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The macro-financial implications of house price-indexed mortgage contracts

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HIGHLIGHTS

- A mortgage contract that eliminates negative equity is constructed.
- The contract reduces outstanding debt when house prices fall.
- The contract is compared to a standard contract in an incomplete markets model.
- Changes in leverage, default, consumption, and interest rates are quantified.
- Aggregate and distributional effects are both considered.

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ABSTRACT

I explore an alternative mortgage contract that limits negative equity by tying outstanding debt to an index of house prices. This is done in an incomplete markets model, that is calibrated to match US micro- and macro-data. I find that switching from a non-recourse contract to an indexed contract reduces the default rate from .72% to .11% and expands homeownership rates among the young and the poor but pushes up the equilibrium base mortgage rate by 90 basis points. The volatility of net cashflows to financial intermediaries also increases slightly under the new contract.

1. Introduction

A standard, non-recourse mortgage does not adjust its terms when the value of the underlying collateral changes. One consequence of this contract structure is that large reductions in house prices will cause households to have negative equity. Recent empirical work suggests that negative equity, coupled with unemployment and a weak asset position, leads to mortgage default.[1]

Consequently, a contract that adjusts with house prices to prevent negative equity will preclude default. This is accomplished by shifting the burden of the house price reduction to the lender. If house prices drop and a household is hit with an income shock simultaneously, she can sell, rather than defaulting. Under a standard contract, a household that experiences the same set of shocks can neither sell nor make payments, resulting in a breach of contract that initiates the foreclosure process.

In the following section, I setup an incomplete markets model in the style of Huggett (1993) and Aiyagari (1994) that features mortgage default. The model will not have aggregate uncertainty, as in Krusell and Smith (1998) but will emulate it in a stationary model by constructing regions that experience idiosyncratic shocks to housing productivity. This second tier of idiosyncratic shocks (above households, but below the aggregate economy) makes it possible to create localized credit crunches, as default probabilities and house price movements comove within a region. I then solve and simulate the model under two classes of contracts: (1) a standard, non-recourse mortgage contract; and (2) an alternative, house-price-indexed (HPI) contract, which is constructed

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1 See Gerardi et al. (2013) and Foote et al. (2008).

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to eliminate negative equity. The latter contract is similar to the shared-responsibility mortgage (SRM) proposed by Mian and Sufi (2014, Ch. 12).

2. The model

2.1. Firms

The firm side of the economy consists of (1) a consumption goods producer who rents labor services; and (2) a region-specific technology that permits all households to transform the consumption good into housing units.

2.1.1. Consumption goods

Consumption goods are produced using labor and are subject to decreasing returns:

$$Y_t = N_t^{\alpha}. \tag{1}$$

Firms maximize profits, yielding the factor price for labor, where N_t is the mass of employed workers:

$$w_t = \alpha N_t^{\alpha-1}. \tag{2}$$

2.1.2. Housing investment

The housing production specification is based on Glover et al. (2011) but allows for regional heterogeneity. Agents in each region have access to a linear technology that transforms the consumption good into housing. If agent i in region j builds with c_{it}^h units of the consumption good, it will yield ih_{it} new units of housing:

$$ih_{it} = c_{it}^h e^{U_{jt}}, \tag{3}$$

where $U_{jt} = u_H + \rho_H U_{jt-1} + \epsilon_{jH}, \epsilon_{jH} \sim N(0, \sigma_{jH})$. Total housing investment can be written as follows:

$$IH_t = \sum_{i \in I} \sum_{j \in J} c_{it}^h e^{U_{jt}} \mu_i, \tag{4}$$

where μ_i is agent i's mass and where IH_t denotes the aggregate. The housing stock evolves as follows:

$$H_{t+1} = H_t + IH_t - \delta_H H_t, \tag{5}$$

where δ_H is housing stock depreciation.

2.2. Households

Households work for T^W periods, retire and receive a pension for T^R periods, and then perish with certainty. An employed household that is age a and productivity type g at time t receives a wage, $w_t \eta_{ag}$, where η_{ag} is productivity weight of age cohort a and permanent productivity type g. Unemployed and retired agents receive a transfer payment from the government, x_t. Households pay an age and productivity-specific tax, Γ_{it}, which yields the following income process:

$$y_{it} = \begin{cases} w_t n_{a_{it} g_{it}} - \Gamma_{a_{it} t} & \text{if employed} \\ x_t & \text{if unemployed or retired.} \end{cases} \tag{6}$$

Households consume two types of goods: (1) non-durable goods, which serve as the numeraire; and (2) service flows from housing, which are proportional to the size of the housing stock, h_{it}:

$$u(c_{it}, h_{it}) = \frac{c_{it}^{1-\sigma_c}}{1-\sigma_c} + \frac{h_{it}^{1-\sigma_h}}{1-\sigma_h}. \tag{7}$$

Households also accumulate bank deposits, borrow in the form of collateralized mortgages, and choose whether or not to default on mortgage debt, yielding the following budget constraint:

$$c_{it} + \phi(h_{it}, h_{it-1}) + d_{it} + p_{jt}^h h_{it} + m_{it} = y_{it} + (1+r)d_{it-1} + p_{jt}^h h_{it-1}(1-\delta_H) + b_{it}. \tag{8}$$

Note that p_{jt}^h is the relative price of housing, m_{it} is the mortgage payment, and b_{it} is the unpaid balance on the mortgage.

Households face a concave adjustment cost, $\phi(h_{it}, h_{it-1})$, which generates lumpy investment (i.e. infrequent moves). As in Iacoviello and Pavan (2013), there is a minimum house size, $\underline{h}$, and agents who cannot own have access to a small, fixed amount of non-housing shelter.[2]

Additionally, I apply a novel constraint that makes holders of one-period mortgages behave as if they held long-term debt:

$$b_{it}^H \le \begin{cases} \lambda p_t^h h_{it} & \text{if } |h_{it} - h_{it-1}| > 0 \\ \lambda p_t^h h_{it} & \text{if } b_{it-1} < \lambda p_t^h h_{it} \,\&\, h_{it} = h_{it-1} \\ b_{it-1} & \text{otherwise,} \end{cases} \tag{9}$$

where $\lambda \in (0, 1)$ denotes the maximum loan-to-value ratio. The regional subscript, j, is omitted to simplify notation.

This constraint identifies when a household in the model moves and then uses each move to identify when a new contract is needed. If a household does not move, then it may remain in the same mortgage, even if the LTV ratio constraint is violated; however, if it does move, then a new contract is needed and the LTV ratio constraint must be satisfied. This achieves the following: (1) it prevents spurious default that arises from one-period contracts with a collateral constraint; (2) it permits mortgage equity withdrawal within an existing contract; and (3) it allows negative equity, rather than forcing instantaneous deleveraging.

I also borrow a constraint from Iacoviello and Pavan (2013) that limits borrowing to a fraction, γ, of discounted, remaining lifetime earnings:

$$b_{it}^I = \gamma E_t \sum_{s=t}^{T-a+s} \beta^{T-a+t} y_{is}. \tag{10}$$

In addition to acting as a debt-to-income constraint and a feasibility of repayment constraint, this restriction also requires households to amortize smoothly over the lifecycle, matching a critical feature of longer-term debt contracts. The final constraint combines the previous two:

$$b_{it} \le \min\{b_{it}^H, b_{it}^I\}. \tag{11}$$

That is, the maximum amount a household can borrow is the minimum implied by the two borrowing constraints.

Deposits yield the equilibrium interest rate, r, and borrowers pay an individual-specific mortgage rate, ξ_{it}, which depends on the contract structure. Defaulters ($\psi_{it} = 1$) forfeit their housing stock and are temporarily excluded from the mortgage market.

With the choice problem fully specified, we may collect the state variables, $z_{it} = \{d_{it-1}, \psi_{it-1}, h_{it-1}, b_{it-1}, \epsilon_{it}, a_{it}, g_i, r, p_{jt}^h\}$ and the parameters $\Omega = \{\alpha, \sigma_h, \gamma, \lambda, \rho_{jU}, \sigma_{jU}, \delta_h\}$ to simplify notation. The dynamic programming problem for the household, subject to Eqs. (1)–(11), may be written as follows:

$$V_{it}(z_{it}; \Omega) = \max_{\{c_{it}, d_{it}, h_{it}, b_{it}, \psi_{it}\}} u(c_{it}, h_{it}) + \beta E_t V_{it+1}(z_{it+1}; \Omega). \tag{12}$$

[2] A common, alternative assumption is that the cost of renting is a function of the expected, next period house price and depreciation; however, this suggests much more rental price volatility than we see empirically at a business cycle frequency—especially in the years surrounding the Great Recession.