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Speculative behavior in a housing market: Boom and bust

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ABSTRACT

We study a housing market with household buyers, speculative investors and property developers in a Walrasian scenario. We show that in addition to the factors that affect the real demand of household buyers and the development cost of property developers, investors' speculative behavior is an important factor explaining housing price evolution and dynamics. In particular, investors' extrapolative expectations may drive the housing price to persistently deviate from its benchmark value and even to explode. In contrast, investors' mean-reverting strategy can balance out the position of trend extrapolators, which may stabilize an otherwise explosive housing market. Moreover, the evolutionary process of housing prices driven by investors' speculative behavior is path-dependent in the sense that different initial market conditions may result in different price paths, which corresponds to the localization property empirically documented in the real housing market. In addition, within the stylized model, we provide some policy implications through analyzing the limitation and effectiveness of policy adjustments via down payment and development cost, and find that the decrease of development cost is a better measure to adjust the housing market when it booms or busts.

1. Introduction

In the traditional economic paradigm that underpins the influential rational expectation real estate models of Alonso (1964), Rosen (1979) and Roback (1982), housing prices are determined by fundamental economic factors including national income, monetary policy, population growth, rents and interest rates. Many empirical studies of housing prices, however, have shown that there are often large movements in housing prices that apparently cannot be explained by these fundamental factors (Shiller, 2005, 2008). In a review of the Fed's forecasting record leading up to the financial crisis, Potter (2011) acknowledges a "misunderstanding of the housing boom ... [which] downplayed the risk of a substantial fall in house prices.".

A weak explanatory power of economic factors on housing prices is known as the housing price puzzle or anomaly. One of the most important puzzles for housing economists is the strong persistence of price changes from one year to the next. Over the last three decades, an increasing number of anomalies and puzzles have been uncovered in empirical research. They include, for example, (i) price changes are predictable (Case and Shiller, 1989; Clayton, 1998; Schindler, 2013); (ii) price changes and construction levels are quite volatile in many markets; (iii) over longer time periods, the price changes mean revert while quantity changes persist; (iv) most variations in housing prices are local, not national. We refer to Glaeser et al. (2014) for additional discussion of these empirical anomalies. Therefore, the explanations of housing price movements based solely on fundamental economic factors are unsatisfactory. As a result, researchers have shifted their attention from economic factors towards incorporating the microstructure of housing prices, in particular, by considering agents' demand and supply based on their bounded rationality and heterogeneity.

In fact, the idea of heterogeneity and bounded rationality among agents has long been successfully applied to asset pricing in the stock market. Empirical studies (such as Lux (1998), Chiarella et al. (2014), Kabundi et al. (2015)) and theoretical analyses (such as Day and Huang (1990), Brock and Hommes (1997, 1998), Föllmer et al. (2005), He et al. (2009), Wang et al. (2013)) have shown that heterogeneity and bounded rationality among investors are important factors that affect the volatility of asset pricing. They can be used to explain many puzzles and stylized facts in the stock market, including the equity-premium puzzle, interest rate puzzle, volatility clustering, excess volatility and fat tails (see Basak (2005), Boswijk et al. (2007), De Grauwe (2012), He and Li (2015), and therein). We refer to Hommes (2006) and Chiarella et al. (2009) for surveys of the developments in this literature.

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In the past decades, an increasing number of studies provide ample evidences about heterogeneity and bounded rationality of investors in housing markets. For example, Piazzesi and Schneider (2009) use data on expectations from the Michigan Survey of Consumers to study household beliefs during the US housing boom in the early 2000s and show that the data are characterized by heterogeneity and mutual feedback between housing price expectations and actual housing prices. Applying different methodologies, two studies on a broad set of international securitized real estate markets, conducted by Schindler et al. (2010) and Serrano and Hoesli (2010), provide the evidence that persistence and predictability in real estate returns can be used to earn excess returns compared to a passive strategy. Schindler (2013) finds that investors can obtain excess returns from both autocorrelation-based and moving average-based trading strategies compared to a buy-and-hold strategy. Gelain and Lansing (2014) show that under fully-rational expectations, the model significantly underpredicts the volatility of the US price-rent ratio for reasonable levels of risk aversion but the moving-average model predicts a positive correlation such that agents tend to expect high future returns when prices are high relative to fundamentals - a feature that is consistent with a wide variety of survey evidences from real estate markets. Bolt et al. (2014), by analyzing the housing markets of eight different countries, find that the data support heterogeneity in expectations, with temporary endogenous switching between fundamental mean-reverting and trend-following beliefs based on their relative performance. Shiller (2005, 2008) concludes that speculative thinking among investors, the use of heuristics such as extrapolative expectations, market psychology in the form of optimism and pessimism, herd behavior and social contagion of new ideas (new era thinking), and positive feedback dynamics are elements that play an important role in determining housing prices.

There is still a lack of theoretical studies about the impact of heterogeneity and bounded rationality on housing prices. Granziera and Kozicki (2015) show only the extrapolative expectation model with time-varying extrapolation coefficient is consistent with the run up in housing prices observed over the 2000–2006 period and subsequent sharp downturn. Gelain and Lansing (2014) demonstrate that the model can approximately match the volatility of the price-rent ratio in the data if agents employ a simple moving-average forecast rule for the price-rent ratio. These studies focus on bounded rationality of agents but ignore potential heterogeneity among them. Malpezzi and Wachter (2005) and Dieci and Westerhoff (2012, 2013) consider both heterogeneity and bounded rationality and show that the models can generate real estate cycles. However, in the models, the demand and supply of agents are given exogenously rather than coming from their own objectives. Bolt et al. (2014) consider the endogenous demand by optimizing agents' mean-variance utility but the supply is fixed.

This paper revisits the traditional supply-demand mechanism in housing markets in light of the understanding that fundamental economic factors alone are not the sole drivers of housing price movements. We present a discrete-time model of housing prices considering both economic factors and heterogeneous agents. An important difference with the models of Malpezzi and Wachter (2005) and Dieci and Westerhoff (2012) is that they use a price adjustment rule based on excess demand which is exogenously given, while our approach uses a temporary equilibrium price model where all demands and supplies are endogenously determined based on agents' own objectives and financial constraints. The equilibrium model is similar to Bolt et al. (2014) but with two important differences. Firstly, they fix the housing supply, whereas the supply amount in our model is endogenously decided by property developers through maximizing their profit. Secondly, their fundamental housing price is determined by rents while in our approach, the fundamental value of houses depends on real demand and supply which rely on the fundamental economic factors like national income, development costs and down payment. Within the stylized model, we analytically study the impacts of real demand, development cost and speculative behavior on housing prices using stability and bifurcation theories. An interesting theoretical contribution of our analysis is that from the viewpoints of speculative behavior and heterogeneity among agents, it can explain various stylized facts in housing markets, like persistence and predictability in housing price movements which are connected with the stability of different steady states and the local characteristics of housing price changes which corresponds to the co-existence of two attractors.

The paper proceeds as follows. In Section 2, we set up an equilibrium framework with three types of agents, house buyers, investors and property developers, and study a benchmark market without speculative investors. Compared with the benchmark market, Section 3 studies a one-period case and analyzes the impact of investors' speculative behavior on housing prices. In Section 4, we examine investors with dynamic beliefs who follow two specific strategies - extrapolation and mean-reversion, by stability and bifurcation theories. In Section 5, within our framework, the paper gives some policy implications on a housing market with speculative investors by analyzing the limitation and effectiveness of policy adjustments through down payment and development cost. In addition, we use real data on the Beijing housing market to demonstrate the applicability of the model and the economic meaning of it. Section 6 concludes the paper. All the proofs of the technical results are given in the Appendix.

2. The model

We consider a housing market with two types of property consumers, including house buyers and investors, and one type of property developers who supply houses. At any given time, house buyers and investors decide their property demands while property developers decide how many units of houses to be constructed, based on their own objectives and budget constraints. In particular, the three types of agents have the following specification of preferences.

2.1. Preference of house buyers

A house buyer (denoted by agent B) has real demand for houses and thinks a house as a necessity. At time n, there are $\varphi_n^B(>0)$ house buyers who enter into the housing market. Each house buyer makes a decision about how many units of houses to buy by maximizing his/her consumption utility subject to his/her ability to make down payment at the time. Without bankrupt and solvency constraint,[2] agent B's optimization problem can be written as

$$(OP^B):\ \max_{C_n^B, h_n^B}\ U^c(C_n^B) + k^B U^h(h_n^B) \quad \text{s. t.}\quad C_n^B + \theta^B P_n h_n^B = Y_n^B, \tag{2.1}$$

where P_n is the housing price (without the rent) per unit of houses at time n, C_n^B and h_n^B denote the consumption amounts, respectively, of goods and houses by agent B at time n, $U^c(\cdot)$ and $U^h(\cdot)$ are agent B's utility functions respectively of goods and houses, k^B is the significance factor of properties to agent B compared with his/her goods consumption, $\theta^B \in (0, 1]$ is the down payment ratio on agent B's mortgage and Y_n^B is agent B's income at time n. In (2.1), it shows that as long as the house buyer has the financial capacity to pay the down payment, he/she will buy houses to maximize his/her consumption utility at that time and then exit from the housing market. At time $n+1$, a total of φ_{n+1}^B new house buyers will enter into the housing market and make their buying decisions. Without loss of generality, we assume that agent B's income is constant, that is $Y_n^B \equiv Y^B$ for every time n. In addition, to simplify the analysis, we assume that agent B adopts the logarithmic utilities[1] for both goods and houses, that is $U^c(x) = U^h(x) = \ln(x)$.

[2] In a general case, the solvency of a house buyer should be considered, which can be done within the framework given by Adam et al. (2011). In this paper, we emphasize the impact of speculative behavior from investors and leave the general case for future work.