Recourse Mortgages, Nominal Rigidities and Slow Recoveries*

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Abstract

Mortgage recourse systems, by discouraging default, magnify the impact of nominal rigidities and cause deeper and more persistent recessions in the presence of long-term debt. We study a quantitative model with agents heterogeneous in idiosyncratic income and housing values. Following a collapse of house prices, an economy with recourse mortgages induces lower default and, because of heterogeneity in the marginal propensity to consume and downward interest rate rigidities, depresses aggregate consumption relative to a non-recourse economy. Recourse mortgages can account for 25% of the difference in recovery between the U.S. (non-recourse country) and Spain (recourse country).

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1 Introduction

The recovery from the 2007-08 financial crisis has been more slowly in Europe than in the U.S. For example, both Spain and the U.S. experienced a similar fall in housing prices over the first three years of the crisis (also the initial output drop was similar), however in Spain it took four additional years for all the main macroeconomic variables to stabilize and start to recover. In this paper we study whether differences in the housing finance system can account for this divergence in the recovery. We focus on the recourse nature of most of the European housing systems. In a recourse system the mortgage lender can pursue a defaulted borrower for the balance of the mortgage after foreclosing on the home. In a non-recourse system, the debt obligation disappears when the lender repossesses the house that serves as collateral. The literature has shown that in practice basically all the states in the U.S. are non-recourse (Corbae and Quintin 2014, Harris and Meir 2015).

We analyze a quantitative general equilibrium model with long-term debt, default and downward rigidities in interest rates. Agents are heterogenous in idiosyncratic income, housing tenure choices, and house value shocks. We use the model to compare two economies identical in every aspect, except that one has a recourse mortgage system while the other has a non-recourse system. Following a negative housing price shock, the non-recourse economy has higher default rates than the recourse economy. Households are more willing to default when lenders cannot seize their other assets and income. Default redistributes wealth from the wealthy households (who are lenders) towards the low-income households (who are borrowers). As a consequence, low-income households cut their consumption by a smaller amount in the non-recourse economy. Since these are households with a higher marginal propensity to consume, for the same initial shock, aggregate consumption falls less and recovers faster in the non-recourse economy. The same dynamics apply to output when there are downward nominal rigidities that make output "demand-driven".

As highlighted by Hall (2011), deep recessions are associated with frictions that prevent the adjustment of the real interest rate. If all prices were perfectly flexible, following a collapse in housing prices the real interest rate would fall to encourage the wealthy households to consume. Aggregate output and consumption would recover quickly because the drop in the interest rate generates an increase in demand from the savers. However, as discussed by Korinek and Simsek (2016) among others, the reaction differs when there is a lower bound on the real interest rate. For example, from the combination of the zero-lower bound on nominal rates and sticky inflation expectations. In these economies, prices do not serve as shock absorbers, the drop in borrowers' consumption is not compensated by an increase in the savers' consumption, and the economy moves into a "rationing equilibrium" with output below fundamentals.

In this paper we show that default can partially undo nominal rigidities. These rigidities lengthen the recession as the insufficient fall in interest rates discourages the savers from increasing their consumption. However, in the presence of rigidities, mortgage default opens an adjustment channel by redistributing wealth away from the savers who are unwilling to consume. Mortgage recourse systems, by discouraging default, magnify the impact of nominal rigidities and, in the presence of long-term mortgage debt, lead to deeper and more persistent recessions.[1]

In our benchmark calibration we obtain that following a 20% drop in housing prices, the immediate drop in aggregate consumption is around 2% in both the recourse and the non recourse economy. This number is consistent with the dynamics of the U.S. and Spain between 2007-09. However, the two economies display different patterns of recovery. In the economy without recourse, foreclosures spike shortly after the housing price drop. This leads to wealth redistribution towards the pre-shock borrowers, which are the households with a higher marginal propensity to consume. However, in the recourse economy these borrowers are bound to their debts (long-term debt is key to prevent debt from disappearing after each period) and reduce their consumption accordingly. The result is a much larger and protracted drop in consumption in the recourse economy.

In the data, the average difference in aggregate consumption between Spain and the U.S. since the start of the crisis is 12 percentage points. For our benchmark calibration the recourse nature of the European system accounts for 25% of that difference. The bulk of the disparity is accounted for in the different consumption responses of the pre-crisis borrowers at the middle and bottom of the wealth distribution.

This paper confirms Campbell (2013) insight that the housing finance system affects the reaction of the economy to shocks. This is the first paper to study how the recourse or non-recourse nature of the system affects the intensity and duration of a recession.[2] Hatchondo, Martinez and Sanchez (2015) show that recourse affects the choice of leverage before crises. Ghent and Kudlyak (2011) estimate that borrowers are 30% more likely to default in non-recourse states. Corbae and Quintin (2015) find that recourse economies are less sensitive to aggregate home price shocks. We obtain the opposite result because we analyze a model with downward rigidities that allows for demand-driven output, like Auclert and Rognlie (2016),

[1]This version of the paper does not incorporate yet the negative externalities associated to default that the literature has discussed (Hedberg and Krainer 2012, Mian, Sufi and Trebbi 2015).

[2]Rubio (2011) and Garriga, Kydland and Sustek (2013) show that variable or fixed payment mortgages alter the transmission mechanism of monetary policy.

Eggertsson and Mehrotra (2016), Fahri and Werning (2016) or Korinek and Simsek (2016). This literature on nominal rigidities and insufficient aggregate demand has not studied the role of mortgage default as a palliative for the rigidities.

The rest of the paper is organized as follows. Section 2 discusses the motivating facts. Section 3 presents the model. Section 4 discusses the benchmark calibration. Section 5 contains the results. Section 6 concludes.

2 Facts

During the 1996-2006 period Spain and the U.S. had similar patterns of rising housing prices and mortgage debt, together with large current account deficits (Gete 2009). Between 2007 and 2011 housing prices fell by around 20% in both countries. However, the length of the recession and the dynamics of the recovery have been very different across the two countries.

Figure 1 shows that in Spain it took 6 years for housing prices to reach the bottom and start to recover. In the U.S. it only took four years. Figure 2 shows that in terms of real output, the pattern is even more striking. While GDP had returned to pre-crisis levels in the U.S. after 3 years, the recovery took much longer in Spain. The main reason behind the gap between U.S. and Spain after the crisis is the different dynamics of private consumption, which we plot in Figure 3. In Spain it took nearly seven years for aggregate consumption to stop falling. By then GDP and consumption were only about 90-95% of their pre-crisis levels.

Figure 4 shows that U.S. households have reduced their debt burden from the peak in 2007 considerably faster than Spain. This is the motivation for this paper. Spain is a country with a strong recourse mortgage system that grants lenders full recourse to the borrowers' personal assets and future income until all the mortgage debt is paid. In the U.S., even if most states are in theory recourse states, in practice they mostly behave as non-recourse because of the legal hurdles and costs associated with pursuing deficiency judgments.

3 Model

We analyze a closed economy composed by a continuum of households, firms, one representative lender and a residential investment trust (REIT). The model is real and the equilibrium section discusses how we capture the downward interest rate rigidities that, in a nominal model can be microfounded with the zero-lower bound and anchored inflation expectations.

3.1 Households

Households' utility function depends on consumption of the numeraire good (c), the service flow from housing (s), and labor supply (ℓ),

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t u(c_t, s_t, \ell_t). \tag{1}$$

Housing services can be rented at rental price P_{st}, or obtained from owning a house. The price of a house is P_{ht}. One unit of housing stock h equals one unit of shelter services. If a household owns a house, it must live in that house. To allow for well-defined renters and owners, and to ensure that a household is always capable of affording housing, there is a minimum house size for ownership $h \geq \underline{h}$, but no minimum size for rental.

Households supply labor and receive an idiosyncratic labor productivity shock $z \in Z$. This shock follows a finite state Markov chain with transition probabilities $\lambda(z'|z)$ and unique invariant distribution $\Lambda(z)$.[3] Because of the law of large numbers, λ and Λ describe the fraction of households receiving a particular productivity shock. Household labor earnings at time t are $wz\ell$, where w is the wage per unit of effective labor.

There are idiosyncratic random depreciation shocks δ such that if a house of size h is bought today, then next period the size of the house is $(1-\delta)h$. These shocks make the houses risky assets because their value can change.

Households can invest in one-period deposits d' which pay $(1+r')d'$ next period. Households can also invest in shares (υ') of a REIT that owns the stock of rental housing and then pays as dividends its rental income. The price of a share of REIT is P_r. We normalize the number of REIT shares to equal the number of rental units such that the dividends from the REIT are $P_s\upsilon$. No arbitrage condition by unconstrained households implies that the relation

$$1 + r_{t+1} = \frac{P_{st+1} + P_{rt+1}}{P_{rt}} \tag{2}$$

holds at any time. Households are indifferent between holding deposits and rental housing. We denote households' wealth by a.

If a household buys a house she can use it as collateral for long-term mortgage debt. Mortgagors choose the size of the first payment m, while the subsequent mortgage payments decay geometrically at rate μ, that is, $m_{t+1} = m$, $m_{t+2} = \mu m$, and so on. If the household sells the

[3] Here and in what follows, a prime denotes the value at the start of next period.

house she has to pay the current mortgage payment m_t, and buy back the promised sequence of future payments. That is,

$$Q_t m = m + \frac{\mu m}{1 + r_{t+1}} + \frac{\mu^2 m}{(1 + r_{t+1})(1 + r_{t+2})} + ... \tag{3}$$

where Q_t denotes the amount that the lender receives for a mortgage with current payment equal to one. The expression (3) is the present value of the remaining promised sequence of mortgage payments discounted at the risk-free rate sequence.[4] For a household promising a repayment m' the loan size is $q(m', h, a', z)m'$, where the function $q(m', h, a', z)$ is defined below in the lenders section. It accounts for the probability of borrower's default and for her assets.

Households can default on their debts. We consider recourse mortgages in our benchmark model. Then we compare with non recourse mortgages. In case of default, the lender seizes the house and sells it for $P_h(1-\delta)h$. In a non-recourse system the sale of the house extinguishes the mortgage debt. However, with recourse, if the revenue from the sale of the house is not enough to cover the household's debt ($P_h(1-\delta)h < Q_t m$), then the lender garnishes a fraction ϕ of the household's income and liquid assets $(wz\ell + (1 + r)d + (P_r + P_s)v)$ until the outstanding debt is paid. We assume that households must rent while they are making recourse payments.

At the beginning of the period, a household observes the realization of its earnings and housing depreciation shocks (if she has a house). After observing these shocks, the household makes her housing and portfolio decisions. Next, we discuss the value functions for the different situations in which a household can be. We write the model recursively.

3.1.1 Renters with no debt

A renter with no debt chooses whether to buy, take a mortgage and become a homeowner, or to keep renting:

$$V^{renter}(a, z) = \max \left\{ V^{buy}(a, z), V^{rent}(a, z) \right\}. \tag{4}$$

[4] This way to model long-term debt follows Chatterjee and Eyigungor (2015).

The value from buying a house is:

$$V^{buy}(a,z) = \max_{c,h,d',\upsilon',\ell,m'\geq 0} \left\{ u(c,h,\ell) + \beta \mathbb{E} V^{owner}(h,m',a',z',\delta') \right\} \tag{5}$$

$$\begin{aligned} \text{subject to:} \quad & c + P_h h + d' = wz\ell + (1+r)d + q(m',h,a',z)m' \\ & h \geq \underline{h} \\ & a' = (1+r\prime)d' + (P_r' + P_s')\upsilon'. \end{aligned}$$

If the renter chooses to rent again her value function is:

$$V^{rent}(a,z) = \max_{c,s,d',\upsilon',\ell\geq 0} \left\{ u(c,s,\ell) + \beta \mathbb{E} V^{renter}(a',z') \right\} \tag{6}$$

$$\begin{aligned} \text{subject to:} \quad & c + P_s s + d' + P_r \upsilon' = wz\ell + a \\ & a' = (1+r\prime)d' + (P_r' + P_s')\upsilon'. \end{aligned}$$

3.1.2 Owners

An owner chooses whether 1) to keep her current house (and make the mortgage payment if any to avoid default), we denote the value of this option by $V^{keep}(h,m,a,z,\delta)$; 2) to sell the house (and prepay the mortgage if any), we denote the value of this option by $V^{sell}(h,m,a,z,\delta)$; 3) to default and become a renter, we denote the value of this option by $V^{def}(h,m,a,z,\delta)$. The household chooses the option with higher value:

$$V^{owner}(h,m,a,z,\delta) = \max \left\{ V^{keep}(h,m,a,z,\delta), V^{sell}(h,m,a,z,\delta), V^{def}(h,m,a,z,\delta) \right\}. \tag{7}$$

Next, we describe each of these options:

An owner keeping the house has to cover the housing depreciation costs and pay her mortgage payment (if any). She solves:

$$V^{keep}(h,m,a,z,\delta) = \max_{c,d',\upsilon',\ell\geq 0} \left\{ u(c,h,\ell) + \beta \mathbb{E} V^{owner}(h,m',a',z',\delta') \right\} \tag{8}$$

$$\begin{aligned} \text{subject to:} \quad & c + P_h \delta h + m + d' + P_r \upsilon' = wz\ell + a \\ & m' = \mu m \\ & a' = (1+r\prime)d' + (P_r' + P_s')\upsilon'. \end{aligned}$$

An owner selling the house has to cover housing depreciation costs, buy back the promised sequence of future mortgage payments, and be a renter in the current period since for simplicity we preclude owner to owner transitions. She solves:

$$V^{sell}(h,m,a,z,\delta) = \max_{c,s,d',v',\ell\geq 0} \left\{ u(c,s,\ell) + \beta \mathbb{E} V^{renter}(a',z') \right\} \tag{9}$$
$$\text{subject to:} \quad c + P_s s + Qm + d' + P_r v' = wz\ell + a + (1-\delta)P_h h$$
$$a' = (1+r\prime)d' + (P_r' + P_s')v'.$$

Finally, an owner can default on her mortgage. In this case she does not cover the housing depreciation cost, and must rent in the current period. Like in Hatchondo, Martinez and Sanchez (2015), to ensure convergence we assume that with a probability θ the debt obligation disappears. In this case the household becomes a renter with no debt as in (4). However, with probability $1-\theta$ the debt remains and the household needs to make the maximum payments ζ until the debt is fully paid ($m' = 0$). The indicator function $\mathbf{1}_{m'=0}$ denotes when the household is clear of debt. Owners that default on their mortgage solve:

$$V^{def}(h,m,a,z,\delta) = \max_{c,s,d',v',\ell\geq 0} \left\{ u(c,s,\ell) + \beta \mathbb{E} \begin{bmatrix} (\theta + (1-\theta)\mathbf{1}_{m'=0})\, V^{renter}(a',z') \\ +(1-\theta)\mathbf{1}_{m'>0} V^{defaulter}(m',a',z') \end{bmatrix} \right\}$$
$$\text{subject to:} \quad c + P_s s + d' + P_r v' = wz\ell + a - \zeta \tag{10}$$
$$m' = \max\left\{ \frac{(Qm - P_h(1-\delta)h - \zeta)(1+r\prime)}{Q\prime}, 0 \right\}$$
$$\text{where:} \quad \zeta = \begin{cases} \phi(wz\ell + a) & \text{if } Qm > P_h(1-\delta)h \\ 0 & \text{else.} \end{cases}$$
$$a' = (1+r\prime)d' + (P_r' + P_s')v'.$$

A household who defaulted last period but keeps a positive mortgage balance solves the same problem than an owner who decides to default (shown above) but when the house has already been seized:

$$V_t^{defaulter}(m,a,z) = V_t^{def}(h=0,m,a,z,\delta=0).$$

3.2 Lender

There is a risk-neutral representative lender who collects deposits at the risk-free rate r and gives mortgages. A mortgagor that promises to pay m' next period receives $q(m',h,a',y)m'$

resources today. Competition ensures that the lender makes zero-profits. That is, the loan granted equals the expected repayments. These repayments are: 1) when $I^{keep}(h, m', a', z', \delta') = 1$ the mortgagor will repay the promised mortgage flow and keep in good standing next period; 2) when $I^{sell}(h, m', a', z', \delta') = 1$ the mortgagor will sell the house and pay the full mortgage; 3) when $I^{def}(h, m', a', z', \delta') = 1$ the mortgagor will default. Thus, the loan amount determines the mortgage price q that satisfies the equation:

$$
\begin{aligned}
q(m', h, a', z)m' = \frac{1}{1+r}\mathbb{E}\Big[& I^{keep}(h, m', a', z', \delta')\big(m' + q(\mu m', h, a'', z')\mu m'\big) \\
& + I^{sell}(h, m', a', z', \delta')Q'm' \\
& + I^{def}(h, m', a', z', \delta')\big(P_h(1-\delta')h + \zeta' + q^{default}(m'', a'', z', m'')\big)\Big].
\end{aligned} \tag{11}
$$

where the value of a mortgage in default is given by expected payments ζ' that the borrower will make:

$$
q^{default}(m', a', z)m' = \frac{1}{1+r_t}(1-\theta)\mathbb{E}\Big[\zeta' + q^{default}(m'', a'', z')m''\Big].
$$

3.3 Firms and equilibrium

There is a continuum of firms with a linear technology that transforms one unit of effective labor n into one unit of the consumption good (numeraire).

The economy has a given aggregate stock of owner-occupied housing H_o and a given aggregate stock of rental housing H_r. We denote by $\tilde{y}_t$ the sum of aggregate demand for goods plus housing investment to cover depreciation costs:

$$
\begin{aligned}
\tilde{y}_t = & \int c_t^{owner}(h, m, a, z, \delta)\, d\Psi_t^{owner}(h, m, a, z, \delta) + \int c_t^{renter}(a, z)\, d\Psi_t^{renter}(a, z) \\
& + \int c_t^{defaulter}(m, a, z)\, d\Psi_t^{defaulter}(m, a, z) + P_{ht}\mathbb{E}\left[\delta_t\right] H_o
\end{aligned} \tag{12}
$$

We assume that there is a lower bound on the real interest rate

$$
r \geq \underline{r}. \tag{13}
$$

For example, nominal rates face the zero-lower bound and inflation expectations are anchored. When the economy hits the lower bound (13) then we assume there is rationing in goods markets, like in Korinek and Simsek (2014). That is, competitive suppliers solve

$$\Pi = \max_{n \geq 0} \left\{ n - wn \right\} \quad \text{subject to} \quad n \leq \tilde{y} \;\; \text{if } r = \underline{r},$$

where $\tilde{y}$ is aggregate demand that constrains output when (13) binds. In this case, the wage w is such to encourage households to work and generates firms profits ($w < 1$) that we rebate to households according to their productivity to avoid creating a new channel of wealth redistribution. In the quantitative simulations we assume that $\underline{r}$ is the level of interest rates in the stationary equilibrium.

An equilibrium is a sequence of interest rates, owner occupier price, rental house price, and rents $\{r_t, P_{ht}, P_{rt}, P_{st}\}$, individual decision rules, mortgage price function $\{q_t(m', h, a', z)\}$, a sequence of distributions $\{\Psi_t^{owner}(h, m, a, z, \delta), \Psi_t^{renter}(a, z), \Psi_t^{defaulter}(m, a, z)\}$ such that, given initial distributions $\Psi_0^{owner}(h, m, a, z, \delta)$, $\Psi_0^{renter}(a, z)$ and $\Psi_0^{defaulter}(m, a, z)$, the decision rules are optimal, the mortgage pricing function satisfies (11), the distribution of households is consistent with the exogenous law of motion and the decision rules, and the owner-occupied housing, rental housing, credit, and goods market clear.

4 Calibration

We divide the parameters into two groups. First, those that we assign exogenously following micro-evidence and standard values in the literature. Second, those parameters endogenously selected to match some targets. Table 1 summarizes the parameters. A period in the model corresponds to a year.

A. Parameters calibrated exogenously. We assume CRRA utility over a CES aggregator and GHH preferences modified as in Bayer et al. (2015) to ensure that labor supply only depends on the aggregate wage per efficiency unit:

$$u(c, s, \ell) = \frac{\left[\eta \left(c - \psi z \frac{\ell^{1+\frac{1}{\gamma}}}{1+\frac{1}{\gamma}} \right)^{\frac{\epsilon-1}{\epsilon}} + (1-\eta) s^{\frac{\epsilon-1}{\epsilon}} \right]^{\frac{\epsilon(1-\sigma)}{\epsilon-1}}}{1-\sigma} \tag{14}$$

With these preferences, all households optimally choose to supply the same number of hours given the aggregate wage: $\ell_t = \left[\frac{w_t}{\psi}\right]^{\gamma}$. This allows to calibrate the earnings process directly from earnings data and simplifies the solution of the model as discussed in the Appendix.

Several papers have argued that the elasticity of intratemporal substitution ϵ is below one. We set ϵ to 0.5, a value within the accepted range. We set the Frisch elasticity of labor supply γ to 0.5, and the disutility of labor to ψ to 6.25 so that hours worked equal 40% of their time endowment in steady state.

In the model, individual earnings are given by $wz\ell$. Since under our preferences all households choose the same number of hours, labor earnings are proportional to labor productivity z. To calibrate the earnings process, we follow the literature and assume

$$\begin{aligned} \ln z' &= \bar{z} + \rho \ln z + \varepsilon, \\ \varepsilon &\sim N(0, \sigma_\varepsilon^2), \end{aligned} \tag{15}$$

and we set the standard deviation of the innovations σ_ε to 0.129 like Storesletten, Telmer and Yaron (2004), and the persistence parameter ρ to match the earnings Gini index 0.43 of the 2004 Survey of Consumer Finances (SCF) for prime age households with positive wage income.[5] The value for $\bar{z}$ is chosen so that the mean productivity over the cross section equals 1.

We set $\underline{\delta} = 0$ and $\bar{\delta} = 0.22$, following Pennington-Cross (2006), who find that the loss in value of a foreclosed house is about 22%. The mortgage decay parameter μ is set to 0.985. The benchmark economy features no recourse and thus we set the fraction labor income and deposits garnished by lender ϕ to 0. For the recourse economy, we set ϕ to 0.5.

B. Parameters calibrated endogenously. The remaining parameters of the model (β, σ, η, $\underline{h}$ and ω), are calibrated to match the following targets for the U.S. (non recourse economy): 1) An equilibrium risk-free rate of 1%. 2) An aggregate share of housing services over total consumption expenditures of 14.1%. This is the average value over the last 40 years from NIPA data reported by Jeske, Krueger and Mitman (2013). 3) A homeownership rate of 66%, that is the U.S. average during the period 1970-2014. 4) A median leverage ratio for mortgagors of 61%, this value comes from the 2004 SCF. 5) A foreclosure rate for mortgagors of 1.5%, which is consistent with U.S. mortgage foreclosures between pre-2006 and post-2015. Table 2 compares the empirical targets with the model-generated moments.

[5] We approximate equation (15) with a seven-state Markov chain using the method of Rouwenhorst (1995). The Online Appendix reports the values for the income realizations (y), Markov transition matrix $\pi(y'|y)$ and invariant distribution $\Pi(y)$.

5 Results

We consider an unexpected shock to housing values, namely, an increase in the probability ω of the high realization of the depreciation shock $\bar{\delta}$. The shock is calibrated to trigger a collapse in housing prices of 20% at impact, as Figure 5 shows. Since homeowners must cover the depreciation of their houses, an unexpected increase in depreciation risk triggers a subsequent increase in foreclosures and a decrease in housing demand from non-owners, putting downward pressure on housing prices. Figure 6 displays the transition path for the aggregate foreclosure rate while Figure 7 shows that the aggregate consumption dynamics.

Figures 5 and 7 show that after a similar fall in housing prices in the non-recourse and recourse economies, the recourse economy displays a slower recovery in housing prices and aggregate consumption. First we discuss the common mechanisms and then the differences.

In both economies, the increase in foreclosures and the drop in housing demand raises rental rates, thus reducing consumption for renters and defaulters. The decrease in demand for mortgage credit triggers a drop in the real interest rate. Output becomes demand-driven once the real interest rate binds (13). The goods market becomes rationed and lower demand for labor leads to lower wages.

Figures 8 and 9 plot the consumption response by percentiles of the wealth distribution in the stationary equilibrium before the shock hits. The shock has asymmetric effects on consumption across households depending on their tenure, default status, and balance sheet. This heterogeneity translates into marginal propensity to consume (MPC).

In both economies households in the lowest percentile of the wealth distribution reduce consumption the most. Most of these households are renters and high leveraged mortgagors. These households are characterized by a large MPC out of transitory income changes. Consumption for these households falls strongly because housing wealth falls or because rents increase. Mid-wealth households, who are mostly mid-leveraged mortgagors, homeowners with no debt, and wealthier renters, display a smaller reduction in consumption as their MPC is lower. On the contrary, rich-wealth households, who are low leveraged mortgagors, homeowners with no debt and large assets in the form of deposits and REIT shares, increase their consumption. Rich-asset, low risk renters benefit from lower mortgage rates and access homeownership. The drop in the interest rate encourages rich households to reduce their savings and increase consumption.[6]

[6]The no-arbitrage condition between deposits and REIT shares implies that REIT share prices raise as interest rate falls and rents increase. Gete and Zecchetto (2016) study a model with wealth redistribution from renters to landlords.

The different dynamics of the two economies can be explained with the different paths of default shown in Figure 6. Under non recourse mortgages, households can reduce their debt burden faster. However, many mid and low-wealth, high-indebted households that would have defaulted under non-recourse prefer not to do so under recourse, preventing them from discharging their debt burden faster. Moreover, households that default under recourse are still liable for the outstanding mortgage debt. Under non-recourse those households have their debt extinguished even if the value of the house did not cover the debt balance.

The faster debt discharge of the high MPC households in the non-recourse economy encourages faster consumption growth and higher housing demand that raises housing prices. With recourse, households who default need to devote a fraction of their total income to recourse payments, reducing their consumption. The depressing effects on consumption are much larger.

6 Conclusions

In this paper we have studied whether the structure of the housing finance system can alter the reaction of the economy to housing shocks. We demonstrated that when agents are heterogenous in their marginal propensities to consume, and if there are long-term mortgages and downward interest rate rigidities, then recourse housing systems slow the recovery. Quantitative simulations of the model show that the results are non-trivial, up to 3 percentage points of aggregate consumption. That is 25% of the average gap between the U.S. and Spain can be attributed to the recourse mortgage system.

The paper shows that mortgage default triggers a mechanism to mitigate the consumption effects from downward interest rate rigidities. Those rigidities prevent a fall in interest rates from stimulating demand from the wealthy households, who are the savers of the economy. Default redistributes wealth away from those households making their lack of consumption less painful for the economy.

A caveat to our results is that in this model there are no negative externalities from default. Future research will evaluate how incorporating externalities would alter the results.

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Tables

Table 1: Parameters (benchmark calibration).

Parameter	Value	Description
		Exogenous Parameters
Parameter	Value	Description
ϵ	0.5	Intratemporal elasticity of substitution
γ	0.5	Frisch elasticity labor supply
ψ	6.25	Disutility labor supply
ρ	0.986	Persistence labor earnings
σ_ε	0.129	Volatility labor earnings
γ	0.78	Foreclosure recovery rate
$\underline{\delta}$	0	Low realization housing depreciation
$\overline{\delta}$	0.22	High realization housing depreciation
μ	0.985	Mortgage decay
ϕ	0	Assets garnishment ($\phi = 0.5$ if recourse)
		Endogenous Parameters
η	0.518	Housing share in consumption
σ	2.13	CRRA parameter
β	0.948	Discount factor
$\underline{h}$	4.82	Minimum house size
ω	0.082	Probability high depreciation shock

Table 2: Steady state moments: recourse and no recourse.

Variable	Recourse	No recourse
Risk-free rate (%)	1	0.98
Homeownership rate (%)	67.3	65.2
% of homeowners with debt	86.6	59.6
Foreclosure rate (%)	0.94	1.54
Mean mortgage spread (%)	0.447	0.789
Std. deviation mortgage spread (%)	0.388	0.363
Wealth Gini index	0.56	0.59
Median debt-to-value mortgagors (%)	73.4	67.5
% mortgagors with debt-to-value $\geq$ 90%	14.1	0
Housing stock / GDP	4.14	4.13
Mortgage stock / GDP	1.39	1.16
House price	1	0.98
Shelter price	0.0343	0.0348
Price-to-rent ratio	29.1	28.2

Note: This table compares the steady state moments of the economy with recourse and with no recourse. Bp means basis points.

Figures

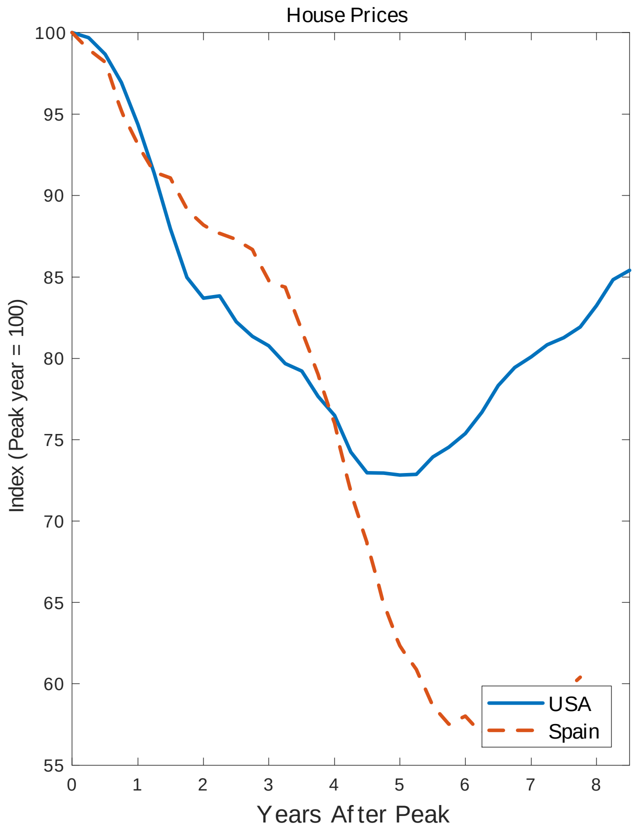

Figure 1. Real Housing Prices in Spain and the U.S. after the 2007-08 Crisis.
Source: Analytical House Price Database (OECD).

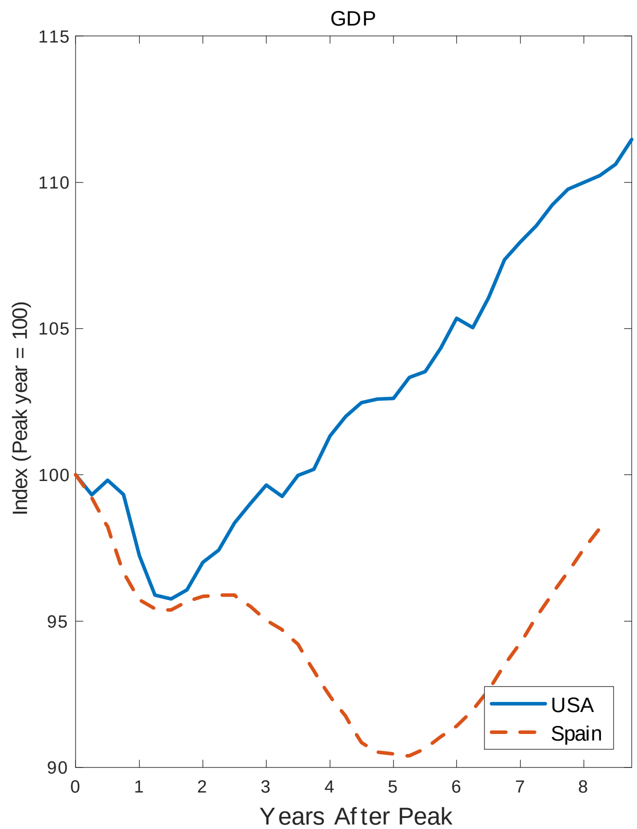

Figure 2. Real Gross Domestic Product in Spain and the U.S. after the 2007-08 Crisis. Source: OECD National Accounts

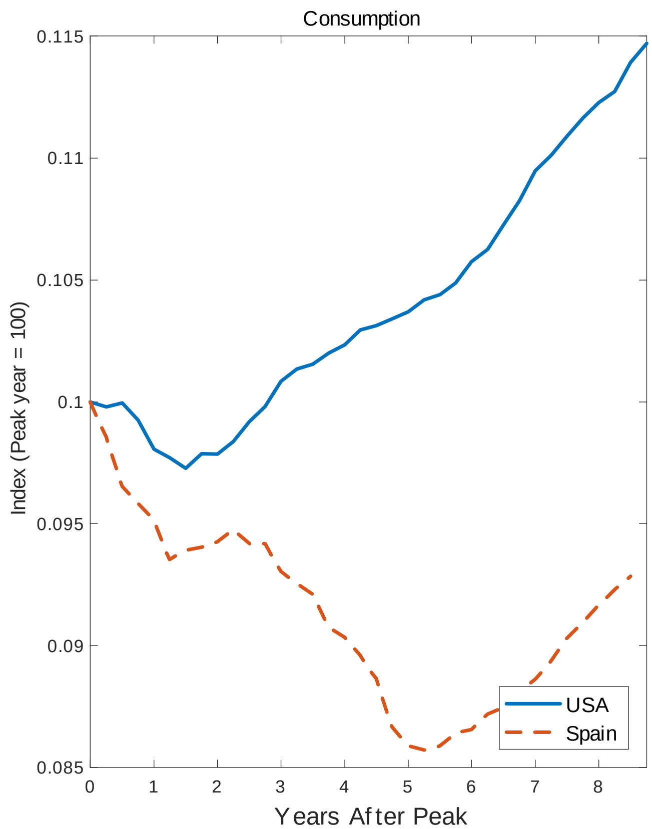

Figure 3. Real Aggregate Consumption in Spain and the U.S. after the 2007-08 Crisis. Source: OECD National Accounts.

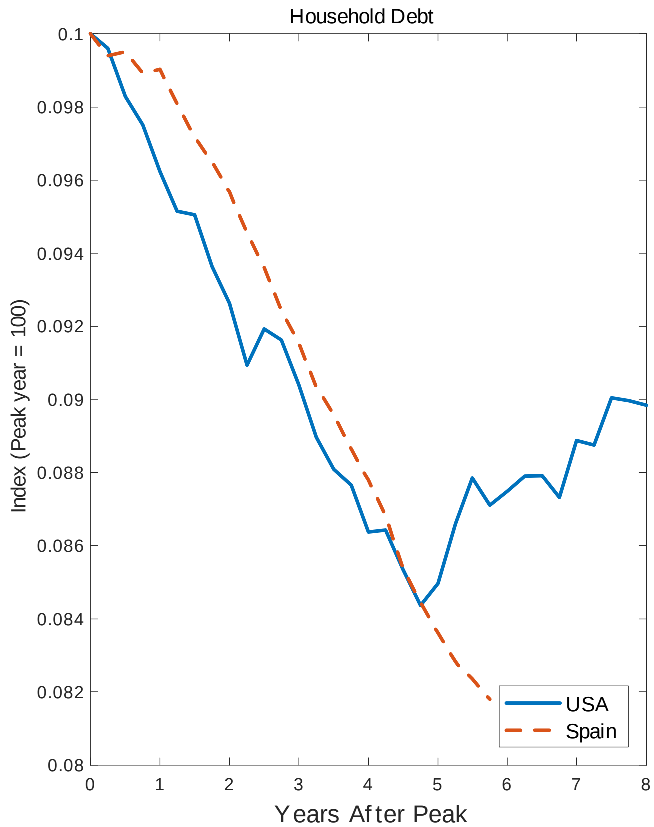

Figure 4. Household Mortgage Debt Balances in Spain and the U.S. after the 2007-08 Crisis. Source: Datastream.

Figure 5. Simulated paths of housing prices in economies with and without recourse for same initial drop.

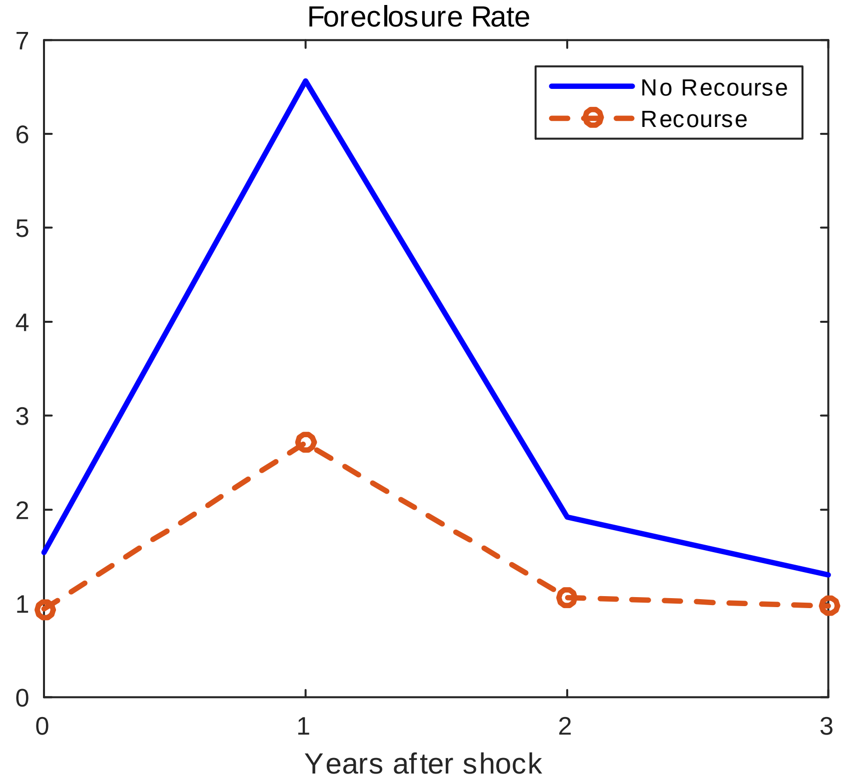

Figure 6. Simulated paths of housing foreclosures with and without recourse for same initial drop of housing prices.

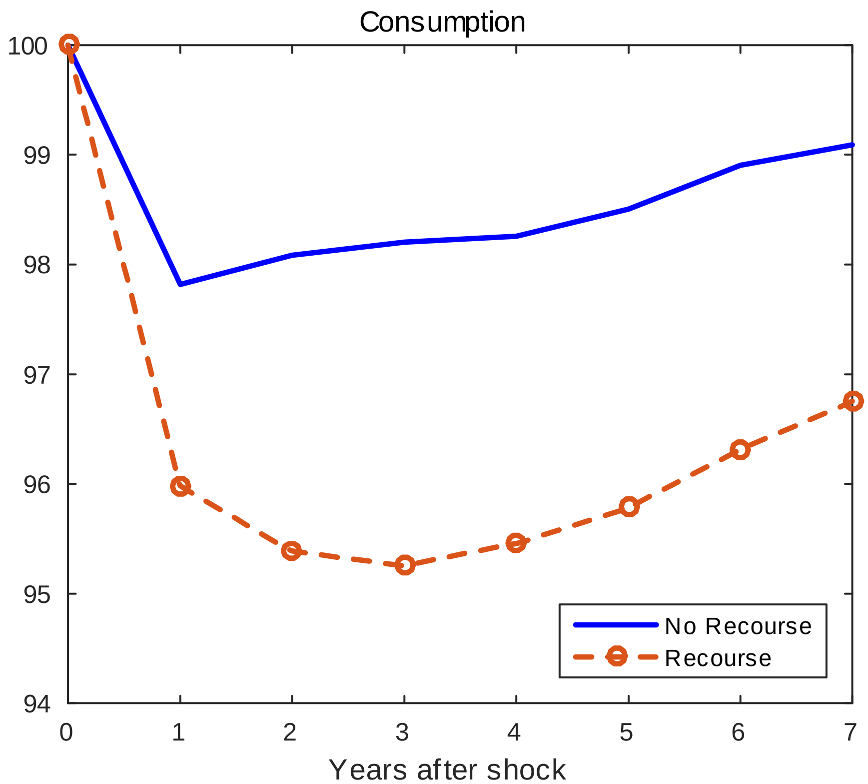

Figure 7. Simulated paths of consumption with and without recourse for same initial drop of housing prices.

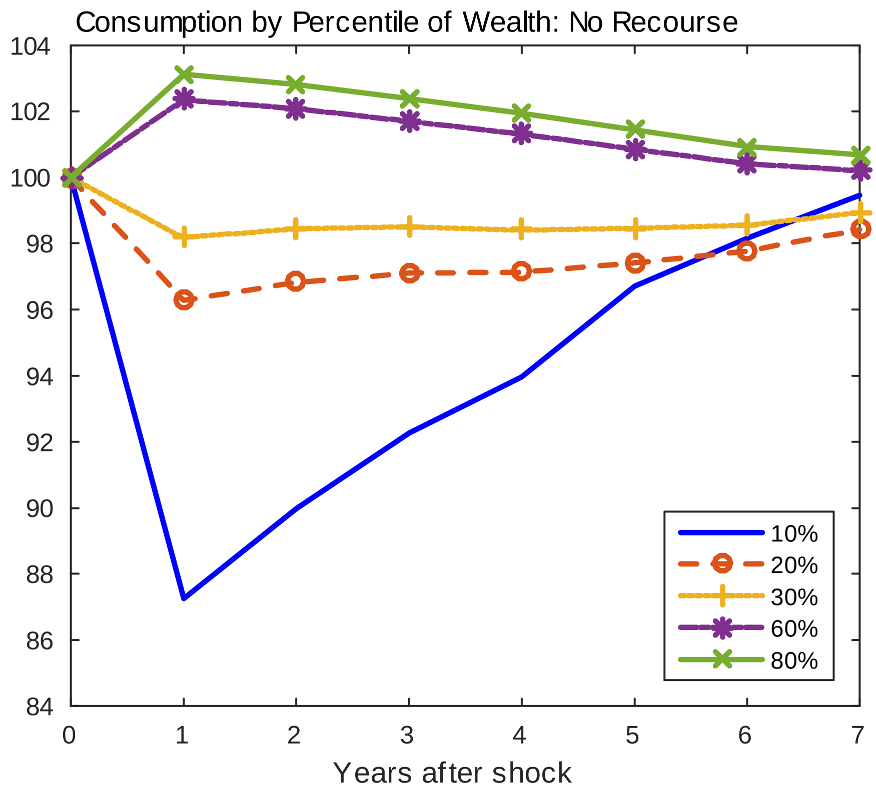

Figure 8. Simulated paths of consumption per wealth percentile in the non-recourse economy.

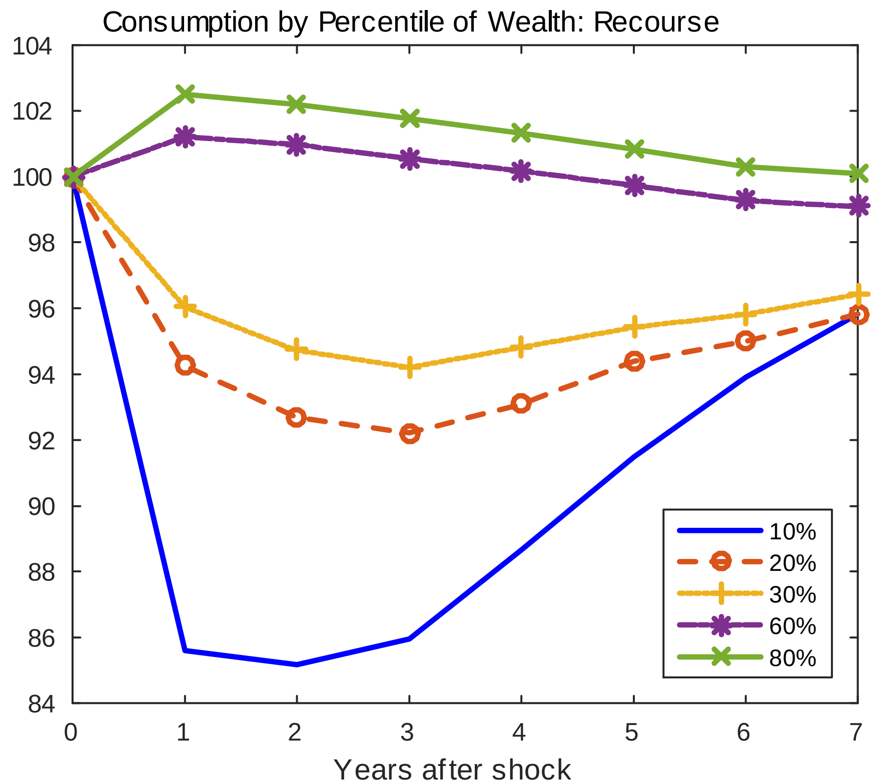

Figure 9. Simulated paths of consumption per wealth percentile in the recourse economy.