



Heterogeneous expectations, boom-bust housing cycles, and supply conditions: A nonlinear economic dynamics approach



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ABSTRACT

We combine a standard stock-flow housing market model, incorporating explicit relationships between house prices, the housing stock, and the rent level, with a parsimonious expectation formation scheme of housing market investors, reflecting an evolving mix of extrapolative and regressive expectation rules. The model results in a two-dimensional discrete-time nonlinear dynamical system. Based on realistic parameters, the model is able to generate endogenous boom-bust housing market dynamics with lasting periods of overvaluation and overbuilding. We thus exploit our model to investigate how real forces, in particular supply conditions, interact with expectations-driven housing market fluctuations.

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1. Introduction

Housing market dynamics may be investigated within theoretical frameworks where agents are fully rational and forward looking. In such perfect-foresight or rational-expectations frameworks, price fluctuations are regarded as temporary adjustments to sequences of exogenous shocks impinging on the fundamentals of the housing market, such as rents, population growth, construction costs, the user cost of capital, etc. (Poterba, 1984, 1991; Clayton, 1996; Glaeser and Gyourko, 2007; Brunnermeier and Julliard, 2008). However, this approach is at odds with a number of actual housing market phenomena. For instance, there is evidence against real estate market efficiency (Case and Shiller, 1989, 1990) and, in particular, there are boom-bust housing cycles which cannot be explained by changes in economic fundamentals (Wheaton, 1999; Shiller, 2007).

A large body of economic literature has thus accepted the view that housing market dynamics depend at least partially on some kind of bounded rationality and on the behavioral heterogeneity of housing market investors. Most prominently, Shiller (2005) argues that elements such as optimism and pessimism, herd behavior, and feedback expectations need to be taken into account to model the dynamics of housing markets. Trends in this direction are common to a wide range of research fields broadly related to economics and finance, including behavioral economics (Cutler et al., 1991; Shiller, 2008), real estate economics (Wheaton, 1999; Malpezzi and Wachter, 2005), urban economics (Glaeser et al., 2008), and financial economics (Piazzesi and Schneider, 2009; Burnside et al., 2012).

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A recurring theme of this strand of literature is the joint impact of the speculative behavior of housing market investors and the real side of housing markets on the dynamics of house prices.¹ Let us briefly recap a number of central insights on this issue:

- (1) Housing is both a consumption good and an investment good. Housing prices thus include a fundamental component, based on the rent level, and a speculative bubble component, based on the price expectations of housing market investors. In this respect, the price-rent ratio is an important indicator of the state of housing market bubbles (Himmelberg et al., 2005; Gallin 2008; Campbell et al., 2009).
- (2) The real side of housing markets (housing durability, supply elasticity, construction lags) differs strongly across housing markets and may interact in different ways with housing market investors' speculative demand (Wheaton, 1999; Malpezzi and Wachter, 2005).
- (3) Housing markets with a less elastic supply, due to structural and/or institutional constraints, tend to display longer and more pronounced bubbles (Glaeser et al., 2005, 2008; Gyourko, 2009; Grimes and Aitken, 2010; Paciorek, 2013).
- (4) Developers' price expectations, along with development lags, may generate periods with significant overbuilding (Chinloy, 1996; Grenadier, 1996; Lee, 1999; DeCoster and Strange, 2012).
- (5) The level of overbuilding attained during boom phases is an important factor, along with changes in market sentiments, for the timing and size of crashes (McCue and Belsky, 2007; Haughwout et al., 2012).

In recent years, the Bounded Rational Heterogeneous Agent approach (BRHA for short) to the dynamics of speculative markets has been able to contribute to the financial and economic literature in a number of important directions (for surveys, see Chiarella et al., 2009; Hommes and Wagener, 2009; Lux, 2009). Since BRHA models incorporate in a simple and tractable way the behavioral heterogeneity of agents, they provide plausible qualitative explanations for bubbles and crashes in various types of markets and clear-cut analytical results on how such phenomena may depend on agents' behavioral characteristics. Applied to financial markets, for instance, one of the most popular schemes in the BRHA literature is based on the interaction between chartists and fundamentalists (Day and Huang, 1990; Chiarella, 1992; De Grauwe et al., 1993; Brock and Hommes, 1998). Chartists extrapolate past price trends into the future and exert a destabilizing impact on prices. In contrast, fundamentalists expect a mean reversion and act as a stabilizing force. By assuming that their market impact varies endogenously (depending on a variety of behavioral, evolutionary or market factors), their interplay typically results in nonlinear dynamic models with two opposite forces in action, giving rise to complex endogenous price dynamics.

We believe that the BRHA approach may also improve our understanding of the dynamics of housing markets. So far, there has been little effort in this direction, mostly aimed at showing how house prices can fluctuate and deviate substantially from their fundamentals in the presence of heterogeneous investors (Dieci and Westerhoff, 2012, 2013), or at estimating the impact of extrapolative beliefs (Eichholtz et al., 2015; Kouwenberg and Zwinkels, 2014; Bolt et al., 2014). Our choice of relying on a simple BRHA setup is not just motivated by the goal to provide explanations for bubbles and crashes in housing markets. The ability of BRHA models to generate such kind of dynamics is a well-established result. Instead, by positing that the dynamics of housing markets is at least partially due to the behavior of heterogeneous investors, we seek to understand how behavioral factors and the real side of housing markets jointly influence housing prices and stocks. Put differently, we adopt a simple BRHA model since it can generate expectations-driven cycles very naturally, whilst remaining analytically tractable. It is therefore an ideal setup to address the above discussed issues and to provide clear-cut qualitative insights into how the real side of housing markets interacts with the fluctuations initiated by speculative forces.

Our main findings can be summarized as follows.

- (1) Our stock-flow housing market model with perfect-foresight expectations represents a discrete-time generalization of Poterba (1984, 1991). The model's unique steady state is either unstable or saddle-path stable. If it is saddle-path stable, a fundamental shock, raising the steady-state coordinates of the house price and the housing stock, causes an immediate overshooting of house prices, followed by a monotonic convergence of house prices towards their new steady state and a monotonic correction of the housing stock without overbuilding. This adjustment pattern is qualitatively very similar across a wide range of values for the depreciation rate, the interest rate, the elasticities of the supply of new housing, and the demand for housing services.
- (2) Yet these parameters play a vital role for the dynamics of housing markets under more reasonable backward-looking expectations. Within our BRHA housing market model, a strong extrapolative behavior of housing market investors always destabilizes the model's fundamental steady state, either via a pitchfork bifurcation and the emergence of multiple steady states or via a Neimark-Sacker bifurcation and the appearance of oscillatory dynamics. In particular, the loss of stability may produce very different outcomes depending on the elasticities of the supply of new housing and the demand for housing services. For instance, our analytical and numerical investigation reveals that house price bubbles tend to be shorter under a more elastic supply of new housing or a less elastic demand of housing services. Similarly, a

¹ Of course, there exist also broader macroeconomic issues related to the effects of housing market speculation, such as loose credit conditions or economy-wide effects of housing market crashes (Iacoviello, 2005; Adam et al., 2011; Geanakoplos et al., 2012; Favilukis et al., 2013).

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