The user cost, home ownership and housing prices: Theory and evidence from the US

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Abstract

From 1995 to the beginning of the subprime crisis, there was a substantial rise in real house prices and an increase in home ownership rates in the US. To understand this episode, we consider changes to the cost of home ownership over the period. The cost of owner-occupied housing services is measured by the user cost of housing which depends not only on house prices but on the preferential tax treatment of owner-occupied housing services, the availability of collateralized credit, the insurance role of owner-occupied housing against rental-price risk, as well as current and expected transaction costs. We then estimate the user cost of owner-occupied housing using U.S. data and show that it did not increase during the years of the price upsurge, which might explain the observed home ownership pattern. We also discuss possible factors that might explain the co-existence of rising housing prices and increasing home ownership rates.

Keywords: home ownership, user cost, rent-price ratio, collateralized borrowing constraints, house price risk, transaction costs.

Glossary:
home ownership rate: the number of owner-occupied housing units as a percentage of the total number of housing units.
User cost (of owner-occupied housing): the costs of the services provided by an owner-occupied housing unit incurred by the household consuming those services.
Tenure choice: the decision to rent or own a home.

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1 Home ownership and price patterns

From the mid-90s to 2007, we witnessed a substantial rise in real house prices and no significant decreases (and even modest increases) in home ownership rates. For example, in the US, the home ownership rate increased from 66.27 to 68.15 percent from 1998 to 2007, while houses appreciated around 60 percent in real terms over the same period. The question that arises is why this is the case when, at first sight, it may appear that owning a home becomes relatively more expensive than renting when house prices go up as rental prices tend to move only sluggishly with house price increases. Figure 1 depicts the price-rent ratio for houses, as well as the home ownership rate in the US from 1975 to 2009. The price-rent ratio is calculated by dividing two indices: the all-transactions house price index reported by the Federal Housing Finance Agency (FHFA hereafter) and the rental price of tenant-occupied non-farm housing from NIPA, both deflated by the CPI (all but shelter), at the quarterly frequency. (The price-rent ratio is normalized to be one in the first quarter of 1975.) The home ownership rate is computed using data from the U.S. Housing Vacancy Survey as the number of owner-occupied housing units as percentage of the total number of housing units. Prior to 1995, the changes in the price-rent ratio and home ownership rates were modest compared to the trajectories of both series after that date. There is also a positive and significant correlation between the two series. The price-rent ratio also increased significantly in many other OECD countries as documented by Girouard, Kennedy, van den Noord, and Andr (2006).

Why did home ownership not decrease significantly as houses were becoming more expensive? The answer to this question hinges on understanding that house prices alone are not a good proxy for the cost of home ownership. There are other costs but also benefits associated with owning a home that cannot be ignored. On the benefits side, buying a house insulates the consumption of housing services from variations in the rental price of housing as rents do vary with house prices. In terms of taxation, owner-occupied housing services are not taxed and mortgage interest payments and property taxes are also deductible from the income tax base in many countries, including the US. Houses also provide access to collateralized credit. On the cost side, houses are illiquid assets and, hence, a very poor vehicle for shielding nondurable consumption against transitory income risk. Furthermore, homeowners wealth is also exposed to house-price risk whereas renters wealth is not.

The housing literature in economics argues that there is a more appropriate measure of the cost of owning houses called the *user cost* of owner-occupied housing services. In what follows, we focus on understanding the user cost measure (which can be derived from a simple model of housing as the shadow price of housing services) and evaluate the growing literature that assesses whether the recent spree on house prices can be explained by fundamentals.

2 The user cost of owner-occupied housing

To introduce the concept of user cost, we focus first on a simple model of housing tenure in the presence of house-price risk.

2.1 The shadow price of housing services for homeowners

Following Díaz and Luengo-Prado (2008), we study a model in which investment in housing stock is subject to transaction costs (convex for simplicity) and where households face uncertainty about house prices, their earnings, and their lifespan.

Households live for up to T periods and face an exogenous probability of dying each period. They derive utility from nondurable goods and from housing services obtained from either renting or owning a home. One unit of housing stock provides one unit of housing services in both cases. The per-period utility of an individual of age t born in period 0 is $u\left(c_t, (1-x_t)\, f_t + x_t\, h_t\right)$ where c_t stands for nondurable consumption, f_t is the amount of housing services acquired in the rental market, h_t is the amount of services yielded by the household's residential stock, and x_t is a home ownership indicator. Households cannot buy and rent at the same time and discount the future at the rate ρ. ζ_t is the probability that a household is alive in period t.

Let m_t denote outstanding mortgage debt at the end of period t, which must satisfy the condition $m_t \leq (1-\theta)\, q_t\, h_t$, where q_t is the relative price of housing. This means that when buying a house, households must make a down payment $\theta\, q_t\, h_t$. Also, houses serve as collateral for loans (home-equity loans) with a maximum loan-to-value ratio $1-\theta$.

Households maximize expected life-time discounted utility and the household problem can be written as:

$$\max_{\{c_t,\, f_t, h_t,\, d_t, m_t,\, x_t\}_{t=0}^{T}} E_0 \sum_{t=0}^{T} \frac{1}{(1+\rho)^t} \zeta_t\, u\left(c_t, (1-x_t)\, f_t + x_t\, h_t\right), \tag{2.1}$$

subject to

$$\begin{aligned} c_t + (1-x_t) r_t^f f_t + d_t - m_t + x_t q_t h_t + \mathcal{C}\left(h_t, h_{t-1}\right) \leq \\ \widehat{w}_t + \left(1+\widehat{r}^d\right) d_{t-1} - (1+\widehat{r}^m)\, m_{t-1} + (1-\delta_h-\widehat{\tau}_h) x_{t-1} q_t h_{t-1}, \ \ \forall t = 0, \ldots, T, \end{aligned} \tag{2.2}$$

$$m_t \leq (1-\theta) q_t h_t \ \ \forall t = 0, \ldots, T-1, \ \ m_T = 0, \tag{2.3}$$

$$c_t \geq 0, \ f_t \geq 0, \ h_t \geq 0, \ d_t \geq 0, \ m_t \geq 0, \ x_t \in [0,1], \ \ \forall t = 0, \ldots, T, \tag{2.4}$$

where equation (2.2) if the budget constraint with expenses on the left-hand-side and resources on the right-hand-side. r_t^f is the rental price of housing, δ^h is the depreciation rate of housing, and $\widehat{\tau}_h\, q_t\, h_{t-1}$ are property taxes net of deductions. $\widehat{w}_t$ is after-tax earnings and $\widehat{r}^d$ is the net return to financial assets, d_t. For simplicity, the return to financial assets is riskless, as is the mortgage interest rate denoted by $\widehat{r}_m$ after tax deductions. Both interest rates are constant over time and $\widehat{r}^d \leq \widehat{r}^m$. The convex (and differentiable) adjustment cost $\mathcal{C}\left(h_t, h_{t-1}\right)$ is zero if the change in the stock is smaller than $\delta^h h_{t-1}$ and increases with the difference $h_t - h_{t-1}$. We assume the adjustment cost is convex to facilitate the analysis, but bear in mind that convex adjustment costs produce slow and continuous movements in housing investment, as opposed to the lumpy movements observed in reality (see Grossman and Laroque 1990).

Households who opt for renting equate the marginal rate of substitution of housing services for nondurable consumption to the rental price of housing; that is, the shadow price of housing

services is the rental price of housing:

$$\frac{u_s(c_t, s_t)}{u_c(c_t, s_t)} = r_t^f. \tag{2.5}$$

Different scenarios are possible for households who decide to become homeowners. If households are sufficiently wealthy and carry no mortgage debt, the shadow-price of housing services is:

$$\frac{u_s(c_t, s_t)}{u_c(c_t, s_t)} = \mathcal{C}_1(h_t, h_{t-1}) q_t + \frac{\widehat{r}^d q_t}{1+\widehat{r}^d} - \frac{E_t(q_{t+1} - q_t)}{1+\widehat{r}^d} + \frac{E_t\left[q_{t+1}\left(\delta^h + \widehat{\tau}_h + \mathcal{C}_2(h_{t+1}, h_t)\right)\right]}{1+\widehat{r}^d} - \xi_t, \tag{2.6}$$

where $\mathcal{C}_1(h_t, h_{t-1})$ is the partial derivative of the current adjustment cost with respect to h_t, and $\mathcal{C}_2(h_{t+1}, h_t)$ is the partial derivative of the adjustment cost in period $t+1$ with respect to h_t. Expression (2.6) shows that the shadow price of owner-occupied housing comprises current transaction costs, $\mathcal{C}_1(h_t, h_{t-1}) q_t$, the present value of the forgone return to housing equity, $\widehat{r}^d q_t$, the present value of future capital gains, $E_t(q_{t+1} - q_t)$ (with a negative sign), the present value of the cost of maintenance, property taxes and future transaction costs, $E_t\left[q_{t+1}\left(\delta^h + \widehat{\tau}_h + \mathcal{C}_2(h_{t+1}, h_t)\right)\right]$, and finally a term which comprises covariances, ξ_t.

Homeowners who are not liquidity constrained (equation (2.3) is not binding) but carry debt face the shadow price:

$$\frac{u_s(c_t, s_t)}{u_c(c_t, s_t)} = \mathcal{C}_1(h_t, h_{t-1}) q_t + \frac{\widehat{r}^m q_t}{1+\widehat{r}^m} - \frac{E_t(q_{t+1} - q_t)}{1+\widehat{r}^m} + \frac{E_t\left[q_{t+1}\left(\delta^h + \widehat{\tau}_h + \mathcal{C}_2(h_{t+1}, h_t)\right)\right]}{1+\widehat{r}^m} - \xi_t, \tag{2.7}$$

which is greater than or equal to (2.6) because $\widehat{r}^m \geq \widehat{r}^d$, which increases the forgone return to housing equity. That is, holding debt increases the shadow price of owner-occupied housing services.

Finally, the shadow price for liquidity constrained homeowners is:

$$\frac{u_s(c_t, s_t)}{u_c(c_t, s_t)} = \mathcal{C}_1(h_t, h_{t-1}) q_t + \frac{\left[\theta\left(\lambda_t / E_t\lambda_{t+1} - 1\right) + (1-\theta)\widehat{r}^m\right] q_t}{\lambda_t / E_t\lambda_{t+1}} - \frac{E_t(q_{t+1} - q_t)}{\lambda_t / E_t\lambda_{t+1}} + \frac{E_t(q_{t+1})\left(\delta^h + \widehat{\tau}_h + E_t\,\mathcal{C}_2(h_{t+1}, h_t)\right)}{\lambda_t / E_t\lambda_{t+1}} - \xi_t, \tag{2.8}$$

which is even higher than (2.7) and depends on homeowner's wealth. The poorer the homeowner, the higher the shadow price of owner-occupied of housing services. Note this shadow price decreases with the down payment.

In summary, the shadow price of owner-occupied housing services or expected user cost comprises current transactions costs, the forgone return to housing equity and/or the cost of mortgage payments plus future expected transaction costs, maintenance and property taxes, minus expected capital gains. Moreover, this shadow price, as opposed to the rental price, depends on households' wealth.

From now on, we assume the rental price of housing r_t^f is:

$$r_t^f = \frac{\widehat{r}^d q_t - E_t\left(q_{t+1} - q_t\right) + E_t\left(q_{t+1}\left(\delta^h + \widehat{\tau}_h\right)\right)}{\left(1-\tau_y\right)\left(1+\widehat{r}^d\right)}, \tag{2.9}$$

where τ_y is a proportional income tax rate. The rental price varies with house prices and incorporates the fact that housing rental income is taxable. This specification can be interpreted as the user cost for a landlord who is neither liquidity constrained nor is subject to adjustment costs. The landlord can deduct local housing taxes from income taxation but must pay income taxes on rental income. This choice is consistent with the estimates in Sinai and Souleles (2005), who find that the house price-rent ratio capitalizes expected future rents, as any other asset. Under this assumption, the shadow price of owner-occupied housing is not equal to the rental price because owner-occupied housing services are not taxed, even for homeowners who are not liquidity constrained and do not bear any transaction costs. The difference between the price of rental units and the shadow price of owner-occupied housing services is further amplified if the homeowner holds debt and is liquidity constrained.

2.2 The housing tenure decision

A household will buy a home if the shadow price just described is lower than the rental price of housing. Therefore, the rental price is the maximum price a household is willing to pay for housing services. The lowest shadow price, regardless of the evolution of prices, would be that of a homeowner who is not liquidity constrained, not planning to move, who bought its place in a previous period and has no mortgage, $\left(1-\tau_y\right) r_t^f - \xi_t$—combine equations (2.9) and (2.6) to get this expression. Thus, the shadow price of owner-occupied housing services must lie in the interval:

$$\frac{u_s\left(c_t, s_t\right)}{u_c\left(c_t, s_t\right)} \in \left[\left(1-\tau_y\right) r_t^f - \xi_t, r_t^f\right]. \tag{2.10}$$

We assume the covariance term ξ_t is nonnegative but its value depends on aggregate as well as idiosyncratic uncertainty. Clearly, the distribution of shadow prices for homeowners depends on market frictions, as well as the distributions of wealth and income. Importantly, the home ownership rate does not depend on the evolution of the price-rent ratio, but on the evolution of this shadow price with respect to the rental price. If more households turned to buying rather than renting during the last business cycle, it is because either liquidity constraints were eased, the tax advantages of home ownership increased, the covariance term ξ_t rose significantly for some reason, or because of divergence in expectations on housing appreciation between homeowners and landlords. Indeed, recent literature argues that the reduction in the down payment (meant to capture financial deregulation) is one of the main determinants of the observed increase in home ownership rates in the US (see Quercia, McCarthy, and Wachter 2003, Chambers, Garriga, and Schlagenhauf 2009 or Díaz and Luengo-Prado 2010, for instance).

2.3 Expected versus effective user costs

We have demonstrated that both the shadow price of owner-occupied housing services and the rental price incorporate expectations about future events, but while the rental price is well defined,

the shadow price is not for two reasons: 1) Non-convex adjustment costs, and 2) house-price uncertainty which opens a wedge between the shadow price (used by the household to make the tenure choice decision) and the realized cost of housing. Simply put, we may make saving decisions based on an expected return of, say, 10 percent, but if the actual return is 2 percent we record in our books the realized return of 2 percent, not the expected return of 10 percent.

Therefore, the actual cost of owning is an ex-post user cost (i.e., after uncertainty has been revealed) defined as follows:

$$uc_t = \Psi\left(h_t, h_{t-1}\right) q_t + q_t \left[\frac{\left(1-\mathcal{M}_t\right)\widehat{r}^d}{1+\widehat{r}^d}\right] + q_t \left[\frac{\mathcal{M}_t\,\widehat{r}^m}{1+\widehat{r}^d}\right] - \frac{\left(q_{t+1}-q_t\right)}{1+\widehat{r}^d} + \frac{q_{t+1}\left(\delta^h + \widehat{\tau}_h + \Gamma\left(h_{t+1}, h_t\right)\left(1-\delta^h\right)\right)}{1+\widehat{r}^d}. \quad (2.11)$$

Note the correspondence between the shadow price shown in (2.8) and the ex-post user cost. The first term is $\Psi\left(h_t, h_{t-1}\right) q_t$, the incurred buying cost. The second term, where $\mathcal{M}_t$ is the mortgage loan-to-value ratio, represents the forgone return of home equity. The third component, $\mathcal{M}_t\, q_t\, \widehat{r}^m_{t+1}$, measures the cost of the mortgage. The fourth component is the accrued capital gain (with a negative sign, since it lowers the user cost). The fifth term reflects maintenance costs, selling costs, $\Gamma\left(h_{t+1}, h_t\right)$, and property taxes (net of deductions). The last four terms are discounted by the after-tax interest rate. This user cost definition is different from that used by Poterba (1984), Himmelberg, Mayer, and Sinai (2005), and Poterba and Sinai (2008) in two respects: (1) we include transaction costs and, (2) we differentiate the cost of a dollar from own wealth invested in housing (given by the return to the alternative asset), and the cost of a borrowed dollar (the mortgage interest rate net of income tax deductions). This implies that user costs vary across households in the same location because of differences in mortgage loan-to-value ratios as well as differences in the time of house purchase.

A comparison of this expression to the rental price in equation (2.9) tells us that the difference between the two measures depends on the interest rate spread, the distortion imposed by the fact that owner-occupied housing services are not taxed, the existence of adjustment costs, and the divergence between expected and actual capital gains/losses.

2.4 Estimates of the effective user cost

Díaz and Luengo-Prado (2008) and Poterba and Sinai (2008) provide estimates for the average effective user cost in the US. Poterba and Sinai (2008) use data from the 2004 Survey of Consumer Finances (SCF), abstract from transaction costs, and estimate an average user cost of 6 percent in annual terms. They also report a real house-price inflation between 1980 and 2002 of 0.73 percent per year. They argue the user cost would increase by 10 percent if landlord tax treatment was applied to owner-occupied housing. Díaz and Luengo-Prado (2008) use data from the 1989 to 2004 waves of the SCF to calibrate a model that reproduces several aggregate statistics for those 15 years. These authors assume there is no home-price appreciation on average over the period. When transaction costs are ignored, Díaz and Luengo-Prado (2008) obtain a 4.4 percent annual user cost, or 5.3 percent if adding the average annual house-price inflation of 0.73 reported by Poterba and Sinai (2008). Thus, the estimates are close.

Davis, Lehnert, and Martin (2008) construct a quarterly time series of the user cost-price

ratio for the aggregate stock of owner-occupied housing in the United States, starting in 1960, by merging micro data from the last five decennial censuses of housing with indices for house prices and rents. They show that the rent-price ratio ranged from 5 to 5.5 percent between 1960 and 1995, but rapidly declined after 1995 falling below 4 percent by 2003 (those authors ignore transactions costs.) Figure 2 shows Davis, Lehnert, and Martin's estimate of the user cost-price ratio and the rent-price ratio. Since we do not have information on the units of the rent-price ratio, we have adjusted the latter so that both ratios are equal in the first quarter of 1975. The data of Davis, Lehnert, and Martin (2008) is available at Land and Property Values in the U.S., Lincoln Institute of Land Policy `http://www.lincolninst.edu/resources/`. The evolution of both ratios is similar for the period considered, but the estimated user cost-price ratio has been below the rent-price ratio since 1980 so factors other than house-price appreciation have been at play for the recent increases in home ownership. These factors range from changes in household characteristics such as age, income and education to relaxation of credit constraints. See Andrews and Sánchez (2011) for a very thorough evaluation.

As for the dispersion of the user cost across homeowners, Poterba and Sinai (2008) report that the user cost across households in their sample ranges from 4.7 to 7.2 percent, and that it decreases with household's wealth. Díaz and Luengo-Prado (2008) show that the user cost decreases with wealth and age. They also find that transaction costs increase the average effective user cost from 4.4 to 4.7 percent and find that its most important effect is increasing the dispersion of user cost across households since selling and buying depend on idiosyncratic households factors.

Díaz and Luengo-Prado (2008) conduct several exercises to assess how the difference between the average effective user cost and the rental price vary with financial conditions and other institutional features of the economy. For instance, a reduction of the down payment does not affect the rental price of housing but it lowers the user cost so that more households prefer owning to renting and, therefore the home ownership rate increases. Theirs is a partial equilibrium model economy, where prices follow a stochastic process exogenously given, but it illustrates some of the factors that may affect separately the demand for owner-occupied housing and rental housing.

We want to reiterate that the estimated effective user cost that most studies compute is different from the ex-ante measure that affects the tenure decision. Nevertheless, Díaz and Luengo-Prado's estimates are obtained by simulating a model economy that mimics some key features of the US, instead of direct computation using a formula such as equation (2.11) and the observed house-prices, interest rates, etc. in the US, which is what Poterba and Sinai (2008) and Davis, Lehnert, and Martin (2008) do. Díaz and Luengo-Prado find that the income tax rate is a good proxy of the difference between the rental price and the average ex-ante user cost.

3 User costs, house prices and home ownership rates

Since the mid-90s to 2007, we witnessed major financial deregulation of mortgage markets accompanied by historically low interest rates and rising incomes. We have argued that, even though house prices went up, the effective user cost remained below the rental price of housing as we did not observe decreases in home ownership rates. It is even possible that the higher housing prices were due to a demand effect caused by mortgage innovations and other factors such as changes in household characteristics and demographic trends. Many researchers are exploring frameworks that can jointly explain the observed behavior of housing prices and home ownership rates.

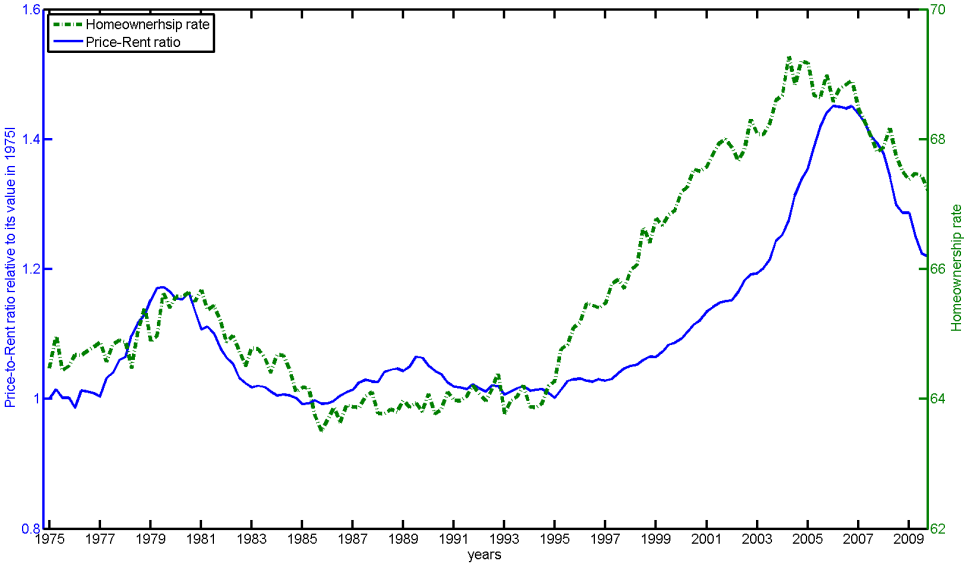
Sommer, Sullivan, and Verbrugge (2010) develop a rich model in which both house prices and rents are determined endogenously. With a combination of low interest rates, lower down payment requirements, and rising income, they can explain about half of the observed increase in the price-rent ratio from 1995 to 2005. Although these findings are important, they cannot be taken as definite as households in their model can easily convert owned housing to renting and vice-versa, which could bias the results. Also, most of the action seems to be driven by additional demand from lower interest rates.

Favara and Imbs (2010) conduct an empirical study, focusing on branching deregulation in the US starting in 1994. These authors use an index capturing cross-state differences in regulatory constraints to interstate branching and find that the number and volume of mortgage loans rose with deregulation episodes. They also show that house prices increased significantly in response to deregulation (unrelated to securitization), particularly in MSAs where the elasticity of new housing supply is relatively low. Davis and Heathcote (2007) show that (demand) fundamentals such as per-capita income and interest rates systematically correlate with house prices through the price of residential land as opposed to the price of structures which is determined by supply-side factors. These authors also stress that an inelastic housing supply is key for understanding the behavior of house prices. Pavlov and Wachter (2011) find that regions that received a high concentration of aggressive mortgage lending instruments (such as interest rate only mortgages, negative amortization loans, etc.) experienced larger price increases and later declines, making the point that the these products magnify real estate market cycles.

Ortalo-Magné and Rady (2006) argue that, in a theoretical life-cycle model of the housing market with a fixed housing supply and a property ladder, the easing of credit constraints may trigger a joint increase in home ownership and house prices if there is a sufficiently large number of potential home buyers and homeowners who are credit constrained. Sanchez-Marcos and Ríos-Rull (2007) incorporate this argument in a model economy where households are subject to aggregate as well as idiosyncratic shocks and calibrate the model to reproduce selected facts of the U.S. economy with mixed success. This work points out the difficulty of delivering high variability in house prices and a positive correlation between prices and transactions in a micro-funded model economy, even in a world where the housing stock is fixed.

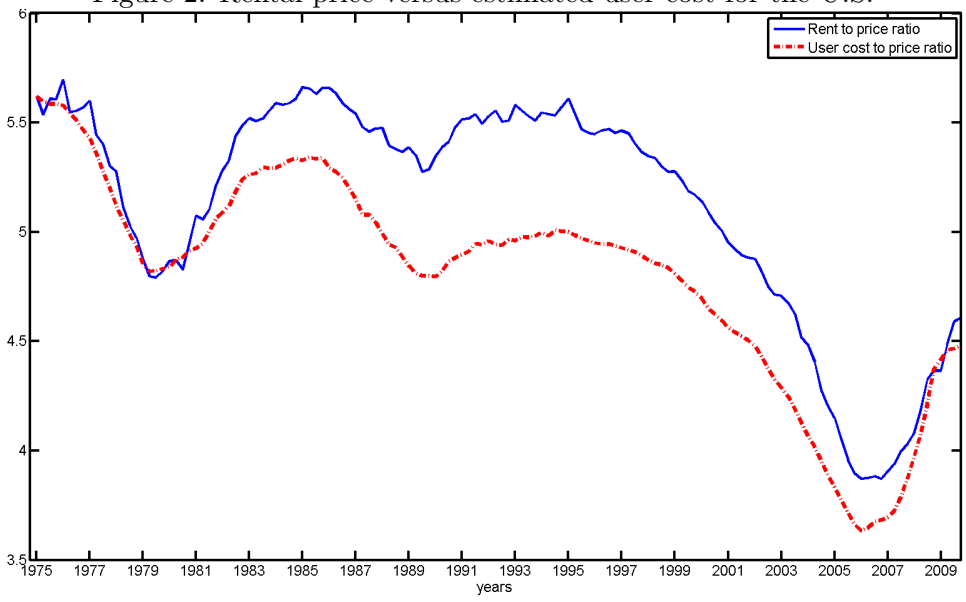
Other authors point out the importance of psychological factors in understanding the upsurge in prices. Surveys of home buyers as conducted by Karl Case and Robert Shiller—see Case and Shiller (2003) or Shiller (2007) for a description—are a good starting point to look beyond fundamentals. These authors define a housing bubble as "a situation in which excessive public expectations of future price increases cause prices to be temporarily elevated". In housing booms, they report, most respondents to those surveys expect home-price increases over the next several years and in the short run. Also the amount of local excitement and discussion about real estate is patent, which was clearly the case for several years before the crisis. Understanding how expectations are formed and vary across different economic agents is also very important. Briefly, whether fundamentals can jointly explain the behavior of house prices and home ownership patterns since 1995, depends on the definition of fundamentals and, in our opinion, remains an open and quantitative question.

Figure 1: Price-rent ratio and home ownership for the U.S.



Note: The home ownership rate is computed using data from the U.S. Housing Vacancy Survey, and is the number of owner-occupied housing units as percentage of the total number of housing units. The price-rent ratio is calculated by dividing two indices: the all-transactions house price index reported by the Federal Housing Finance Agency and the rental price of tenant-occupied non-farm housing from NIPA, both deflated by the CPI (all but shelter).

Figure 2: Rental price versus estimated user cost for the U.S.



Note: The user cost is the rent of owner-occupied housing as a fraction of the purchase-only price index reported by the Federal Housing Finance Agency, as estimated by Davis, Lehnert, and Martin (2008).

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