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Conclusions from the Current Crisis**

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Foreclosure and Bankruptcy - Policy Conclusions from the Current Crisis*

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Abstract

The recent episode of rising consumer bankruptcy and increasing foreclosure rates has sparked a lively debate about how to best tackle the crisis in the U.S. housing market. This paper contributes to the debate by providing an explicit model of the interactions of households' decisions to declare Chapter 7 bankruptcy, and to enter into foreclosure. We construct a model to show that the interaction of bankruptcy exemption limits and mortgage regulation has an impact on the prevalence of bankruptcy and foreclosure. We use state-level data to show empirically that our model predictions are plausible. We argue that policy proposals that focus solely on one aspect of the twin-crisis are likely to be misguided. In particular, we show that in the short-run a switch from non-recourse mortgages to recourse mortgages may have little effect on foreclosures, but could dramatically increase the number of bankruptcies.

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1 Introduction

The recent turmoils in the U.S. economy have been accompanied by an unprecedented joint increase in bankruptcy and foreclosure rates. In 2008, U.S. consumer bankruptcy filings increased by nearly 33 percent over the previous year, to a total of over 1 million. During the same period, over 2.3 million properties faced foreclosure, which represents an 81 percent increase over 2007 and a 225 percent increase over 2006. This twin-crisis of rising foreclosure and bankruptcy rates, alongside the increasing unemployment rate, has been the most visible effect of the recent economic downturn on American households. It is not surprising, then, that there has been a lively debate amongst policy-makers and economists regarding the causes of and potential solutions to the crisis, which has resulted in a number of proposals to change the existing regulatory framework.

The question of what has caused the twin-crisis of consumer bankruptcy and foreclosure, and thus what needs to be done to address it, however, is far from settled. As *The Economist* put it bluntly: "Is it that homeowners cannot afford to pay; or is it that they are declining to do so, because their homes are now worth less than their mortgages?" The Obama administration's talk about cram-down legislation, which would allow bankruptcy courts to reduce mortgage principals, suggests that policy makers have identified negative home equity as the primary problem leading to foreclosures. President Obama's stimulus plan, on the other hand, primarily addresses a homeowner's ability to service their regular mortgage payments, as supposed to whether their mortgages are "underwater." On February 18, he pledged \$75 billion to subsidize the refinancing of mortgages to homeowners at the risk of default, which will lead to lower monthly payments for those homeowners.

Before a cure for the twin-crisis can be proposed, we must arrive at a correct diagnosis of the factors that influence a household's decision to declare bankruptcy and enter into foreclosure. Both bankruptcy and foreclosure essentially provide a crude form of insurance to households that continuously receive shocks to their income and the value of their (housing) assets. Therefore it is obvious that these negative shocks should be part of any explanation of household behavior. However, the interaction of these shocks with the regulatory framework in determining an agent's decision needs to be analyzed in more detail to assess and eventually justify some of the far-reaching policy-proposals that are currently being discussed. This paper attempts to take a step in that direction. As we will show below, while negative home equity is a crucial element in the decision to enter into foreclosure, it is its interaction with idiosyncratic income and expenditure shocks and the regulatory environment (both in terms of bankruptcy and foreclosure regulation) that will eventually determine the behavior of households.

The purpose of this paper is to provide a framework that allows us to think about the relationship between foreclosure and bankruptcy, both empirically and theoretically. We build an analytical framework in which decisions regard-

ing bankruptcy laws, homestead exemption and foreclosure procedures can be analyzed. In particular, we compare the behavior of households who hold non-recourse mortgages, which include the option of just walking away from an underwater mortgage, with the behavior of households holding recourse mortgages, that do not offer this option. To do this, we set up a two-period model that captures the main interactions between an agent's decision to declare bankruptcy or default on their mortgage under different policy environments; that is, we attempt to capture how bankruptcy rules and foreclosure procedures affect agents' budget constraints and action spaces. We use this model to derive predictions about how foreclosure and bankruptcy rates will respond to house-price movements and income shocks. We exploit variations in state laws regarding foreclosure procedures to analyze whether the predictions of our model can be verified in the data, and use this model to evaluate a number of recent policy proposals.

We arrive at the following conclusions:

- The effect on foreclosure rates of turning mortgages from non-recourse into recourse loans crucially depends on (i) the existing bankruptcy exemption limits and (ii) the net non-housing asset position of those agents defaulting on their mortgage. Under generous bankruptcy exemption limits, or for agents with few non-housing assets, such a switch will have only small effects on reducing foreclosure rates, while driving more agents with underwater mortgages into bankruptcy.
- In an environment where households expect a further decline in house prices, the reduction in the face-value of the mortgage required to induce agents to accept changes to recourse mortgages is substantial.
- In recourse states, a lowering of the exemption limits in bankruptcy can be a powerful tool to reduce foreclosures. This could be achieved without having to change existing contracts, and could thus potentially be implemented in a quick and timely manner.
- In states such as California where it is legally possible to obtain a deficiency judgement, but where the process of doing so is expensive and time-consuming, a good step in the right direction would be to make the pursuit of deficiency judgements easier, while simultaneously lowering property exemption levels in bankruptcy.
- In non-recourse states, a simultaneous introduction of recourse mortgages with a lowering of bankruptcy exemption limits promises to be successful at reducing foreclosure and bankruptcy rates.

In the following, we will start by giving a brief overview of the policy environment considered by this paper, focusing on the provisions of Chapter 7 of the U.S. Bankruptcy Code and the relevant aspects of mortgage debt regulation. We also provide a short review of the existing literature dealing with related

questions. We then introduce our model and provide simulations of household behavior, followed by an empirical plausibility test of our model's predictions. We conclude by using our model to illustrate and expand on the policy conclusions summarized above.

2 The Current Policy Environment

2.1 Chapter 7 Bankruptcy

In the U.S., individuals filing for consumer bankruptcy usually do so under either Chapter 7 (so-called "liquidation bankruptcy") or Chapter 13 (a "consumer reorganization", or debt adjustment procedure). Under Chapter 7 bankruptcy, a debtor surrenders his or her non-exempt property to a bankruptcy trustee who then liquidates the property and distributes the proceeds to the debtor's unsecured creditors. In exchange, the debtor is entitled to a discharge of his or her unsecured debt. Chapter 7 is the most common form of consumer bankruptcy in the United States, and is the type of bankruptcy considered in this paper.¹

The bankruptcy code allows each individual filing for Chapter 7 bankruptcy to keep basic assets considered necessary for the debtor's "fresh start" after bankruptcy. While Article I Section 8 of the U.S. Constitution gives Congress the power to provide "uniform laws on the subject of bankruptcy throughout the United States", exemption levels do in fact vary on a state-by-state basis. Sixteen states allow debtors to elect the bankruptcy code exemptions. In those states, debtors can choose between the federal exemptions and those in the law of their state. For the remaining states, the state exemptions apply without the debtor being able to choose the federal property exemption level.

Housing assets are treated separately from non-housing assets in the case of Chapter 7 bankruptcy. If the individual does not own positive equity in the house (i.e. the outstanding mortgage balance exceeds the current home value less costs of sale), the agent will be able to keep the house, provided he continues to service the mortgage interest payments. A bankruptcy does not allow the agent to discharge any secured debt such as a mortgage, which was secured by using the house as collateral.

If the agent owns positive equity in the house, whether or not the agent will be able to keep the house crucially depends on the level of homestead exemption specified in the state bankruptcy code. If the agent's equity in the home is below the exemption level, he can keep the house. If he owns more equity than the allowed exemption, it is possible that the agent could lose the house. Some

¹Under Chapter 13, the debtor retains ownership and possession of all of his or her assets, but must devote some portion of his or her future income to repaying creditors, generally over a period of three to five years. Unlike under Chapter 7, debts are not discharged immediately, though the payment plan agreed upon during the proceedings may lead to a less-than-full repayment of debts. The amount of regular payment and the period of the repayment plan depend upon a variety of factors, including the value of the debtor's property and the amount of a debtor's income and expenses relative to the state median.

agents in this situation may choose to file bankruptcy under Chapter 13, which is not modeled in this paper.

The amount of the homestead exemption can vary dramatically from state to state. For example, in Oklahoma and Texas the homestead exemption is unlimited. In Vermont, only homestead property up to seventy five thousand dollars is exempt and in New Jersey there is no homestead exemption at all. Other property exemptions also vary significantly. In Texas, couples filing jointly can keep assets up to \$60,000, while New Jersey limits property exempt in Chapter 7 bankruptcy to \$2,000.

2.2 Mortgages: Recourse and Non-Recourse

Whether a mortgage is recourse or non-recourse becomes important when the agent defaults on the interest payments. A non-recourse mortgage is secured by a pledge of collateral, typically the real property, without personal liability of the borrower. If the borrower defaults, the lender can seize the collateral, but the lender's recovery is limited to the collateral. Recourse mortgages, on the other hand, allow a lender to seek a deficiency judgement if in the sale of a foreclosed house the mortgage cannot be repaid in full - the borrower will remain liable for the difference.

Whether or not lenders can seek a deficiency judgement in the case of foreclosure with negative equity is a policy choice and varies by state. In states like Missouri, Mississippi and Massachusetts, deficiency judgements are never possible, while in other states like Florida they are. In many states, the distinction is blurred. California offers lenders two routes to foreclosure, judicial foreclosure and non-judicial foreclosure, depending on whether a "power of sale" clause exists in the contract. A "power of sale" clause is a provision in a mortgage, in which the borrower pre-authorizes the sale of property to pay off the balance on a loan in the event of their default. If no "power of sale" clause exists in the mortgage, the judicial process of foreclosure involves filing a lawsuit to obtain a court order to foreclose. Using this type of foreclosure process, lenders in California may seek a deficiency judgment and under certain circumstances, the borrower may have up to one year to redeem the property. The process of judicial foreclosure is expensive and time-consuming for the lender. Non-judicial foreclosure, on the other hand, is a quicker and less expensive way for the bank to take the collateral once the borrower has stopped servicing the interest payments. In California, lenders may not seek a deficiency judgment after a non-judicial foreclosure sale.

3 Literature Review

There has been a substantial literature on the effects of certain aspects of bankruptcy regulation on consumer behavior. The literature on modeling the foreclosure decisions of households is less developed. However, little work has been done on modeling the interaction between the two decisions. This is the focus

of our paper, as analyzing how this joint decision is influenced by the policy environment is crucial for effective policy analysis.

Most papers assessing the causes and welfare effects of bankruptcy regulation abstract from asset-price movements, home-ownership and mortgage decisions. Livshits et al. [16] compare the relative welfare effects of the "Fresh Start" Chapter 7 bankruptcy (which allows agents to discard their unsecured debts) with a continental-European "No Fresh Start" bankruptcy rule. Their model features an endogenized mortgage interest rate, and agents receiving both income and expense shocks. They find that under most reasonable parameterizations, and in the presence of large expense shocks (such as medical bills), the fresh-start system of the U.S. achieves higher welfare than the European alternative. However, their model has no durable goods or housing; since most of the exemptions specified by states relate to durable goods, their model cannot capture the importance of exemption limits, and their interaction with the housing market that has been a driving force in the recent wave of bankruptcies. Domowitz and Sartain [5] also find that households are more likely to file for bankruptcy in response to an idiosyncratic shock such as job loss or high medical bills, and show that households respond to the incentive structure provided by the bankruptcy regulation to maximize the benefit from filing. In their analysis of the effects of bankruptcy law, Lehnert and Maki [14] use state-level data on bankruptcy rates to show that higher exemption levels are associated with higher bankruptcy rates.

The literature on optimal mortgage default usually uses an option-theoretic approach to determine the optimal default date. In the most basic model, the borrower will default if the value of the house falls below the value of the mortgage, where the value of the mortgage is some function of the unpaid principal and the option inherent in keeping the house and defaulting next period (Kau and Keenan [11], Kau, Keenan and Kim [12]). Most option-theoretic models of default, however, are unable to capture the effects of individual-specific income or expenditure shocks and abstract away from a potential bankruptcy decision of the household. In their analysis of the home-ownership experiences of sub-prime borrowers in Massachusetts, Gerardi, Shapiro and Willen [8] conclude that house price depreciation and initial Loan-to-Value ratios play an important role in generating foreclosures, and that negative home equity is a necessary, but not a sufficient condition for default. They set up a simple model in which they follow the existing literature in modeling mortgage default as an option. Their model predicts that when house-price appreciation is high, one will observe fewer foreclosures. However, they do not consider bankruptcy at all (unsecured borrowing is always repaid), and by concentrating on only one state (a non-recourse state), they are unable to use their model to consider the effects of recourse and non-recourse mortgages. The model we introduce below captures all of the dynamics and comparative statics of the Gerardi et al. paper, but also shows how they interact with bankruptcy and foreclosure laws.

To our knowledge, Lin and White [15] is the only paper that models the interaction between the bankruptcy choices of the agents and their foreclosure

decision. In their model, the interest rate is fixed while lenders react to increasing default probabilities by rationing credit. Lin and White focus on the implications of allowing recourse mortgages on the availability of home loans to borrowers given different bankruptcy regulation. They find that borrowers are significantly more likely to be denied home purchase loans if they live in states with higher bankruptcy exemptions. Their model, however, focuses on non-recourse mortgages, which does not allow us to evaluate the different policy environments explicitly. They also abstract from the option-value benefit of continuing to service an underwater mortgage emphasized by Gerardi et al. Our model below incorporates both, the option benefit of servicing an under water mortgage, as well as the availability of bankruptcy to the borrower, thereby combining the two main points stressed in Gerardi et al. and Lin and White.

4 Model Description

4.1 Model Overview

We analyze a two-period model, in which the agent derives utility both from the consumption of goods and the consumption of housing services. In the first period, there is no uncertainty. The agent receives a fixed income, which he distributes among consumption, housing services and savings. To consume housing services, the agent can either purchase or rent the housing units. The agent can further increase his resources in the first period by unsecured borrowing, and by taking out a mortgage on his home in the case when he chooses to purchase a house. In Period 2, the agent receives an income shock and a house price shock and he has the option to declare bankruptcy, to enter into foreclosure or to do both (or neither). Given his assets and liabilities carried forward from Period 1, the agent chooses whether to exercise any of the foreclosure / bankruptcy options and how to spend his remaining resources on consumption, housing and saving. The agent's choice of bankruptcy and foreclosure may restrict his housing and consumption choice: if he enters into foreclosure, the agent loses his home and has to rent. If he declares bankruptcy, he can keep his old home and mortgage, but will not be able to buy a new house or increase his mortgage. The agent dies at the end of Period 2 when there is another shock to house prices. All assets are sold, all debts are paid off, and the remaining assets are bequeathed to the agent's descendents. If the net assets are negative, the descendents can choose to not accept the inheritance. In Period 2, the agent derives utility from this expected inheritance to his descendents. In this paper we focus on the agent's decisions in Period 2; in particular, we analyze how the agent's response to shocks changes with the policy environment, given certain asset holdings he arrives with from Period 1 ².

²In an extension to this paper, we also consider a model that assess agent's first-period choices more closely, using endogenized interest rates. This allows us to calculate the longer-term welfare effects of policy, much of which will work through changes in the interest rate.

4.2 Detailed Model Description

In **Period 1** the agent receives a certain income y_1 . He makes the choice of how many units of consumption goods and housing services to purchase, and whether to rent ($r_1 = 1$) or buy a home ($r_1 = 0$) in order to receive housing services. We follow Piazzesi, Schneider and Tuzel [21] and assume that the agent's period utility function is given by the following power utility over a CES aggregator:

$$U(c, H) = \frac{((c^\alpha + \omega H^\alpha)^{\frac{1}{\alpha}})^{1-\rho}}{1-\rho}$$

where $\rho = \frac{1}{\sigma}$ with σ representing the inter-temporal elasticity of substitution, and $\alpha = \frac{\varepsilon-1}{\varepsilon}$ with ε representing the intra-temporal elasticity of substitution. Larger values of ε represent an increased willingness of agents to substitute between consumption and housing within one period. As $\varepsilon \rightarrow 0$, the goods behave like perfect complements. For $\varepsilon \rightarrow 1$, this utility function approaches the Cobb-Douglas utility function used by Gerardi, Shapiro and Willen [8]. Larger values of ρ represent a smaller willingness of agents to substitute consumption over time.

The rental cost of a housing unit $\phi(p_1^h)$ is related positively to the purchase cost of housing, p_1^h , as described in Section 4.3 below. If the agent decides to purchase housing, he can finance that purchase by taking out a mortgage M_1 up to the value of the house at an interest rate i_1^m . In our specification of the budget constraint the agent will have to pay the interest rate on the mortgage in terms of positive home equity. By choosing this specification, we allow one variable, the mortgage interest rate i_1^m , to capture both the price and the quantity margin of lending available to lenders (see Section 4.4). Essentially, the agent will have to make a downpayment equal to a fraction $\frac{i_1^m}{1+i_1^m}$ of the mortgage he chooses; that is, the downpayment equals the discounted value of the interest payments.

The agent also decides whether to save or take out unsecured credit (up to an external borrowing constraint given by a fraction \bar{u} of his current income) at interest rates i_t^s and i_1^u respectively. We denote the agent's value in the respective period by V_t . The agent's choice problem in Period 1 can be summarized as below:

$$V_1 = \max_{s_1, u_1, c_1, H_1, r_1, M_1} \frac{((c_1^\alpha + \omega H_1^\alpha)^{\frac{1}{\alpha}})^{1-\rho}}{1-\rho} + \beta E_1 V_2(r_1, H_1, M_1, u_1, s_1)$$

s.t.

$$y_1 + \frac{1}{1+i_1^m} M_1 + \frac{1}{1+i_1^u} u_1 = c_1 + \frac{1}{1+i_2^s} s_1 + r_1 [\phi(p_1^h) H_1] + (1 - r_1) p_1^h H_1$$

$$M_1 \in \left[0, \frac{1}{1+i_1^m} (1 - r_1) p_1^h H_1\right]$$

$$u_1 \in [0, \bar{u} y_1]$$

$$s_1 \geq 0$$

The first constraint is the usual budget constraint. The second constraint states that the agent cannot take out a mortgage that is worth more than the value of the house and also specifies that the agent cannot take out a mortgage on rented housing.

In **Period 2**, the agent receives two shocks, one to his income and one to the value of his housing assets. In our simple model, the shock to income captures both the income and the expense shock of Livshits et al. [16]. The income and house prices observed in Period 2 are given by $y_2 = y_1 \cdot \varepsilon_2$ and $p_2^h = p_1^h \cdot \eta_2$, where ε_2 and η_2 represent the income and house price shock respectively. The distribution of both of these shocks is known in advance to both agents and lenders, and thus taken into account when making decisions in Period 1. We assume that both shocks are distributed according to a Weibull distribution.

After observing the realization of these shocks in Period 2, the agent starts by making two choices: Whether or not to declare bankruptcy, and whether or not to default on the mortgage from Period 1 and enter into foreclosure. This choice, in combination with the policy parameters set by the government (homestead and property exemption in case of bankruptcy, possibility of deficiency judgement for mortgage lenders), determines the budget constraints faced by the agent in Period 2. Similarly to Period 1, agents allocate the resources given by the relevant budget constraint to saving and to the purchase of consumption and housing goods (where the decision to buy or rent may be constrained by the choice of whether to default on previous mortgages). Unsecured borrowing is not available in this period, since the agent will die at the end of the period and not have any future income to repay his debt

After the death of the agent at the end of Period 2 and after the realization of another shock to house prices, all assets are sold, all debts are paid off, and the remaining assets are bequeathed to the agent's descendents. If net assets are negative, the descendents will choose not to accept the inheritance. In Period 2 the agent derives utility from this expected bequest, and has a decreasing marginal utility from higher expected bequests. The expected net assets that will be bequeathed are given by:

$$W_3 = W_3((1 - r_2)H_2, M_2, s_2) = E_2[\max[(1 - r_2)(p_3^h H_2 - M_2) + s_2, 0]]$$

The agent's problem in Period 2 is thus given by the following formulation:

$$V_2((1 - r_1)H_1, M_1, u_1, s_1) = \max_{s_2, c_2, H_2, r_2, M_2, f, b} \frac{((c_2^\alpha + \omega H_2^\alpha)^{\frac{1}{\alpha}})^{1-\rho}}{1-\rho} + \frac{\beta W_3^{1-\rho}}{1-\rho}$$

The budget constraint the agent faces depends on his choice of bankruptcy (b) and foreclosure (f). There are four different cases:

	$b = 0$	$b = 1$
$f = 0$	Case 1	Case 2
$f = 1$	Case 3	Case 4

In all four cases, the constraints on the maximization problem consist of a budget constraint, a constraint on the maximum available mortgage, as well as a non-negativity constraints on savings. The budget constraint specifies the resources, denoted by $resource_2$, that are available in the period. These are determined by the agent's income and house price shock (ε_2 and η_2), as well as the choice between bankruptcy and foreclosure and a potentially available mortgage M_2 . For simplicity, we assume in all budget constraints that the agent starts out by paying back all of his outstanding liabilities and sells all his assets. He can buy them back immediately and at the same price. If the agent chooses to keep his liabilities, his interest payments are subtracted from the amount he receives back.

The ability to take out a mortgage M_2 , and the maximum quantity of mortgage allowed, will depend on both the previous period's mortgage M_1 , as well as the agent's choice regarding bankruptcy or foreclosure.

Constraints for Case 1: No Bankruptcy, No default/foreclosure

$$resources_{2,1} + \frac{1}{1+i_2^m} M_2 = c_2 + \frac{1}{1+i_2^s} s_2 + r_2 [\phi(p_2^h)H_2] + (1-r_2)p_2^h H_2$$

$$\text{where } resources_{2,1} = y_2 + s_1 + (1-r_1)p_2^h H_1 - M_1 + u_1$$

$$M_2 \in \left[0, (1-r_2) \max\left[\frac{1}{1+i_2^m} p_2^h H_2, M_1 * I_{(H_2=H_1)}\right]\right]$$

$$s_2 \geq 0$$

The first constraint is the usual budget constraint, and has a similar form to that described for Period 1 above. The constraint on the Period 2 mortgage M_2 limits the mortgage to the value of the house $p_2^h H_2$ (subject to the requirement on paying the interest in home-equity). However, it allows the agent to stay in his old house ($H_2 = H_1$) and keep his old mortgage M_1 in any case, even if that mortgage exceeds the current house value. This is contingent on the household servicing the interest payments on that mortgage.

Constraints for Case 2: Bankruptcy + No default/foreclosure

$$resources_{2,2} + \frac{1}{1+i_1^m} M_2 = c_2 + \frac{1}{1+i_2^s} s_2 + r_2 [\phi(p_2^h)H_2] + (1-r_2)p_2^h H_2$$

$$\text{where } resources_{2,2} = \min[\bar{y}, y_2 + s_1] - bc + \underbrace{(1-r_1) \min[p_2^h H_1 - M_1, \bar{H}]}_{\text{Home equity agent takes into next period}}$$

$$M_2 \in [0, (1-r_2)M_1 * I_{(H_2=H_1)}]$$

$$s_2 > 0$$

In the resource-constraint, \bar{y} represents the the property exemption level, which is set on a state-by-state basis, and represents the maximum quantity of non-housing assets (in our model savings from Period 1 and income in Period 2)

that the agent is allowed to keep after declaring bankruptcy. Similarly, \bar{H} represents the homestead exemption limit, the maximum amount of (positive) home equity that can be carried into the next period when choosing bankruptcy. This means that the agent's Period 2 resources are any non-housing assets that he holds up to the property exemption limit \bar{y} , as well as any positive home equity that he is allowed to keep. The variable bc represents a fixed cost of bankruptcy; this captures any potential non-financial stigma-costs. Any unsecured debt from the previous period, u_1 , is discarded in bankruptcy.

The constraint on the mortgage M_2 represent the fact that as long as the agent keeps his house and services his mortgage interest payments, he can always choose to keep the existing mortgage (or pay down some of it), even in bankruptcy. However, since bankruptcy will harm the credit rating, the agent will not be able to increase the size of the mortgage, even if house-prices have increased. Nor will he be able to finance a new house by a mortgage. Note that the mortgage rate paid by the agent on his Period 2 mortgage in the case of bankruptcy is i_1^m , the mortgage rate set in Period 1 - refinancing at a potentially lower interest rate is not possible.

Constraints for Case 3: Default + foreclosure, no bankruptcy

$$resources_{2,3} = c_2 + \frac{1}{1+i_2^s} s_2 + \phi(p_2^h) H_2$$

$$\text{where } resources_{2,3,non-recourse} = y_2 - fc + s_1 - u_1$$

$$resources_{2,3,recourse} = y_2 - fc + s_1 - u_1 - (1 - fdiscount) \cdot \max[(M_1 - p_2^h H_1), 0]$$

$$s_2 \geq 0$$

We follow Campbell and Cocco [3] in assuming that upon entering into foreclosure, the agent needs to rent. When entering into foreclosure, the agent will bear a fixed foreclosure cost fc . This can be interpreted as the costs of being forced to move house. In non-recourse states, when entering into foreclosure, the agent is able to fully discard the mortgage (while giving up his house), without having to cover potential negative equity. In recourse states, the agent remains liable for the difference between the market value of the foreclosed house and the face value of the mortgage. The foreclosure discount, $fdiscount$, means that the agent may not have to pay the full difference between the house value and the mortgage (equivalently, even in recourse states, the lenders will be unable to recover their full lending). This can be interpreted in two ways: we can think of it as a time discount, because the bank needs time to get a deficiency judgement. Alternatively, we can also think of it as the probability of the bank choosing to pursue a deficiency judgement. This is not equal to one, since the bank incurs costs to obtain deficiency judgements. The agent only considers the expected value he has to pay, as the realization of getting a deficiency judgement is not modeled. In states like California, where obtaining deficiency judgements is costly, this foreclosure discount can be significant.

Constraints for Case 4: Default + Foreclosure, bankruptcy

$$resources_{2,4} = c + \frac{1}{1+i_2^s} s_2 + \phi(p_2^h) H_2$$

$$\text{where } resources_{2,4} = \min[\bar{y}, y_2 + s_1] - fc - bc$$

$$s_2 \geq 0$$

When the agent defaults on his mortgage, and simultaneously declares Chapter 7 bankruptcy, he will be able to discard negative home-equity, independently of whether the mortgage was issued in a recourse state or a non-recourse state. The agent uses his remaining assets (which are determined by the state's property exemption level \bar{y}), to rent housing H_2 , purchase consumption goods c_2 , and save amount s_2 to bequeath to descendants.

4.3 Linking rental costs to house prices

To complete the model, we require a specification for $\phi(p_t^h)$, the function that links the rental cost of housing to current house-prices. Equilibrium in the housing market implies that the expected annual cost of owning a house should equal the annual cost of renting. Expressing the annual user cost of housing, u_t , as a percentage of the price of the house, this condition is:

$$\phi(p_t^h) = p_t^h u_t$$

Himmelberg et al. [9] show that in equilibrium the user cost of housing, or "imputed rent," is determined by six factors: The cost of foregone interest i_t^s that the homeowner could have earned when saving instead of buying the house; Property taxes ω_t that need to be paid on the house; The benefit from the tax deductibility of mortgage interest payments, where τ_t is the income-tax rate; The maintenance cost for the home δ_t ; The expected appreciation in the home value, g_{t+1} ; and a risk premium χ that compensates the owner for the uncertainty in house price development. The formula for the user cost of housing is then:

$$u_t = i_t^s + \omega_t - \tau_t(i_t^m + \omega_t) + \delta_t - g_{t+1} + \chi$$

In our analysis of homeowners we take into account the benefit from expected appreciation of the housing asset. When computing the rental cost of housing, we need to take account of the same factor. We abstracted away from the benefits of mortgage-interest payment deduction to the property owner. To be consistent, we will also not consider this term in the specification of the user cost of housing. We also abstract away from maintenance costs and the property taxes.

Therefore, our rental cost specification is:

$$\phi(p_s^h) = (\bar{r} - g_t + \chi) \cdot p_s^h = (\bar{r} - E_1[\eta_{t+1} - 1] + \chi) \cdot p_s^h$$

5 Model Simulation and Policy Conclusions

We now simulate the agent’s choice in Period 2 of the model to arrive at some interesting policy conclusions about . We start by outlining our base-line parameterization, and show how our assumed preference parameters fit in the pre-existing literature. We then show three basic simulations of the agent’s decision in Period 2, in which we hold the policy environment fixed to illustrate the determinants of the agents’ decisions. We then analyze how changes in the policy environment affect the behavior of agents in our model, using this to arrive at some policy conclusions.

5.1 Parametrization

Preference Parameters: We choose a value for the inter-temporal elasticity of substitution of $\sigma = 0.5$, which is consistent with values estimated from micro-data. For example, Attanasio and Weber [2] estimate this parameter to be between 0.48 and 0.67. Our choice of the parameter $\varepsilon = 1.5$ is similarly consistent with literature estimates (Ogaki and Reinhart [18] estimate it to be in the range 1.04 to 1.43, Piazzesi et al. [21] find a point estimate of 1.26 and McGratten et al. [17] find a parameter value of 1.75) We assume a parameter value of 1 for ω and use a discount factor β of 0.95.

Other Parameters We set the risk-free interest rate \bar{r} equal to 0.05. Also, the exogenous borrowing limit in Period 1 is set to 70% of income in that period. House price shocks are assumed to follow a Weibull distribution. Unless otherwise specified, the baseline parameterization assumes a 10% appreciation of house prices in Period 3.

5.2 Simulating Period 2 Behavior

In the following we present three simulations of the agent’s behavior in Period 2 of the model that help explain the dynamics and trade-offs inherent in our model. We first analyze how the behavior of an agent with positive home equity varies as his realized income increases. We then analyze the agent’s behavior as his mortgage rises and his home equity falls and eventually becomes negative. We show that the amount of home equity is an important variable both in the decision to declare bankruptcy (through the homestead exemption) and in the decision to enter into foreclosure. Finally, we show how the decision to enter foreclosure depends crucially on the agent’s expectations of next period’s house prices.

5.2.1 Reaction to Income Shocks - Positive Home Equity

The first simulation focuses on the agent’s decision to declare bankruptcy. The agent has positive home equity, so we can assess the agent’s bankruptcy decision in isolation of the foreclosure decision (if you have positive home-equity,

you would be better off selling the house on the market than defaulting on the mortgage). The agent, however, has some unsecured debt, that he could discharge in bankruptcy in exchange for his un-exempt assets. Figure 1 show the agent’s decision as his income increases.

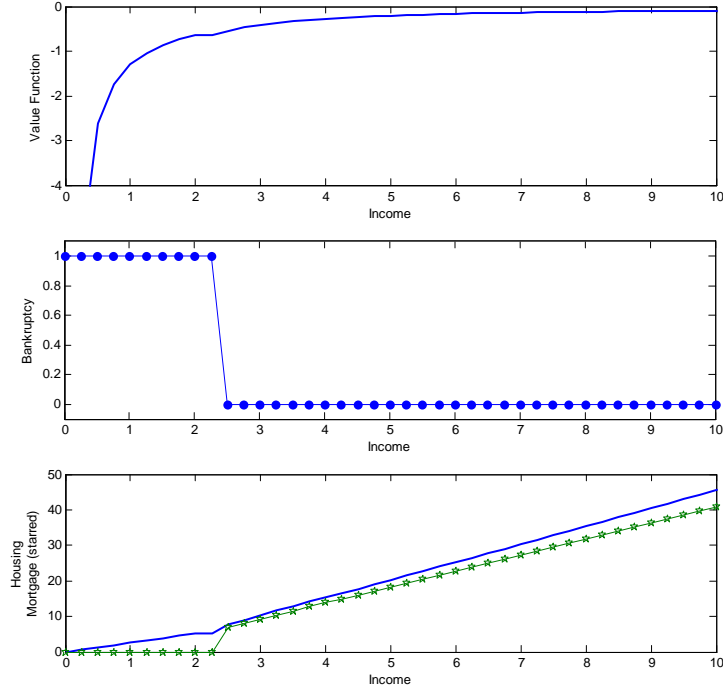


Figure 1. Income-shock response of positive home-equity agent

State Variables: $s_1 = 0$, $u_1 = 4$, $H_1 = 10$, $M_1 = 7$, $p_2^h = 1$

Policy Variables: Property exemption, Homestead exemption = 2

If the agent has very low income, the agent chooses to declare bankruptcy. This allows him to discharge the unsecured debt u_1 , while his income is so low that he can claim the the property exemption and keep all his income. Since the agent’s home-equity exceeds the exemption level, he has two options in bankruptcy: To give up his house, or to keep the house and associated mortgage, and pay the difference between home-equity and homestead exemption with the income that he can keep through bankruptcy (the upper bound of this is given by the property exemption level). When the agent has very low income, he chooses not the keep his house. As the agent becomes richer, the income he would have to give up under bankruptcy increases (i.e. while his income rises, he continues to only keep the property exemption), and he eventually decides not to declare bankruptcy, but to pay back his unsecured debt and purchase a house (partially financed by a mortgage). Note that in the absence of any home

equity the agent would keep declaring bankruptcy for higher income levels.

5.2.2 Behavior as home equity varies

Figure 2 highlights the role that the value of the agent’s home equity plays in determining his bankruptcy and foreclosure decision. We assume an expected appreciation of house-prices next period of 10%, so a house is a worthwhile investment. As houseprices decrease on the horizontal axis, home equity falls and will eventually become negative. Since the agent has some unsecured borrowing, he can benefit from discharging his debt in bankruptcy.

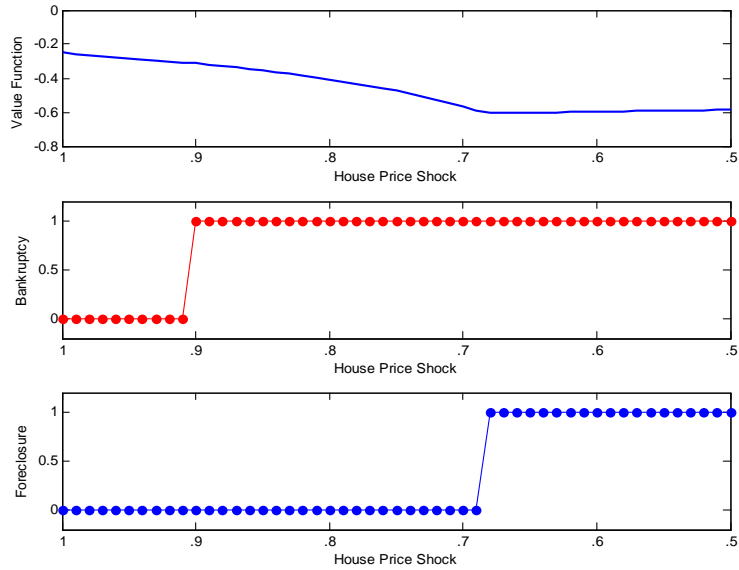


Figure 2: Behavior as home equity varies

State Variables: $s_1 = 0$, $u_1 = 2$, $H_1 = 10$, $M_1 = 7$, $y_2 = 4$

Policy Variables: Property exemption, Homestead exemption = 2

Focusing first on the bankruptcy decision, Figure 2 shows that when the agent has high home equity, he prefers to pay his unsecured debt, because in the case of bankruptcy he could only keep the homestead exemption. As house prices decrease, home equity falls below the exemption limit, and the agent chooses to declare bankruptcy. He is still able to keep his house and mortgage through bankruptcy (as long as he pays his interest payments), but he can no longer invest in additional housing, which would be a profitable investment.

When houseprices have fallen by 30%, all home-equity is wiped out, so entering into foreclosure becomes an attractive choice for the agent. Due to the expected appreciation of house-prices next period, the agent does not immediately enter into foreclosure (this is the option-value emphasized by Gerardi et al [8]). But as house prices decrease further, home-equity is becoming so

negative, that the agent finally chooses to foreclose on his house, and rent instead. This is the point at which the benefits from discharging the underwater mortgage exceed the benefits from future house price appreciation. The agent has to rent and the value function remains constant, since the agent spends the same income (i.e. the property exemption level) independently of house prices and the amount of negative homeequity. The agent's choice is independent of whether his mortgage is recourse or not since he declares bankruptcy anyways and he would therefore not have to pay for any additional claims of the mortgage lenders.

5.2.3 Behavior under different expectations of future house-prices

We saw above that the expectation of future house-price increases are an important consideration for agents, which may encourage him to service an underwater mortgage. Figure 3 shows the behavior of two agents, one of whom is expecting a future appreciation of 10%, while the other is expecting prices to remain constant. Both agents hold a mortgage that is underwater.

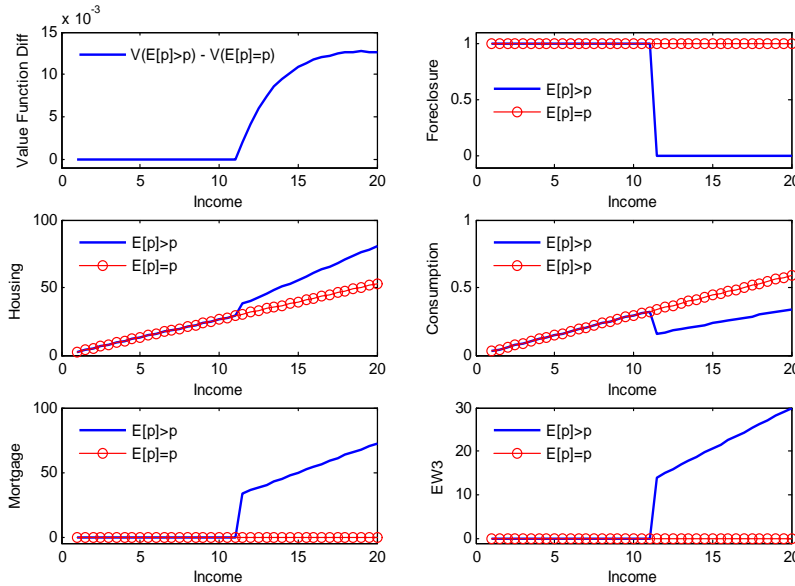


Figure 3. Behavior under different expected houseprices

$E[p]>p$: 10% appreciation; $E[p]=p$: No appreciation; Variance: 0.12

State Variables: $s_1 = 0$, $u_1 = 0$, $H_1 = 12$, $M_2 = 16$, $p_2^h = 1$

Policy Variables: Non-recourse, Property exemption, Homestead exemption = 2

The top-left panel of Figure 3 shows the excess of the value function of the household that is expecting the appreciation. Until an income of about 12, both households act identically - they enter into foreclosure and spend all income on current consumption and rented housing. Since they are not in a recourse state, and have no unsecured debt, the foreclosure decision is independent of any bankruptcy regime. As the agents become richer and their current consumption increases, their gain from increased current consumption decreases (decreasing marginal utility). The utility from bequeathing is higher for the agent who expects a house price appreciation, as his expected bequest is higher given the same investment in housing. As marginal utility is decreasing for current consumption and housing, it will eventually fall below the marginal utility of bequeathing net assets for the agent expecting a high house price. This is the case at an income of 12. We see that the household no longer enters into foreclosure, and purchases more housing, while reducing consumption. The agent who does not expect any appreciation, however, still enters into foreclosure. The agent's expectations on future house prices, as well as his income level, are thus a crucial factor in the decision of whether to service an underwater mortgage.

This importance of the expected house price shock to analyzing policy proposals will be seen below, where we show its relevance to determining whether agents would agree to changes in their mortgage contracts that require mutual consent.

5.3 Assessing Policy Proposals

There have been a number of proposals made in recent months on how to deal with the economic crisis in the U.S. in general, and the housing market crisis in particular. Reducing foreclosures has become one of the primary goals of policy. This is because beyond the individual tragedies that stand behind a family having to give up their home, foreclosures have shown to further depress house prices in the region, lowering expectations of future house prices, and setting of a downward spiral of further foreclosures. Such "asset fire sales" have been analyzed in other contexts (see Pulvino [22], Vishny and Shleifer [24]). Empirically, Pennington-Cross [20] shows that house-prices of houses sold in foreclosure is about 22% lower than the market-price constructed via the OFHEO repeat sales index. This suggests that reducing the number of foreclosures is a desirable step towards stabilizing the housing market. Beyond a mandated moratorium on foreclosure, which has been much discussed, a number of regulatory changes have been suggested. One proposal that has attracted a lot of attention comes from Martin Feldstein, who argued in his testimony to the Senate Finance Committee on November 18, 2008 that:

The key to preventing further defaults and foreclosures among the current negative equity homeowners³ is to shift those mortgages into loans with full recourse, allowing the creditor to take other assets or a fraction of wages if the homeowner defaults. But the offer of a low interest rate loan is not enough to induce a homeowner with substantial negative equity to forego the opportunity to default and escape the existing debt.

Substituting a full recourse loan requires the inducement of a substantial write down in the outstanding loan balance. Creditors have an incentive to accept some write-down in exchange for the much greater security of a full recourse loan. The government can bridge the gap between the maximum write down that the creditor would accept and the minimum write down that the homeowner requires to give up his current right to walk away from his debt. [6]

We have argued above that any policy proposal regarding changing the status of mortgage loans from non-recourse to recourse needs to consider the prevailing bankruptcy environment. A proposal such as Feldstein's could have an impact via two different channels: Firstly, if house prices fall further, the behavior of underwater agents in a recourse and a non-recourse environment will be different. Secondly, as Figure 2 showed, by reducing negative home equity (which comes with a write-down of some of the mortgage face value), will reduce foreclosures directly. We will first analyze the effect that a switch from non-recourse to recourse mortgages would have in an environment of falling house-prices, assuming that home-owners would agree to such a switch on the condition of some reduction of their mortgage face value. We will then analyze how far one would have to reduce the face-value of mortgages for individual agents to agree to a switch from non-recourse to recourse loans.

Figure 4 illustrates the mechanism that Feldstein had in mind when proposing his solution. It shows the behavior of an agent with negative home equity of 4 as his income increases. We show the behavior under both a recourse policy and a non-recourse policy. In both policy-environments, agents expect a house price appreciation of 10%. The bankruptcy regime is held constant across mortgage regimes.

³Feldstein also had a second proposal for stopping homeowners with positive equity from falling into negative equity, in which the government would offer a low-interest "mortgage replacement loan" that would be full recourse. Here another question to be answered is how credible it is for the government to go after its citizens to make up potential deficiencies.

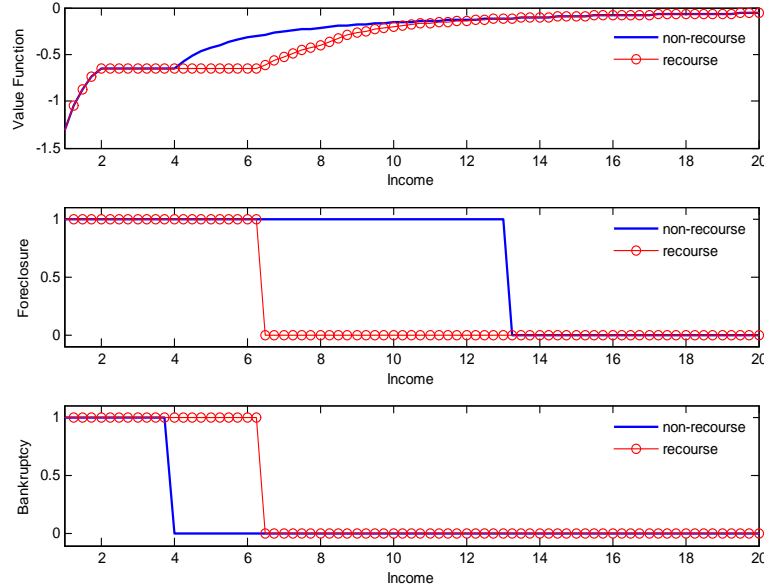


Figure 4. Behavior of "underwater" agents as income varies

State Variables: $s_1 = 0$, $u_1 = 2$, $H_1 = 10$, $M_1 = 14$, $p_2^h = 1$

Policy Variables: Property exemption, Homestead exemption = 2

In the non-recourse state, the agent's negative home-equity drives him into foreclosure even for very high income realizations, since he can just walk away from the mortgage. Very poor households will also declare bankruptcy, since the difference between their income and the exemption level is smaller than the unsecured debt of 2 that they can discharge in bankruptcy. Only for very rich agents is it worthwhile to keep paying the underwater mortgage and keep the house, since their marginal utility of bequeathing the house (which is expected to increase in value) to their descendents exceeds their marginal utility of higher consumption today. The equivalent interpretation in a multi-period model would be that the agent chooses to transfer consumption into the future by keeping his investment in housing.

In a recourse state, the agent's behavior is very different. The recourse nature of mortgages requires agents to pay the difference between the value of their home and their mortgage. For relatively poor agents, this additional liability leads them to declare bankruptcy, while still entering into foreclosure. As the agent's income increases, his excess earnings over the bankruptcy exemption level exceeds the deficiency judgements he incurs, so bankruptcy is no longer an attractive choice. This also renders foreclosure unattractive, since agents now have to repay the full loan amount and can't just walk away from the house. They therefore choose to keep the house.

Figure 4 thus demonstrates that the effect of switching from non-recourse to recourse loans depend on the agent's income: if he is relatively poor, such a switch will not deter him from foreclosure, but drive him into bankruptcy as well. If the agent is relatively affluent, however, such a switch successfully deters him from foreclosing on his home. The income level at which this change occurs depends on the generosity of the prevailing bankruptcy law. This is effectively illustrated by looking at Figure 5.

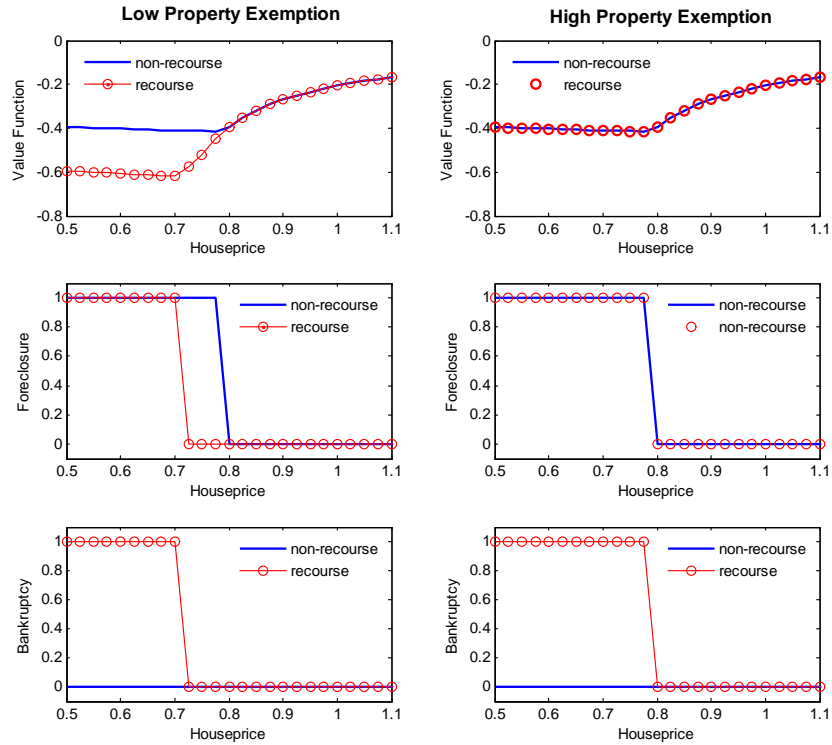


Figure 5. Switch from non-recourse to recourse

State Variables: $s_1 = 1$, $u_1 = 0$, $H_1 = 10$, $M_1 = 9$, $y_2 = 2$

Policy Variables: Property exemption: Low = 2, High = 4, Homestead exemption = 2

Figure 5 analyzes the behavior of an agent who has taken out a large mortgage in Period 1. The agent has savings of 1, and no unsecured borrowing. House prices in the previous period were equal to 1 and we simulate how the agent's behavior changes with the realized house price in second period. When house prices increase, the agent has no incentive to declare bankruptcy or enter into foreclosure. If houseprices are low enough, however, the agent has an incentive to default on his mortgage. In non-recourse states, the agent will never declare bankruptcy, as he has no unsecured debts. His decision to enter into

foreclosure is hence independent of the bankruptcy laws and therefore is the same in the left and the right columns.

In recourse states the agent's decision to enter into foreclosure depends on the bankruptcy laws, especially the generosity of the property exemption. In the right column the property exemption is so high that the agent can always keep his non-housing assets when he declares bankruptcy (his net assets are worth 3, less than the exemption limit of 4). Once he has an incentive to default on his mortgage, he will do so. The recourse nature of his mortgage requires him to pay the difference between his home value and mortgage. However, the agent discharges this debt completely in bankruptcy. By declaring bankruptcy the agent essentially circumvents the recourse nature of the loan and achieves the same allocation as in the non-recourse setting, the only difference being him entering into bankruptcy.

In the left column, the property exemption is less generous, and the agent would have to give up part of his non-housing assets in bankruptcy. As long as the non-housing assets he would need to give up in case of bankruptcy exceed the value of the deficiency from his mortgage, he has no incentive to walk away from his home and is deterred from entering into foreclosure. Only as houseprices fall even more, does his home equity become so negative that he finally chooses to enter foreclosure and bankruptcy.

In the case with low-property exemption we can therefore again see the effect anticipated by Feldstein: Switching from recourse to non-recourse will increase the negative house price shock necessary to push an agent into foreclosure. While this leads to lower foreclosure rates, bankruptcy rates for agents receiving very bad house price shocks will rise.

However, Figure 5 also shows that with generous bankruptcy exemptions the switch from non-recourse to recourse has little to no effect on the foreclosure rates, while still raising bankruptcy rates. Since most agents do not have many assets above the bankruptcy exemption level, entering bankruptcy for them is not very costly. Therefore, our proposal is that beyond switching mortgages from non-recourse into recourse, we will need to ensure that the property exemption limits determined by the states are sufficiently low to discourage bankruptcy. How low would be "sufficiently" low would have to be determined by looking at the average non-housing assets held by the typical family that currently enters into foreclosure.

An additional difficulty with Feldstein's proposal is to determine the exact amount by which the face value of mortgages would have to be reduced to induce agents to accept the change in their contract terms. In an environment of falling house prices, households would require a significant reduction in their outstanding mortgage balances to be enticed to accept a switch.⁴ This is since

⁴In the November 18, 2008 hearing of the House Financial Services Committee, Chairman Barney Frank commented how Congress would "have a hard time legally forcing it [the change from recourse to non-recourse] on others."

for households expecting house prices to fall further, the option to "walk away" from a mortgage is very valuable. Our model has too few periods to quantify the exact reduction in mortgage face value necessary to compensate the household for the loss of the default option. This is because our way of ruling out negative bequests allows all households to discard their negative home-equity at the end of Period 2, whether or not they live in a recourse state. Nevertheless, our model allows us to calculate a lower bound on the mortgage face-value reduction necessary. This is shown in Figure 6.

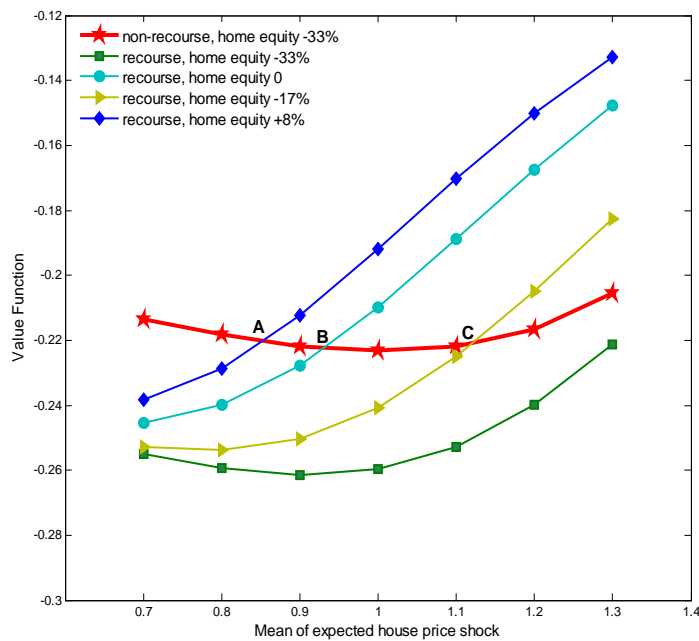


Figure 6. How much would we have to reduce the principal?

On the horizontal axis we vary the household's expectation over next period's house price shock. As agents expect a higher house price shock, their welfare increases. Welfare also slightly increases for falling houseprice beyond a certain point, which may seem unintuitive at first. However, this is due to the fact that if house prices fall a lot, the household will definitely default on his mortgage and enter into foreclosure. He will therefore need to rent housing units. Since renting costs decrease with house prices, the benefit of lower rental cost outweighs the negative effects of low home equity at very low house prices.

Figure 6 looks at the welfare of a number of households in different situations. The starred line represents the value function of our baseline household: A household in a non-recourse state that holds a mortgage which is about 33%

under water. This would be a prime target group for the proposal discussed above. The other value functions correspond to households in recourse states with different amounts of home equity. The graph shows that the point where the agent would be willing to switch from the baseline situation into a recourse contract with reduced mortgage principal depends on his expectation of future house prices. If agents expect house prices to fall by another 15% on average, they are just indifferent between staying in the baseline scenario and switching to a recourse mortgage where his principal is reduced such that he owns positive home equity of 8% (point A). As the decline in expected houseprices falls to 7% (point B), he is willing to switch when his mortgage is just reduced to the point where he has no more negative equity. As expected house prices rise further, he is willing to switch for ever falling values of home equity (point C).

Figure 6 demonstrates the role played by expected house prices in determining the principal reduction necessary to persuade agents to change to recourse mortgages. For the evaluation of the long term effects of a switch from non-recourse loans to recourse loans, the interest rate channel also needs to be considered. In particular, while a switch to a recourse regime reduces the insurance provided to agents, it also reduces the risks to mortgage lenders. In a competitive lending industry, this should lead to significantly lower interest rates, which will facilitate consumption smoothing. A more detailed discussion of this channel, including a quantification of welfare effects, will be presented in future versions of this paper.

6 Empirical Analysis

One of the key features of the model outlined above is the link between foreclosures and bankruptcy when house prices are falling, especially in recourse states. In the following, we use state level data to empirically test key predictions of our model resulting from this link. This allows us to determine whether the predictions of our model are confirmed by the data. It also enables us to assess the economic significance of the effects predicted by our model.

6.1 Data

We obtain data on foreclosures from RealtyTrac. RealtyTrac reports foreclosure filings and rates for all states since 2006 on their website. We use the total number of filings per quarter for a given state to calculate the foreclosure rate. The total number of filings does not equal the number of total properties in foreclosure since each property can receive several filings during the foreclosure process. For the last year RealtyTrac also reports the number of properties with filings. To be able to use quarterly data and include earlier years in the analysis, we use the total number of filings. The foreclosure rate is measured as the number of foreclosure fillings per 1000 housing units in a given state in 2006. Data on bankruptcy filings on the state level is obtained from the American Bankruptcy Institute (ABI) for the years 2006 to 2008. The data does not

allow us to distinguish between business and non-business filings. The yearly data, however, is split into business and non-business filings and indicates that consumer bankruptcy accounts for over 90% of filings in the recent years. The bankruptcy rate is the number of bankruptcy filings per 1000 individuals using the total population of the respective year. Note that the bankruptcy and foreclosure rate therefore don't refer to the same base, as there are usually more than one individual living in a housing unit. They are therefore not directly comparable; however, using a less natural bankruptcy rate variable as bankruptcies per 1000 housing units (the same denominator as for the determination of foreclosure rate) does not change our results.

For information on house prices we use the well known OFHEO house price index. In the regression analysis we further include unemployment rates and the homeownership rates. We use the lagged homeownership rates to ensure that we are not capturing the change in homeownership due to foreclosures. All these data is obtained through FRED, the information system of the Federal Reserve Bank of St. Louis. Most data is on a quarterly level, except for population and homeownership rates, which are only available on an annual basis. We define a recourse dummy that is equal to 1 if the state explicitly allows deficiency judgments. If deficiency judgements can not be obtained (or only under certain very restrictive circumstances), the dummy is equal to zero. We therefore only classify states as recourse if deficiency judgements are always and easy to obtain.

The following table contains summery statistics of the most important variables for the whole sample. The appendix contains summary statistics divided by year. There are 612 quarter-state observations: for the years 2006 to 2008 (12 quarters) we have data for the 50 states plus Washington DC. Bankruptcy rate and foreclosure rate are measured as described above. All other variables are measured in percentage points.

Summary Statistics				
Variable	Mean	Std. Dev.	Min.	Max.
Foreclosure Rate	2.975	3.813	0.01	46.539
Bankruptcy Rate	0.706	0.365	0.14	2.176
House Price (Quarterly % Δ)	0.383	1.665	-10.144	4.556
House Price (Annual % Δ)	3.572	6.273	-21.795	32.874
Unemployment Rate	4.694	1.251	2.267	9.833
Unemployment Rate (Annual % Δ)	3.776	19.543	-56.747	114.815
Recourse State	0.569	0.496	0	1
Home-ownership rate (lagged)	70.039	5.634	45.8	81.3
Number of Observations	612			

6.2 Empirical Strategy

We first estimate the following regression equation, where we include state fixed effects to control for persistent differences across states:

$$brate_{it} = \alpha + \beta_1 \mathbf{frate}_{i,t-1} + \beta_2 (\mathbf{frate}_{i,t-1} * \mathbf{I}_{recourse_i}) + \beta_3 \mathbf{HP_change}_{it} + \mathbf{X}_{it} \beta_x + \varepsilon_{it}$$

where:

$brate_{it}$	bankruptcy rate
$frate_{i,t-1}$	lagged foreclosure rate
$I_{recourse_i}$	indicator whether state is recourse or not
HP_change_{it}	change in house prices relative to previous year / quarter
X_{it}	control variables, including unemployment, homeownership rate and state fixed effects

The model predicts that an increase in foreclosures leads to higher bankruptcies, especially in recourse states. It therefore predicts a positive coefficient on the foreclosure rate ($\beta_1 > 0$) and its interaction term with the recourse dummy ($\beta_2 > 0$). Note that we can't include the recourse dummy itself. Since it is constant over time and almost colinear to the state fixed effects, it is dropped in the regression.

Even though our model stresses the fact that bankruptcy and foreclosure are joint decisions, we use the lagged foreclosure rate in the regression analysis for several reasons: First, as far as we are concerned about endogeneity or a third factor influencing both, using the lagged foreclosure rate may alleviate this problem. Second, our model assumes that there is no uncertainty about the price a house will be sold for in foreclosure and hence about the amount of a possible deficiency judgment. In reality this is not true. Households may want to wait until their house is sold and the bank has decided whether or not to obtain a deficiency judgement before declaring bankruptcy. Moreover, a household receives a first foreclosure notice soon after the household stops making required mortgage payments. A foreclosure therefore appears in the foreclosure rate which includes all filings very early in the foreclosure process. At the same time, the household's decision to declare bankruptcy is only recorded once he has officially filed for bankruptcy with a court. This usually happens later in the process as the household is likely to take some time to gather the necessary information or to try to negotiate with creditors. Thus it seems justified to use the foreclosure rate lagged by a quarter.

We also estimate an alternative specification where we exclude the lagged foreclosure rate, but instead include an interaction term of the change in house prices and the recourse dummy. The model predicts that in recourse states a drop in house prices will lead to higher bankruptcy rates not only directly, but also indirectly by increasing the number of agents facing deficiency judgements after foreclosing on their homes. The interaction term of house price change and the recourse dummy therefore allows us to test for the existence of the foreclosure channel without including foreclosures as a right hand side variable, which may raise issues of endogeneity, even when using the lagged rate. Note that we can not formally estimate an instrumental variable specification since

our model predicts a direct effect of house prices on bankruptcy (through the reduction in home equity) so the exclusion restriction would not be satisfied.

6.3 Results

Table 1 contains the estimation results with the bankruptcy rate as the dependent variable and the lagged foreclosure rate included on the right hand side. Since we use the lagged foreclosure rate, we only have 11 quarters of observations, giving us a total of 561 datapoints.

	(1)	(2)	(3)
	Bankruptcy Rate	Bankruptcy Rate	Bankruptcy Rate
Foreclosure Rate $_{t-1}$	0.0461*** (0.00466)	0.0363*** (0.00477)	0.0307*** (0.00491)
Foreclosure Rate $_{t-1}$ * Recourse	0.0101 (0.00553)	0.0114* (0.00534)	0.0104* (0.00501)
Homeownership Rate	-0.0362*** (0.00657)	-0.0317*** (0.00638)	-0.0261*** (0.00598)
Unemployment Rate (Quarterly % Δ)	0.00978*** (0.000737)	0.00765*** (0.000790)	
House Prices (Quarterly % Δ)		-0.0291*** (0.00468)	
House Prices (Annual % Δ)			-0.00590*** (0.00160)
Unemployment Rate (Annual % Δ)			0.00395*** (0.000330)
R-squared	0.906	0.912	0.924
N	561	561	561

Standard errors in parentheses, Regression also includes state-level fixed effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The table shows that for all specifications the foreclosure rate in the previous quarter significantly increases the bankruptcy rate. The interaction term of the foreclosure rate with the recourse dummy is positive as well, indicating that foreclosures raise the bankruptcy rate more in recourse states. It is also significant, when we control for the house price change. The change in house prices relative to the previous quarter (in column 2) or relative to the previous

year (column 3) both have significant negative effects on the bankruptcy rate. This is consistent with the model which predicts a higher bankruptcy rate when house prices decrease. Recall that home equity is amongst the most significant assets that most households would have to give up in bankruptcy. Falling house-prices reduce home equity, making bankruptcy less costly. Therefore our empirical analysis is consistent with the prediction from our model. The change in unemployment, both compared to the previous quarter and to the previous year also have positive effects on the bankruptcy rate. This is intuitive and can be interpreted as capturing the income shock in the model.

Table 2 does not directly include the foreclosure rate as an explanatory variable. Instead we include the interaction of the house price change with the recourse dummy. In recourse states we would expect bankruptcies to increase due to the higher number of deficiency judgements agents face when foreclosing on their home after house prices have fallen. The interaction term captures this foreclosure channel of falling house prices on the bankruptcy rate.

Table 2

	(1)	(2)
	Bankruptcy Rate	Bankruptcy Rate
House Prices (Quarterly % Δ)	-0.0524*** (0.00697)	
House Prices (Quarterly % Δ)* Recourse	-0.0167* (0.00842)	
Unemployment Rate (Quarterly % Δ)	0.00930*** (0.000926)	0.00743*** (0.000884)
Homeownership Rate	-0.0375*** (0.00800)	-0.0395*** (0.00747)
House Prices (Annual % Δ)		-0.0168*** (0.00166)
House Prices (Annual % Δ) * Recourse		-0.00472* (0.00201)
R-squared	0.851	0.870
N	612	612

Standard errors in parentheses, Regression also includes state-level fixed effects

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In column 1 we use the house price changes relative to the previous quarter and in column 2 relative to the previous year. The results are as predicted by the model. Negative house price development increases the bankruptcy rate,

significantly. The interaction term with the recourse dummy has a significant negative coefficient, as well. This is consistent with the notion that a fall in house prices increases bankruptcies through the foreclosure channel in recourse states. We use the change of unemployment rate relative to the previous quarter. One may be worried that this is picking up seasonal effects, but including quarterly dummies to control for this does not change the results.

Beyond their statistical significance, our estimates are also economically significant. The coefficients estimated in Table 2 imply that a 10% fall in house prices over the previous year (as measured by the OFHEO index) is associated with an increase of 16.9 bankruptcies per 100,000 individuals per quarter in non-recourse states, and an increase of 21.8 bankruptcies per 100,000 individuals per quarter in recourse states. When you compare this with an average rate of 52 bankruptcies per 100,000 households per quarter in 2006, the effect of the recourse laws are economically important. This analysis would suggest, for example, that in a non-recourse state like Arizona, which experienced a 15% decline in house prices in 2008, the introduction of recourse mortgages would have increased the number of observed bankruptcies by 10 percent. This corresponds to an additional 500 bankruptcies in the fourth quarter alone.

7 Conclusions

We presented a two period model to examine an agent's joint decision to declare bankruptcy and enter into foreclosure. An agent's decision to declare bankruptcy is primarily driven by the amount of unsecured debt relative to his income and the legal regulations concerning property and homestead exemptions. The agent's incentives to enter into foreclosure are more complex: negative home equity is necessary to make foreclosure worthwhile, but expected house price development plays a crucial role due to the option value associated with holding a property with negative home equity. The foreclosure decision is further influenced by the possibility of deficiency judgements in recourse states. Deficiency judgments transform negative home equity into unsecured debt and hence link the decision to enter foreclosure to the bankruptcy decision. Low bankruptcy exemption limits deter agents in recourse states with relatively high income from entering into foreclosure as bankruptcy is costly to them so that they cannot just walk away from their mortgage. For agents with lower income, bankruptcy is still a desirable option, so their bankruptcy rates increase with foreclosures. A first empirical analysis using state level data confirmed the basic mechanism in our model that link bankruptcy to foreclosure, and shows that effects are of economic significance. We use our model to evaluate certain policy proposals raised recently to fight the increasing number of foreclosures. We find that the effects of switching from non-recourse to recourse mortgages on the foreclosure rate depend on households income levels, expected future house-prices and the prevailing bankruptcy regime. In particular, our policy proposals can be summarized as below:

- The effect on foreclosure rates of turning mortgages from non-recourse into recourse loans crucially depends on (i) the existing bankruptcy exemption limits and (ii) the net non-housing asset position of those agents defaulting on their mortgage. Under generous bankruptcy exemption limits, or for agents with few non-housing assets, such a switch will have only small effects on reducing foreclosure rates, while driving more agents with underwater mortgages into bankruptcy.
- In an environment when households expect a further decline in house prices, the reduction in the face-value of the mortgage that is required to induce agents to accept changes in their mortgage contracts that make them recourse is substantial.
- In recourse states, a lowering of the exemption limits in bankruptcy can be a powerful tool to reduce foreclosures. This could be achieved without having to change existing contracts, and could thus potentially be implemented in a quick and timely manner.
- In states such as California where it is legally possible to obtain a deficiency judgement, but where the process of doing so is expensive and time-consuming, a good step in the right direction would be to make the pursuit of deficiency judgements easier, while simultaneously lowering property exemption levels in bankruptcy.
- In non-recourse states, a simultaneous introduction of recourse mortgages with a lowering of bankruptcy exemption limits promises to be successful at reducing foreclosure and bankruptcy rates.

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Summary Statistic by Year

	2006		2007		2008		Total			N	
	Mean	σ	Mean	σ	Mean	σ	Mean	σ	Max.		
Foreclosure Rate	1.73	1.65	2.91	3.13	4.28	5.29	2.97	3.81	0.01	46.54	612
Bankruptcy Rate	0.52	0.26	0.70	0.31	0.90	0.40	0.71	0.36	0.14	2.18	612
House Price (Quarterly % Δ)	1.49	1.13	0.47	1.08	-0.81	1.80	0.38	1.66	-10.14	4.56	612
House Price (Annual % Δ)	8.41	5.62	3.53	3.75	-1.22	5.12	3.57	6.27	-21.79	32.87	612
Unemployment Rate	4.43	1.02	4.35	1.01	5.30	1.44	4.69	1.25	2.27	9.83	612
Unemployment Rate (Annual % Δ)	-9.43	8.70	-1.67	8.58	22.43	21.11	3.78	19.54	-56.75	114.81	612
Recourse State	0.57	0.50	0.57	0.50	0.57	0.50	0.57	0.50	0.00	1.00	612
Home-ownership rate (lagged)	70.28	5.88	70.22	5.57	69.62	5.45	70.04	5.63	45.80	81.30	612