-\hat{\lambda}\hat{\omega}\hat{\beta})+(1-\hat{\beta})\right]}\right)(\rho+\omega)(1-\hat{\omega}\hat{\sigma})P \tag{16}$$

The home price effect of wage compensation depends on frictions in the labor market. It is decreasing in α and increasing in β. It also depends on frictions in the housing market – the effect is increasing in λ. However, it is unambiguously decreasing in σ.

Lemma 2 clearly demonstrates that there are important interactions between housing market and labor market conditions. To begin, a higher home price reduces the value of working because the surplus obtained from finding a job is lower if there are more severe costs for gaining access to housing. From this perspective, tighter housing market conditions (as exemplified by a higher home price) lead to higher work disincentives and higher wages.

While our result may appear counterintuitive, we believe it is bolstered by related evidence on housing prices and savings among renters. For example, Case, Quigley, and Shiller (2005) lament: "Thus it appears that housing prices may reduce, rather than increase the savings of renters." Moreover, Engelhardt (1994) observes that higher housing prices are associated with a lower probability of savings among prospective home buyers in Canada. In particular, he finds that each additional $1000 in housing prices contributes to $300 less in assets among such households. That is, the available evidence indicates that incentives to save for a downpayment are lower if housing prices are higher. The novelty of our work is that we show that the same mechanisms also contribute to work disincentives in the labor market. *In other words, there are substantial financial disincentives and labor market disincentives from higher housing prices.*

Moreover, the Lemma shows that the magnitude of the home price effect also depends on *frictions* in both sectors of the economy. First, the magnitude depends on labor market frictions. One of the important motivating factors for workers in the labor market is eventual access to a home. Thus, frictions in the labor market interact with housing market conditions and affect wage bargaining.

Notably, the higher housing price is a work disincentive, lowering the value of a job since the net surplus to be obtained in the housing market will be lower. However, as it becomes easier for workers to find a job, the amount of time that an individual will remain in the home is higher relative to their life span. *Therefore, the home price effect on wages is smaller if it is easier for workers to find a match in the labor market because the amount of time it takes to get access to the housing market is shorter.* That is, the work disincentive from higher housing prices is lower if it easier for workers to find jobs. It is standard that the effects of the worker contact rate (α) are the opposite of the vacancy contact rate (β). However, the mechanisms from the housing market to labor market activity are new to the literature.

Second, the magnitude of the home price effect depends on frictions in the housing market. Moreover, as it is easier for workers to find a home, the discounted price of the home will increase. As a result, the compensation to the worker must increase. That is, the work disincentive from higher housing prices is higher if it is easier for a worker to match with a home in the housing market.

There is much attention in the housing literature on the utility that individuals obtain from homeownership. Yet, such factors do not appear in models of labor market activity. In particular, the value of home ownership is an important motivating factor for workers in the labor market as observed in the following lemma:

Lemma 3 *(Homeownership Effect on Wages). The importance of homeownership on the wage function is represented by:*

$$-\left(\frac{\hat{\lambda}(\rho+\lambda)}{[(\rho+\omega)+\hat{\lambda}(\rho+\lambda)]}\right)\left(\frac{(1-\hat{\alpha})(1-\hat{\lambda}\hat{\omega}\hat{\beta})}{[(1-\hat{\alpha})(1-\hat{\lambda}\hat{\omega}\hat{\beta})+(1-\hat{\beta})]}\right)\left(\frac{(\rho+\sigma)+\hat{\omega}(\rho+\omega)}{(\rho+\sigma)}\right)z \quad (17)$$

The home ownership effect is increasing in α and decreasing in β. It is also decreasing in λ if ω is sufficiently small.

The interpretation of the homeownership effect is pretty close to the interpretation for the home price effect. The surplus from finding a job is higher when the utility from homeownership rises. As a result, higher values of homeownership are associated with lower wages. However, frictions in each market affect the magnitude of the effect. *First, the negative impact of the ownership effect is stronger if α is higher.* The reasoning is the same as the home price effect – when it is easier for individuals to find a job, they get access to the surplus from housing in a shorter amount of time. That is, it becomes easier to get access to the utility from homeownership. *Consequently, the surplus from matching with an individual job vacancy is higher which accelerates the wage compression from housing.* The results for the remaining frictions follow analogously.

We conclude with a summary of three important conclusions from our partial equilibrium model of labor market activity:

1. Overall productivity and real GDP will have less impact on wage income if the housing market is tighter. (Labor Productivity Effect and Housing Frictions)

2. Housing prices should have a smaller impact on wages if it is easier for workers to find jobs. (Home Price Effect and Labor Frictions)

3. The utility from home ownership will have a larger impact on wages if it is easier for workers to find jobs. (Home Ownership Effect and Labor Frictions)

That is, search frictions in the housing market affect the magnitude of labor productivity on wages. Similarly, search frictions in the labor market affect the magnitude of housing prices on wage compensation.

4.2 Steady-State Equilibrium with Exogenous Price of Housing

We next formally define a steady-state equilibrium in the economy with an exogenous price of housing. We also establish that the steady-state exists and is unique.

Definition 1. A steady-state equilibrium in the economy with an exogenous price of housing, P, is a wage function $w(P, \beta, \alpha^*)$ and a vector (α^*, U^*) satisfying the following conditions:

(i) (Symmetric Nash Bargaining):

$$J_e^{0*} - J_u^* = \Pi_f^{0*} - \Pi_v^* > 0 \tag{18}$$

(ii) (Steady State):

$$\alpha^* U^* = \beta^* V^* = m_0 M(U^*, V^*) \tag{19}$$

$$\alpha^* U^* = \eta^* \tag{20}$$

The Steady-State Matching Condition

As the matching technology is constant returns to scale, the contact rate for an unemployed worker to a vacancy may be expressed as:

$$\alpha = m_o M(1, \frac{V}{U}). \tag{21}$$

Since $\alpha U = \beta V$, we can establish:

$$\alpha = m_o M(1, \frac{\alpha^*}{\beta}) = \alpha^{ss}(\beta; m_o). \tag{22}$$

This equation characterizes the steady state locus in the labor market. By Assumption 1, α^{ss} is also continuous. Its properties are summarized in the following Lemma:

Lemma 4. (*The Steady-State Locus in the Labor Market with an Exogenous Housing Price*) *Under Assumption 1 the function* $\alpha = \alpha^{SS}(\beta; m_0)$ *satisfies the following properties:*

$$\text{(i) } \partial\alpha^{SS}/\partial\beta < 0 \text{ and } \partial\alpha^{SS}/\partial m_0 > 0 \quad \text{(ii) } \lim_{\beta\to 0} \partial\alpha^{SS}/\partial\beta = -\infty \text{ and } \lim_{\beta\to\infty} \partial\alpha^{SS}/\partial\beta = 0$$

Exogenous Contact Rate of Vacancies

For simplicity, in the partial equilibrium model with exogenous housing prices, we assume there is a fixed number of firms operating in the economy. Consequently, the rate at which a vacancy contacts an unemployed worker is exogenous and independent of α. By comparison, in the general equilibrium framework, we consider endogenous entry of vacancies so that all matching rates are determined in steady-state equilibrium.

Characterization of Steady-State Equilibrium

As observed in the Figure below, it is easy to show that a unique steady-state in the economy with an exogenous housing price exists:

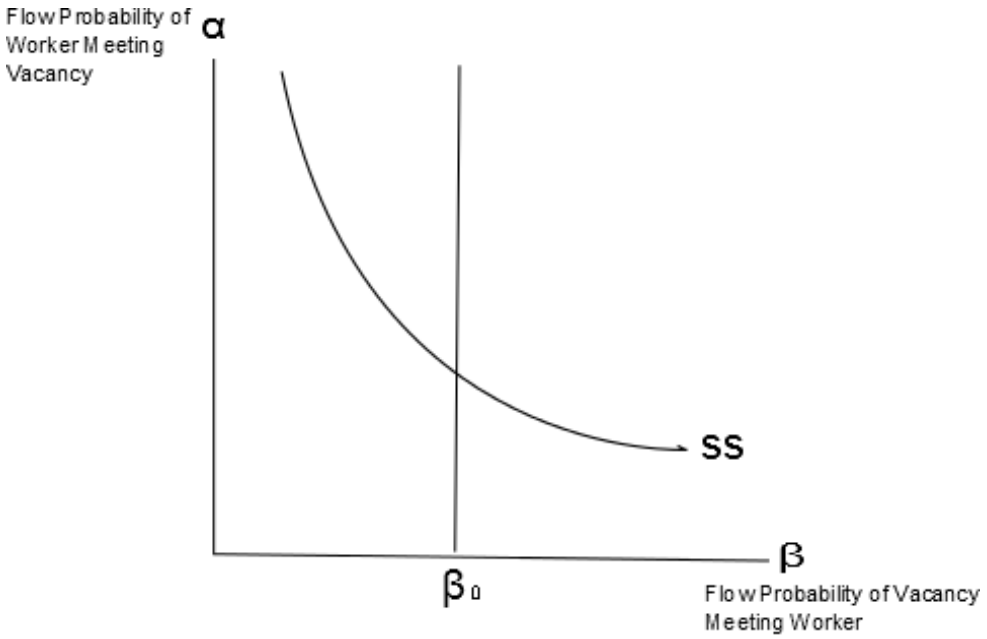


Figure 1: Existence and Uniqueness of Steady-State with Exogenous Price of Housing

Due to the downward-sloping property of the steady-state locus, an increase in β leads to a decrease in the steady-state equilibrium matching rate, α^*. An increase in m_0 will be associated with an increase in α^* since the steady-state locus will shift up.

5 Steady-State II (Exogenous Wage Rate)

We now turn to a partial equilibrium model of the housing market in which we assume wages are exogenous. In doing so, we address the question, "How does labor market activity affect housing market conditions?" We also study how the utility from homeownership feeds into housing prices.

Housing inventory depends on population demographics as reflected by ω. That is, individuals will sell their homes upon experiencing an aging shock in which they start to lose utility from owning a home. Demand for homes depends on the number of workers who exit unemployment and become attached to their jobs.[9]

The steady-state equilibrium consists of a housing price function, the steady-state population of buyers and sellers, and equilibrium contact rates between buyers and sellers. In particular, two conditions must be satisfied in the steady-state: (i) symmetric Nash bargaining over the price of a home and (ii) steady-state matching.

5.1 Bargaining

Following contact between a buyer and seller, Nash bargaining between the two determines the price of a home. Since individuals must be employed in order to gain access to the housing market, the match surplus for an individual acquiring a home is: $J_e^1 - J_e^0 - P$. A home buyer will agree to any price such that the value of being employed is greater or equal to the price he pays for his home, $J_e^1 - J_e^0 \geq P$. Similarly, the seller's value from selling their home is represented by $P - J_r$, the price they receive minus the value of being retired.

The positive surplus resulting from bargaining over the price of a home is divided evenly between the buyer and seller as dictated by the symmetric Nash rule:

$$P - J_r = J_e^1 - J_e^0 - P \tag{23}$$

In turn, the housing price function is presented in Proposition 2:

Proposition 2 (House Price). As determined by symmetric Nash bargaining, the house price function is:

$$P = \left(\frac{(\rho + \sigma)}{\rho + (\rho + \sigma)(1 - \hat{\omega}\hat{\sigma})(1 - \hat{\lambda})} \right) \left[\left(\frac{(1 - \hat{\lambda})}{(\rho + \omega)} - \frac{1}{(\rho + \lambda)} \right) w + \left(\frac{(1 - \hat{\lambda})}{(\rho + \omega)} + \frac{(1 - \hat{\lambda})\hat{\omega} + 1}{(\rho + \sigma)} \right) z \right] \tag{24}$$

There are two separate components of the house price function. Similar to the wage function, we split the home price function into two components. The following two lemmas describe the comparative statics of each component:

[9] For example, Mankiw and Weil (1989) find that in the 1970s, housing prices experienced upward pressue as the baby boom generation entered the housing market.

Lemma 5 (Labor Income Effect on Housing Prices). *The impact of wages on housing prices is represented by the following component of the house price function:*

$$\left(\frac{(\rho+\sigma)}{\rho+(\rho+\sigma)(1-\hat{\omega}\hat{\sigma})(1-\hat{\lambda})}\right)\left(\frac{(1-\hat{\lambda})}{(\rho+\omega)}-\frac{1}{(\rho+\lambda)}\right)w \tag{25}$$

The labor income effect on housing prices depends on frictions in the housing market, but is independent of frictions in the labor market. It is decreasing in λ is sufficiently large. It is also decreasing in σ if ω is sufficiently low.

Since homeowners do not experience involuntary job separations, frictions in the labor market do not affect housing prices. So, what is the impact of labor market conditions on housing market activity? It primarily depends on earnings in the labor market.

Moreover, the impact of earnings on housing prices depends on the extent of search frictions in the housing market. Notably, labor market activity has less impact on housing prices if frictions facing home buyers are lower. The interpretation is pretty straightforward. As it becomes easier for buyers to find a suitable home, they have more options in the housing market. Consequently, the value of any particular match in the housing market is lower and housing prices depend more on the desire of individuals to sell their homes rather than the income of the buyer. *Alternatively, labor market activity has a stronger impact on housing market activity if the housing market is tight - if it is more difficult for buyers to find homes.*

Lemma 6 (Homeownership Effect on Housing Prices). *The value of homeownership on housing prices is represented by:*

$$\left(\frac{(\rho+\sigma)}{\rho+(\rho+\sigma)(1-\hat{\omega}\hat{\sigma})(1-\hat{\lambda})}\right)\left(\frac{(1-\hat{\lambda})}{(\rho+\omega)}+\frac{(1-\hat{\lambda})\hat{\omega}+1}{(\rho+\sigma)}\right)z \tag{26}$$

The homeownership effect on housing prices is decreasing in λ. The effect of σ is ambiguous.

The impact of frictions facing buyers is intuitive. As it becomes easier for buyers to find a suitable home, the value of any particular home would be lower. Consequently, the importance of homeownership will be weaker if λ is higher.

5.2 Steady-State Equilibrium with an Exogenous Wage Rate

At this juncture, we formally define a steady-state equilibrium in the economy with an exogenous wage rate. We also demonstrate that the steady-state exists and is unique.

Definition 2. A steady-state equilibrium in the economy with an exogenous wage rate, w, is a price function $P(w, \sigma, \lambda^*)$ and a vector (λ^*, E_0^*) satisfying the following conditions:

(i) (Symmetric Nash Bargaining):

$$P^* - J_r^* = J_e^{1*} - J_e^{0*} - P^* > 0 \tag{27}$$

(ii) (Steady State):

$$\lambda^* E_0^* = \sigma R^* = h_0 H(E_0^*, R^*) \tag{28}$$

The Steady-State Matching Condition

As the matching technology is constant returns to scale, the contact rate for a home buyer may also be written as:

$$\lambda = h_o H(1, \frac{R}{E_0}) \tag{29}$$

Even further:

$$\lambda = h_o H(1, \frac{\lambda}{\sigma}) = \lambda^{ss}(\sigma, h_o) \tag{30}$$

This equation characterizes the steady-state locus in the housing market. By Assumption 2, λ^{ss} is continuous. Its properties are summarized in the following Lemma:

Lemma 7. (*The Steady-State Locus in the Housing Market with an Exogenous Wage Rate*) *Under Assumption 2 the function* $\lambda = \lambda^{SS}((\sigma, h_o)$ *satisfies the following properties:*

(i) $\partial\lambda^{SS}/\partial\sigma < 0$ and $\partial\lambda^{SS}/\partial m_0 > 0$ (ii) $\lim_{\sigma\to 0} \partial\lambda^{SS}/\partial\sigma = -\infty$ and $\lim_{\sigma\to\infty} \partial\lambda^{SS}/\partial\sigma = 0$

Exogenous Contact Rate of Sellers

For simplicity, in the partial equilibrium model with an exogenous wage rate, the rate at which a seller contacts a buyer is exogenous and independent of λ. By comparison, in the general equilibrium framework, all matching frictions will be endogenously determined.

Characterization of Steady-State Equilibrium

As observed in the Figure below, it is easy to show that a unique steady-state in the economy with an exogenous wage rate exists:

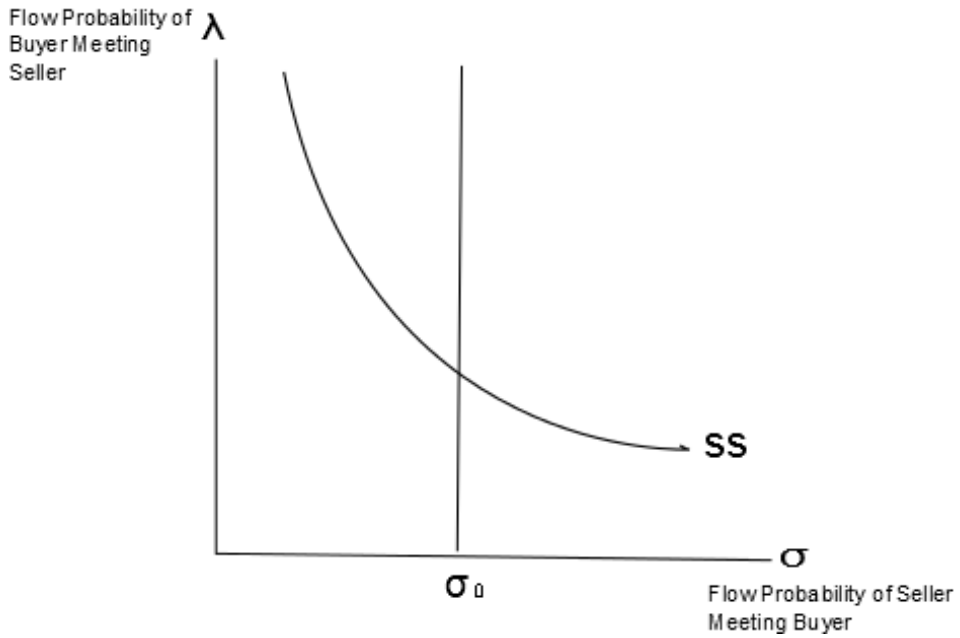


Figure 2: Existence and Uniqueness of Steady-State with Exogenous Wage Rate

Due to the downward-sloping property of the steady-state locus, an increase in σ leads to a decrease in the steady-state equilibrium matching rate, λ^*. An increase in h_0 will be associated with an increase in λ^* since the steady-state locus will shift up.

6 Steady-State III (General Equilibrium)

Finally, we turn to a general equilibrium framework in which housing prices and wages are both determined endogenously. As the general equilibrium model cannot be solved analytically, we choose to move towards a quantitative analysis in which wages and prices along with the level of transactions costs are all simultaneously determined.[10] Doing so allows us to look at the magnitude of the deep connections between housing and labor market activity.

In order to understand the general equilibrium implications of our dual search structure, it is helpful to review the main insights from the two partial equilibrium models.

[10] Given these significant connections, one might easily conclude that there are strategic complementarities between housing and labor market activity. Consequently, it is likely that multiple, Pareto-ranked levels of activity would emerge in a general equilibrium model of housing and labor market behavior. However, in our framework, wages and housing prices are strategic substitutes. For more discussion on strategic complementarities, see Cooper and John (1988).

First, from the partial equilibrium model of the labor market:

1. Overall productivity and real GDP will have less impact on wage income if the housing market is tighter. (Labor Productivity Effect and Housing Frictions)

2. Housing prices should have a smaller impact on wages if it is easier for workers to find jobs. (Home Price Effect and Labor Frictions)

3. The utility from home ownership will have a larger impact on wages if it is easier for workers to find jobs. (Home Ownership Effect and Labor Frictions)

Second, from the model of the housing market:

4. Wages have a stronger impact on housing market activity if the housing market is tight (i.e., more difficult for buyers to find homes). (Labor Income Effect and Housing Frictions)

5. The utility from homeownership has a smaller impact on prices if the frictions facing buyers are lower. (Homeownership Effect and Housing Frictions)

6.1 Calibration

As we are moving on to numerical solutions for the model, the general equilibrium framework can be more flexible. To begin, in contrast to the partial equilibrium model of the labor market, we consider an economy with endogenous firm entry. That is, the steady-state number of job vacancies will be such that expected profits from creating a vacancy are exhausted: $\Pi_v^* = \upsilon_0$. In addition, following Shimer (2005), we set worker bargaining power to be equal to .72.

As we describe below, the model is parameterized so that it is able to match a number of important features of the U.S. economy. Our principal focus is to study the implications of the model for two critical aspects of economic performance: housing and unemployment. Consequently, we are primarily interested in studying the implications of the model for housing prices and the duration of unemployment spells.

The calibration exercise aims at explaining behavior at the monthly frequency. Thus, we choose parameter values from the monthly frequency if possible. We set the monthly discount rate at $\rho = .0033$ from Head and Lloyd-Ellis. The rate at which firms contact workers, $\beta = 1.355$, corresponds to Shimer. The average duration of a vacant home in 2011, $\sigma = 0.12$, comes from the U.S. Census. Elasticities of the matching functions in the labor market and housing market, $\theta = 0.6$ and $\phi = 0.4$, are established in Blanchard and Diamond (1991) and Genesove and Han (2012). Using monthly GDP per capita and the average number individuals in a household, $y = 10,496$ in order to match median household income for 2011. Based upon available data, it takes about one month for the average homebuyer to find a suitable home to purchase. Therefore, the matching rate of homebuyers is equal to 1.

Since the duration of unemployment and housing prices are our two primary targeted variables to study, we have the following free parameters: z and υ_0.

Table 1: Parameter Values

Parameter symbol	Parameter value	Parameter and source
α	0.10	Matching rate for unemployed individuals (BLS)
β	1.355	Matching rate for vacancies (Shimer 2005)
η	0.009	Population growth rate
ρ	0.0033	Monthly discount rate (Head and Lloyd-Ellis)
σ	0.12	Matching rate of seller (US Census)
λ	1	Matching rate of buyer (US Census)
ω	0.028	Labor market withdrawal rate
θ	0.60	Elasticity of matching function in the Labor Market
ϕ	0.40	Elasticity of matching function in the Housing Market
χ	0.28	Bargaining power of the firm (Shimer 2005)
y	10,496	Output (World Bank)
z	1,317.25	Utility from owning a home
v_0	160,655	Cost of Creating Vacancy

After parameterizing the model we solve the system of eleven equations to pin down all of the endogenous variables in our model. Endogenous variables in the model are: the price of a home (P), the probability that a worker contacts a job vacancy (α), wages (w), the unemployment rate, the number of unemployed individuals (U), the number of employed individuals without a home (E_0), the number of employed individuals with a home (E_1), and the number of retirees (R) who are seeking to sell their homes. The matching parameters m_0 and h_0 are also free parameters which are determined in equilibrium.

Ideally, withdrawal of workers from the economy would be chosen based upon life-expectancy or the expected duration of active labor market participation. However, existence of a steady-state equilibrium is a problem if ω is too low. Instead, we pick $\omega = 0.028$ to correspond to the average length of time that a household remains in a home. Parameters z and v_0 are selected to match the average sales price of a new home in the United States in October 2011 and the average duration of unemployment. According to the U.S. Census Bureau, the median sales price of a new home in 2011 was equal to \$212,300. The average duration of unemployment at the time was 10 months, implying that α should be equal to 0.10. In order to match these two outcomes, $z = 1317.25$. In addition, v_0 is pinned down at 160,655 reflecting the low job separation rate in the model. Moreover, wages must be sufficiently high to match housing prices. Consequently, the number of vacancies must be sufficiently low so that workers command sufficiently high wages. Please refer to Table 2 below for our baseline calculations:

Table 2: Baseline Calibration for Model

Duration of Unemployment Spell (α)	.10
Price of Home (P)	212,322
Wage (w)	4,880.67
Unemployed	.090
Employed without Home (E_0)	.009
Employed with a Home (E_1)	.316
Retired (R)	.075
Unemployment Rate	18.3%
Housing Matching Parameter (h_0)	.43
Labor Matching Parameter (m_0)	.64

Our baseline model is pretty successful in matching the price of a home and the average duration of an unemployment spell. The flow probability of finding a job vacancy is right in line with the duration of unemployment in October 2011. The price of a home is slightly higher than in the data ($212,300). However, the unemployment rate is much higher than October 2011.

With the baseline calculations in mind, we now seek to answer our first question: "*How do frictions in the labor market affect labor market activity and housing market conditions?*" To quantitatively address the question, we look at numerical calculations of our general equilibrium framework. From the number reported in Shimer (2005), we consider that firms are able to contact workers more easily. This could be interpreted as a reduction in tightness of the labor market. The flow probability, $\beta = 1.355$, indicates that it takes nearly three weeks (0.74 months) for a firm to fill a job vacancy. Our alternative calculations that $\beta \approx 1.40$ imply that it only takes 0.71 months. That is, our calculations below are roughly based upon firms filling a vacancy about one day earlier. Please refer to Table 3 below:

Table 3: Housing Prices and Unemployment Spells (The Impact of Lower Search Frictions Facing Firms in the Labor Market)

	Baseline (2011)	$\beta = 1.40$	$\beta = 1.41$
Duration of Unemployment Spell (α)	0.10	0.10	0.092
Price of Home (P)	212,322	212,320	212,319
Wage (w)	4,880.67	4,880.61	4,880.59
Unemployed	.09	.045	.041
Employed without Home (E_0)	.009	.009	.009
Employed with a Home (E_1)	.316	.316	.316
Retired (R)	.075	.075	.075
Unemployment Rate	18.3%	10.0%	9.2%
Housing Matching Parameter (h_0)	.43	.43	.43
Labor Matching Parameter (m_0)	.64	.64	.64

As can be observed from the Table, the reduction in search frictions facing firms primarily shows up in terms of lower unemployment. As frictions decline, the number of unemployed and the unemployment rate also decline. There is only a small impact on wages and housing prices. As illustrated in Figure 1 in the partial equilibrium model of the labor market, the flow probability that a vacancy contacts a firm must fall if the probability that a vacancy contacts a worker is higher.

Based upon the results in Table 3, labor market frictions do not appear to have much impact on housing prices – at least when the model is parameterized based upon the utility of owning a home. However, this is also likely to reflect the manner in which the labor market affects housing conditions. Recall our framework is designed to be free of "wealth effects" from the housing market. (See Cunningham and Reed (2012a,b)) By comparison, it is the desire of individuals to become a homeowner, the pursuit of the "American Dream," that affects worker incentives and labor market and housing market activity.

We turn to our second question, "*How do frictions in the housing market affect labor market activity and housing performance?*" Based upon calculations from the U.S. Census Bureau, the flow probability of a vacant home finding a buyer is such that $\sigma = .12$. As a basis of comparison, we consider alternative probabilities $\sigma = .16$ and $\sigma = .20$. These numbers imply that the time required for a seller would fall from over 8 months to 6.25 months and 5 months respectively. For the insights generated by the model, please refer to Table 4:

Table 4: The Impact of Lower Search Frictions from the Housing Market

	$\sigma = .12$	$\sigma = .16$	$\sigma = .20$
Duration of Unemployment Spell (α)	0.10	0.065	0.03
Price of Home (P)	212,322	216,936	221,757
Wage (w)	4,880.67	5,013.03	5,151.35
Unemployed	.09	.138	.290
Employed without Home (E_0)	.009	.009	.009
Employed with a Home (E_1)	.316	.316	.316
Retired (R)	.075	0.065	0.03
Unemployment Rate	18.3%	26.6%	44%
Housing Matching Parameter (h_0)	.43	.48	.525
Labor Matching Parameter (m_0)	.64	.40	.30

Obviously, if the market turns more favorable to sellers, prices in the housing market increase. The model indicates cutting the time to sell a home to nearly half would be associated with a roughly 4.5% increase in housing prices. However, higher prices in the housing market would have a significant negative external effect on the labor market. As it becomes more difficult to achieve the American Dream and buy a home, higher prices are a significant work disincentive, driving wages up by over 5.5% (since workers have more bargaining power than firms). In turn, unemployment spells and the economy's unemployment rate would increase dramatically. Thus, the calibration results clearly indicate that tight housing markets forge a significant barrier to employment in the labor market.

We now ask, "*Can the surge in housing prices during the recent housing boom (prior to the bust) be explained by our model? And, what impact would it have on the labor market?*" Our calibration analysis was able to rationalize housing prices in October 2011 based upon the utility value of owning a home, z. So, an interesting question is how much would housing incentives need to improve in order to boost prices back to the pre-housing bust levels. Table 5 attempts to match the level of housing price appreciation experienced during the housing boom in the United States:

Table 5: Can the Surge in Housing Prices During the Housing Boom Be Explained By the Model?

	$z = 1317.25$	$z = 1350$	$z = 1375$
Duration of Unemployment Spell (α)	.10	.053	.018
Price of Home (P)	212,322	217,599	221,629
Wage (w)	4,880.67	5,002.04	5,094.68
Unemployed	.09	.170	.481
Employed without Home (E_0)	.009	.009	.009
Employed with a Home (E_1)	.316	.316	.316
Retired (R)	.075	.075	.075
Unemployment Rate	18.3%	29.7%	54.6%
Housing Matching Parameter (h_0)	.43	.370	.244
Labor Matching Parameter (m_0)	.64	.43	.43

Based upon observations from the table, it is simply not possible to explain the surge in housing prices experienced during the boom based upon our model. If the utility from homeownership were to improve, housing prices would increase but it would lead to quite a loss in employment. The increase in the utility from homeownership would drive housing prices and wages up by the same amount, severely impacting the duration of unemployment spells along with an increase in unemployment. Again, as higher housing prices are a significant work disincentive, the model demonstrates that a strong housing market may have strong negative implications for labor market activity.

7 Conclusion

In response to the recent housing boom and bust in the United States, there has been increased attention to studying the implications of housing market activity for the labor market. For example, Dohmen (2005) constructs a model of housing and unemployment in which housing restricts labor market mobility. Based upon the same approach, Coulson and Fisher (2009) pay special attention to wage determination in a model with labor market frictions. Their empirical findings indicate that homeownership is associated with lower wages but also a lower incidence of unemployment. Rather than focusing on the implications of homeownership, Cunningham and Reed (2012a,b) study the implications of housing equity for labor market outcomes using the American Housing Survey. In particular, they observe that negative equity plays a significant role in workers' incentives and outcomes. Notably, workers in a negative equity position earn wages that are around 7% lower than other homeowners.

Nearly all of the work on housing and labor markets is partial equilibrium in nature, studying outcomes among individuals with different housing endowments. Our goal is to study the process of housing acquisition along with labor market activity. As a consequence of this approach, we show that the desire of individuals to establish stable employment so that workers can eventually purchase a home plays a significant role in labor market incentives. That is, the pursuit of the "American Dream" is an important component of activity in the labor market. As a result, frictions in the housing market can affect labor market activity. In turn, labor market frictions also play a role in housing markets.

The desire to purchase a home can greatly impact labor market activity. However, "tight" housing markets with higher prices limit access to housing and can significantly deteriorate the level of employment. This argument is supported by numerous calibration exercises in our work. For example, if frictions facing sellers in the housing market are lower, prices in the housing market increase. While this is good for sellers, it bears a significant negative external impact on the labor market. Workers, facing higher prices, command even higher wages as a result. Higher wages lead to longer unemployment spells and less job market activity. Consequently, our work suggests that policymakers should be very careful in implementing policies targeted towards housing - housing market conditions are likely to generate significant external effects to other sectors of the economy, especially the labor market.

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