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A behavioral model of house prices☆

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ABSTRACT

This paper proposes a model in which house prices are determined by economy-wide nominal income and nominal mortgage payments in the short run, while being determined by acquisition costs in the long run. The model, to a large extent, explains the 1995–2007 housing market run-up in the OECD countries by lower mortgage repayments, decreasing nominal interest rates, and increasing nominal GDP, partly induced by a large inflow of migrants. Empirical estimates give strong support for the model and suggest that it explains house prices in the OECD better than alternative models.

1. Introduction

The house price run-up in the OECD countries in the period 1995–2007 has often been attributed to rising income per household, increasing proportions of the population in the 20–35 year age group, lower nominal interest rates, and capital market innovations, in conjunction with an inelastic supply of houses in the short run (see, *e.g.* McCarthy and Peach, 2004; International Monetary Fund, 2004; OECD, 2005a; Brunnermeier and Julliard, 2008). However, there is no well-developed theory connecting house prices to income, demographic factors, nominal interest rates and capital market innovations. Despite this, income per capita or income per household remains one of the principal driving variables in the short as well as the long run in almost all models of house prices (Buckley and Ermisch, 1982; Meen, 1990, 2002; International Monetary Fund, 2004; OECD, 2005a; Gallin, 2006; Girouard et al., 2006). Thus far it has not been established theoretically why home prices should be positively related to income and, particularly, why the income elasticity of house prices is often close to one in empirical estimates that are, typically, calculated over relatively short periods. Nor has it been shown why house prices are responsive to migration and demographic factors in the short run but not in the long run and why house prices

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respond to financial innovations that change the mortgage payment profile over the time-span of a loan without changing the real user cost of capital. While liquidity constraints influence the shadow price of borrowing in traditional intertemporal optimization models, the testable implications of the theory have been difficult to derive due to the unobservability of key variables in such models (see for example Chah et al., 1995).

This research establishes a simple behavioral housing price model in which prices are driven by demand in the short run but by supply in the long run. The model is henceforth referred to as a repayment model. In the short run house prices adjust to the level at which the nominal mortgage expenditure is a fixed proportion of the after-tax income of house buyers based on the lending rules of banks. Anybody who has taken a mortgage loan knows that banks are willing to lend up to the amount at which the mortgage repayments are equal to a fixed proportion of current and expected income. This rule has long been stressed in the literature on loan provisions (see for example Weicher, 1977; Guttentag et al., 1991; Hulchanski, 1995; Savage, 1999; McCarthy and Peach, 2004). From this relationship it is shown that house prices are determined by the nominal mortgage interest rate, the principal repayment, the down payment, the after tax disposable income of house-buyers and house owners, financial innovations, and the net flow of potential house owners into the housing market. In the long run it is assumed that house prices are determined by the replacement costs of houses under the principle that house buyers and developers have an incentive to build new homes if house prices exceed their replacement costs.

The repayment model is behavioral in the sense that house buyers fail to acknowledge that inflation lowers the real value of debt and, as such, is consistent with the notion of money illusion (Shafir et al., 1997). Thus, house buyers are willing and able to take larger loans in periods of low inflation and low nominal interest rates than in periods of high inflation and high nominal interest rates because nominal mortgage expenses per dollar borrowed are lower. Thus, the repayment model deviates from conventional house price models in which house prices are determined entirely by the intertemporal decisions of consumers, by the present value of rent/housing services, or by the replacement costs of houses (Tobin's q models). In intertemporal models of consumers, the optimal allocation of housing services over the life cycle is determined by real user costs of housing and the marginal rate of substitution between housing services and consumption of non-durables. This marginal rate of substitution is usually assumed to be a positive function of income and demographic variables in the short run as well as in the long run (see for a survey Gallin, 2006; Girouard et al., 2006). In the repayment model the relevant measure of the cost of capital is the current after-tax nominal mortgage interest rate plus principal repayments.

The repayment model is outlined in the next section and the behavioral assumptions underlying the model are discussed in Section 3. Empirical estimates for the OECD countries are presented in Section 4 and the implications of the model are discussed in Section 5. Section 6 concludes the paper.

2. The model

The model consists of both a demand and a supply side with house prices being determined by demand in the short run and supply in the long run. First consider the short run.

2.1. Demand for houses

When a household applies for a housing loan, the bank and the household agree on a maximum fraction of the household's after-tax income that is available for mortgage repayments after other expenses are paid. The maximum is usually in the range of 25–30% depending on the country and the economic circumstances at the time, however, it rarely exceeds 30% (Weicher, 1977; Hulchanski, 1995; Bourassa, 1996; Savage, 1999). Based on the household's income, fixed expenses, mortgage expenses and other information, the bank estimates the maximum obtainable loan and, therefore, the household's highest affordable price. Since the housing stock is fixed in the short run, the nominal housing affordability of the average house buyer and the number of house buyers will, therefore, determine the average house price. The validity of this hypothesis is discussed in the next section.

To show how house prices are related to repayments consider the fraction of the current and expected disposable income of the representative house buyer, i, that is required to service the mortgage debt:

$$\Psi_{it} = \frac{[(i_{it} + t^p_{it})(1 - \tau_{it}) + \phi_{it}]M_{it} \cdot P^h_{it}}{Y^{\alpha}_{it}[E(Y_{i,t+1})]^{1-\alpha}} \tag{1}$$

where Y_i is current nominal disposable income (including government transfers) of the representative house buyer, E is the expectation operator, t^p is the property tax rate, τ is the tax rate at which interest rates and property taxes can be deducted, i is the nominal lending rate, ϕ is the ratio of the principal repayment as a percentage of the housing loan, P^h is the per square meter house price, M_i is the size of the house in square meters that the representative buyer purchases, Ψ_i is the fraction of the representative house buyer's current and expected disposable income that is used to service the mortgage debt, and α is the relative weighting of contemporaneous and expected income in the lending provision, $0 \leq \alpha \leq 1$. The weight, α, depends on the importance of current as opposed to expected income in the lending and borrowing decision. Since expected income measures the ability of the borrower to pay off the loan, full weight should, in principle, be given to expected income. However, current income may have full weight in the lending decision as some lending models may use current income as opposed to expected income in the lending decision.