The Market for Real Estate Presales: A Theoretical Approach

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Abstract

Presale agreements have become a pervasive worldwide practice for residential sales, especially in many Asian markets. Although there is a burgeoning empirical literature on presales agreements, only a few papers actually address their theoretical foundations. We create a set of interrelated theoretical models for explaining how and why developers and buyers engage in presale contracts for non-completed residential dwellings. Given heterogeneous consumer beliefs about future market prices, developers and buyers enter into presale agreements to mitigate, two intertwined, fundamental risks: those of real estate market valuation and default. Our analyses are consistent with prior empirical findings and provide additional theoretical insights for understanding the market for presales.

Keywords: presale, hedge real estate risks, housing, heterogeneous beliefs

JEL Classification: G12, G14, G21, H31

The Market for Real Estate Presales: A Theoretical Approach

We create a set of theoretical models for explaining how and why developers and buyers engage in presale contracts for non-completed residential dwellings. Buyers and sellers enter into presale agreements in order to mitigate the future real estate price uncertainty and default risks.[1] Likewise, residential builders use presale real estate agreements in order to secure buyers for either un-built or under-construction dwellings, thereby assuring sales and frequently obtaining substantial payments in advance of occupancy. By entering into a presale agreement, homebuyers gain housing price security and reduced future housing search costs, but at the same time, they incur the risk that the developer will not perform according to the agreement. A presale agreement is frequently employed when the purchaser agrees to buy the property according to specifications outlined on the builder's plans. In some cases, the prospective purchaser previews a similarly constructed demonstration model dwelling. In other cases, the buyer will view multimedia presentations or print literature in order to make a presale purchase decision.

Over the past five decades, presales have become a popular practice for property transactions, particularly in many Asian markets. Most residential condominium sales in Hong Kong, Taiwan, China, Korea, and Singapore, for example, utilize presale contracts. In the United States, during the pre-subprime crisis housing boom, presales became a substantial part of many residential markets, including the condominium markets in San Diego, Washington, D.C., and South Florida. During the ensuing real estate downturn in the United States, buyers,

[1] Real estate builder-developers and household buyers-owners confront multi-faceted risks in building or buying a dwelling unit. The developer, for example, may face risks associated with land entitlements, access to utilities, legal challenges, ownership title, building code enforcement, labor and materials availability, weather induced delays, and so forth. Similarly, the homebuyer is exposed to risks related to financing costs and availability, income instability, job mobility, and so forth. In our analysis of the presale agreements market, we abstract from most of these genuine risks. We explore how the pre-sales agreements are used to mitigate two linchpin risks faced by the developer and buyers: the risks of market value changes and default.

builders, and lenders became more cautious, retreating from the use of presale contracts. These contracts also provide lenders more confidence to lend or adjust the loan-to-value ratio. In many cases, U.S. lenders now require residential project developers to pre-sell a minimum percentage of the project before they will lend or release funds.[2]

Presale contracts attract both developers and consumers since the contracts can spread real estate valuation risks between developers and consumers and among consumers with varied expectations about future real estate prices. Furthermore, presales serve as a vehicle for price discovery for to-be-built dwellings since the presale price contains information, among other things, about expectations of future real estate prices and inflation. The presale price and transaction volume signal future real estate market conditions and can be utilized to identify real estate cycles.

What are the benefits of a presale transaction (a spot price sale at unit completion) to purchasers and developers? Should the presale price be higher or lower than the price of existing comparable dwellings? How big a premium or discount should a developer charge for the presale dwellings? What factors determine the scale for presale market demand? How do the prices and volume of presales help us understand the hot and cold real estate markets? These are the key questions we will explore in our analysis. Consistent with the existing empirical literature, our analysis extends and improves upon existing theoretical modeling for presale markets in three ways. First, we employ a micro-economic market equilibrium framework. Our framework nests the option approach, the latter of which necessarily assumes risk-neutrality and the ability to create replicating portfolios.

Second, by permitting heterogeneous beliefs across households in a competitive marketplace,

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[2] In the United States, Fannie Mae established regulations that require most condo developers to pre-sell 70% of the condo units before closing deals with buyers. Previous rules required a presale rate of 51% (see Fannie Mae 2008)

our analysis engenders a separating equilibrium for the co-existence for the housing spot and presale markets. Third, we explain, in part, the real estate cycle.

We have included a series of interrelated theoretical models that explore the role that presale real estate contracts play in the pricing and risk hedging of residential real estate, especially for new construction.[3] We introduce the real estate market risk (Model I) and then proceed to include the related default risk (exogenous default in Model II and endogenous default in Model III). Models I and II examine presale contracts as standard forward contracts; Model III is equivalent to treating presales in an option framework (in the spirit of Lai, et al. 2004). Furthermore, with heterogeneous buyers, our model jointly determines the equilibrium price for presale dwellings and the scale for presale demand. In this way, our analytic framework creates a separating (co-existing) equilibrium for buyers in the spot and presale markets.

The remainder of the paper is organized as follows. In the next section, we briefly review the literature on presale real estate contracts. “The Equilibrium Pricing Strategy” describes the principles of the equilibrium pricing strategy. In the fourth and fifth sections, we present a set of three related models (a base model and two extensions) for presale pricing, assuming heterogeneous buyer beliefs. In each model, by solving the joint maximization problems for buyers and developers, we calibrate the joint solutions for the optimal presale premia and the scale for the presale market. We discuss the implications of the various assumptions and the determinants of the separating equilibrium for the spot and presale markets. “Concluding Comments” concludes the paper.

[3] Our analyses are general, and, in principle, apply to non-residential real estate.

Literature Review

The presale phenomenon has generated a sparse but growing set of mostly empirical studies, suggesting that the apparent benefit of risk-sharing between purchaser and developer requires a discount for buying a housing unit in the presale market (see Wong et al. 2006, and Deng and Liu 2009, for a recent survey). The presale price should contain further discounts for unrealized service flows for the interim between presale and ultimate occupancy. Hwang and Quigley (2009) estimate, for the Singapore condominium market, the consumption service presale discount to be 1.7% annually. The view that presale units should sell at a discount to spot sales prices is supported by Ong (1997) and Gwin and Ong (2000), who are also the first to identify the potential presale market moral hazard problem. They contend that pre-sale housing (vis-à-vis sales at completion) has a higher incidence of defects (in the Singapore market). However, in a more recent study, Chau et al. (2007) find that the presales moral hazard risk may be offset by builder reputational effects. They also find that presold units in Hong Kong command a premium of6.37% over spot prices, and presales accounted for more than 53% of all housing sales during the period 2000–2003. An even higher presale premium is observed in the Taiwan housing market. Chang and Ward (1993), for example, find the presale premium to be 36% in Taipei during the period 1988–1990. According to their model, the optimal proportion of presales is 51%.

Assuming risk-neutral economic agents, Shyy (1992) and Lai, et al. (2004)develop two prior theoretical models for presales contracts, based upon compound real options. In these models, buyers are indifferent to the choice between purchasing a property as a presale or completed dwelling; the authors suggest, therefore, that the presale system creates a barrier to entry. Using a similar real option framework, Chan et al. (2008) observe that presales mitigate a developer's financing constraint by providing development equity and reducing financing costs. These models do not take into account that buyers are likely to be risk-averse (as featured in our model). Our model demonstrates that pre-selling a portion of real estate units before completion can be optimal because it mitigates developer and buyer risks. This outcome is the result of two realistic features in our model: heterogeneous beliefs and risk aversion.

Our theoretical approach utilizes economic market equilibrium theory, in contrast to previous theoretical frameworks that use no-arbitrage approaches (e.g., Shyy 1992 and Lai, et al. 2004). We emphasize that the presale agreement pricing is an equilibrium outcome derived from the behavior of real estate market participants. The standard option pricing approach relies upon one's ability to create a replicating portfolio for the underlying assets; this is unrealistic for presale contracts since the underlying assets have not yet traded (i.e., they need to be built). Our model is also distinguished from other theoretical frameworks (Chan, et al. 2008; Fan et al. 2009, among others), which assume a single representative consumer and a representative developer. Our analysis, by contrast, introduces buyers with heterogeneous beliefs about the future real estate price distribution. This assumption is reasonable and generates insights about risk-sharing behavior among market participants as well as the determinants for the scale of presale demand and the separating equilibrium in which presale and spot transactions coexist.

The Equilibrium Pricing Strategy

Model Set-up

To model the effects of a presale contract in the real estate market, we begin with a simple endowment economy. The model has one period with two dates–$t = 0$ and $t = 1$–and one risky consumption-good–housing.[4] The housing price at $t = 1$ is $H_1 = H_0 + \tilde{\mu}$ where H_0 is a hypothetical price at $t = 0$, $\tilde{\mu}$, a random variable unknown to consumers, is normally distributed with mean zero. We further assume the interest rate in this economy is zero.

There are two types of agents in this economy: consumers (buyers) and developers (sellers). Consumers are the real estate buyers and owners, each possesses equal initial wealth W_0 at $t = 0$, and each will own and consume housing services from one unit of housing at $t = 1$.[5] They are risk-averse with Constant Absolute Risk Aversion (CARA)[6] utility over terminal wealth W.

$$U(W) = -\frac{1}{\gamma}\exp(-\gamma W). \qquad (1)$$

Consumers have heterogeneous beliefs, as modeled in Scheinkman and Xiong (2003) and Xiong and Yan (2010).

We model the development industry as a competitive industry with many homogenous firms. Each developer is endowed with a permit for housing development. All developers commence building at t=0 and complete construction for occupancy by consumers at t=1. In this simple endowment economy, the scale of developer activity is pre-determined. Total new development is assumed to be small relative to the existing housing stock. Therefore, the price of the to-be-built real estate is determined by the market of existing units. Developers can hedge their production risk by pre-selling to-be-built units at t=0; they produce dwellings with

[4] For simplicity, we use one consumption good–housing. Our results remain unchanged when there are two or more consumption goods (for example, housing and a composite non-housing consumption good).

[5] As illustrated in Saini and Souletes 2005, all households start life "short" housing services. We are essentially modeling the first-time home buyers' housing service consumption decisions.

[6] Although the CARA utility does not contain a wealth effect, the main insights for our analyses do not depend upon the choice of the particular utility function. Another form of utility function frequently used is Constant Relative Risk Aversion (CRRA), which also engenders similar results.

sales price uncertainty and may utilize a presale agreement as a future hedging strategy. Such analyses have been discussed extensively by Sandmo (1971), and Leland (1972), who study the competitive firm's production and hedging strategies when facing price uncertainty.[7] Developers face the uncertain house price H1 and the total number of units to be developed is assumed to be nonrandom in this economy.[8]

The Basic Principles of Equilibrium Pricing Strategy

The objectives for solving the market equilibrium are twofold: 1) to derive the market clearing price for the presale contract and 2) to determine the scale of presale contracts demand.

The strategy for solving this equilibrium model involves jointly maximizing the utilities for both consumers and developers. We first assume there is a market price for presale contracts, and then we calibrate the equilibrium market-clearing price that maximizes the developer utility functions. In the first step, we solve the consumer's maximization problems, assuming housing prices for the spot and presale market are given. Since there is a continuum of heterogeneous consumers, the marginal consumer, who is indifferent to choosing between buying the housing unit on the spot market or the presale market, determines market equilibrium. Therefore, the critical level of mean belief μ^*, which is a function of the market price of presales, divides housing acquisitions into two tiers.

The consumer's consumption decision rule can be summarized as follows:

(A1) Buy a housing unit on the presale market if $E[U_F(W_1)] > E[U_S(W_1)]$

(A2) Buy a housing unit on the spot market if $E[U_F(W_1)] < E[U_S(W_1)]$

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[7] This paper combines this line of literature with the more current research strand of optimal consumption.

[8] In order to construct houses, the developers must obtain permits in advance that specify the size of construction and time of start and/or completion. If the quantities of production are allowed to vary, along with the size of forward hedging, the results remain unchanged. As established by Feder et al. (1980), in the presence of the forward market, a complete separation is maintained between the production decision and the hedging (forward selling) decision. Chan et al. (2008) also find that the presale method does not affect a developer's production decision.

(A3) Be indifferent regarding the choice[9] between the presale or spot market transaction if $E[U_F(W_1)] = E[U_S(W_1)]$.

In the second step, we derive equilibrium endogenously for the market price for presales. Developers decide at $T = 0$ whether to sell part or all of their housing units before completion, and if so, how much is to be charged for a presale. Since all developers are identical and the market is competitive, the price of the presale contract can be regarded as being determined by the industry. Therefore, it is convenient to assume that a representative developer (or the central planner in the economy) decides how many units to offer on the presale market versus the spot market. The equilibrium presale price is determined by solving the problem of maximizing the expected utility of profit from both the presale and spot markets. The developer's control variable is how much to charge for a presale unit.

With the scale of demand for presale and spot markets solved in the first step, the developer's maximization problem determines the market price for presale contracts. Because the market scale is a function of the presale price, the representative developer trades off between the revenues from each sale and the number of buyers the developer attracts for presale and spot markets.

Equilibrium Models of Presale with Heterogeneous Agents

Presale as a Forward Contract without Default Risks (Base Model)

Following Scheinkman and Xiong (2003) and Xiong and Yan (2010), we model

[9] We abstract away from the consumer's option for buying the existing housing unit at time 0. Purchasing an existing dwelling unit at $t = 0$ and leaving it unoccupied is equivalent to a consumer or investor taking on the role of supplier of a house at time 1. The individual can leave the unit vacant and live in it later, and can, in fact, enter a futures contract him- or herself with a third party and/or sell it on the spot market during time 1. All of these "roles" are consistent with our model and simply change the way we account for individuals who may have multiple roles—consumer in time 1, investor in time 0, buyer in time 0, and supplier in time 1.

consumer heterogeneity since all consumers share the same view concerning the variance but have different expectations for the mean expected appreciation for the housing price at $\mathrm{t} = 1$. We index consumers by their mean beliefs μ_i and assume that μ_i is uniformly distributed in an interval $[-k, k]$. The parameter k measures the heterogeneity of beliefs, which means consumer i believes that H_1 has a normal distribution with mean $H_0 + \mu_i$ and variance σ^2.

The Consumer's Problem

For consumer i, let $U_F^i(\mathrm{W}_1)$ and $U_S^i(\mathrm{W}_1)$ be consumer *i*'s utility functions derived from terminal wealth using presale and spot transactions, respectively. The price of a presale contract is defined as $\mathrm{P}_0 \equiv \mathrm{H}_0 + \pi$, where H_0 is a hypothetical housing price at $\mathrm{t} = 0$ for a virtual real estate unit that is completed but not available for occupancy until $\mathrm{t} = 1$. π is the hedging premium ($\pi > 0$) or discount ($\pi < 0$), which is determined in the presale market. (For brevity, we use hedging premium in the remainder of the text to represent the difference between presale price and H_0.)

Consumer *i*'s utility maximization problem can be written as follows:

$$MaxE\left[U_F^i(\mathrm{W}_1)\right] = \frac{1}{-\gamma} e^{-\gamma[\mathrm{W}_0 - \mathrm{P}_0]} \tag{1}$$

and

$$MaxE\left[U_S^i(\mathrm{W}_1)\right] = E\left[\frac{1}{-\gamma} e^{-\gamma(\mathrm{W}_0 - \mathrm{H}_1)}\right] \tag{2}$$

$$= \frac{1}{-\gamma} e^{-\gamma[\mathrm{W}_0 - (\mathrm{H}_0 + \mu_i)] + \frac{1}{2}\gamma^2\sigma^2}$$

The marginal housing consumer is indifferent in choosing between buying on the spot market or the presale market. He or she would derive the same utility from either the presale transaction or the spot market purchase. Combining Eqs. (1) and (2) yields

$$E[U_F(\mathrm{W}_1)] = E[U_s(\mathrm{W}_1)] \tag{3}$$

$$-\frac{1}{\gamma}e^{-\gamma[\mathrm{W}_0-(\mathrm{H}_0+\pi)]} = -\frac{1}{\gamma}e^{-\gamma[\mathrm{W}_0-(\mathrm{H}_0+\mu_i)]+\frac{1}{2}\gamma^2\sigma^2}$$

$$-\gamma[\mathrm{W}_0 - \mathrm{H}_0 - \pi] = -\gamma[\mathrm{W}_0 - \mathrm{H}_0 - \mu_i] + \frac{1}{2}\gamma^2\sigma^2.$$

Therefore, the critical value of belief of the marginal consumer can be characterized as

$$\mu^* = \pi - \frac{1}{2}\gamma\sigma^2. \tag{4}$$

Because there is a continuum of heterogeneous beliefs, the marginal consumer with mean μ^* can be inferred from Eq. (4). The consumption decision rule, therefore, can be expressed equivalently as:

(B1) Buy a housing unit on the presale market if $\mu_i > \mu^*$

(B2) Buy a housing unit on the spot market if $\mu_i < \mu^*$

(B3) Be indifferent between the presale or the spot market transaction if $\mu_i = \mu^*$

For a given distribution of consumer beliefs, we can determine the scale for market demand for both markets. This critical level of mean belief μ^*sub-divides consumption demand into two markets: the spot market and the presale market. Specifically, if a consumer is more bullish than the marginal consumer, he or she will choose to buy a real estate unit via the presale market, and vice versa. Figure 1 displays the demand scale for presale and spot real estate transactions. The market demand for a presale contract is $\frac{k-\mu^*}{2k}$. That is, the proportion of $\frac{k-\mu^*}{2k}$ consumers will choose buying a presale-contract real estate at $\mathrm{t} = 0$. Similarly, the proportion of households buying housing units in the spot market will be $\frac{k+\mu^*}{2k}$.

As long as $-k < \mu^* < k,$ there will be a separating equilibrium: presale contracting and spot market transactions jointly exist in the marketplace. $\mu^* = -k$ indicates that there is no spot market; all housing units are sold as presales. Conversely, $\mu^* = k$ signifies that there is no market demand for presale contracts.

The Developer's Problem

The development industry is competitive with many homogeneous builders, and each one is a price taker. The price of a presale contract is determined by all developers in the market. To solve the market equilibrium price of a presale contract, we introduce a presale aggregator, the central planer, who is risk-neutral and maximizes joint profits from the spot transactions and presales:

$$\underset{\pi}{\text{Max}}\, f = E[U(\text{Profit})] = (H_0 + \pi - C_0)\, presale + E(H_1 - C_1) spotsale \tag{5}$$

where C_0 and C_1 are unit construction costs when the developer pre-sells and spot-sells, respectively. The two costs may not be necessarily the same since normally the developers enjoy a financing benefit for using the presales. Deng and Liu (2009) estimate that presale contracts enjoy a financing benefit of about 250 basis points for condominiums in Beijing, China. Developers usually collect presale deposits and use presale contracts as collateral to borrow. We denote this financing advantage as $\Delta \text{C} = C_1 - C_0$.

The developer's expected utility from profits generated by an average consumer can be expressed as the following:

$$f = (H_0 + \pi - C_0)\left(\frac{k - \mu^*}{2k}\right) + (H_0 + \mu_d - C_1)\left(\frac{k + \mu^*}{2k}\right). \tag{6}$$

Note that μ_d is the difference in expected housing price movement between the developer and an average consumer. μ_d can potentially be negative, indicating a hot market in which the consumer demand side has a higher expectations than that of the developer.

The following first-order condition yields the optimal pricing strategy for the developer.

$$\frac{\partial f}{\partial \pi} = \left(\frac{k - \mu^*}{2k}\right) + (H_0 + \pi - C_0)\left(-\frac{1}{2k}\right) + (H_0 + \mu_d - C_1)\left(\frac{1}{2k}\right) = 0. \tag{7}$$

$$\pi^* = \frac{1}{2}\left(k + \mu + \frac{1}{2}\gamma\sigma^2 - \Delta C\right) where\ \Delta C = C_1 - C_0. \quad (8)$$

The market equilibrium price for one dwelling unit purchased via the presale market is $H_0 + \pi^*$. The optimal premium is a function of the developer's belief about the future housing price, future real estate risk σ^2, the purchaser's heterogeneity measure, and the developer's financing benefit.

Discussion of Presale Equilibrium Results

Most fundamentally, Model I lays out the basic risk-sharing mechanism for consumers and providers. Even though it is simple, this model provides a framework with which to analyze market equilibrium for the presale contract price and quantity. The presale equilibrium price equals the hypothetical price at time zero, H_0 plus a presale hedging premium (or discount) π^*, $P_0 = H_0 + \pi^*$. The second component of the equilibrium result is the market demand for presales dwelling units. The critical value of consumer mean belief is solved jointly with π^* from the equilibrium.

Equilibrium Price and Market Size of Presales

It is important to note the characteristics of the presale equilibrium and the factors that influence the level of the presale-hedging premium and presale demand.

$$\pi^* = \frac{1}{2}\left(k + \mu_d - \Delta C + \frac{1}{2}\gamma\sigma^2\right). \quad (9)$$

Equation (9) reveals that the optimal hedging premium or discount is related to the consumer heterogeneity, k, the developer's belief about housing price expected growth rate relative to consumers, μ_d, the financing advantage through presale, ΔC, and the market risk of the housing price at $t = 1$, σ^2. The larger the future housing price risk or the higher the level of consumer heterogeneity about the price risk, the higher the presale premium will be in market equilibrium. This premium is meant to compensate the developer for insuring the future price risk. Conversely, if the presale generates higher financing benefits for developers, or the developers believe the future price will be grow at a lower rate than most consumers think, then the developers have an incentive to reduce the presale premium in equilibrium. In some circumstances, the developers want to offer a presale price discount. Therefore, the overall sign of hedging premium, π^*, can be negative when μ_d is negative and ΔC is large enough to offset other two terms in Eq. (9).

In addition to the presale premium, a unique feature of these models is that one can determine the number of presale transactions. Essentially, the scale of the presale market is determined by the marginal consumer, who is indifferent when choosing between a spot market transaction and a presale purchase. As Fig. 1 shows, a lower critical value of expected growth rate of housing prices will induce a larger presale market. Combining the market equilibrium premium derived from Eq. (9) with critical belief Eq. (9), we obtain the equilibrium value of consumer belief, μ^*:

$$\mu^* = \frac{1}{2}\left(\mu_d + k - \Delta C - \frac{1}{2}\gamma\sigma^2\right). \tag{10}$$

Assuming that buyers have heterogeneous, uniformly distributed beliefs about future housing prices, the market demand for a presale contract is $\frac{k-\mu^*}{2k}$, that is, the proportion of $\frac{k-\mu^*}{2k}$ that consumers will choose when buying a presale-contract real estate at $t = 0$. Similarly, the proportion of households buying housing units in the spot market will be $\frac{k+\mu^*}{2k}$. The presale demand can be written as

$$presale = \frac{1}{4k}\left(k - \mu_d + \Delta C + \frac{1}{2}\gamma\sigma^2\right). \tag{11}$$

The scale of the presale market is determined by consumer heterogeneity, market risk of housing prices, developer's differentials in expected price appreciation, and developer's benefits from presale. There are two interesting results to consider regarding presale transaction volumes. The first is the strategic role of a forward contract for a developer. The presale volume can be reduced if developers believe that they will be better off holding onto inventory and selling the projects after completion. The second is the effect of housing price risk. Equation (9) shows that a higher price risk is associated with a higher presale premium; at the same time, more presale transactions are made in the market. The two results are all consistent with the empirical findings in a hot real estate market in Asia during the period 1999–2010 (Chau, et al. 2007).

Consumption heterogeneity also plays an important role in presale markets. Specifically, a higher level of consumer heterogeneity is associated with both a higher presale price and a larger presale transaction volume. As consumers' beliefs about future price growth rates diverge, the developer can charge a higher price for presale contracts, other things being equal. The increased heterogeneity also creates a greater need for a hedging price risk. Although beyond the scope of the current study, it would be interesting to investigate what factors influence consumption heterogeneity. Information asymmetry and transparency are possible answers, which may explain why presales are dominant in emerging markets in addition to the higher price volatility in those markets.

Comparative Statics

To understand the determinants of equilibrium results and the dynamics of presale transactions, we run several comparative statics. Figure 2 plots the relation between the presale hedging premium of and market risk at different levels of the consumer future housing price belief heterogeneity. The figure illustrates that higher presale premiums are charged by developers for higher housing price risks. For example, when consumers' beliefs about future housing price appreciation are represented by a uniform distribution [−30%, 30%] and the expected variance is 20%, the presale premium is 25% of H_0 level. Higher consumer heterogeneity about future housing price beliefs also corresponds to a higher hedging premium. Figure 3 plots the relation between the size of the presale market and market risks at different levels of consumer beliefs, demonstrating that greater presale transactions are associated with higher housing price risks. For example, when consumers' beliefs about future housing price appreciation are uniformly distributed [−50%, 50%] and the expected variance is 20%, the demand for presale contracts will amount to approximately 30% of the development market.

Figures 4 and 5 plot the effects of developer financing advantages on the equilibrium presale premium and market size. Figure 4 demonstrates the relation between the hedging premium of presale and market risk at different levels of the financing advantage through presale, ΔC; it shows that larger financing advantages will lower the presale premium charged by a developer. For example, when consumers' beliefs about future housing price appreciation are uniformly distributed [−30%, 30%] and the expected variance is 20% and if presales reduce financing costs by 10%, the presale premium is 10% of H0; the corresponding premium is 30% if there are no financing advantages. Figure 5 plots the relation between presale market size and market risks at different levels of the presale financing advantages, ΔC. Panel B of the figure demonstrates that the greater the presale financing advantages, the greater the increase in the presale market size. For example, when consumers' beliefs about future housing price appreciation are uniformly distributed [−30%, 30%] and the expected variance is 20%, and if presales provide a 20% reduction for financing costs, the presale demand will be approximately 40% of total development. Figures 4 and 5 illustrate the importance of the presale financing cost savings. As financing savings decrease to zero, presales will diminish, particularly in riskier markets.

Extensions

To explore the role that presale real estate contracts play in the pricing and risk hedging of residential real estate,[10] we provide two extensions. We introduce developer default risk (Extension I) and consumer default risk (Extension II). Similar to the base case, Extension I features the presale as a standard forward contract. Extension II, however, is equivalent to treating presales in an option framework (see Lai, et al. 2004).

Extension 1: Presale as a Forward Contract with Developer Default Risk

Suppose that with probability p the presold real estate unit cannot be completed[11] at $T = 1$. The value $\alpha \in [0, 1]$ is the proportion of the presale price lost by the consumer because of the seller's default. Conceptually speaking, the loss might be viewed as the portion of the presale contract "deposit" that is non-recoverable, given the default.

The consumer-buyer's utility from a presale transactions is thus:

$$Max\ EU_F(W_1) = (1-p)\frac{1}{-\gamma}e^{-\gamma[W_0-P_0]} + pE\left[-\frac{1}{\gamma}e^{-\gamma[W_0-\alpha P_0-H_1]}\right]. \tag{12}$$

In the above formulation, the presale contract will be consummated with a probability of $1-p$, (as in the base model). In a default situation, the presale purchaser would lose a proportion, α, of the presale investment and would subsequently need to buy a dwelling in the spot market (price W_1). At the same time, a consumer achieves his or her utility from a spot

[10] Our analysis is general, and, in principle, applies to non-residential real estate.
[11] Developer default may relate to "non-delivery" of the dwelling unit on time or delivery on time but with significant dwelling defects. We assume developer default risk is exogenous.

transaction as

$$Max\ EU_s(W_1) = E\left[-\frac{1}{\gamma}e^{-\gamma(W_0-H_1)}\right]. \tag{13}$$

Equating the expected utility of a presale contract with the expected utility of the spot market purchase, we derive the critical value of mean belief:

$$\mu^* = \pi - \frac{1}{2}\gamma\sigma^2 + \beta(H_0 + \pi) > \mu^* \text{ (base case)} \tag{14}$$

where $\beta = \frac{p\alpha}{1-p}$.

If there is no default risk ($p = 0$) or if the presale buyer's deposit is 100% recoverable-refundable ($\alpha = 0$), then the second element in Eq. (14) vanishes, and the critical value reduces to that which is in the base case scenario.

As before, the developer's challenge is to maximize the expected utility from profits based on market demand from the spot and presale markets by choosing the hedging premium. In the case of an exogenous developer completion failure (i.e., default), presumably the developer would not be able to realize any revenue but may in fact incur losses from his or her initial investment. With probability 1-p, the developer achieves the utility as in the Base Model:

$$f = E\underset{\pi^*}{U}(R) = (1-p)\left[(H_0 + \pi - C_0)\frac{k-\mu^*}{2k} + (H_0 + \mu - C_1)\frac{k+\mu^*}{2k}\right]. \tag{15}$$

The optimal hedging premium π^* can be solved using the first-order condition:

$$\pi^* = \frac{1}{2(1+\beta)}\left[k + (1+\beta)(\mu - \Delta C) + \frac{1}{2}\gamma\sigma^2 - \beta H_0\right]. \tag{16}$$

If the default probability is zero or the buyer's default loss is fully recoverable, the default does not affect the pricing of the presale contract. Therefore, the premium will be the same as the no- default risk case, the base Model (i.e., if $p = 0$ or $\alpha = 0$, then $\beta = 0$, the risk premium reduces to that of the base case). A higher exogenous default rate or a higher loss given a default makes presale contracts less attractive. The transaction volume will therefore be smaller than those without default risk.

Extension II: Presale as an Option Contract with Endogenized Consumer Default

We now extend the basic model by endogenizing consumer default. Assume that consumers secure a presale contract by using a small cash down payment at $T = 0$ to obtain the right (but not the obligation) to purchase the housing unit in the future $T = 1$. The presale transaction can be regarded as an option contract. The consumer pays α portion of the presale price (the option price) to purchase the right to obtain one dwelling unit in the future at a pre-specified price (the exercise price). The presale buyer has the legal right to walk away from the purchase agreement by forfeiting the deposit and will do so if the spot housing price is sufficiently lower than the presale contract exercise price. When the consumer decides to forfeit the presale contract, the maximum buyer loss is equal to the pre-sale down payment. The consumer's option, however, is granted at the developers' expense, which, in turn, should be reflected in the presale premium. (For analytic convenience, in the case of the real estate developer default, we assume the consumer's deposit will be recovered fully.)

With the endogenized default option, the consumer maximizes the following utility function using presale contracting:

$$MaxEU_F = E\max\left\{-\frac{1}{\lambda}e^{-\gamma[W_0-P_0]}, -\frac{1}{\lambda}e^{-\gamma[W_0-H_1-\alpha P_0]}\right\}$$

$$= -\frac{1}{\lambda}e^{-\gamma[W_0-P_0]} + e^{-\gamma[W_0-\alpha P_0]}E\max\left\{0, -\frac{1}{\lambda}e^{\gamma H_1} + \frac{1}{\lambda}e^{\gamma(1-\alpha)P_0}\right\}. \qquad (17)$$

The first term of Eq. (14) is identical to utility in the base case whereas the second term represents the call option, which has a non-negative value.

Subsequently, if period 1 is a hot housing market, where $H_1 > (1-\alpha)P_0$, the consumer will proceed to exercise the presale contract; when the market is cold, where $H_1 \leq (1-\alpha)P_0$, the consumer will default on the presale contract.

The maximum expected utility a consumer derives as the presale buyer is

$$EU_F = -\frac{1}{\gamma}e^{-\gamma[W_0-P_0]}N(-d) - \frac{1}{\gamma}e^{-\gamma(W_0-\alpha P_0)+\gamma P_1+\frac{1}{2}\gamma^2\sigma^2}N(d-\gamma\sigma) \qquad (18)$$

$$where\ d = \frac{(1-\alpha)P_0 - (H_0+\mu_i)}{\sigma}.$$

The maximum expected utility a consumer derives from buying on the spot market is

$$EU_s = -\frac{1}{\gamma}E\left[e^{-\gamma(W_0-P_0)}\right] = -\frac{1}{\gamma}e^{-\gamma(W_0-H_0-\mu_i)} + \frac{1}{2}\gamma^2\sigma^2.$$

Again, by equating expected spot-market and presale-market utilities, the critical value for risk aversion will be

$$\mu^* = L(\pi) - \frac{1}{2}\gamma^2\sigma^2 - H_0 \qquad (20)$$

$$where\ L = \frac{1}{\gamma}log\left[\frac{e^{\gamma P_0}N(-d)}{1-e^{\gamma\alpha P_0}N(d-\gamma\sigma)}\right].$$

The corner cases:

$When\ \mu^* = k$, all transactions are spot sales

$L(\pi) = k + H_0 + \frac{1}{2}\gamma\sigma^2$

$When\ \mu^* = -k$, all transactions are presales

$L(\pi) = -k + H_0 + \frac{1}{2}\gamma\sigma^2$.

The developer's maximum utility of profits

$$Max\ EU_F(profit) \qquad (21)$$

$$= E\{(P_0 - C_0)[1 - I_A(H_1)] - (\alpha P_0 + H_1 - C_1)I_A(H_1)\}$$

$I_A(H_1)$ is an indicator function defined as

$$I_A(H_1) = \begin{cases} 1 \text{ if } H_1 \in A \ or\ H_1 < (1-\alpha)P_0 \\ 0 \text{ if } H_1 \notin A \ or\ H_1 \geq (1-\alpha)P_0 \end{cases}. \tag{22}$$

Therefore the total utility of the development industry can be written as

Total profit the developer obtains from both markets is

$$EU = \frac{k-\mu^*}{2k} EU_F(profit) + \frac{k+\mu^*}{2k} EU_S(profit) \tag{23}$$

$$= \frac{k-\mu^*}{2k} E\{(P_0 - C_0)[1 - I_A(H_1)] - (\alpha P_0 + H_1 - C_1)I_A(H_1)\}$$

$$+ \frac{k+\mu^*}{2k}(H_0 + \mu_d).$$

The first order-condition yields the equation for solving the optimal premium π^*

$$\pi^* = \arg\max_{\pi} \left\{ \frac{k-\mu^*}{2k} \left[(P_0 - C_0)N(-d) + E[(\alpha P_0 + H_1 - C_1)I_A(H_1)] \right] + \frac{k+\mu^*}{2k}(H_0 + \mu_d) \right\}. \tag{24}$$

where μ^*, P_0, and d are functions of π

Equation (22) does not have a closed-form solution, as do the previous models. Numerical methods can be employed to generate an intuition that will highlight the option feature of presale contracts.

If a presale contract is written such that there are more protections granted to the consumer, that is, the consumer can walk away without exercising the option to buy, and then the presale can achieve even greater currency among consumers. Developers, however, will simply incorporate the option premium into the presale price. Table 1 provides a summary of the analytic results for the presale market pricing and scale for the basic model, Extension I, and Extension II.

Concluding Comments

Our study is one of the first market equilibrium analyses designed to provide a theoretical foundation for explaining the extensive worldwide practice of residential real estate presale agreements for uncompleted dwellings. Presale contracts benefit both consumers (buyers) and developers (sellers). Focusing on two risks intrinsic to all presale contracts—market value and default—we investigate the effects of these presale risks on presale contract pricing. Assuming heterogeneous agents in the residential real estate market, we examine and explain risk-sharing and hedging effects for homebuyers and developers. We also explore how hedging premiums and the level of presale contracting activity are functions of market risk, heterogeneous beliefs of consumers, financing benefit, and default probability of buyers and developers.

In addition to developing a simple theoretical model for explaining underpinnings of the presale real estate market, there are at least two extensions and refinements, beyond the scope of this paper, that are worthy of additional theoretical analysis and empirical exploration. The first is to take into account the combination and interplay of high search costs and real estate market segmentation. In such circumstances, these market "imperfections" would create complex and perhaps important explanatory elements for the overall presale contracting marketplace. Second, most residential real estate acquisitions, including those purchased using the presale contract, require third-party financing. The interactions created by the presale contract between and among the lender, buyer, and seller are likely to be fraught with complex risk-sharing behavior, with substantive moral hazard and adverse selection risks. Untangling these risks through innovative lending contracts is an area ripe for future research.

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Table 1. Comparative model analysis. This table compares the equilibrium price and quantity of presale contracts under the assumption of heterogeneous beliefs. The base model treats presale as a forward contract without considering default risks. Extension I treats presale as a forward contract with exogenous default risks. Extension II further endogenizes consumer default and treats the presale as an option contract. The three models of presale assume a two-period endowment economy with two types of CARA-utility agents: heterogeneous consumers and homogeneous developers in real estate industry. The future housing price H_1 is assumed as normally distributed with mean $H_0 + \mu$ and standard deviation of σ. The price of a presale contract is defined as $P_0 = H_0 + \pi$, where H_0 is a hypothetical housing price at $t = 0$ for a virtual real estate unit that is completed but not available for occupancy until $t = 1$. π is the hedging premium ($\pi > 0$) or discount ($\pi < 0$), which is determined in the presale market. Other variables used in Table 1 are as the following: $\beta = \frac{p\alpha}{1-p}$, where p is default probability of timely construction and α is loss severity.

	Base model	Extension I	Extension II
Market Description	Presale as a Forward Contract No Default Risks	Presale as a Forward Contract With Exogenous Default Risks	Presale as an Option Contract With Endogenized Consumer Default
Equilibrium Quantity of Presales is $N_0 = \frac{k-\mu^*}{2k}$ Where the Critical Consumer Belief is μ^*	$\mu^* = \pi - \frac{1}{2}\gamma\sigma^2$	$\mu^* = \pi - \frac{1}{2}\gamma\sigma^2 + \beta P_0$ $where\ \beta = \frac{p\alpha}{1-p}$	$\mu^* = L(\pi) - \frac{1}{2}\gamma\sigma^2 - H_0$ $where\ L(\pi) = \frac{1}{\gamma}\log\left[\frac{e^{\gamma P_0}N(-d)}{1-e^{\gamma P_0}N(d-\gamma\sigma)}\right]$
Equilibrium Price of Presales is $P_0 = H_0 + \pi^*$	$\pi^* = \frac{1}{2}\left(k + \mu_d - \Delta C + \frac{1}{2}\gamma\sigma^2\right)$	$\pi^* = \frac{k + (1+\beta)(u_d - \Delta C) + \frac{1}{2}\gamma\sigma^2 - \beta H_0}{2(1+\beta)}$	No closed-form solution Solved by numerical method.
Where the Optimal Hedging Premium is π^*	$where\ \Delta C = C_1 - C_0$	$where\ \Delta C = C_1 - C_0$	

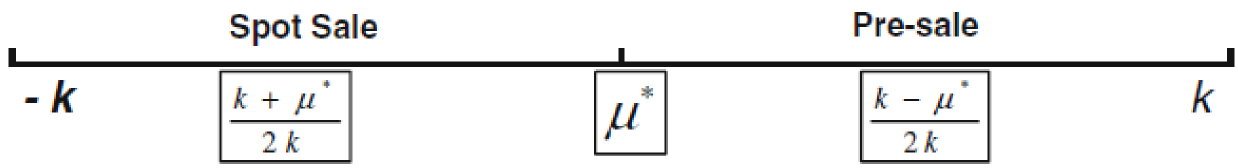

Figure 1. Equilibrium distribution of real estate demand in the presence of presale contracts. Under uniform distribution of consumer beliefs, the marginal consumer-buyer separates the total real estate demand into the presale market and the spot market. More bullish buyers will enter the presale market whereas bearish buyers trade on the spot market.

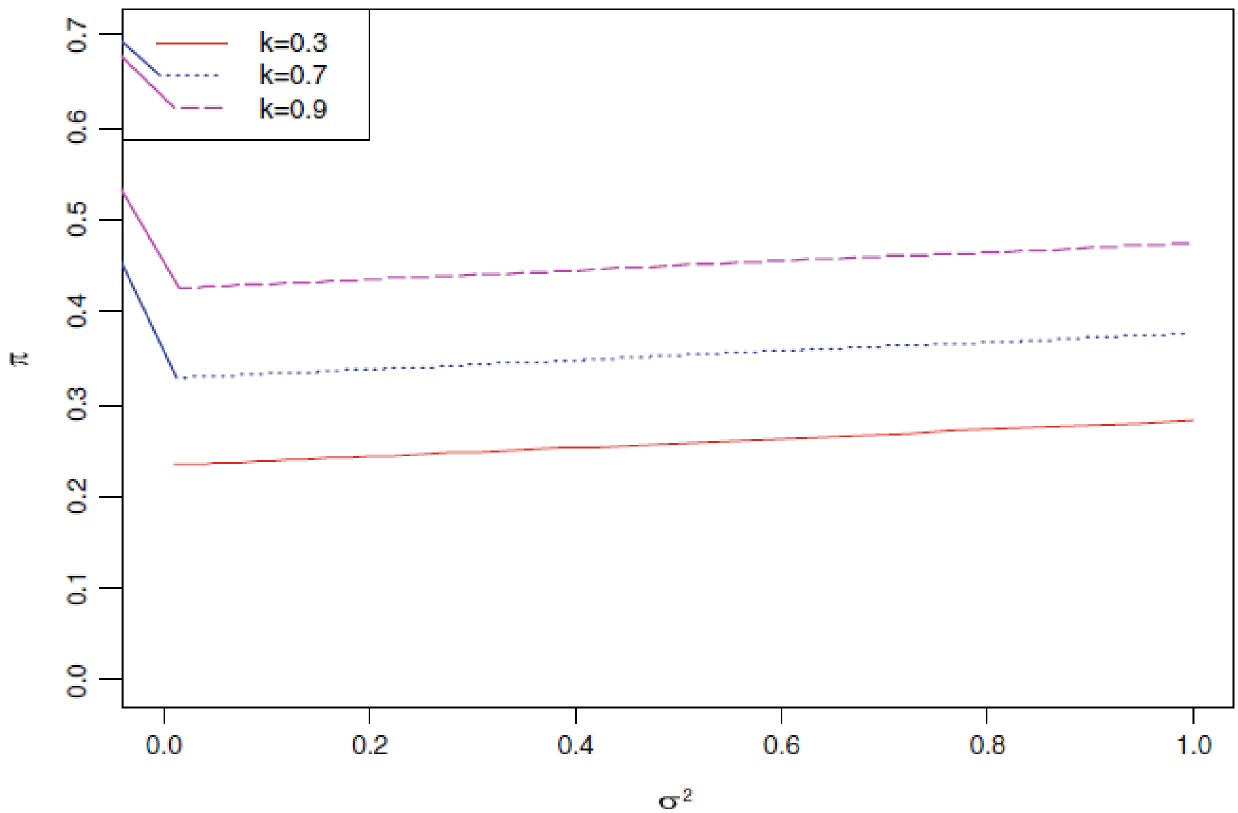

Figure 2. Equilibrium hedging premium with different levels of consumer beliefs. This figure plots the relationship between the hedging premium of presales and market risk at different levels of consumer heterogeneity in beliefs about future housing price. It shows that higher presale premiums are charged by developers for higher housing price risks. For example, when consumers' beliefs about future housing price appreciation fall in a uniform distribution [−30%, 30%] and expected variance is 20%, the presale premium is 25% of H_0 level. In addition, the higher the consumer heterogeneity in beliefs about future housing price, the higher the hedging premium.

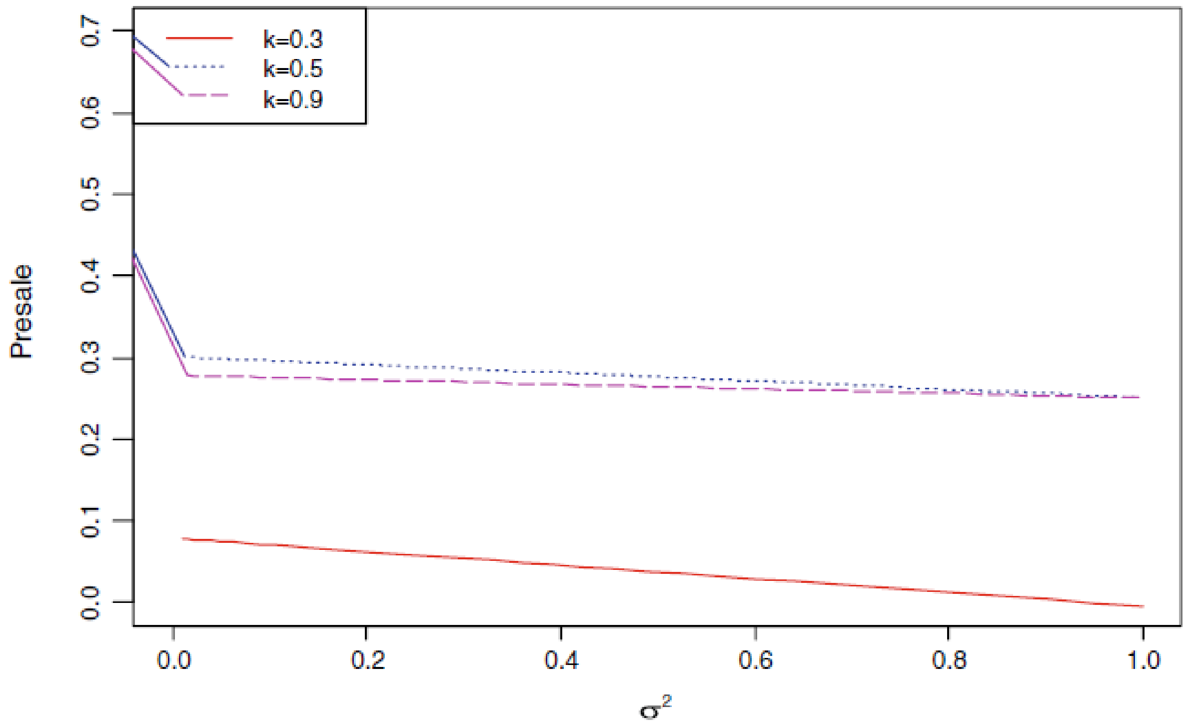

Figure 3. Equilibrium presale market size with different levels of consumer beliefs. This figure plots the relationship between the size of the presale market and market risks at different levels of consumer heterogeneity in beliefs about future housing price. It shows that greater presale transactions are associated with higher housing price risks. For example, when consumers' beliefs about future housing price appreciation fall in a uniform distribution [−50%, 50%] and expected variance is 20%, the presale demand is approximately 30% of the development size. In addition, the higher the consumer heterogeneity in beliefs about future housing price, the greater the market size of presales.

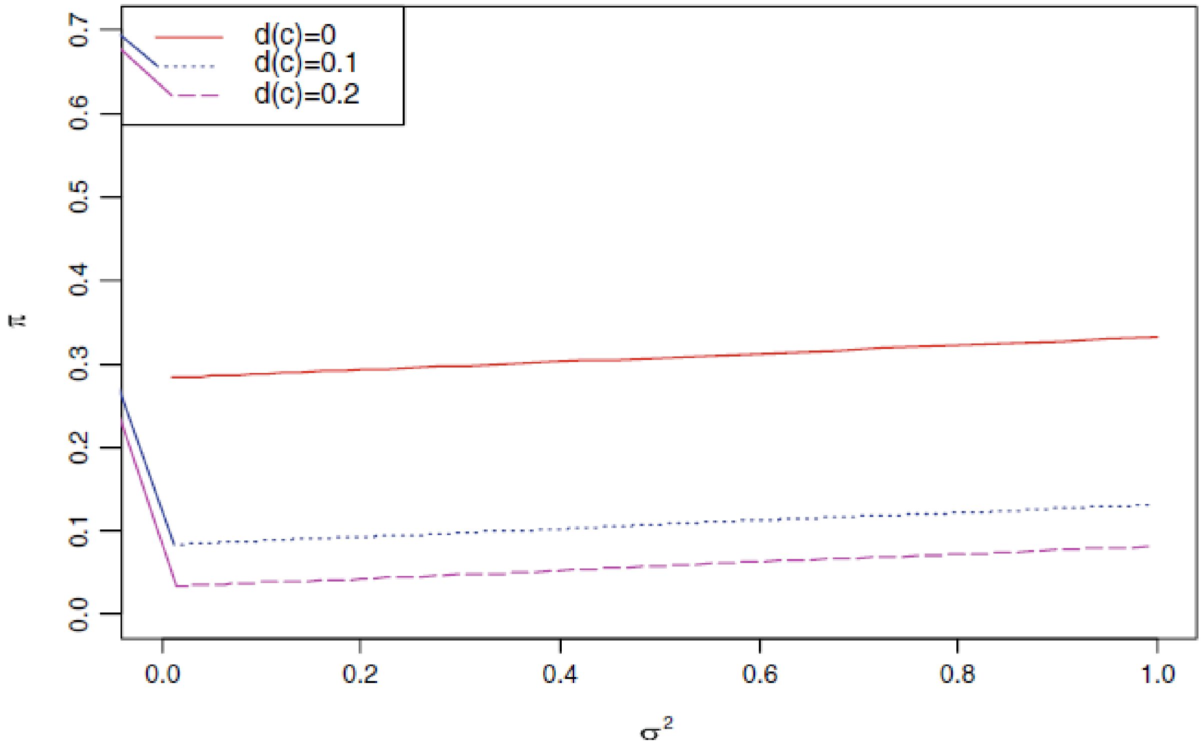

Figure 4. Equilibrium hedging premium with different levels of presale financing advantage. This figure plots the relationship between the hedging premium of presale and market risk at different levels of the financing advantage through presale, d(c). It shows that the bigger the financing advantage of presale, the lower the presale premium charged by a developer. For example, when consumers' beliefs about future housing price appreciation fall in a uniform distribution [−30%, 30%] and expected variance is 20%, and if presale provides a 10% cost reduction via a financing channel, the presale premium is 10% of the H_0 level; the corresponding premium is 30% if there are no financing advantages.

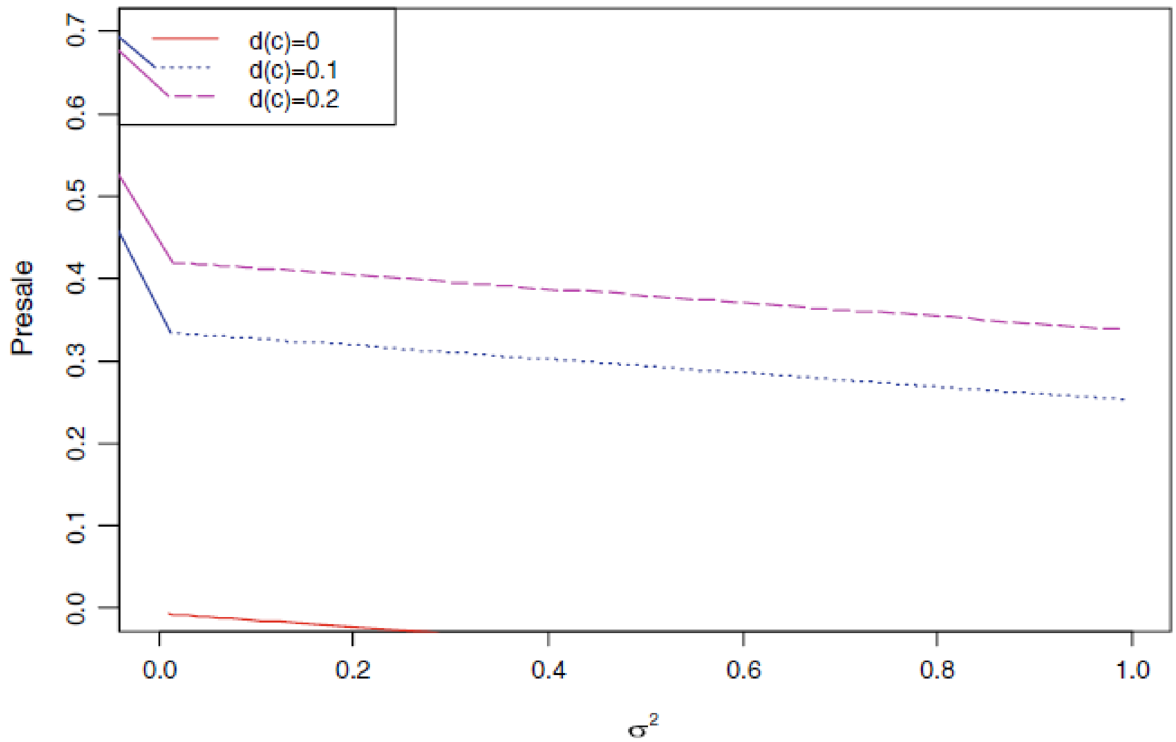

Figure 5. Equilibrium presale market size with different levels of presale financing advantage. Panel B plots the relationship between size of the presale market and market risks at different levels of the financing advantage through presale, d(c). It shows that a greater presale financing advantage corresponds to a bigger presale market. For example, when consumers' beliefs about future housing price appreciation fall in a uniform distribution [−30%, 30%] and the expected variance is 20%, and if presales provide a 20% cost reduction via a financing channel, the presale demand is approximately 40% of the development size.