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Credit constraints, house prices, and the impact of life cycle dynamics

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HIGHLIGHTS

- Housing behavior is sensitive to the choice of life cycle vs. infinite horizon model.
- Life cycle features magnify the equilibrium house price response to tighter credit.
- Model dynamics depend both on stocks and flows of housing and mortgage debt.
- Greater housing churn and flows of high leverage debt are key sources of volatility.

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ABSTRACT

How does the life cycle impact house price dynamics? This paper investigates how equilibrium house prices respond to a tightening in credit constraints under two different but similarly calibrated models: one an infinite-horizon setting and the other a life-cycle environment. The main conclusion is that house price dynamics are magnified by the presence of life cycle features. Two primary explanations stand out: the distinction between *stocks* and *flows* of mortgage debt in the cross-section and the importance of gross housing tenure flows, i.e. churn.

1. Introduction

Events in global housing markets over the past 15 years have sparked intense interest in the determinants of house prices and their macroeconomic spillovers. However, with researchers coming at these issues from a variety of angles, no consensus has emerged regarding the choice between which of two canonical classes of model to employ: the infinite-horizon framework or a life-cycle environment. For topics that deal explicitly with age or demographics, life-cycle models are clearly necessary. However, for the broad umbrella of macroeconomics and housing as a whole, the question remains regarding how much the life cycle impacts housing dynamics, particularly prices.

Undoubtedly, many papers *utilize* a life-cycle macro-housing model, such as Corbae and Quintin (2015); Chambers et al. (2009); Li et al. (2016); Bajari et al. (2013); Hatchondo et al. (2015); Ortalo-Magné and Rady (2006); Attanasio et al. (2012); Favilukis et al. (2017). In some cases, the authors even study housing demand or other housing-related individual behavior over the life cycle. However, this paper sets out to study the impact of the life cycle

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itself on the dynamic house price response to a tightening in borrowing limits relative to an infinite-horizon model. In that sense, this paper is most similar in spirit to Peterman and Sager (2018), who study the implication of life cycle motives for the optimal level of public debt. Also related is Wong (2018), who examines how demographics alter the transmission of monetary policy. Wong (2018) takes house prices as given, whereas the focus here is on equilibrium price dynamics.

The main finding in this paper is that life-cycle features magnify the decline in house prices after a tightening in down payment requirements relative to an infinite-horizon model, even when the two economies feature a nearly identical stock of housing wealth, liquid assets, and distribution of outstanding mortgage debt. However, behind these similarities, important differences between the two environments give clues about the source of amplification. First, the life cycle model features a thicker right tail in the *flow* of high-leverage new loans among borrowers lower down on the income scale. Because these borrowers are closest to the margin of renting and buying, their housing demand is most sensitive to credit constraints. Second, the life cycle model is characterized by significantly greater housing tenure churn between owning and renting. When credit tightens, rent-to-own transitions in the life-cycle model decline especially severely, which depresses housing demand and prices.

2. The model economy

The life-cycle and infinite-horizon economies both feature heterogeneous households, rental and owner-occupied markets for obtaining shelter, and competitive banks.

2.1. Households

Households have utility over consumption c and shelter s given by

$$\mathcal{U}(\{(c_t, s_t)\}_{t=0}^{\infty}) = \sum_{t=0}^{\infty}(\beta\rho)^t \frac{\left(c_t^{\omega} s_t^{1-\omega}\right)^{1-\sigma}}{1-\sigma},$$

where ρ is the survival probability. Shelter can be purchased as apartment space $s = a \in [0, \overline{a}]$ each period at unit price p_a or enjoyed as a dividend from owner-occupied housing, $s = h \in H$, which exists in fixed supply. Segmentation by quality, $\overline{a} \leq \min H \equiv \underline{h}$, partially motivates the decision to buy rather than rent. Houses are traded in a decentralized market with search frictions, as in Hedlund (2016). Sellers of house h choose list price x_s and sell with *decreasing* probability $\eta_s(x_s, h)$, while buyers choosing house h and bid price x_b buy with *increasing* probability $\eta_b(x_b, h)$. In other words, there is a trade off between the gains from trade and expected search time. Households receive a stochastic income endowment $e \cdot z$ with transitory $e \in E$ drawn from $F(e)$ and persistent $z \in Z$ that follows $\pi_z(z'|z)$. All households can save in one-period bonds b traded at price q, while homeowners can also borrow using defaultable mortgages. In the stylized life cycle economy, households who die are replaced by newborns at the lowest state $\underline{z} \in Z$ with zero assets, debt, and housing.

After learning their endowment (e, z) at the beginning of the period, homeowners with cash at hand y (the sum of income and bonds b), house h, and mortgage m first decide whether to list their house on the market and at which price x_s. Selling outcomes are then realized, and remaining homeowners with mortgages decide whether to make a regular payment, refinance, or default. Besides losing their house, defaulting borrowers also receive a credit flag $f = 1$ that excludes them from future borrowing until the flag disappears with probability $1 - \lambda_f$.

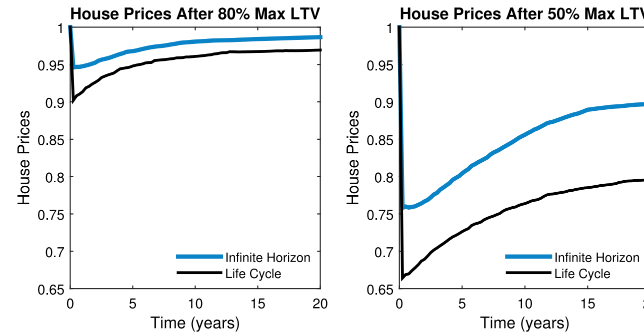

Fig. 1. House price dynamics after a tightening in downpayment constraints.

Table 1
Steady state model comparison.

Description	Infinite Horizon	Life Cycle
Homeownership Rate	68.1%	68.0%
Owner Housing Wealth/Income	3.95	3.99
Med Owner Liq Assets/Income	0.33	0.29
Median Loan-to-Value (LTV)	60.3%	57.5%
Share with $LTV \geq 80\%$	26.8%	24.4%
Share with $LTV \geq 90\%$	9.9%	12.9%
Share with $LTV \geq 95\%$	4.8%	8.4%
Foreclosure Rate	0.68%	0.43%

Note: The life cycle model has an annualized survival probability of $\rho = 0.975$, which implies an expected 40-year life span.

Agents entering the period without a house choose whether to continue renting or to search for a house to purchase. Prospective buyers with access to credit choose how much of the purchase to finance with debt vs. accumulated savings, while buyers with bad credit flags must pay entirely out of their existing cash at hand. The next section describes the mortgage lending environment and structure of loan contracts. Appendices B.2 and B.3 provide the value functions and equilibrium conditions, respectively.

2.2. Banks

Competitive banks have access to external financing at interest rate r. Mortgages are long-term contracts where default occurs in equilibrium. Thus, banks price each new mortgage m' individually according to the default risk of each borrower with state vector $X = (m', b', h, z)$. At origination, the borrower receives resources $q_m(X)m'$, and subsequently, the borrower makes payments $l \leq \underline{l} \equiv \frac{r_m}{1+r_m} m$ in excess of a minimum, interest-only payment each period. Borrowers roll over unpaid balances at rate r_m. Borrowers can also refinance subject to a proportional origination cost ζ.

Banks repossess and sell the houses of defaulting borrowers, losing a proportion χ of the proceeds to foreclosure costs. In the life cycle economy, if a borrower dies, the bank receives proceeds from an estate sale up to the value of outstanding debt. Appendix B.1 describes the recursive equilibrium mortgage pricing equation.

3. Calibration

The infinite horizon and life cycle calibrations both target the same key features of the mid-2000s U.S. economy, with some parameters set externally and the remainder determined jointly. The calibration details are provided in Hedlund (2018). Table 1 briefly compares the infinite horizon and life cycle economies.

4. Results

As Fig. 1 clearly shows, the quantitative response of house prices to a tightening in credit constraints depends significantly