Theoretical and Empirical Analysis of the Multiperiod Pricing Pattern in the Real Estate Market

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We examine empirically and theoretically the multiperiod pricing pattern in the real estate market. First, in a game theoretic framework, we identify conditions for determining whether potential closing prices increase or decrease and marginally increase with time on market. Then, by observing rental housing transactions, we empirically find evidence that the difference between the list price and the settlement price rises and marginally decreases with time on market. This empirical result is consistent with a perfect Nash equilibrium previously proposed in the model.   © 2002 Elsevier Science (USA)

Key Words: real estate; prices; time on market; perfect Nash equilibrium.

I. INTRODUCTION

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Several models in the real estate literature refer to the optimal stategy for pricing real estate units. Stull (1978), for example, analyzes the rental housing market and concentrates on the properties of a rental probability function. He deduces that the greater the potential tenants arrival rate, the higher the probability of locating a tenant willing to pay the asked rent price, *ceteris paribus*, and further, that the probability of locating a renter declines faster with a rise in the rent price asked for less desirable properties. The two major results in his model are the declining sequence of asked rent prices and the associated decreasing expected waiting time.

In his derivation of a declining sequence of asked prices in real estate sale transactions, Read (1988) emphasizes the seller's imperfect information regarding

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the housing quality. He numerically solves for the sequence of optimal asked prices, exogenously assuming a consumer arrival rate, a fixed sale period, and a maximum number of buyers. His simulation produces an optimal pricing schedule which, once again, decreases over time. The intuition underlying his result is that when a landlord fails to reach a match with a buyer—given the specific flow of shoppers—he concludes that his property is of lower quality and drops the price.

The empirical literature in the area provides evidence from real estate sale transactions.[1] It generally finds that the ratio of selling price to list price is inversely related to time on market.

In contrast to previous studies, we provide empirical evidence of pricing patterns in the rental housing market. Furthermore, we incorporate a game theoretic approach to analyze real estate pricing under a multiperiod framework.

We should note that while our theoretical framework may conceptually also include sale transactions (as well as transactions of a family of other goods[2]), we restrict our empirical attention to the rental of real estate.

We first construct a game theoretic framework where potential renters and a landlord interact in a multiperiod setup. At each period the seller encounters one potential renter, arbitrarily drawn from a set of possible renters, who distribute according to their willingness to pay for real estate services.

We examine the attained equilibrium under two settings: in the first (second) the landlord (a potential renter) provides a price offer to which a potential renter (the landlord) may agree or disagree. If a rejection occurs, the round is replayed in the subsequent period with a new arbitrary potential renter. The game terminates at the first period in which the price offered by one party is accepted by the other.

In general, conditions of perfect Nash equilibrium in mixed strategies require that the landlord's reservation price at any period be equal to the expected present value of his future reservation prices. Therefore, when the landlord is the first mover, the outcome of the equilibrium is a price that is declining (rising) and marginally increasing with time on market, if the conditional probability of a transaction is relatively low (high) and if the landlord is relatively patient (impatient).

If a potential renter is the first mover, however, then equilibrium closing prices never decrease with time on market. The specific price pattern in this case depends on the landlord's time preference factor and is independent of the conditional probability of realizing a transaction.

Our empirical test is conducted along the lines of Belkin *et al.* (1976), Janssen

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[1]See Belkin *et al.* (1976), Janssen and Jobson (1980), Kang and Gardner (1989), and Yavas and Yang (1995).

[2]As implied by the setup of the model, our analysis may apply to every transacted good of which the actual market price may not be perfectly determined *ex ante* (e.g., a competitive price does not exist) and from which prices in future transactions of the seller will not be affected *ex post*.