“Mortgage Recourse Provisions and Housing Prices”

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Mortgage Recourse Provisions and Housing Prices

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Abstract

In light of the large swings in housing prices in the United States in recent years, there has been considerable interest in trying to understand the various factors which led to the boom and bust of the housing market. In this paper, we explore the impact of the legal environment from provisions for mortgage default across U.S. states. To do so, we develop a rigorous general equilibrium framework which incorporates the possibility of strategic default among mortgage holders to study the implications of mortgage recourse for mortgage market and housing market activity. While housing demand should be higher in markets with less legal control, lenders also adjust the amount of mortgage credit provided. In order to begin to understand the empirical implications of our theoretical model, we use simple regression analysis on housing prices at the MSA-level using the Case-Shiller Home Price Index. Notably, our results indicate that supply-side factors in mortgage lending dominate the demand-side factors. That is, a lack of legal control regarding mortgage default did not contribute to the housing bubble. Instead, it appears that housing prices appreciated more in states which provided lenders with more protection. Therefore, states should carefully consider revising the bankruptcy provisions for housing. While policymakers might be tempted to believe that eliminating recourse provisions would encourage housing market activity, our work suggests otherwise as supply-side factors for mortgage funding appear to be critically important. Alternatively, policymakers might consider that protections for mortgage holders are crucial in order to protect risk-averse borrowers from weak housing market conditions. However, such protections are likely to exacerbate weakness in the housing market as intermediaries also seek to protect risk-averse depositors from mortgage-related losses.

Keywords: Housing, Mortgage Default, Recourse, Strategic Default

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1 Introduction

There have been a number of explanations for the recent housing bubble in the United States. Historically low interest rates adopted around the time of the 2001 recession and subsequent weak, jobless recovery have often been cited. Another potential explanation involves government policies to promote housing, especially lower income groups. For example, the Federal Housing Enterprises Regulatory Reform Act of 1992 states: “The purpose of these goals is to facilitate the development in both Fannie Mae and Freddie Mac of ...day-to-day operations to service the mortgage finance needs of low-and moderate-income persons, racial minorities and inner-city residents.”

Other explanations focus on developments in financial markets. Bernanke (2005) argues that much of the appreciation of housing prices was a reaction to a “global savings glut” in which the United States ran large current account deficits. For a variety of reasons, large flows of funds came to the United States from the developing world at a time when business spending was low. As a result, much of the capital was invested in the residential sector of the economy. Another possibility was the rise of the “shadow” banking sector in which non-traditional financial intermediaries acquired large amounts of assets, especially in the housing sector. Notably, Gorton and Metrick (2012) present evidence showing that around 80% of subprime mortgages were financed through securitizations in which large pools of mortgage loans were sold to special purpose vehicles. As a consequence, mortgage-related debt became the largest fixed income market in the United States from 2004-2006. Finally, the proliferation of the 30 year fixed rate mortgage has been cited as it allowed borrowers to finance higher priced homes through smaller mortgage payments. According to data from the Federal Housing Finance Agency, the average term to maturity on conventional loans was 24.1 years in 1985. By comparison, in 2007, it was more than 5 years longer at 29.2 years.

Another argument is that the cost of strategic default was too low. That is, homeowners without ‘skin in the game’ could simply choose to walk away as housing conditions started to deteriorate. For example, Feldstein (2008) argues: “The ‘no recourse’ mortgage is virtually unique to the United States. That’s why falling house prices in Europe do not trigger defaults, since the creditors’ potential to go beyond the house to other assets or to a portion of payroll earnings is enough to deter defaults.” However, in 2009, Nevada became a limited recourse state in order to protect mortgage borrowers. Thus, there is considerable debate

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1In December 2000, the target for the federal funds rate stood at 6.5%. In January 2001, the Federal Open Market Committee lowered the target by 100 basis points partly in response to weak business spending. This began a period of unprecedented (at the time) monetary policy accommodation in which the target was lowered all the way to 1% in June 2003. Though the level of accommodation was pulled back beginning a year later, the target has not returned to the rates of the year 2000.

2In particular, the Department of Housing and Urban Development (HUD) set a goal target of 40% in 1996 for mortgages to low-moderate families. The number was raised a range of 50%-55% from in 2001 to 2004. It was further increased to a range of 51%-56% from 2005-2008.

3Notably, Geithner (2008) suggests that overnight tri-party repos funded approximately $2.5 trillion of assets in early 2007. Boulware, Ma, and Reed (2014) study the impact of monetary policy shocks on activity in the repo market. In addition, Boulware and Reed (2014) look at the impact of changes in monetary policy on commercial paper market activity which is also cited as an explanation for the growth in housing market activity prior to the financial crisis.
surrounding the legal landscape of the mortgage market. One might argue that borrowers in states without recourse provisions would be tempted to borrow more as it would be relatively easy for them to strategically default on their mortgage obligations. Alternatively, policymakers might consider that protections for mortgage holders are vitally important to protect risk-averse borrowers from weak housing market conditions.

The objective of this paper is to study the implications of the legal environment regarding mortgage default for housing market activity. In many states, lenders have the ability to pursue a deficiency judgement against a mortgage borrower who defaults. In other states, ‘non-recourse’ states, lenders cannot. Thus, there are significantly different option values to strategic default across the United States. While housing demand is higher in markets with less legal control, lenders may also adjust the amount of mortgage credit provided.

In order to carefully address this issue, it is first important that one develop a rigorous general equilibrium modeling framework capable of illuminating the incentives of different groups of participants in mortgage lending activity. To begin, it is critical that the model incorporate a well-defined motivation for financial intermediation in order to adequately articulate the incentives of financial intermediaries and their mortgage lending behavior. That is, following Smith (2003), ‘intermediation should be taken seriously.’ Towards this goal, we consider that financial intermediaries perform important risk-pooling services on behalf of their risk-averse depositors as in Diamond and Dybvig (1983). In their framework, individuals are subject to exogenous, idiosyncratic liquidity risk. From an alternative perspective, depositors are subject to shocks to their rate of time preference.

In contrast to the Diamond and Dybvig model, the return to the bank’s funding opportunities is endogenous in our model as we construct a general equilibrium model of housing and mortgage demand. In our framework, there is a mortgage market with two different groups of participants. On the one hand, financial intermediaries supply funding to the mortgage market in order to generate interest income on behalf of their depositors who seek productive returns for their deposit funding. On the other, potential homebuyers seek access to mortgage credit in order to purchase homes.

Interestingly, the model incorporates the possibility of strategic default among mortgage borrowers. Mortgage borrowers are also subject to idiosyncratic shocks to the value that they obtain from homeownership. If they experience negative utility shocks, the value of owning declines and borrowers may be better off choosing to default on paying back their mortgages. The decision to ‘walk away’ from their mortgage debt obligations depends on the legal environment regarding mortgage default.\(^4\) If intermediaries do not have the ability to impose a default penalty, the cost of strategic default is very low. On the other hand, the decision is non-trivial if lenders can exact larger penalties for default.

In our general equilibrium framework, borrowers choose the amount of housing demand to maximize their expected lifetime utility. In mortgage markets where borrowers are subject to legal recourse for default, the demand for housing will be lower. On the flip side, credit funding to the mortgage market will be higher if lenders know that they can impose penalties upon buyers ex-post. In this manner, the supply-side incentives of banks in our theoretical framework might reflect the behavior of lenders discussed in recent work by Goodman and

\(^4\)Mills and Reed (2014) study financial contracts in environments with two-sided moral hazard where both lenders and borrowers have the ability to walk away from agreements.
Levitin (2014). In their empirical analysis, they find that state variation in the potential for involuntary modifications to be made to mortgages had a significant impact on mortgage interest rates. In particular, interest rates on loans in states where ‘cramdown’ was allowed were higher than other states. They conclude that lenders were taking into account the risk of principal modification.

A priori, it may be difficult to determine the overall effects of mortgage recourse provisions for housing market activity – the supply and demand-side factors conflict with each other. In order to begin to understand the empirical implications of our theoretical model, we use simple regression analysis on housing prices at the MSA-level using the Case-Shiller Home Price Index. Notably, our results indicate that supply-side factors in mortgage lending dominate the demand side factors. That is, a lack of legal control regarding mortgage default did not contribute to the housing bubble. Instead, it appears that housing prices appreciated more in states which provided lenders with more protection. Our findings are particularly important as some states consider adjustments to the legal landscape of the housing market.

Our work contributes to an emerging literature studying the implications of negative equity and strategic default. To begin, Foote et al. (2008) conduct a rigorous examination of the behavior of underwater homeowners in Massachusetts in 1991. In particular, they contend that negative equity is not a sufficient condition for strategic default. Instead, they conclude that most underwater homeowners will not choose to default unless they experience a “double trigger,” an adverse life event such as a divorce or health shock along with the position of negative equity. Bhutta et. al. (2010) expand upon Foote et. al. by studying non-prime borrowers across four different states: Arizona, California, Florida, and Nevada. Their analysis also supports the “double trigger” hypothesis. Moreover, they find that homeowners do not strategically default unless they owe more than 60% above the value of their home.

In contrast to previous analysis, Ghent and Kudlyak (2011) offer evidence indicating that strategic default is a prevalent occurrence. Notably, they find that borrowers in non-recourse states are more likely to default – especially, at high appraisal values. For example, individuals with homes appraised between $500,000 and $750,000 were more than twice as likely to default in states which protect mortgage borrowers. In comparison to the existing literature which examines the incidence of strategic default in mortgage markets, our objective is to show the implications of legal recourse and the possibility of strategic default for conditions in the housing market.\footnote{Cunningham and Reed (2012, 2013) examine how the extent of negative equity affects labor market activity.}

The remainder of the paper is as follows. Section 2 describes the physical description of the theoretical model. Section 3 focuses on housing market activity while Section 4 studies the mortgage market. Section 5 studies the economy in general equilibrium. Section 6 discusses the data used in regressions while Section 7 provides the empirical evidence from our regressions. Section 8 provides concluding remarks.

## 2 Theoretical Model

In this section, we present our theoretical model of mortgage default and recourse provisions. The structure we adopt is similar to that of Diamond-Dybvig (1983). However, our model...
includes a market for housing and does not focus on bank runs. Instead, we analyze the effects of mortgage recourse on the supply and demand of mortgages. In general equilibrium, mortgage recourse provisions affect housing prices. Our model economy consists of depositors, homebuyers, homesellers, and competitive banking and housing markets.

2.1 Depositors

The economy lasts for three periods, \( t = 0, 1, 2 \). There is a continuum of depositors indexed by \( i \in [0, 1] \). Each depositor has constant relative risk aversion preferences:

\[
 u(c_1 + \psi_i c_2) = \frac{(c_1 + \psi_i c_2)^{1-\theta}}{1-\theta}
\]

where \( c_t \) is equal to consumption in period \( t \) and \( \theta < 1 \). Similar to Diamond-Dybvig, depositors in our model economy face liquidity risk. That is, they face uncertainty regarding their desire to consume. As a reflection of this risk, the parameter \( \psi_i \) is a random variable with support \( \{0, 1\} \) which is realized in period 1. In contrast to standard Diamond-Dybvig models which look at run behavior, an individual’s realization of \( \psi_i \) is publicly known. The probability that \( \psi_i = 0 \) where the depositor is impatient is equal to \( \pi \). Each depositor is endowed with \( y_0 \) units of the consumption good in period 0.

2.2 Homebuyers

Homebuyers do not have endowments in period 0 or period 1. However, they are endowed with \( y_2 \) units of the consumption good in period 2. Their preferences over consumption and housing services are:

\[
(1 - q) \left[ \phi \frac{(c_2)^{1-\theta}}{1-\theta} + (1 - \phi) \frac{(h_2)^{1-\theta}}{1-\theta} \right] + q \left[ \frac{(c_2)^{1-\theta}}{1-\theta} \right]
\]

Similar to depositors, homebuyers are subject to idiosyncratic risk. In contrast to depositors, homebuyers are subject to idiosyncratic risk from the utility of homeownership. With probability \( q \), they only value consumption. With probability \( (1 - q) \), they derive utility from consumption and housing where the weight placed on consumption is equal to \( \phi \). As in the case of depositors, \( \theta < 1 \). The total population of homebuyers is equal to \( B \).

2.3 Homesellers

Homesellers are endowed with a stock of homes in time 0. However, they do not obtain any utility from homeownership. In contrast, they obtain utility from consumption in period 0:

\[
u(c_0) = \frac{(c_0)^{1-\theta}}{1-\theta}.
\]

The size of each seller’s endowment is equal to \( H_0 \). As the total population of homesellers is equal to 1, it is also equal to the total housing supply that will be available in period 0.
2.4 Timeline

In period 0, homesellers receive their endowments of the housing stock. Depositors also receive their endowments of the consumption good and deposit their income in financial intermediaries. Next, homebuyers seek access to mortgage financing from intermediaries. With their mortgage credit, they purchase homes from homesellers in the housing market. With the income they receive from sales of their homes, consumption among homesellers occurs. In period 1, depositors experiencing liquidity shocks withdraw their funds from banks. In period 2, homebuyers observe their utility from housing. Depending on the realization of the value of homeownership and the legal environment regarding mortgage default, homebuyers repay their mortgage obligations. Financial intermediaries transfer all of the income they receive from mortgage settlement to their remaining depositors.

3 Housing Market Activity

As previously mentioned, the housing market is in operation in period 0 as that is the timeperiod in which sellers seek to gain income from the sale of their homes and obtain utility from consumption. The price of a unit of housing is equal to \( P \). As we describe below, the housing market is in operation in period 0 before homebuyers know how much they will value housing. In order to purchase a home in period 0, homebuyers will need to borrow funds from financial intermediaries. The interest rate in the mortgage market is equal to \((1 + r)\).

The desire of individuals to repay their mortgage obligations depends on two factors. The first is the utility that they obtain from remaining in the home. The second is the legal environment regarding mortgage recourse. If \( \phi = 1 \), individuals will not obtain any utility from housing. However, if there are mortgage recourse provisions in place, financial intermediaries will be able to recover a proportion \( \delta \) of the funds that homeowners promised to repay.

In this context, the income available for consumption is state-dependent. If \( \phi = 1 \), income allocated to consumption is:

\[
c_2 = y_2 - \delta(1 + r)Ph_2
\]

However, if individuals receive utility from housing services where \( \phi \in (0, 1) \):

\[
c_2 = y_2 - (1 + r)Ph_2
\]

Individuals will choose the amount of housing to maximize their expected lifetime utility:

\[
\max_{h_2} (1 - q) \left[ \phi \frac{(c_2)^{1-\theta}}{1 - \theta} + (1 - \phi) \frac{(h_2)^{1-\theta}}{1 - \theta} \right] + q \left[ \frac{(c_2)^{1-\theta}}{1 - \theta} \right]
\]

The first order condition reveals:

\[
(1-q)(1-\phi)h_2^{-\theta} = (1-q)\phi [y_2 - (1 + r)Ph_2]^{-\theta} (1+r)P + q [y_2 - \delta(1 + r)Ph_2]^{-\theta} \delta(1+r)P
\]
The left-hand side reflects the expected marginal utility from housing while the right-hand side is the expected marginal utility from consumption.

Let an individual’s housing demand function be denoted as \( h^d(P, r, \delta, y_2) \). In order to completely characterize a homebuyer’s demand function for housing, we offer the following Lemma:

**Lemma 1. (Housing Demand Comparative Statics in the Presence of Mortgage Recourse).** Suppose that \( h^d < \frac{y_2}{(1+r)P} \). A homebuyer’s demand function behaves as follows:

\[
\frac{dh^d}{dP} < 0, \quad \frac{dh^d}{dr} < 0, \quad \frac{dh^d}{dy_2} > 0. 
\]

We begin by discussing the effects of housing prices on housing demand. As can be observed from the right-hand side of (1), an increase in housing prices raises the expected marginal utility from consumption. To counter this increase, the demand for housing will be lower. Similar logic applies to the effects of mortgage rates. In terms of the mortgage recourse parameter \( \delta \), it raises the expected marginal utility from consumption in the event that the homebuyer draws a negative shock from the utility of housing services. Consequently, the marginal utility in this state is the lowest in economies where legal recourse for mortgage default is not possible \( (\delta = 0) \). In this manner, housing demand would be higher the lower the penalties from mortgage default. An increase in income \( (y_2) \) lowers the expected marginal utility from consumption and thereby raises housing demand.

An equilibrium in the housing market occurs when the total demand for housing is equal to total supply. Noting that the total population of homebuyers is equal to \( B \) and the total population of homesellers is equal to \( H_0 \), an equilibrium in the housing market occurs at a price \( (P) \) where \( Bh^d(P) = H_0 \).

Substituting the supply of housing into the demand for housing implies that:

\[
(1-q)(1-\phi) \left( \frac{H_0}{B} \right)^{-\theta} = (1+r)P \left[ (1-q)\phi \left( y_2 - (1+r)P \left( \frac{H_0}{B} \right) \right)^{-\theta} + q\delta \left( y_2 - \delta(1+r)P \left( \frac{H_0}{B} \right) \right)^{-\theta} \right] 
\]

From this condition, we are able to derive a relationship between \( P \) and \( r \) where the housing market is in equilibrium:

**Lemma 2. (Housing Market Equilibrium Locus).** The housing market equilibrium relationship is given by:

\[
\frac{dP}{dr} = \frac{- \left[ \theta(1-q)\phi (H_0/B) [\Psi]^{-\theta-1} + \theta q\delta^2 \Phi (H_0/B) [\Omega]^{-\theta-1} + q\delta [\Omega]^{-\theta} P + (1-q)\phi [\Psi]^{-\theta} P \right]}{\theta(1-q)\phi (H_0/B) [\Psi]^{-\theta-1} + \theta q\delta^2 \Phi (H_0/B) [\Omega]^{-\theta-1} + (1-q)\phi(1+r) [\Psi]^{-\theta} + q\delta(1+r) [\Omega]^{-\theta}} 
\]
We observe an inverse relationship between housing prices and interest rates in order for the housing market to be in equilibrium. As observed in (1), an increase in interest rates raises the expected marginal utility from consumption. For a given level of housing in which the market is in equilibrium, the expected marginal utility must fall back to the initial level. This only occurs if the price of housing falls. Consequently, the housing market equilibrium locus would be downward-sloping.

By way of driving down the demand for housing, higher interest rates reduce the price of housing. We turn to the role of recourse provisions on the housing market equilibrium locus:

**Lemma 3.** *(Partial Equilibrium Effects of Recourse Provisions through Housing Market Activity).* Assume that the condition in Lemma 2 holds. Along the housing market equilibrium locus,

$$
\frac{dP}{d\delta} = \frac{-\theta q\delta (1 + r)^2 P^2 \left( \frac{H_0}{B} \right) [\Omega]^{-\theta - 1}}{\theta (1 - q) \phi (1 + r)^2 P \left[ \Psi \right]^{-\theta - 1} + (1 - q) \phi (1 + r) \left[ \Psi \right]^{-\theta} + \theta q \delta^2 (1 + r)^2 P \left( \frac{H_0}{B} \right) [\Omega]^{-\theta - 1}}
$$

Consequently, \( \frac{dP}{d\delta} < 0 \).

The impact of mortgage recourse is straightforward. An increase in \( \delta \) raises the marginal utility of consumption when individuals receive negative shocks to housing utility. Similar to the effects of mortgage rates, housing prices must fall in order to maintain the demand for housing. Therefore, an increase in the costs of mortgage default shifts the housing market equilibrium locus down. In this manner, the partial equilibrium effects of mortgage recourse are clear.

### 4 Mortgage Market Activity

The mortgage market is open in period 0 as that is the period in which homebuyers will seek mortgage funding to buy homes from sellers. As mortgage credit is extended by financial intermediaries, we turn to their behavior.

#### 4.1 The Bank’s Problem

Financial intermediaries pool risk on behalf of depositors in a perfectly competitive market. Since the banking sector is perfectly competitive, financial intermediaries must offer a return schedule to maximize their expected utility:

$$
\pi \left( \frac{(c_1)^{1-\theta}}{1 - \theta} \right) + (1 - \pi) \left( \frac{(c_2)^{1-\theta}}{1 - \theta} \right)
$$
As the population of depositors is equal to 1, the deposit base of a representative intermediary is also equal to 1.

The balance sheet constraint of an intermediary is:

\[ 1 = R_0 + BM_0 \]

where \( R_0 \) denotes reserves, \( M_0 \) is the amount of mortgage credit extended to an individual homebuyer, and \( BM_0 \) represents total mortgage lending. Payments to early depositors are such that:

\[ \pi c_1 = R_0 \]

The interest rate in the mortgage market is \( r \). Although the mortgage rate is fixed, realized mortgage income depends on more than mortgage rates. To clarify, idiosyncratic credit risk for each borrower is present in the sense that borrowers may choose to default on their loans in which case banks only recover a portion \( (\delta) \) of the mortgage interest obligations. The probability that a borrower would prefer to walk away from their obligations is \( q \) as that is the probability that a homebuyer realizes zero utility from housing services. Though each homebuyer experiences idiosyncratic risk to utility from housing, the law of large numbers applies so that the total income from the mortgage market is deterministic and equal to \( q(1 + r)BM_0 + (1 - q)(1 + r)BM_0 \). Therefore, payments to patient depositors satisfy:

\[ (1 - \pi)c_2 = q(1 + r)BM_0 + (1 - q)(1 + r)BM_0 \]

Consequently, the bank’s choice of mortgage lending seeks to maximize the expected utility of its depositors:

\[
\max_{BM_0} \pi \left[ \frac{(1 - BM_0)^{1-\theta}}{1 - \theta} \right] + (1 - \pi) \left[ \frac{(q\delta(1 + r)BM_0 + (1 - q)(1 + r)BM_0)^{1-\theta}}{1 - \theta} \right]
\]

For impatient depositors, their consumption is equal to \( 1 - BM_t \). While patient individuals consume the amount \( q\delta(1 + r)BM_0 + (1 - q)(1 + r)BM_0 \). It is clear that consumption for patient depositors is a function of loan repayment. The first order condition for this problem is:

\[
\pi (1 - BM_0)^{-\theta} B = (1 - \pi) [q\delta(1 + r)BM_0 + (1 - q)(1 + r)BM_0]^{-\theta} [q\delta(1 + r)B + (1 - q)(1 + r)B]
\]

The left-hand side represents the loss of utility for impatient depositors if the bank issues more credit to a homebuyer. By comparison, the right-hand side represents the increase in utility among the patient depositors should the bank extend higher levels of mortgage funding. Consequently, (3) is effectively an optimal risk-sharing condition between impatient and patient depositors.
Let the mortgage supply function of an intermediary be defined as $M^s(\pi, r, \delta, q)$. The mortgage supply function by the intermediary is given by:

**Lemma 4. (Mortgage Supply Function).** The mortgage supply function of an intermediary is given by:

$$M^s(\pi, r, \delta, q) = \frac{(\pi B)^{\frac{1}{\sigma}}}{[(1 - \pi)(1 + r)B [q\delta + (1 - q)]]^{\frac{1}{\sigma}} [1 + r)B [q\delta + (1 - q)] + (\pi B)^{\frac{1}{\sigma}} B}$$

The comparative statics of the mortgage supply function are summarized in the following Lemma:

**Lemma 5. (Mortgage Supply Comparative Statics).** The mortgage supply function of an intermediary behaves as follows:

$$\frac{dM^s}{dr} < 0, \quad \frac{dM^s}{d\pi} > 0, \quad \frac{dM^s}{dq} > 0, \quad \frac{dM^s}{dr} < 0.$$

An increase in the degree of liquidity risk among depositors lowers the gains from lending to the mortgage market as there will be less patient depositors who would receive income from mortgage lending by the intermediary. Consequently, mortgage supply is decreasing in $\pi$. By comparison, an increase in mortgage rates raises the marginal utility to be experienced by patient depositors. An increase in the likelihood that homebuyers ultimately experience negative shocks to housing utility lowers mortgage lending as it reduces expected income in the mortgage market.

As our focus is on the implications of mortgage recourse, an increase in the ability of intermediaries to recover their mortgage losses raises the marginal utility of patient depositors. In turn, banks supply more funding to the mortgage market.

Next, we turn to our mortgage market equilibrium condition. Setting mortgage supply equal to mortgage demand, $M^d = P(\frac{H_0}{B})$, yields the following relationship between housing prices and mortgage rates in the mortgage market:

$$P\left(\frac{H_0}{B}\right) = \frac{(\pi B)^{\frac{1}{\sigma}}}{[(1 - \pi)(1 + r)B + (1 - q)(1 + r)B]^{\frac{1}{\sigma}} [q\delta(1 + r)B + (1 - q)(1 + r)B] + (\pi B)^{\frac{1}{\sigma}} B}$$

**Lemma 6. (Mortgage Market Equilibrium Conditions).** Along the mortgage market equilibrium locus,

$$\frac{dP}{dr} = \frac{\frac{1}{\sigma} [(1 - \pi)(1 + r)B + (1 - q)(1 + r)B]^{\frac{1}{\sigma}} [(1 - \pi)^{\frac{1}{\sigma}} (1 + r)B^3 [q\delta + (1 - q)]}{\left\{[(1 - \pi)(1 + r)B + (1 - q)(1 + r)B]^{\frac{1}{\sigma}} (1 + r)B [q\delta + (1 - q)] + (\pi B)^{\frac{1}{\sigma}} B\right\}^2 H_0}$$
Since $\theta < 1$, $\frac{dP}{dr} > 0$.

As shown in the optimal risk-sharing condition, higher mortgage rates raise the marginal utility among the patient depositors. At the higher level of mortgage rates, the only way to maintain a given level of mortgage lending would be through a reduction in mortgage income. This takes place if housing prices are higher because higher housing prices reduce mortgage demand. Consequently, the mortgage market equilibrium locus would be upward-sloping.

Our main focus is on understanding the impact of mortgage recourse provisions on both housing demand and mortgage supply. The impact of mortgage recourse is described in the following Lemma:

**Lemma 7.** *(Partial Equilibrium Effects of Recourse Provisions through the Mortgage Market).* The impact of mortgage recourse on the mortgage market equilibrium locus is:

$$\frac{dP}{d\delta} = \frac{\frac{1}{q} [(1 - \pi) [q\delta(1 + r)B + (1 - q)(1 + r)B]]^{-\theta} q(1 + r)^2 B^3 [q\delta + (1 - q)]}{[(1 - \pi) [q\delta(1 + r)B + (1 - q)(1 + r)B]]^{-\theta} (1 + r)B [q\delta + (1 - q)] + (\pi B)^{-\theta} B} \frac{H_0}{H_0}$$

Since $\theta < 1$, $\frac{dP}{d\delta} > 0$.

On the supply side, we find that higher recourse penalties would be associated with higher housing prices. The impact of higher recourse penalties is similar to an increase in mortgage rates as both would lead to higher levels of mortgage income. Consequently, higher penalties shift the mortgage market equilibrium locus higher and show that banks would lend more if they had greater protection from mortgage default.

## 5 General Equilibrium

Having described activity in both the housing and mortgage markets on a partial equilibrium basis, we seek to study behavior in general equilibrium. Recall that the relationship between housing prices and mortgage rates in which the housing market is in equilibrium is given by:

$$(1-q)(1-\phi) \left( \frac{H_0}{B} \right)^{-\theta} = (1+r)P \left[ (1 - q)\phi \left( y_2 - (1 + r)P \left( \frac{H_0}{B} \right) \right)^{-\theta} + q\delta \left( y_2 - \delta(1 + r)P \left( \frac{H_0}{B} \right) \right)^{-\theta} \right]$$

(5)
By comparison, the mortgage market equilibrium is described by:

\[ P \left( \frac{H_0}{B} \right) = \frac{(\pi B)^{\frac{1}{\pi}}}{[(1 - \pi) [q\delta(1 + r)B + (1 - q)(1 + r)B]]^{\frac{1}{\pi}}} \left[ q\delta(1 + r)B + (1 - q)(1 + r)B + (\pi B)^{\frac{1}{\pi}} B \right] \]

We will prove existence and uniqueness of an equilibrium through standard intermediate value theorem arguments. First, as \( r \to 0 \), \( P \to \infty \) in order to for the right-hand side of (5) to line-up with the left-hand side. By comparison, as implied by (6) \( P \) converges to:

\[ \left( \frac{1}{\pi B} \right)^{\frac{1}{\pi}} \left( \frac{1}{[(1 - \pi) [q\delta B + (1 - q)B]]^{\frac{1}{\pi}}} \left[ q\delta B + (1 - q)B + (\pi B)^{\frac{1}{\pi}} B \right] \right) \]

In stark contrast, as \( r \to \infty \), \( P \to 0 \) in order for the housing market to be in equilibrium. The mortgage market is the exact opposite. Consequently, there are unique values of \( P^* \) and \( r^* \) where both the housing and mortgage markets are in equilibrium.

However, the model does not deliver unambiguous conclusions regarding mortgage recourse. That is, the model reveals a discrepancy between the demand-side effects and supply-side effects of lender protection. On the demand-side, more lender protection lowers housing prices. Conversely, an increase in lender protection drives up housing prices from the supply-side. A priori, it is difficult to determine which effect dominates. Given our impasse, we turn to empirical analysis to provide further insights.

### 6 Data

The primary point of our work is to examine the implications of recourse provisions for the level of price appreciation during the recent housing bubble in the United States. As we are seeking to study the potential for strategic default on prices, it is important that we examine a price series which is relatively homogeneous over time. Thus, we use the (seasonally-adjusted) Standard and Poor’s Case-Shiller Home Price Index (HPI) which is often cited in economic releases on housing market conditions. This index looks at average monthly changes in home prices across twenty metropolitan areas, measured in year 2000 dollars.

There are a variety of housing price series available. For example, the Federal Housing Finance Agency puts out an index every quarter. However, it has a cap on the limit of the mortgage and thus does not account for homes financed by jumbo mortgages. Moreover, the Case-Shiller HPI accounts for jumbo mortgages and adjusts for quality of homes over time. It is also available for the entire sample period of interest, the acceleration and bust of the housing bubble.

As is well-known, there was a substantial amount of regional variation in the extent of price appreciation during the years of the housing boom. Our objective is to investigate whether protection for mortgage borrowers in some real estate markets was part of the reason. Based upon the classifications in Ghent and Kudlyak (2011), there are eleven states which are non-recourse states during our sample period: 1. Alaska, 2. Arizona, 3. California,

As a benchmark, Figure 1 presents the HPI data for the metro areas in recourse states. As the index is based upon year 2000 prices, most of the data is relatively close to 100 in 2001. Most housing markets in recourse metro areas peak in 2006. For example, Miami, Tampa-St. Petersburg, and Washington, D.C. were the most expensive housing markets in recourse states and peak at that time. Prices from 2001 - 2006 increased by 137% in Miami and doubled during the same time in Tampa-St. Petersburg. After the bust, however, many markets experienced little appreciation relative to 2001. In fact, prices in the Detroit metro area were substantially lower in 2010 than 2001.

We turn to price behavior in the non-recourse metropolitan areas. As in the case of markets in recourse states, most of the non-recourse markets peaked in 2006. Los Angeles, San Diego, and Phoenix were the most expensive markets at their peak. Prices in Los Angeles and San Diego more than doubled from 2001 - 2006. Relative to 2001, again, most markets experienced much less appreciation after the bust than over the bubble period. Since 2006 appears to be the peak in prices for most markets, we refer to the first half of the sample (2001 - 2005) as the ‘boom’ period and the second half (2006 - 2010) as the ‘bust’ period.

What accounts for the price variation over time and across markets? It has already been documented by Ghent and Kudlyak that interest rates do not appear to be different between recourse and non-recourse metro areas. We find the same pattern in the data. So, instead, we turn to other conditions in mortgage markets such as term to maturity.

Figures 3 and 4 show the average term to maturity across markets in our sample period. The average term to maturity in recourse markets is a little higher than in non-recourse areas. The variation is also higher. In both types of markets, maturities became the shortest in 2003. They generally increased from there until 2007. As housing markets softened in 2007, maturities also decreased.

Numerous studies have pointed to changes in the price of land as one of the principal driving forces for the behavior of housing prices. Glaeser et. al. (2008) show that housing prices are prone to greater price appreciation in markets where the supply of land is less elastic. In addition, Davis and Palumbo (2008) contend that home prices will be much more dependent on land prices going forward. Figures 5 and 6 below present the data from Davis and Heathcote (2007) updated through 2010 across recourse and non-recourse markets.

The differences in land prices across both types of markets are striking. The mean price of a parcel of land in a non-recourse market over the entire period is $321,572. By comparison, the price in a recourse market is less than half of the value at $147,986.

7 Empirical Results

We present summary statistics for all of our variables in Table 1. Newly available data from the BLS on metro GDP begins in 2001 while our sample period ends in 2010. Thus, for each

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metro area we have 10 years of annual data. The data on metro area GDP is reported in real terms, based upon year 2000 prices. It is measured in millions of dollars. Thus, the average metro GDP is just over $250 billion and the maximum is around $1 trillion (New York - Northern New Jersey - Long Island in 2010). Mortgage interest rates and housing market indicators come from the mortgage interest rate survey:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Observations</th>
<th>Mean</th>
<th>S.D.</th>
<th>Min</th>
<th>Max</th>
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<td>2001</td>
<td>2010</td>
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<td>Unemployment Rate</td>
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<td>150.7</td>
<td>40.4</td>
<td>69.6</td>
<td>276.6</td>
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</table>

Table 1: Summary Statistics

Unfortunately, data on Charlotte, North Carolina and Las Vegas, Nevada is not available in the survey so we only have observations for eighteen metro areas. As shown in the table, about 40% of our observations come from housing markets in non-recourse states. As a benchmark, we begin with a specification in column (I) of Table 2 that attempts to look at the determination of housing prices absent the presence of recourse provisions. As one would expect, the results show that higher levels of local income and higher income security support higher housing prices. Similar insights follow by studying the implications of the business cycle. At the mean value of the housing price index of 150, an increase in the market’s unemployment rate lowers the price index by over 7 points which translates into housing prices that are nearly 5% lower.

We continue by studying the role of supply-side factors in the regression equation, in particular, land prices and the share of housing costs that come from land. Both factors are highly significant and add considerable explanatory power for housing prices, indicating that one of the important factors in the appreciation of housing prices was the increasing scarcity and cost of land. This confirms the arguments in Davis and Palumbo (2008). It is also consistent with Glaeser et. al. (2008). Moreover, land prices and scarcity weaken the effects of GDP and unemployment in each market.

One would also expect that credit market conditions play an important role in housing prices. In order to consider such factors, we add the effective interest rate, term to maturity of mortgage loans, and the loan to value ratio. These conditions in the mortgage market certainly played an important role in housing prices, but they do not appear to have dominated the role of the business cycle. Both GDP and the unemployment rate are highly significant and retain the same degree of economic significance. The price of a parcel appears to be
overshadowed by credit markets, but the scarcity of land becomes even more relevant. It appears that the trend towards 30-year mortgages was an important factor. As mentioned in the introduction, the average maturity on conventional fixed-rate loans increased by five years from 1985 - 2007. The point estimate indicates that the longer maturities would be associated with an increase by more than 100 points of the housing price index. Interest rates are also important.

Our principal objective is to study the implications of strategic default for housing prices. To do so, we include a dummy variable according to whether non-recourse provisions were in place in a given market. Since each MSA is in a state where mortgage recourse provisions do not change over the course of the sample period, it is not possible to use MSA-level fixed effects. Simply, there is no way to separate the effects of the MSA-level unobservables from the effects of the mortgage recourse provisions. However, we believe the results in the third column of the Table are informative. Notably, the protection for borrowers has an important impact on prices in such markets but it appears that the supply behavior dominates. We are particularly interested in understanding the role of protection for borrowers across the different housing markets. To begin, we look at the impact during the housing boom (the first half of the sample).

The results reveal some interesting characteristics about the housing boom and the legal environment offering protection for mortgage borrowers. First, local level GDP does not have as much impact on housing prices during the boom. Its point estimate is smaller and it is not statistically as significant as during the full sample period. However, the unemployment rate is even more important pointing to the gains in the labor market as an important driver of housing. The scarcity of land is highly significant and the low level of interest rates had a significant impact on housing appreciation. Moreover, housing inflation was higher in recourse markets than non-recourse markets and it is significant beyond the 5% level. Consequently, it appears that lenders were more aggressive in markets where they could pursue deficiency judgements.

Activity in the years following the peak in prices is quite different than during the acceleration period. First, local GDP and unemployment do not have an impact on prices. Thus, it appears that the housing market was less sensitive to local macroeconomic conditions. Land value starts to approach conventional significance levels and detracts from prices. Scarcity of land remains an important variable. The impact of conditions in the mortgage market is a bit illusive. Higher effective interest rates are associated with higher prices. Maturities continue to be important, but also loan to value is significant. Moreover, lending in non-recourse markets is not statistically different than recourse markets. In summary, housing market activity in the second half of the bubble period is much different than the first half.

In terms of activity during the acceleration of the bubble, is it possible that borrowers in non-recourse markets were bigger credit risks? Consequently, prices would be lower in non-recourse areas. In order to account for this possibility, we include a measure of credit risk in the regression model. For example, it could be that there are more borrowers paying high interest rates in markets with more unemployment in non-recourse markets. Therefore, we include a “subprime” interest rate factor in the regression in the form of an interactive variable (the effective interest rate multiplied by the unemployment rate). The results can be observed in the last two columns of the table. The results are interesting. In markets with higher unemployment rates, higher effective interest rates are associated with increased
housing price pressure which is indicative of the expansion in subprime lending during the housing boom. Moreover, the point estimate for the non-recourse variable is stronger with a higher p-value. Thus, it is reasonable to conclude that there was less lending in markets where mortgage borrowers were protected and lenders were leery about strategic default. However, during the housing bust, we observe the opposite result. Instead, housing prices were lower in markets with higher effective interest rates and unemployment rates. This reflects the greater awareness about subprime default after 2005.

8 Conclusions

There has been considerable debate about the various factors which contributed to the recent housing bubble in the United States. By understanding the forces which led to the bubble and the ensuing “Great Recession,” we may be less inclined to revisit the mistakes of the past. A number of explanations have been put forward – unprecedented easy monetary policy, ‘innovations’ in financial markets and the rise of the “shadow banking system,” large capital account deficits, and government interventions promoting homeownership.

Another argument is that the cost of strategic default was too low. That is, homeowners did not have enough ‘skin in the game’ and simply chose to walk away as housing conditions started to deteriorate. However, in 2009, Nevada became a limited recourse state in order to protect mortgage borrowers. Thus, there is considerable debate surrounding the legal landscape of the mortgage market.

In order to thoroughly understand how mortgage recourse provisions affect housing market activity, we develop a rigorous general equilibrium model with four different groups of housing market participants: homebuyers, homesellers, depositors, and financial intermediaries. In particular, risk-averse homebuyers are subject to idiosyncratic risk regarding the utility from housing. After individuals purchase homes, there is the possibility that they eventually would receive zero utility from housing and therefore would like to walk away from their mortgage obligations to intermediaries. Moreover, depositors are risk-averse individuals who seek risk-pooling services from intermediaries as articulated by Diamond and Dybvig (1983).

Notably, our theoretical framework offers ambiguous conclusions regarding mortgage recourse. On the one-hand, mortgage recourse limits housing demand as homebuyers are leery about their exposure to housing risk. On the other, intermediaries increase their supply of funding to mortgage markets if they are able to recover a greater proportion of their mortgage-related losses.

Empirical analysis seeks to help resolve the debate. Notably, our results indicate that supply-side factors in mortgage lending dominate the demand side factors. That is, a lack of legal control regarding mortgage default did not contribute to the housing bubble. Instead, it appears that housing prices appreciated more in states which provided lenders with more protection. We hope the findings are given some weight in policy debates.
References


Figure 1

Figure 2
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<td>($1.11 \times 10^{-5}$)</td>
<td>($1.24 \times 10^{-5}$)</td>
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<td>-6.80**</td>
<td>-1.185</td>
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<td>($1.65 \times 10^{-5}$)</td>
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