The Role of Housing Equity for Labor Market Activity

Chris Cunningham
Federal Reserve Bank of Atlanta

Robert R. Reed*
University of Alabama

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Abstract

Unlike previous economic recoveries, earnings growth in the current recovery has been particularly soft. We provide a novel explanation for this behavior based upon negative "wealth effects" from housing. Supported by evidence from the American Housing Survey, we demonstrate that workers with negative equity will command lower wages than those with positive equity. Moreover, workers with negative equity value jobs more than others as they seek to avoid the significant costs of mortgage default. In turn, moral hazard in the labor market provides an avenue in which housing prices critically impact the economy's unemployment rate. Extensions to include risk-aversion reinforce these findings. The paper also considers how prospects for future housing prices affect work incentives. We conclude by examining the role of policy to influence labor market outcomes through the incentive to strategically default on a mortgage. Consequently, our work makes important contributions towards housing and labor market policy as the economy evolves from the financial crisis.

1 Introduction

According to the National Bureau of Economic Research, the recent "Great Recession" ended in June 2009. However, economic activity in the current recovery has been sluggish. One of the most visible signs of weakness has been the lack of earnings growth. As seen in Figure 1, average annual earnings growth rates have been below 2% during much of the recovery.

*Cunningham, Federal Reserve Bank of Atlanta, 1000 Peachtree Street, NE, Atlanta, GA, (404) 498-8977, email: Chris.Cunningham@atl.frb.org; Reed, Department of Economics, Finance, and Legal Studies, University of Alabama, 35487, (205) 348-8667, email: rreed@cba.ua.edu.

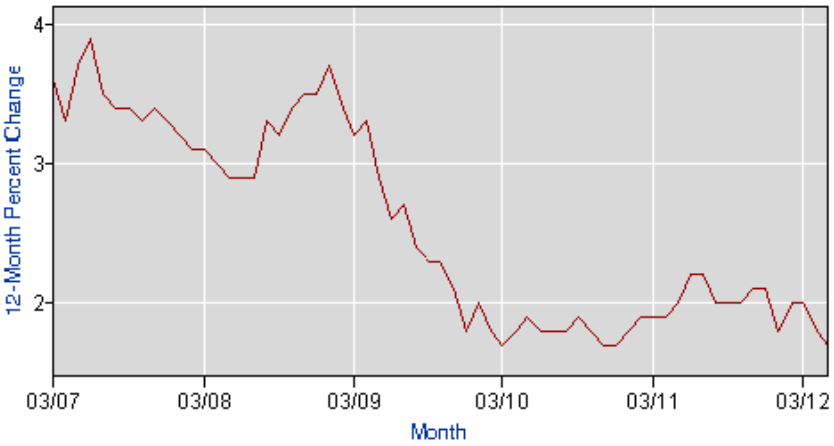

Figure 1: Earnings Growth During "Great Recession" and Recovery

In fact, the current pace of earnings growth is the slowest it has been in over twenty-five years. As can be observed in Figure 2, earnings growth in the jobless recovery following the 1990-1991 recession averaged around 3%.[1]

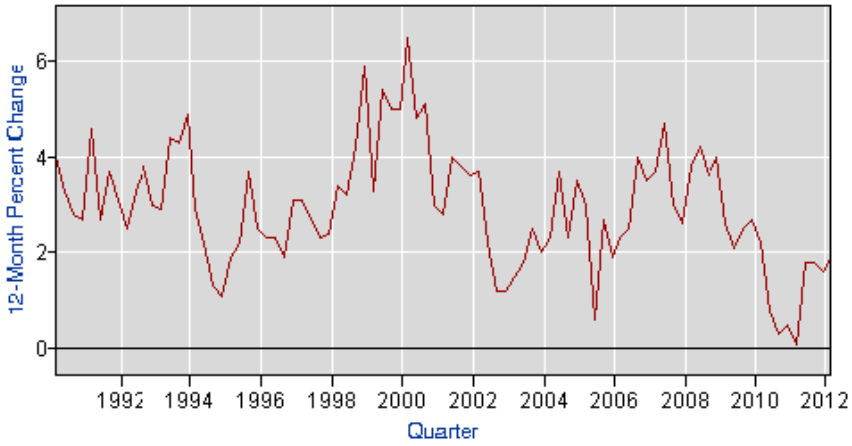

Figure 2: Earnings Growth Since 1990-1991 Recession

Notably, the pace of wage recovery is slower than even the poor pace of the post-2001 recovery.

Why has earnings growth been so weak? One of the unusual characteristics of the current recovery has been the drastic loss of housing wealth. In July 2009,

[1] The data from Figure 1 reflects the seasonably adjusted nominal average hourly earnings among all private sector employees as reported in the Current Employment Survey. By comparison, the longer time-series in Figure 2 represents median usual weekly earnings among full-time employed wage and salary workers in the Current Population Survey.

the median sales price of an existing home in the United States was around $180,000. One year later, prices were down by $10,000 and continued to fall below $160,000 in early 2011. Losses in individual housing markets have been particularly devastating. For example, according to the Case-Shiller data, housing prices in Miami fell to less than half of their value from peak to trough. Due to these losses, many homeowners fell "underwater" on their homes reaching a point where their mortgage debt exceeded their housing equity. This trend does not appear to be easing – in the fourth quarter of 2011, 31.4% of homeowners were underwater, an increase from the same time period in 2010.

Moreover, it is quite clear that the Federal Reserve recognizes that recent housing market conditions have been a drag on labor market activity. Numerous Federal Open Market Committee press releases refer to "continuing weakness in overall labor market conditions" and that "the housing sector remains depressed." In particular, in September 2011, the Federal Reserve began reinvesting its holdings of debt and securities into mortgage-backed securities in an effort to promote housing market conditions. In addition, in January 2012, the Federal Reserve released the white paper, "The U.S. Housing Market: Current Conditions and Policy Considerations," highlighting a number of reforms that could be adopted to revive the housing market. Furthermore, in September 2012, the Federal Reserve expanded its purchases of mortgage-backed securities. Any *additional* monetary policy accommodation would continue to be targeted towards the housing market – at its most recent meeting the Federal Reserve strengthened its commitment to the labor market and housing sector: "If the outlook for the labor market does not improve substantially, the Committee will continue its purchases of Treasury and agency mortgage-backed securities." Thus, housing market conditions will be a significant factor in the direction of monetary policy in the years to come.

How do housing market conditions affect labor market conditions? While the recent "Great Recession" and subsequent economic performance suggest that a significant connection exists, we have little formal understanding of the role of the housing market for labor market activity. Obviously, heavy job losses in the construction sector and the financial sector took place during the housing bust, but much of that job destruction should have occurred by the end of the recession. However, the Federal Open Market Committee continues to believe that "the unemployment rate will decline [only] gradually toward levels that it judges to be consistent with its dual mandate." Consequently, it appears that conditions in the housing sector influence labor market activity beyond the standard sectoral reallocation that is often mentioned.

The objective of this paper is to present evidence along with a rigorous theoretical framework to understand the role of housing equity for labor market activity. From Cunningham and Reed (2012), we present regression analysis from the American Housing Survey (AHS) showing that negative equity workers, in particular, obtain lower wages. A central thesis in our work is that the costs of foreclosure are an important factor in workers' incentives. In particular, workers in a negative equity position have a large incentive to avoid unemployment so that they do not incur the large subjective costs of mortgage default. The AHS

is a house-based panel at the national level conducted every two years. Since the AHS is a house-based panel, we are able to account for important characteristics such as whether the home is in the central city of the metro region. Perhaps most important for our analysis, the AHS contains informative mortgage data that allows us to calculate the homeowner's equity position. Interestingly, our analysis indicates that workers in a negative equity position have wages that are over 7% lower than a typical homeowner.

This evidence, in combination with the cursory evidence on wage growth during the current recovery, is sufficient basis for our modeling framework. As a significant number of workers remain unemployed following the end of the recession, it is clear that involuntary unemployment must be an equilibrium phenomenon. Moreover, based upon our observations about earnings growth and housing prices, the level of housing wealth should also influence equilibrium outcomes.

The idea that "wealth effects" play a role in macroeonomic activity is not new. For example, in their initial contribution, Mankiw and Zeldes (1991) document that consumption growth patterns among stockholders exhibited more volatility than nonstockholders. Moreover, stock returns had a bigger effect on consumption growth among stockholders. Due to the significant capital gains throughout the 1990s, interest in estimating the marginal propensity to consume out of stock market wealth surged. Poterba (2000) concludes that permanent gains from stock prices could raise consumption between three and ten cents for every dollar of gains. Dynan and Maki (2001) find that the marginal propensity to consume among households with moderate securities wealth could be as high as fifteen cents.[2] Anecdotal evidence indicates that capital gains from stock prices factored into monetary policy decisions as Chairman Greenspan testified: "The sharp rise in consumer outlays relative to disposable incomes in recent years, and the corresponding fall in the saving rate, has been consistent with this so-called wealth effect on household purchases."[3]

As a result of the significant house price appreciation prior to the crisis, enthusiasm for studying the consumption effects from housing wealth also ignited. While Mankiw and Zeldes report that around 25% of U.S. households own stock directly, Bertaut and Starr-McCluer (2002) find that residential property represented around 25% of aggregate household wealth in the late 1990s. Yet, most studies indicate that the consumption effects from housing wealth are much stronger than stock prices.

In their largest estimate, Case, Quigley, and Shiller (2001) find that the marginal propensity to consume is only about two cents for every dollar of stock market wealth but could be as high as nine cents for housing wealth in the United States. In addition, Caroll (2006) concludes that the marginal propensity to consume from housing wealth is nine cents. Benjamin, Chinloy

[2] Bertaut (2002) studies the impact of wealth effect across countries, finding that it is stronger in countries in which equities are a larger fraction of aggregate household wealth. Starr-McCluer (2002) observes that stock market wealth may play a role in individuals' decisions regarding retirement savings.

[3] February 2000 Monetary Policy Report Testimony; cited in Bertaut (2002).

and Judd (2004) and Kishor (2007) also observe stronger estimates for housing wealth than financial wealth. In a similar vein as Mankiw and Zeldes, Campbell and Cocco (2007) look at the impact of housing prices on consumption between homeowners and renters in the United Kingdom. In particular, they observe that housing prices affect consumption even among young renters but the effects are strongest for older homeowners. Interestingly, Hryshko, Luengo-Prado, and Sorensen (2010) tie the consumption effects from housing to labor market displacement. In their investigation of homeowners in the Panel Study of Income Dynamics, they find that homeowners who have experienced displacement continue to experience high levels of consumption in periods of rising local home prices but the consumption loss is much higher when house prices are declining.

Notably, the last piece of evidence strongly suggests that housing prices and housing wealth should be an important factor in homeowners' labor market *incentives* – if individuals can continue to receive high levels of consumption following job displacement, their incentives to avoid unemployment would also fall. Conversely, in housing markets such as the current climate, there are strong incentives to avoid being unemployed and underwater. In order to study the impact of housing equity on labor market activity, we adopt an efficiency wage model of the labor market with a novel feature – a role for wealth effects from housing. In our framework, there are two types of workers – those with positive housing equity and others that are underwater. As the number of homeowners who are underwater has been growing since the recession ended, we first discuss how declining housing prices affect their incentives.

To begin, underwater workers do not have any housing wealth to utilize should they become unemployed. This lowers their incentives to shirk, reducing their efficiency wage. However, in the model, job loss leads to foreclosure which generates a significant level of disutility due to social stigma, emotional loss, or sentimental attachment to the home. Notably, Foote et. al. (2008) argue that negative equity homeowners do not default unless a second "trigger" such as a negative employment shock takes place. Bhutta et. al. (2010), Guiso et. al. (2009), and White (2010) contend that individuals have strong emotional or moral conflicts from default.[4] Therefore, following the logic of Shapiro and Stiglitz (1984), involuntary unemployment is an incredibly strong worker discipline device among those who are underwater.[5] There is tremendous potential for this mechanism to be operative – *nearly 1/3 of homeowners in the United States are underwater.*

By comparison, workers with positive equity have housing wealth in the event of unemployment which increases their incentives to shirk. However, if housing prices decline their equity position also falls and depresses their wages along

[4] Guiso et. al. conclude that only 17% of households would strategically default if their equity shortfall climbed to 50% of their home value. Bhutta et. al. find that the median borrower would not default until equity fell to 62% below home value. Foote et. al. observe that only 6.4% of negative equity homeowners defaulted in the following three years after the 1991 recession in Massachusetts.

[5] Reed and Schreft (2008) demonstrate that negative wealth effects from inflation may be responsible for the relationship between inflation and unemployment along the economy's Phillips Curve.

with workers who are underwater. Moreover, as underwater workers are lower cost workers than workers with positive equity, firms have an incentive to make wage offers to the cheapest sources of labor. Consequently, labor market participation by workers with negative equity contributes to higher unemployment rates among workers with positive equity. That is, the presence of "underwater" workers generates a significant negative externality among workers with positive equity.

Our benchmark framework looks at labor market activity if workers are risk-neutral. Section 5 extends the analysis to include risk-averse preferences. Risk-aversion reinforces our benchmark findings. However, by comparison to a setting with linear preferences, diminishing returns to income are important. As workers are more risk-averse, their incentives to avoid unemployment are particularly high. This is especially relevant for workers who are underwater – we demonstrate that housing prices have a both a different qualitative impact and quantitative impact on wages among those who are underwater as their marginal utility of income is the highest in the economy. Our analysis concludes by studying the impact of different scenarios for housing price appreciation as in Foote et al (2008). However, in comparison to their work, we do so in the presence of risk-aversion.

The remainder of the paper is as follows. Section 2 introduces a brief discussion of the literature looking at the relationship between housing market activity and labor market conditions. Section 3 presents some basic regressions which provide evidence that workers with negative equity earn lower wages. Section 4 introduces our benchmark model. Section 5 extends the framework to include risk-aversion and section 6 looks at the impact of future housing prices for labor market outcomes. Section 7 discusses the impact of policies aimed at the costs of mortgage default on labor market activity. Section 8 offers some concluding comments.

2 Related Literature

Although little work has been completed at this juncture, a number of papers have recently begun to study the connections between labor market and housing market activity. Using the 1990 Census supplement to the Current Population Survey, Coulson and Fisher (2009) look at the labor market effects of home ownership. They find that homeowners have a lower incidence of unemployment, but also have lower wages than renters. In comparison to our work, they do not consider how an individual's equity position in their home affects labor market outcomes.

Other theoretical research has also emerged. In particular, Dohmen (2005) and Head and Lloyd-Ellis (2012) focus on the connections between homeownership and labor market mobility. However, workers are price-takers in their models, limiting the connections between housing and labor markets. In contrast, Reed and Ume (2012) develop a dual-search model of labor and housing

in which market participants engage in bargaining. Upon finding a job, workers begin searching for a home so that they can reap the utility gains from home ownership. Thus, the value of a job includes the discounted benefit of access to housing. Consequently, housing market conditions are an important component of labor market incentives.

Coulson and Fisher consider bargaining and price-posting methods of wage determination in their labor market, but do not include a formal housing market in their work. In contrast to these contributions, our analysis focuses on wealth-effects from housing in the presence of moral-hazard in the labor market which generally implies that workers earn information rents. As we explain below, this aspect of labor markets generates significant connections between housing prices and labor market activity.

3 Empirical Evidence on Housing Equity and Wages

In this section, we provide important empirical evidence on housing equity and labor market outcomes. Among all homeowners, we believe the relationship between equity and wages is particularly important for workers in a negative equity position. Notably, at the end of 2011, nearly 1/3 of homeowners were underwater. Obviously, these workers are the most vulnerable participants in the labor market. This vulnerability should affect the compensation they receive. As we describe below, our evidence strongly supports this conjecture highlighting important connections between housing market conditions and labor market activity.

3.1 Data

Our evidence on negative equity and wages is obtained from the national sample of the American Housing Survey (AHS). The AHS is a house-based panel, surveying the same structure every other year. In order to focus on active labor market participants, the sample is restricted to respondents who own a single family home with a real wage of at least $10,000. In order to avoid complications from the housing crisis and exotic mortgages which became popular in recent years, we limit the timeframe to the years between 1985 and 2003. Furthermore, there was also a change in the survey starting in 2005. Thus, we look at nine waves of the survey.

The reported natural log of real wages is the dependent variable in the analysis. Spousal income is excluded so that there is only one observation for each household. There is a potential problem with the AHS in that missing wages were interpolated through a hot-decking procedure – these observations are also excluded. Education is measured by years of completed schooling. We

also include a dummy variable indicating if the spouse earned at least $10,000. Age is included as a third-order polynomial.

We turn now to our measure of equity. In particular, a central hypothesis in our work is that negative equity workers have large incentives to avoid the subjective costs of mortgage default. We follow Schwartz (2006) by using the mortgage rate, principal and term from the first wave in which the current mortgage is observed. This allows us to measure the borrower's total mortgage obligations. A borrower's total mortgage obligation is measured by summing up the current mortgage balance for each mortgage. Net equity is measured by subtracting total mortgage obligations from the owner's current assessment of the home's value. Alternatively, one could use MSA-level housing price indexes but Wallace (2011) reports that they underestimate important idiosyncratic price changes within the MSA. Mian and Sufi (2009) also make similar observations; they observe there is a large amount of inconsistency between within zipcode-level price growth and within-MSA price growth. The following table reports summary statistics for our primary sample:

Variables	Full Sample[6]	Negative Equity
ln(real wage[7])	10.92 (.596)	10.79 (.579)
unemployment rate	0.487 (.017)	0.050(.021)
married	.777 (.416)	.719 (.450)
education		
high school	.245 (.430)	.227 (.420)
some college	.264 (.441)	.306 (.461)
college	.245 (.439)	.225 (.418)
at least one year of graduate school	.179 (.383)	.146 (.354)
white	.839 (.368)	.761 (.427)
male	.776 (.417)	.753 (.431)
age	41.85 (8.809)	39.65 (8.351)
spouse works	.532 (.499)	.482 (.500)
number of persons in household	3.316 (1.489)	3.264 (1.635)
central city		
Total Number of Observations	41,149	677

3.2 Econometric Specification

In our econometric specification, real earnings (w_{it}), are regressed on educational attainment, demographic variables, and variables representing household characteristics. This set of controls is represented by X_{it}. We also include time (Y_t) and space (L_j) fixed effects in order to account for exogenous variability which could affect both an individual's earnings and the price of the home. As previously mentioned, a central hypothesis in our work is that an individual in a negative equity position has a large incentive to avoid unemployment, likely forcing the individual to incur significant subjective costs from mortgage default.

Thus, we also include a dummy variable, $D^{\text{negative } equity}$, if the current remaining principal exceeds the current market price for the home, ν_t. Our preferred regression model is:

$$\ln(w_{it}) = X'_{it}\beta + (L_j * Y_t)'\delta + \theta D_{it}^{\text{negative } equity} + \varepsilon_{it}$$

Formally, our null hypothesis is: $H_0 : \theta \geqslant 0$ and our alternative hypothesis is: $H_a : \theta < 0$. Therefore, θ reflects the percentage change in wages as a result of being in a negative equity position.

Our regression results are as follows:[8]

$D^{\text{negative } equity}$	-.065 (.021)
unemployment rate	.252 (.402)
married	.140 (.012)
education[9]	
high school	.232 (.015)
some college	.374 (.015)
college	.590 (.016)
at least one year of graduate school	.740 (.017)
white	.178 (.010)
male	.353 (.010)
spouse works	-.160 (.009)
Observations	40,579
R^2	.282

Our econometric specification includes duration in the home and controls for demographic and household variables, and fixed effects for metropolitan area, year, and central city status. We also include year*census region fixed effects. The coefficient estimate for $\widehat{\theta}$ is negative and significant at the 1% level, indicating that workers with negative housing equity have wages that are over 7% lower than the average homeowner.

There a number of reasons to be skeptical about our results. For example, one could argue that simultaneity bias from labor market conditions to housing prices is present. There is also the possibility of simultaneity from earnings to outstanding loan balances. Moreover, unobserved heterogeneity about worker characteristics may also obscure the relationship. Yet, Cunningham and Reed (2012) show that the results for negative equity are robust to econometric strategies that address all of these concerns.

[8] Standard errors, measured at the household level using the sandwich estimator, are in parentheses. Specifications also include a third-order polynomial for the individual's age and the number of individuals in the home.

This evidence, in combination with the cursory evidence on wage growth during the current recovery, is sufficient basis for our modeling framework. As a significant number of workers remain unemployed following the end of the recession, it is clear that involuntary unemployment must be an equilibrium outcome in our model. Moreover, based upon our observations about earnings growth and housing prices, the level of housing wealth should also influence equilibrium outcomes. In the following sections, we formally explore the implications of housing wealth for labor market activity in a setting in which moral hazard leads to involuntary unemployment.

4 Benchmark Economy

The economy is populated by a continuum of workers with population mass equal to one. All workers are also homeowners, but have different equity positions. The population of workers with negative equity is η. Though the market price of any home is equal to P_1, negative equity homeowners purchased homes at a relatively high price of P_0. Each homeowner made an initial downpayment of Ω. Assuming that the gross mortgage rate is equal to $(1+r)$, negative equity owners have a negative equity position of $(1+r)(P_0 - P_1 - \Omega)$. In contrast to negative equity homeowners, positive equity owners bought at a fraction of the price, λP_0. Thus, their positive equity position is $P_1 - (1+r)(\lambda P_0 - \Omega)$.

All workers are risk-neutral. Each worker is endowed with one unit of labor. However, full effort requires that the worker incur a disutility of effort equal to e. There is no disutility resulting from zero effort.

There is a single representative firm that produces a homogeneous consumption good using labor and capital. The firm is endowed with a capital stock, K but hires workers in a spot labor market. In addition to choosing the number of workers to hire, it also selects a wage rate to pay each worker in order to maximize profits. The production technology of the firm is $y = K^{\alpha}L^{1-\alpha}$. The production technology for monitoring worker effort is reflected by the conditional probability q of catching a worker who is shirking.

4.0.1 Wage Determination

In order for firms to maximize profits, they must choose a level of compensation towards each worker in order elicit full effort. In particular, the firm can take into account each worker's incentives. This is especially true for individuals with negative equity. For tractability, we assume that employers have complete information about an individual's equity position. While this assumption may not appear to be directly applicable, there are a number of reasons to support it. First, the results from our complete information model are consistent with the empirical evidence in Section 3. Moreover, it wouldn't be difficult for an employer to obtain information about an individual's equity position. As one example, Mian and Sufi (2009) put together zipcode-level price data using the

Fiserv's Case Shiller Weiss indices. RealtyTrack.com also provides information about foreclosures at zip-code level. In addition, the Society for Human Resource Management (2010) reports around 60% of organizations utilize credit checks for candidates of select jobs. In the credit check, information about an individual's mortgage payment history, the presence of a home equity line of credit, and the number of mortgages would also be available.[10]

If a negative equity homeowner does not work, they will be unable to continue paying on their mortgage. As a result of this "double trigger," they will be forced to default. The disutility associated with foreclosure is equal to Δ. However, the same is not true for workers with positive equity. Should they become unemployed, they can sell their home at price P_1 and use their net equity to finance consumption. The determination of wages to each worker is explained below:

1. Wage Payments to Negative Equity Homeowners

If the worker puts forth labor effort, he incurs disutility e and earns wages w_0. However, the individual would be responsible for paying down the mortgage balance of their home. Thus, the benefit of full effort is: $w_0 - e - (1+r)(P_0 - P_1 - \Omega)$. If the worker does not put forth effort, there is a chance that he will be caught with probability q. Consequently, their income would only consist of unemployment benefits b. Moreover, the worker would be forced to default and would incur the disutility associated with foreclosure, Δ. Thus, a firm's choice of wage offers to negative equity homeowners is influenced through the no-shirking constraint:

$$w_0 - e - (1+r)(P_0 - P_1 - \Omega) \geq q(b - \Delta) + (1-q)(w_0 - (1+r)(P_0 - P_1 - \Omega))$$

In order to maximize profits, the firm pays the lowest possible wage:

$$w_0 = \frac{e}{q} + (b - \Delta) + (1+r)(P_0 - P_1 - \Omega)$$

There are two significant components to the negative equity wage rate. First, the larger the costs of mortgage default, the more that a worker wants to avoid the default outcome. Consequently, negative equity workers would be willing to work for low wages. However, the second component reflects their negative

[10] Anecdotal evidence also supports the idea that employers take an individual's equity position into account. As reported by Diana Olick from CNBC, one real estate observer stated: "I was having lunch with a an executive head hunter the other day, and they were stating that corporations are picking their second or third choice for job applicants because they don't want to be stuck with someone who might be underwater with their home. Corporations can discriminate against you based on your financial status, and being in a home that's underwater is a perfectly good reason for an employer not to hire you." (Olick, June 3, 2011). Obviously, this reinforces our position that workers who are underwater are the most vulnerable participants in the labor market.

equity positions. The benefits of working are lower when individuals have larger negative equity positions since their net earnings would be lower after settling their mortgage obligations.

2. Wage Payments to Positive Equity Homeowners

The incentives of positive equity homeowners are much different since they can rely on their equity positions in their homes as a source of non-labor income. If a positive equity homeowner puts forth full effort, he will derive income from both sources: $w_1 + P_1 - (1+r)(\lambda P_0 - \Omega)$. If he is caught shirking, the majority of income would come from equity in the home:

$$w_1 - e + P_1 - (1+r)(\lambda P_0 - \Omega) \geq (1-q)\left(w_1 + P_1 - (1+r)(\lambda P_0 - \Omega)\right) + q\left(b + P_1 - (1+r)(\lambda P_0 - \Omega)\right)$$

$$w_1 = b + \frac{e}{q}$$

Among workers with positive equity, they can always use their equity as a source of income. Thus, under risk-neutrality, wages among workers with positive equity will be independent of housing prices.

3. Labor Demand

A profit-maximizing firm would treat the workers as individuals in segmented labor markets. The firm's demand for the labor services among negative and positive equity workers is determined by its objective:

$$\underset{L_0, L_1}{Max} K^{\alpha}(L_0 + L_1)^{1-\alpha} - w_0 L_0 - w_1 L_1$$

As shown above, negative-equity workers are the lowest cost workers since they want to avoid a "double trigger." Thus, a profit-maximizing firm would select from the pool of negative equity workers first. If it chooses to only hire from the pool of workers with negative-equity, labor demand in that pool would be reflected by:

$$L_0 = \left(\frac{(1-\alpha)}{w_0}\right)^{\frac{1}{\alpha}} K$$

However, if there is sufficient demand after filling jobs with negative equity workers, labor demand for the remaining workforce would be:

$$L_1 = \left(\frac{(1-\alpha)}{w_1}\right)^{\frac{1}{\alpha}} K - \eta$$

Labor market activity can be summarized by the following Proposition:

Proposition 1. Let $\Delta > \overline{\Delta} = \frac{e}{q} + b + (1+r)(P_0 - P_1 - \Omega) - \frac{(1-\alpha)K^{\alpha}}{\eta^{\alpha}}$. In this scenario, all negative equity workers would be hired. Residual demand for workers with positive equity determines the economy's unemployment rate:

$$U^* = 1 - \left(\frac{(1-\alpha)}{b + \frac{e}{q}} \right)^{\frac{1}{\alpha}} K$$

If $\Delta < \overline{\Delta}$, the economy's unemployment rate is:

$$U^* = 1 - \left(\frac{(1-\alpha)}{\frac{e}{q} + (b - \Delta) + (1+r)(P_0 - P_1 - \Omega)} \right)^{\frac{1}{\alpha}} K$$

If the costs of mortgage default are sufficiently strong, wages among negative equity workers would be relatively low. In turn, the residual demand for the remaining pool of workers would be determined by the incentives of workers with positive equity. As they do not have to work to avoid default, the unemployment rate is pinned down by unemployment benefits, the private cost of labor effort (e), and the probability of detecting shirking behavior. By comparison, if the costs of default are low enough, the unemployment rate will be higher and will reflect the incentives of workers with negative equity.

5 The Role of Marginal Utility

We proceed by extending the benchmark framework to include diminishing marginal utility. Suppose that individuals have a utility function $u(I) = \frac{I^{1-\theta}}{1-\theta}$ where θ represents an individual's measure of constant relative risk aversion. Consider a worker who is currently in a negative equity position. If the worker puts forth labor effort, he incurs disutility e and earns wages w_0. However, the individual would be responsible for paying down the mortgage balance of their home. Thus, the net income from full effort is: $w_0 - (1+r)(P_0 - P_1 - \Omega)$. The net *utility* from full effort is:

$$\frac{(w_0 - (1+r)(P_0 - P_1 - \Omega))^{1-\theta}}{1-\theta} - e$$

If the worker does not put forth effort, there is a chance that he will be caught with probability q. Consequently, their income would only consist of unemployment benefits b. However, the worker would be forced to default and

incur the disutility associated with foreclosure, Δ. Thus, the expected net benefit from shirking is:

$$q\left[\frac{b^{1-\theta}}{1-\theta}-\Delta\right]+(1-q)\left[\frac{\left(w_0-(1+r)\left(P_0-P_1-\Omega\right)\right)^{1-\theta}}{1-\theta}\right]$$

As a result, a firm's choice of wage offers to negative equity homeowners is determined through the no-shirking constraint:

$$\frac{\left(w_0-(1+r)\left(P_0-P_1-\Omega\right)\right)^{1-\theta}}{1-\theta}-e\geq q\left[\frac{b^{1-\theta}}{1-\theta}-\Delta\right]+(1-q)\left[\frac{\left(w_0-(1+r)\left(P_0-P_1-\Omega\right)\right)^{1-\theta}}{1-\theta}\right]$$

$$w_0=(1+r)\left(P_0-P_1-\Omega\right)+\left[(1-\theta)\left(\frac{e}{q}-\Delta\right)+b^{1-\theta}\right]^{\frac{1}{1-\theta}}$$

In order to contrast wages under risk aversion to the case of risk-neutrality, suppose that workers are sufficiently risk averse so that $\theta=2$:

$$w_0=(1+r)\left(P_0-P_1-\Omega\right)+\frac{1}{\Delta-\frac{e}{q}+\frac{1}{b}}$$

In either the benchmark or risk-averse settings, the comparative statics are qualitatively the same – more generous unemployment benefits and higher costs of default lower wages. However, if workers are sufficiently risk averse, the cost of default and the cost of labor effort affect wages in a non-linear manner. This takes place because the worker is weighing the benefits of working income which are subject to diminishing marginal utility against the costs of default and effort which impact net utility at a constant rate.

Non-Shirking Wages among Positive Equity Homeowners

Recall that positive equity homeowners bought houses at lower prices, λP_0. Thus, their current net equity position is: $P_1-(1+r)(\lambda P_0-\Omega)$. The net utility from putting forth full effort among positive equity homeowners is:

$$\frac{\left(w_1+P_1-(1+r)(\lambda P_0-\Omega)\right)^{1-\theta}}{1-\theta}-e$$

The net expected utility from shirking is:

$$q\left(\frac{\left(b+P_1-(1+r)(\lambda P_0-\Omega)\right)^{1-\theta}}{1-\theta}\right)+(1-q)\left(\frac{\left(w_1+P_1-(1+r)(\lambda P_0-\Omega)\right)^{1-\theta}}{1-\theta}\right)$$

Therefore, the non-shirking wage paid to workers with positive equity is:

$$w_1 = \left[(1-\theta)\frac{e}{q} + (b + P_1 - (1+r)(\lambda P_0 - \Omega))^{1-\theta}\right]^{\frac{1}{1-\theta}} - [P_1 - (1+r)(\lambda P_0 - \Omega)]$$

Following the discussion of the wage paid to negative-equity workers, consider the example in which $\theta = 2$:

$$w_1 = \frac{b}{1 - \frac{e}{q}(b + P_1 - (1+r)(\lambda P_0 - \Omega))} + (P_1 - (1+r)(\lambda P_0 - \Omega))\left(\frac{1}{1 - \frac{e}{q}(b + P_1 - (1+r)(\lambda P_0 - \Omega))} - 1\right)$$

Note that the effect of current housing prices varies across the two groups of workers - reflecting their different equity positions. If housing prices rise (P_1 increases), then wages of underwater workers fall. On the other hand, wages of workers with positive equity would be higher. For underwater workers, an increase in housing prices means they will owe less debt on their mortgage which increases the returns to providing effort. In turn, firms do not need to compensate them as much to eliminate shirking behavior. In terms of workers with positive equity, an increase in housing prices means an increase in housing wealth which increases their incentive to shirk.

As the impact of housing prices across these two groups contradict eachother, it is easy to see why earnings growth rates have been anemic as the recovery has progressed. Although there has been a general economic recovery since mid-2009, the evidence suggests that the housing recession lasted much longer than the overall recession. Unfortunately, as it is likely to take many years for the housing market to recover from the housing bust, our results indicate that earnings growth in the labor market is likely to be slow for a long time.

6 The Impact of Prospective Housing Prices

In this section, we examine how individuals' perceptions of future housing prices affect their work effort and default decisions. We continue to study workers who are risk-averse. However, we assume that consumption only takes place in period 2. Similar to Foote et. al. (2008), we consider two different scenarios. In the first scenario, house prices decline further by $x\%$. Price depreciation occurs with probability π^L. In the second scenario, house prices rebound to increase by $y\%$ relative to P^1. The second scenario is believed to have probability π^H.

As this setting has a dynamic element, we assume that workers only work in the initial period. Thus, in the initial period, homeowners have two choices.

One choice is to whether to put forth labor effort. The second is the default decision. We assume that workers have a rate of time preference, β, over period 2 utility.

We use a process of backwards induction. First, we consider the possibility that housing prices increase in period 2 so that negative equity homeowners would not be forced to default. In this scenario, both groups of workers would obtain utility:

$$U_0^{2,H} = \frac{\left(w_0 + (1+y)P^1 - (1+r)(P_0 - \Omega)\right)^{1-\theta}}{1-\theta}$$

$$U_1^{2,H} = \frac{\left(w_1 + (1+y)P^1 - (1+r)(\lambda P_0 - \Omega)\right)^{1-\theta}}{1-\theta}$$

In the alternative scenario, prices decline further and negative-equity homeowners must pay even more to settle their mortgage debt:

$$U_0^{2,L} = \frac{\left(w_0 - (1+r)\left(P_0 - (1-x)P_1 - \Omega\right)\right)^{1-\theta}}{1-\theta}$$

$$U_1^{2,H} = \frac{\left(w_1 + (1-x)P^1 - (1+r)(\lambda P_0 - \Omega)\right)^{1-\theta}}{1-\theta}$$

in which we consider that the reduction in housing prices does not change the equity positions of those with positive equity in period 1. Consequently, the expected utility of each group of homeowners in period 2 would be:

$$U_0^2 = \pi^H \frac{\left(w_0 + (1+y)P^1 - (1+r)(P_0 - \Omega)\right)^{1-\theta}}{1-\theta} + (1-\pi^H)\frac{\left(w_0 - (1+r)\left(P_0 - (1-x)P_1 - \Omega\right)\right)^{1-\theta}}{1-\theta}$$

$$U_1^2 = \pi^H \frac{\left(w_1 + (1+y)P^1 - (1+r)(\lambda P_0 - \Omega)\right)^{1-\theta}}{1-\theta} + (1-\pi^H)\frac{\left(w_1 + (1-x)P^1 - (1+r)(\lambda P_0 - \Omega)\right)^{1-\theta}}{1-\theta}$$

We next proceed to study the workers' incentives in period 1. We begin with the negative equity homeowners assuming that default does not take place unless they are unemployed. If the negative equity worker puts forth labor effort in period 1, his discounted expected lifetime utility would be:

$$U_1(e=1) = \beta \left[\begin{array}{c} \pi^H \frac{\left(w_0 + (1+y)P^1 - (1+r)(P_0 - \Omega)\right)^{1-\theta}}{1-\theta} + \\ (1-\pi^H)\frac{\left(w_0 - (1+r)(P_0 - (1-x)P_1 - \Omega)\right)^{1-\theta}}{1-\theta} \end{array} \right] - e$$

On the other hand, should the individual choose to shirk there is a chance that default will occur immediately due to the loss of income:

$$U_1(e=0) = q\left[\beta\frac{(b)^{1-\theta}}{1-\theta} - \Delta\right] + (1-q)\beta\left[\begin{array}{c}\pi^H\frac{\left(w_0+(1+y)P^1-(1+r)(P_0-\Omega)\right)^{1-\theta}}{1-\theta}+\\ (1-\pi^H)\frac{(w_0-(1+r)(P_0-(1-x)P_1-\Omega))^{1-\theta}}{1-\theta}\end{array}\right]$$

Therefore, an individual's non-shirking wage is defined by the following:

$$\begin{aligned}&q\beta\pi^H\left(w_0+(1+y)P^1-(1+r)(P_0-\Omega)\right)^{1-\theta}+\\&q\beta(1-\pi^H)\left(w_0-(1+r)\left(P_0-(1-x)P_1-\Omega\right)\right)^{1-\theta}\\&=(1-\theta)e+q\beta\left(b\right)^{1-\theta}-(1-\theta)q\Delta\end{aligned}$$

For tractability, suppose that $\theta = 2$ and $\beta = 1$. In order to focus on the impact of future housing prices assume that $\Omega = 0$:

$$q\beta\pi^H\left(w_0+(1+y)P^1-(1+r)(P_0-\Omega)\right)^{-1}+$$

$$q\beta(1-\pi^H)\left(w_0-(1+r)\left(P_0-(1-x)P_1-\Omega\right)\right)^{-1}=$$
$$-e+q\beta\left(b\right)^{-1}+q\Delta$$

In addition, let $\Gamma = (1+y)P^1-(1+r)(P_0)$ refer to the the housing wealth among the initially negative-equity workers and $\Psi = (1+r)\left(P_0-(1-x)P_1\right)$ be the amount of mortgage debt in period 2. If the probability of either outcome is the same, the incentive-compatible wage rate is determined by the following quadratic equation:

$$2[q+b(q\Delta-e)]\left(w_0\right)^2+\{2[q+b(q\Delta-e)]\left(\Gamma-\Psi\right)-2qb\}w_0-qb(\Gamma-\Psi)-2[q+b(q\Delta-e)]\Gamma\Psi=0$$

In order to highlight the role of the different possibilities for future prices, let $q\Delta = e$:

$$\left(w_0\right)^2+\{(\Gamma-\Psi)-b\}w_0-\frac{b}{2}(\Gamma-\Psi)-\Gamma\Psi=0$$

If the anticipated mortgage equity exceeds the potential for mortgage debt and unemployment income ($\Gamma > \Psi + b$):

$$w_0 = -\frac{\{(\Gamma - \Psi) - b\}}{2} + \left(\frac{1}{2}\right) \sqrt[2]{(\{(\Gamma - \Psi) - b\})^2 + 2b(\Gamma - \Psi) + 4\Gamma\Psi}$$

The possibility for additional housing equity is summarized in the following lemma:

Lemma 1. *If unemployment benefits are positive, w_0 is decreasing in Γ.*

As long as unemployment benefits are positive, the incentive-compatible wage paid to the negative-equity homeowners is decreasing in the anticipated future housing equity. If one were detected shirking, they would be immediately forced to default. However, the more they can look forward to developing some wealth, future housing prices are a positive work incentive for those currently with negative equity.

We next turn to the effects of housing debt:

Lemma 2. *The incentive compatible wage rate is increasing in Ψ if and only if $b > 2\Gamma$.*

Note that:

$$\frac{\partial w_0}{\partial \Psi} = \frac{1}{2} + \left(\frac{1}{2}\right) \frac{2\{(\Gamma - \Psi) - b\}(-1) - 2b + 4\Gamma}{2\sqrt[2]{(\{(\Gamma - \Psi) - b\})^2 + 2b(\Gamma - \Psi) + 4\Gamma\Psi}} > 0$$

The first part of the derivative reflects a direct incentive effect which is qualitatively the same as the case with risk-neutrality. The second part reflects that the higher debt obligations in period 2 will also affect an individual's marginal utility as marginal utility is sensitive to overall wealth. This effect is not present when considering the effects of an increase in positive equity since positive equity is a supplement to labor income rather than a tax on it. Hence, the effects of an increase in mortgage debt are not as straightforward as an increase in housing equity. Of course, it easily follows that the effects of an increase in housing debt are more difficult since the marginal utility of income is higher in the case of owing mortgage debt than in the case of positive housing equity.

Consequently, unless unemployment benefits are sufficiently generous, an increase in mortgage debt would cause the non-shirking wage of the negative equity homeowners to fall. In the case of risk-neutrality, a direct incentive effect distorts work incentives so that higher mortgage debt would require firms to pay

to higher wages to avoid shirking behavior. However, if workers are sufficiently risk averse, their marginal utility of income is particularly high as a net debtor. Therefore, the loss of labor income as a result of poor work effort would lead to a relatively sizable drop in utility. In turn, workers would want to avoid this possibility unless unemployment benefits can offset their negative equity debt.

7 Optimal Policy

In this section, we examine optimal policy intervention. Suppose that a policymaker can play a role in affecting the costs of default. Again, for tractability, let $\theta = 2$. We consider a setting in which a policymaker would choose a value of Δ that would maximize the ex-ante utility of a representative worker with negative equity:

$$L_0 \left[\frac{(1-q)}{q} e - \Delta - \frac{1}{b} \right] + (\eta - L_0) \left[\frac{b^{1-\theta}}{1-\theta} - \Delta \right]$$

The first-order condition balances the social marginal costs and benefits from the mortgage default penalty:

$$\frac{\partial L_0}{\partial \Delta} \left[\frac{(1-q)}{q} e \right] = \eta$$

The higher mortgage default penalty provides additional labor market incentives and stimulates employment, but it also lowers the utility among those who cannot find work and forced to default. An interior solution for the socially optimal penalty is:

$$\Delta = \left\{ \frac{(1-\alpha)^{\frac{1}{\alpha}}}{\alpha} \left[\frac{(1-q)}{q} e \right] \frac{K}{\eta} \right\}^{\frac{1}{2}} + \frac{e}{q} - \frac{1}{b}$$

The solution indicates that there are a number of factors which influence the socially optimal costs of mortgage default. For example, there is a tight connection between unemployment benefits and optimal costs. If unemployment benefits are more generous, the problems from asymmetric information are exaggerated. Consequently, larger costs from mortgage default can help align private and social incentives for providing labor effort. However, there are limits – if more workers are underwater, the costs from exacting penalties are higher.

8 Conclusions

Unlike previous economic recoveries, earnings growth in the current recovery has been particularly soft. We provide a novel explanation for this behavior based upon negative "wealth effects" from housing. First, we provide empirical evidence that workers with negative equity will command lower wages than those with positive equity. Moreover, workers with negative equity value jobs more than others as they seek to avoid the significant costs of mortgage default. We proceed by providing an efficiency wage model in which moral hazard in the labor market provides an avenue in which housing prices critically impact the economy's unemployment rate. Extensions to include risk-aversion reinforce these findings. The paper also considers how prospects for future housing prices affect work incentives. We conclude by examining the role of policy to influence labor market outcomes through the incentive to strategically default on a mortgage. Consequently, our work makes important contributions towards housing and labor market policy as the economy evolves from the financial crisis.

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