Learning about the Neighborbood: A Model of Housing Cycles

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Executive Summary

In the aftermath of the U.S. housing bubble in the 2000's, there is great interest among academics and policy makers in understanding the determinants of housing cycles. The existing literature has highlighted home buyers' expectations (and in particular extrapolative expectations) as an important determinant (e.g., Case and Shiller (2003); Glaeser, Gyourko, and Saiz (2008); and Piazzesi and Schneider (2009)). Much of the analysis and discussion, however, is made in the absence of a systematic framework that anchors home buyers' expectations on their information aggregation and learning process. Our paper aims to fill this gap by developing a model to analyze information aggregation and learning in housing markets and its implications for housing cycles.

Our model focuses on home buyers' learning about the quality of a neighborhood. People buy a house not just for shelter but also for the neighborhood to which the house belongs. The economic literature has recognized the importance of neighborhood effects in determining housing demand (e.g., Ioannides and Zabel (2003)) and a host of other urban issues (e.g., Durlauf (2004); and Glaeser, Sacerdote, and Scheinkman (2003)). There are many characteristics that affect the living conditions in a neighborhood, such as public safety, quality of local schools, and availability of local amenities like restaurants and public parks. In wealthier neighborhoods, the greater demand for public safety, high quality schools, and nice restaurants tends to attract a greater supply of these amenities, which in turn makes housing in these neighborhoods more desirable.

It is important to recognize that the quality of a neighborhood, which is ultimately driven by the financial health of its residents and the strength of the local economy, is often not directly observable to potential home buyers. Home buyers also face other unobservable factors in housing markets, such as local housing supply conditions. In the presence of these important informational frictions, local housing

markets provide a useful platform for aggregating information. This fundamental aspect of housing markets, however, has received little attention in the literature and is a key focus of our model.

Our paper integrates the standard framework of Grossman and Stiglitz (1980) and Hellwig (1980) for information aggregation in asset markets with a housing market in a local neighborhood. This setting allows us to extend the insights of market microstructure analysis to explore the real consequences of informational frictions in housing markets. In particular, our model allows us to analyze how agents form expectations in housing markets, how these expectations interact with characteristics endemic to a neighborhood, and how these expectations feed into housing prices.

We first present a static setting to highlight the basic information aggregation mechanism with perfectly rational households, and then extend the model to a dynamic setting to characterize the implications of learning about the neighborhood for housing cycles. The model presented herein features a continuum of households in each generation in a closed neighborhood. Each household specializes in producing a consumption good, which can be broadly interpreted as local services such as health care, restaurant services, or plumbing, and needs to trade his good for goods produced by other households in the neighborhood for consumption. The households have a Cobb-Douglas utility function over consumption of their own good, goods produced by other households, and housing. In choosing their housing demand, the households face uncertainty regarding the aggregate productivity of other households, a key aspect of the quality of the neighborhood, which ultimately determines the demand for each household's good and its own housing demand. In a more productive neighborhood, there is a greater demand for each household's good, which in turn makes each household more wealthy and thus have a greater demand for housing consumption. In this way, the complementarity in the households' goods consumption leads to a complementarity in their housing demand.

In our model, each household possesses a private signal regarding the aggregate productivity in the neighborhood. By aggregating each household's housing demand, the housing price aggregates their private signals. The presence of unobservable housing supply shocks, however, prevents the housing price from perfectly revealing the quality of the neighborhood and acts as a source of informational noise in the housing price. In this way, characteristics endemic to local supply and demand determine the informational content of the housing price and affect households' learning from the housing price.

Despite each household's housing demand being non-linear, the Law of Large Numbers allows us to aggregate their housing demand in closed-form and to derive a unique log-linear equilibrium for the housing market. In this equilibrium, the housing price is a log-linear function of the unobservable quality of the neighborhood and the housing supply shock, and each household's housing demand is a log-linear function of its private signal and the housing price. In the equilibrium, a higher housing price does not simply represent a larger cost of housing but also gives a positive signal about the neighborhood. Through this learning channel, supply shocks have a larger negative impact, and demand shocks a smaller positive impact, on the equilibrium housing price than they would in an otherwise identical economy without informational frictions. This is because informational frictions prevent households from fully separating supply shocks from demand shocks and instead they attribute a high housing price partially to a strong aggregate household productivity and partially to a weak supply. This inference in turn amplifies the price impact of supply shocks and attenuates the impact of demand shocks.

Our analysis highlights that supply elasticity can play a subtle role in households' learning---the learning effect is most pronounced in neighborhoods with an intermediate supply elasticity. In neighborhoods with very elastic supply, prices are uninformative about the households' aggregate productivity, while in neighborhoods with very inelastic supply, they are so revealing that households face little uncertainty about the aggregate productivity. Netting out these two forces leads to the strongest reaction in housing demand to prices because of learning in neighborhoods with an intermediate supply elasticity. This non-monotonic effect of supply elasticity on household learning is in sharp contrast to the common wisdom that supply elasticity monotonically attenuates housing cycles. It also provides a new insight for explaining a puzzling phenomenon summarized by Glaeser (2013) and Gao (2013) that, during the U.S. housing cycle in the 2000s, areas with relatively elastic supply like Phoenix and Las Vegas experienced dramatic boom and bust cycles similar to inelastic areas like New York and Los Angeles.

By extending the model into a dynamic setting with overlapping generations of households, we also examine whether the learning effect can help explain the patterns of short-run momentum and long-run reversals observed in housing prices (e.g., Case and Shiller (1989); Glaesar and Gyourko (2006)). In our setting, the mean-reversion of aggregate productivity and housing supply provides a natural explanation to the long-run reversals, but makes it even more challenging to explain the short-run momentum.

Interestingly, in our setting, households in each generation use not only their private signals and the current period housing price but also the housing price of the previous period to learn about the current aggregate household productivity. The households' learning from the previous period's price can lead to housing price momentum under certain conditions, even when shocks to both supply and demand mean-revert over time and household learning is perfectly rational.

To dissect the mechanism, it is useful to discuss how the relative persistence of shocks to aggregate productivity and housing supply affects each household’s learning from the previous period's price. If shocks to aggregate productivity are sufficiently more persistent than shocks to supply, a higher price in the previous period signals a stronger aggregate productivity, which is likely to persist into the current period, and thus cause the households to hold a higher expectation of the current period aggregate productivity. When this learning effect is sufficiently strong---stronger than the opposing force from the inherent mean-reversion of the shocks---the housing price exhibits short-run momentum. On the other hand, if shocks to housing supply are sufficiently more persistent than shocks to aggregate productivity, a higher price in the previous period induces learning in the opposite direction. That is, households perceive the supply in the prior period to be weak and believe the weak supply is likely to persist into the current period, which, conditional on the current period housing price, causes the households to have a lower expectation of the current period aggregate productivity. This inference causes stronger housing price reversals than those caused by the mean-reversion of the shocks.

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