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How do Developers Price New Housing in a Highly Oligopolistic City?

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The profiteering developer is a common figure in debates over housing policy. Governments increasingly use developer profits to justify policies like inclusionary housing. Yet we actually understand little about the competitiveness of housing development. One unresolved question is whether developers use market power to profit when selling new units, especially in highly concentrated markets. We use the case of Hong Kong, where the five largest developers build almost two-thirds of new housing units, to address this question. Using a repeat-sales approach, we find that new condominiums sell at a discount, not a premium. We attribute this lack of market power to the resalable feature of durable goods – the discount is larger when more re-sellers are located nearby – as well as the need for liquidation – the discount is larger when developers have to sell more units simultaneously. Our results suggest that the first-hand market, even in a highly concentrated market, is competitive. They add to a growing body of research work on the role of new housing in affordability, and invite further study of competitiveness in different kinds of housing markets.

Keywords

Developers, Monopoly, Housing Price

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1. Introduction

The profiteering real estate developer is a common figure in policy debates. Animosity to developers and new developments has spurred moratoria on all new construction (Manville and Osman, 2017), and governments use the perception of developer profit to justify policies such as impact fees, community benefits agreements, and inclusionary housing. A recent article in the *Shelterforce* community development magazine on how all cities should adopt inclusionary housing ordinances argues, "where housing development is profitable, the added cost of an inclusionary housing program … can be fairly easily borne." (Reyes, 2018). Yet we actually understand little about the competitiveness of housing development in a systematic manner. In her seminal article, DiPasquale (1999) laments the dearth of knowledge in housing supply and the development process. Many of the holes in our understanding persist today (Been *et al.*, 2017).

The market structure of the real estate industry is also one part of a popular explanation for high housing costs, and advocates often blame new luxury housing for high rents (Tenants Together, 2018). Casual observers might think that potentially corrupt and clearly oligopolistic developers build only for the very rich, and because of their market power, they are able to charge excessive and exorbitant prices for new housing. But is this true? Do developers price new housing units above their market value? We can answer this question, even though it is only one component of developer profit and the market structure.

We use Hong Kong as a case of a highly oligopolistic city to explore this question and provoke further research in other cities with different market structures. The following are some stylized facts of Hong Kong. First, Hong Kong has one of the most expensive property markets in the world. In 2017, the average residential (condo) price reached a record high of US$1700/ft^2 (Rating and Valuation Department, 2018), well out of reach of the vast majority of the population. Second, popular accounts in Hong Kong partly explain unaffordability with the market power of developers:

> "Hong Kong's property market for new flats is rigged in favour of the property tycoons who can withhold their massive landbanks, delay development and slowly release completed flats into the market." (Guy, 2016)

Third, casual evidence presented in the media seems to support this argument. Property developers reportedly sold first-hand condo units at a 20-25% price premium over units sold in the resale market.[1] Fourth, the real estate industry is highly concentrated. A government report in the early 1990s found that seven developers supplied 70% of the new units (Consumer Council 1996), and the

[1] Ming Pao, November 10, 2012.

first-hand market became even more concentrated during 1995-2012. Fifth, property tycoons in Hong Kong always top the list of the richest individuals in the city[2], which makes market power an apparently indisputable truth.

The market power explanation, however, suffers from at least two problems – one empirical and the other theoretical. Empirically, even if the 20-25% premium has been accurately estimated, it could be due to quality differences between first-hand and second-hand units. If higher quality products sell at a higher price, this is not market power. Theoretically, the literature shows that durable-goods monopolists have difficulty in maintaining their market power, partly because they cannot credibly commit to restricting future supply (Coase, 1972) and partly because they cannot control the second-hand market (Bulow, 1982). This is particularly true for real estate, which is more durable than most other products like automobiles. In the case of a condo market where the product is more homogeneous and comparable, developers are inevitably competing with re-sellers in the second-hand market, including buyers who just bought new units in the same building. Our empirical work can therefore shed light on the difficulty in maintaining market power, with real estate as a prime example of highly durable goods.

More generally, apart from market power, what other factors could affect the average pricing of new housing development? Since developers are selling a large number of units, they face a liquidation problem. Given demand uncertainty, inter-temporal sale strategies (e.g. selling in phases) are often used. Some developers might set a high price and wait for buyers to come. Others might set a lower price and quickly transfer the pricing risk to buyers. This means first-hand units can be sold at a premium or discount, depending on the holding cost of developers. Other possible factors that could affect the differential pricing of first and second-hand housing (e.g. presales of new housing; renovation of old housing) will be controlled for, as far as we can, in this study. This offers a more general perspective to understand the patterns of over or underpricing, without confining to the market power argument.[3]

The identification of a discount or premium on new units is an empirical challenge. A first-hand unit is normally higher in quality than a second-hand one, so simple price comparison or even a hedonic approach is insufficient to control for unobserved qualities (e.g. design and building quality). With a highly liquid second-hand market in Hong Kong from 1995 to 2012, we carefully select a sample of repeatedly sold properties for analysis, i.e. properties first sold by a developer to the first owner (first-hand sale), and subsequently sold again by the first owner to another buyer (second-hand sale

[2] See, for example, https://www.forbes.com/hong-kong-billionaires/list/ (last accessed 7/6/2018).

[3] Coulson *et al.* (2019) find that, based on a hedonic study of Las Vegas, new homes can be sold at a premium or discount. This means overpricing should not be taken for granted.

or resale).[4] This repeat sales approach requires that the *same* property is priced twice so that any change in unobserved qualities is minimized. General changes in market price levels over time can be controlled by property price indices.

Our results show that, in contrast to anecdotal evidence, new housing units actually sell at a discount with respect to otherwise identical resales. This first-hand discount, moreover, is larger for the developers who have the highest market share. These findings do not support the market power argument; rather, they suggest that developers with a large inventory tend to reduce the holding cost by selling more quickly and cheaply. Additionally, we find that developers are more sensitive to substitutes than resellers, consistent with the liquidation argument that developers have a much larger quantity to sell than individual owners. This substitution effect stems not just from the units outside the new development but also from within, thus implying that a developer who is selling many units is indeed competing with itself. The inter-temporal sale strategies of developers, apparently, do not completely offset the self-substitution effect.

We hope that this study provokes further research globally. Understanding how the relative concentration of the real estate industry in a city as well as the importance of new housing in its housing market shapes the discount/premium on new units is important. Clearly, developers and new housing play a crucial role in urban growth, and improving the empirical evidence on their role in the housing market can inform policymaking. For example, since liquid second-hand markets constrain the selling power of developers, governments should promote them to the greatest extent possible, say by moving away from transaction taxes and towards property taxes. Additionally, if a liquid second-hand market is in place, any resources for anti-trust investigations in the real estate sector should target the factors of production of developers (e.g. land purchase), not their selling practices. Our study does not investigate the potential market power of developers as buyers of land or development permits, which may be a source of rents.

This paper is organized as follows. Section 2 reviews the literature on market power and demand uncertainty. Section 3 provides an introduction on the Hong Kong condominium market. Section 4 presents our hypotheses, and Section 5 describes the methodology and data that we use. Finally, Section 6 discusses the results and Section 7 highlights their implications for further research on this topic.

[4] The Hong Kong government implemented a series of new tax and mortgage-related measures in 2013 that targeted first-hand markets. To avoid any bias from these measures, we did not consider transactions after 2012.

2. Literature on Market Concentration and Pricing

A highly concentrated market is conducive to anti-competitive behavior, such as collusion, to earn higher profits. The relationship between concentration and profitability of firms has been long studied (Newmark 1990) but the empirical work on this is plagued with measurement problems. For example, accounting data is a noisy measure of economic variables (Schmalensee 1989). At the firm level, accounting data does not provide adequate information on cost at the product level. This is particularly problematic for conglomerates because the allocation of firm-level costs to different business lines is inevitably arbitrary. The interpretation of the co-existence of high profitability and high market concentration is also unclear (Demsetz 1973). Is it a consequence of market power or production efficiency? A highly productive firm would expand its market share and make more profits, but this is a result of competitive efficiency, not monopoly. For durable goods, the possibility of maintaining market power is also widely debated. Coase (1972) conjectures that market concentration cannot give rise to any market power, because buyers rationally expect that durable-goods monopolists are unable to limit future supply. Similarly, Bulow (1982) argues that durable-goods monopolists cannot control the second-hand market unless they only rent their products. Maskin and Tirole (1988) and Esteban and Shum (2008) have generalized these theoretical arguments to a dynamic oligopoly setting, although empirical work is still scant.

To avoid the abovementioned measurement problems, a more recent approach is to measure market power at the product level by using product prices. Prices come directly from market transactions and are thus not subject to accounting manipulation. They are also less vulnerable to interpretation problems because the pure effect of production efficiency should drive prices down. Recent studies have therefore shifted their focus to analyze the relationship between prices and concentration, and examine industries like rental housing (Cronin 1983), banking (Cyrnak and Hannan 1999), airline (Haskel *et al.* 2013), food retailing (MacDonald 2000), and natural gas (Morris 1988). The review by Weiss (1989) finds a positive relationship between prices and concentration in many industries. However, no studies have been conducted on the real estate market (for sale, not rental) so far, which is arguably one of the most durable goods.

Studies that use prices must also contend with measurement challenges. Most products are not identical and thus sellers compete on dimensions beyond price itself (Newmark 2004). Thus, using prices may still be misleading if there are important uncontrolled or unobserved differences in products such as quality (Pautler 2001). To use the price measure, scholars must carefully consider and control for quality differences. The present study contributes to the empirical literature in this sense, by using a repeat-sales approach that can effectively separate quality from prices for durable goods.

As mentioned in the introduction, market power is not the only force at play in pricing new products. Demand uncertainty is another important factor that could affect the pricing decision of sellers. Starting with the assumption that sellers do not know the exact market demand, how do firms set the quantity and price of goods in advance?

Firms use two common inter-temporal pricing strategies to address demand uncertainty. One is to charge a high price initially and then lower the price in a sales period. Retailers that sell seasonal goods or theatre tickets often take this approach (Nocke and Peitz 2007). The other is to set a low price initially to attract early buyers and then raise the price for those who buy late, a common strategy for airline tickets (Möller and Watanabe 2010). Developers use both strategies, although they tend to favor the latter. Sirmans *et al.* (1997) show that developers reduce the price in the earlier phase to ensure that there will be sufficient demand and then increase the price sequentially as more demand information is obtained.

Whichever strategy developers employ, the demand uncertainty theory does not assert that sellers with a large market share should necessarily earn a price premium. Instead, both holding (inventory) cost and product characteristics matter.

On the one hand, sellers with a large inventory generally want to sell quickly. Developers have a strong incentive to speed up sales in order to reduce holding costs (Ott *et al.* 2011). To do so, however, they have to lower the price in order to induce buyers to take the market risk (Lai *et al.* 2004). On the other hand, sellers with a large inventory can also sell in phases in order to gather information about market demand. Gradually selling units is a common strategy and may help them to achieve higher overall revenues on a project (Wang and Zhou 2006).

The effectiveness of phased sales depends on the similarity of products to other substitutes on the market (Haurin 1988). Waiting may not benefit sellers if holding costs are high and close substitutes are available. This means, for durable goods, the substitutability between first and second-hand products should also matter. We cannot find any articles that focus on this question as we do, thus a further contribution of this study is the innovative measure of product similarity inspired by the atypicality measure in Haurin (1988).

3. Condominium Market in Hong Kong

The property market in Hong Kong differs from other cities in at least four important ways. First, the majority of housing units are condominiums in medium to large buildings, typically between 20 and 40-storeys tall. Such buildings are often developed into an estate that houses more than a thousand

units. Second, the vast majority of new housing units sell as condominiums to individuals. Rarely do Hong Kong developers maintain ownership of multi-family housing and rent units out. Instead, the rental market primarily comprises individual property owners who rent out their condominiums in multi-owner buildings. Third, all land is technically owned by the government and sold to developers as leasehold interest through annual land auctions and land use conversions. Finally, roughly half of the population in Hong Kong lives in publicly built housing (30% in public rental housing and 20% in subsidized ownership housing), which means its social-spatial structure is as different from US cities as its built environment (Monkkonen and Zhang, 2014).

In our analysis, we consider the first-hand and second-hand condominium markets separately. They do not operate in isolation from one another, however. Developers employ various strategies to sell their newly built units as they cannot ignore the potential substitutes offered by nearby resellers. The nature of durable goods dictates that in the long-run, second-hand goods will dominate the supply. This is true for Hong Kong condominiums. The annual new supply (first-hand units) constitutes less than 2% of the total stock on average[5]. First-hand units were, on average, 18% of all transactions between 2002 and 2012. On an unadjusted basis, first-hand units were sold at a 5% premium over second-hand units in our sample.

One difference between markets is that property agents coordinate the sale and purchase of second-hand units on behalf of individuals. They match individual buyers with sellers and facilitate negotiation between them. Compared to the first-hand market, the second-hand market is more competitive simply because there are so many sellers with very few units. They therefore do not make use of sale strategies that are otherwise available to developers.

In this study, the focus is on the first-hand units built and sold by real estate developers. According to the Consumer Council (1996), the first-hand market was highly concentrated with a small number of large developers. At that time, seven developers built and sold 70% of the new units. We produce an updated picture for 1995 to 2012 in Table 1, which shows how the first-hand market actually became more concentrated since that report. On average, three developers built and sold 64% of new units and five developers supplied 77%.

Not only is the market concentrated in Hong Kong, few new players have entered the condominium market until recently. The reason for this is not clear. Hong Kong is one of the freest economies in the world[6], thus barriers to entry are low. Capital can easily move in and out, profits tax is low, and the government uses the common law system. The high cost to development, especially land acquisition, may be a barrier, but there is nothing to prevent

[5] Raw data from the Rating and Valuation Department of Hong Kong.
[6] See, for example, http://www.heritage.org/index/country/hongkong (last accessed 7/6/2018).

developers from forming joint ventures in land bidding. Another possible barrier is a lack of local knowledge or contacts, but new firms can buy expertise from professionals and market analysts. The recent aggressive entry of Mainland Chinese developers into the condominium market in Hong Kong, with 40% of the land market share in value terms in 2016,[7] shows that the lack of local knowledge is not a sufficient barrier.

Table 1 Market Share of Major Developers in the First-Hand Condominium Supply Market: 1995-2012

Year	Developers with highest market share					Percent of new housing sold by	
						Top 3	Top 5
1995	A	C	B	E	F	47	52
1996	C	A	B	F	H	51	61
1997	B	A	D	E	C	49	68
1998	A	D	E	B	F	51	62
1999	C	B	A	H	D	73	74
2000	B	C	E	A	J	46	62
2001	B	E	H	A	J	68	80
2002	B	C	D	A	I	55	77
2003	B	G	A	C	F	61	80
2004	B	A	E	D	J	67	71
2005	B	C	A	I	D	66	75
2006	B	A	C	D	E	62	76
2007	A	E	B	C	G	81	87
2008	A	E	C	B	G	59	75
2009	E	B	A	C	G	61	72
2010	A	B	J	E	G	80	89
2011	A	B	D	E	C	78	81
2012	E	A	B	D	J	67	88
Average	**B**	**A**	**C**	**E**	**D**	**56**	**70**

Note: A to J denote the 10 major developers in Hong Kong. "Top 3" ("Top 5") is the total market share of the three (five) largest developers. The figures are compiled by the authors from raw data supplied by the Rating and Valuation Department, Lands Department, Buildings Department, and annual reports of the developers.

The limited research on market concentration for housing development in other major metropolitan areas suggests that the industry is usually not as concentrated as in Hong Kong. Comparable data can be challenging, in part because developers use different limited liability companies (LLCs) for different projects. Buzzelli (2001) suggests that concentration of the North

[7] "On the receiving end: mainland Chinese money pours into Hong Kong real estate", *South China Morning Post*, April 28, 2017.

American house-building industry is low compared to other industries. In part, this is because smaller buildings are much more prevalent. In the City of Los Angeles, for example, over half of the 681 new development projects permitted in 2016 were duplexes and only four had over 500 units (City of Los Angeles, 2017). This type of construction allows smaller and more developers to exist.

Using Los Angeles County as a comparison case, available data report the largest five developers selling 43% of the roughly 3000 new units sold in 2017 (Los Angeles Business Journal, 2018). Many of these homes were in single-family subdivisions, as developers of large multi-family residential projects often hold them as rental properties. Also in contrast to the Hong Kong case, the 3000 new units were less than 1% of the housing stock in the county, and less than 4% of housing transactions that year[8].

4. Development of Hypotheses

Our interest is the price of first-hand units relative to otherwise identical second-hand units. The relative price can be first examined from the market structure perspective. Consider a base-case scenario where first and second-hand markets are segmented. First-hand units are supplied by real estate developers. Abstracting from any strategic interactions in an oligopoly market, we consider the simplest case of a first-hand market with a monopolist developer who faces a downward sloping demand curve. As a profit maximizer, the developer would use his/her market power to restrict supply or price-discriminate buyers such that first-hand price will be set above the competitive level. On the other hand, second-hand units are supplied by many individual resellers who have no market power. These resellers would, on average, sell at a competitive price in the second-hand market. Given these assumptions, a hypothesis on the relative price is:

Hypothesis 1: Ceteris paribus, the price of first-hand units is higher than that of second-hand units, especially when the seller of first-hand units is a developer with a high market share.

The above base-case scenario is probably too simplistic. It ignores the liquidation problem of the developer, who has to sell a much larger quantity than individual resellers. Therefore, another perspective to look at the relative price is that all sellers are price searchers who face demand uncertainty. In the second-hand market, resellers do not know exactly what price to set, but each of them only has one unit to sell and can discover market price through negotiation. In the first-hand market, when the developer releases new products

[8] Data from Census Quick Facts www.census.gov/quickfacts/fact/table/losangelescountycalifornia/PST045217 (last accessed 7/9/2018) and Zillow https://www.zillow.com/research/data/2016 (last accessed 7/9/2018).

to the market, what price should s/he set and how fast will the units sell? Consider two extreme scenarios. On the one hand, if the developer negotiates the price of each unit like resellers, the first-hand price should, on average, be the same as the second-hand price, although this would take a long time and incur a high negotiation cost. On the other hand, if the developer sells all units quickly in one go, this would be like a liquidation sale and the price would be heavily discounted. In practice, developers adopt an intermediate solution by selling in phases to discover demand, thus resulting in a modest liquidation discount. Developers with a high holding cost (e.g. a large inventory) tend to offer a higher discount for faster sales. This gives our second hypothesis on the relative price:

Hypothesis 2: Ceteris paribus, the price of first-hand units is (on average) lower than that of second-hand units. Moreover, the higher the holding cost of developers, the lower the price of first-hand units relative to that of second-hand units.

We can test the holding cost component of *Hypothesis 2* in a number of ways. First, developers with the highest market share hold a larger inventory and should therefore sell at a larger discount, as opposed to a larger premium predicted by *Hypothesis 1*. Similarly, developments with more units should sell at a lower first-hand price. Holding cost also relates to market conditions. When the market has higher liquidity or prices are rising, holding costs are relatively lower and the liquidation discount will be smaller.

A further problem with the base-case scenario that underlies Hypothesis 1 is that the first and second-hand markets are assumed to be completely segmented. What if the two are actually substitutable? When setting the first-hand price, developers would look around and check for similar products. In the case of perfect substitutability, first and second-hand prices should be the same, as developers lose all market power when competing directly with resellers. However, if second-hand units are close but imperfect substitutes, developers may still retain some market power under monopolistic competition. They have more power to charge a first-hand premium if their new developments are more dissimilar to nearby second-hand units. On the other hand, resellers also face competition when new developments emerge. Since they do not have market power whatsoever, there is no second-hand premium to charge, even if their units are dissimilar to nearby new developments. This leads to our third hypothesis on the relative price:

Hypothesis 3: Ceteris paribus, the presence of substitutes lowers the price of first-hand units relative to that of second-hand units. Moreover, this negative effect is stronger when closer substitutes are present.

From the point of view of the developers, competition not only comes from the second-hand market, but also from the first-hand units of other developers as well as the units just sold or to be sold. We therefore divide the substitutes into

three types: 1) similar second-hand units, 2) similar first-hand units from other new developments, and 3) similar first-hand units within the same development. A developer would consider Type 2 substitutes closer than Type 1 because both his/her products and Type 2 are brand new. Whether Type 3 is an even closer substitute is an empirical question. It can be considered the closest substitute because units from the same development must share many common features. However, Type 3 is also under the full control of its developer, who could phase the sale of the units in order to keep any 'self-competition' to a minimum. Our empirical result will inform how close Type 3 substitutes are to first-hand units, as compared to Types 1 and 2.

5. Method and Data

5.1 Measurement of Relative Prices

Implicit in our hypotheses is a comparison of first and second-hand prices. To test them, we must minimize, if not eliminate, any quality difference between first and second-hand units. A hedonic pricing model can control for observable quality differences, but unobservable differences, like the reputation of the developer, could still bias our estimate. We therefore develop a new method based on the repeat-sales idea.

Among many transactions of individual units, we confine our sample to units first sold in the first-hand market from a developer to the first owner, and subsequently sold in the second-hand market from the first owner to another buyer. Abundant repeat sales are available, so sample size is not a concern. Since the unit is virtually the same across the two sales, the difference of the two sale prices removes both observable and unobservable quality differences. Here we define the log ratio of first to second-hand price of unit i (FP_i) as:

$$FP_i = ln\left(P_{i,t1}/P_{i,t2}\right) \quad (1)$$

where $P_{i,t1}$ is the price at which the developer sells unit i to the first-hand buyer at time t_1 (first-hand sale) and $P_{i,t2}$ is the price at which the first-hand buyer resells the same unit to a second-hand buyer at time t_2 (second-hand sale). It is the dependent variable of our study.

FP_i is only nominal because general changes in price levels between t_1 and t_2 have not been taken out. We account for general price changes by using real estate price indices proprietarily constructed for each of the 40 districts in Hong Kong. The transactions used to construct the indices are different from the sample used to generate FP_i such that the indices are completely exogenous. The use of district-level indices, instead of a market-wide index, ensures that heterogeneous price changes due to location-specific shocks are captured. For each FP_i, we similarly define a corresponding log ratio of price index values (SP_i) as:

$$SP_i = ln(PI_{t1}/PI_{t2}) \quad (2)$$

where PI_{t1} is the district price index at t_1, and PI_{t2} is the district price index at t_2. For interpretation, one could regard the difference between FP_i and SP_i as the relative price embedded in our hypotheses – the real price of first-hand units relative to the real price of second-hand units. For empirical analysis, however, we will treat SP_i as an independent variable because this allows a more flexible specification. Since both FP_i and SP_i are estimated by using the repeat-sales method (with different samples), any sample selection bias in FP_i is arguably captured by the same bias in SP_i.

What about price changes due to physical depreciation? This would give FP_i an upward bias. We address this problem in two ways. One is that the age difference ($DAGE_i$) between the first and second sale of unit I will be added as a control variable. The other is to restrict our repeat-sales sample to units sold within five years after completion.[9] Condominiums within five years are still relatively young and it is unlikely that changing ownership will induce significant depreciation or renovation during this time.

Finally, we also have to consider if the first-hand sale takes place before or after building completion. It is quite common for developers in Hong Kong to sell their units before completion (presales). Chau *et al.* (2003) show that the loss in rental income for presales induces a price discount; Lai *et al.* (2004) further show that presales can reduce the bankruptcy and marketing risks of developers. It is therefore important to control for the presales factor whenever first-hand price is compared to second-hand price. As such, we add a dummy variable *PRE*, which has a value of 1 if the first-hand sale is a presale and 0 otherwise, as another control variable.[10] As far as we know, taxes are similar across the two sub-markets, while it is common for developers to pay the agency fee for buyers in the first-hand market (by marking up the price). If there is any bias, it would be towards a first-hand premium rather than a discount. More importantly, our empirical model in the next section will not solely rely on the intercept (average relative price), which could be distorted by the presales factor or agency fee, to test the hypotheses on market power and liquidation problems. Other variables that should not be correlated with presales (e.g. market share of developers; scale of a development) are also used to check consistency and robustness.

[9] We acknowledge that this restrictive sampling method might exaggerate the sample selection bias of the repeat sales method (Gatzlaff and Haurin, 1997), even though our sample period covers a full economic cycle. We tried to extend the repeat-sale restriction from five to ten years, and the results remain similar.

[10] We also follow the cost-of-carry model in Chau *et al.* (2003) to adjust for the discount of presales. The results after the adjustment are similar to the results based on a PRE dummy and not reported here.

5.2 Empirical Model

Using the first-hand price premium and other control variables described above, our empirical model is:

$$FP = a_0 + a_1 SP + a_2 SP^2 + a_3 DAGE + a_4 DAGE^2 + a_5 PRE + a_6 BIG5 + \boldsymbol{DU} + \boldsymbol{SIM} + \varepsilon \quad (3)$$

where a_0-a_6 are coefficients to be estimated; *BIG5* is a dummy variable which equals 1 if the unit is sold by the five developers with the highest market share[11] (see *Table 1*) and 0 otherwise; ***DU*** is a vector of variables that captures the problem of liquidation; ***SIM*** is a vector of variables that measures similarity in different ways; and ε is an error term. We suppress the subscript *i* to simplify presentation. We add squared terms of *SP* and *DAGE* to allow for non-linearity. Table 2 presents the definition of each variable.

Table 2 Description of Variables

Variable	Description
FP	Log of the ratio of first-hand price at t_1 to second-hand price at t_2 for the same unit
SP	Log of the ratio of the district price index at t_1 to the district price index at t_2
SP^2	Square of *SP* (to capture any non-linear effects)
DAGE	Building age at t_1 minus building age at t_2 for the same unit
$DAGE^2$	Square of *DAGE* (to capture any non-linear effects)
PRE	A dummy variable that equals 1 if a unit is sold by the developer before building completion (i.e. a presale) and 0 otherwise
BIG5	A dummy variable that equals 1 if a unit is developed by the five developers with the highest market share and 0 otherwise
Variables related to demand uncertainty (DU)	
DEVS	Development scale, in total number of units within a development
MKTS	Market sentiment, measured by the past 12-month change in market price in log scale before the first-hand sale takes place
VOL	Trading volume in the second-hand market at the time the first-hand sale takes place
Variables related to similarity (SIM)	
S	Number of units within a catchment zone (radius=1 km or 1.5 km)
S3	Number of units within the catchment zone that meet these three criteria: 1) building age is within 5 years, 2) unit size is within ±100 square feet, and 3) floor level is within ±10 storeys
$S3_s$	Number of second-hand units in *S3*
$S3_f$	Number of first-hand units in *S3* from other developments
$S3_w$	Number of first-hand units in *S3* within the same development

[11] We have tried top three developers and the results (not reported) remain similar. Joint-venture projects were not common except for very large sites, which are captured by another variable on development scale (DEVS).

We demean all right-hand-side continuous variables so that we can interpret the intercept, a_0. a_0 is the key parameter to test Hypothesis 1 (market power) against Hypothesis 2 (liquidation). The former predicts that a_0 is positive and the latter predicts that it is negative.

Another parameter that can differentiate the two hypotheses is a_6, the coefficient of *BIG5*. If market power exists, it is most likely associated with developers with a high market share. Hypothesis 1 predicts that a_6 is positive. In contrast, if the liquidation problem prevails, developers with a high market share are likely to suffer most due to their high holding cost; they typically have many projects in the pipeline and are under pressure to sell their units out in a timely manner. If Hypothesis 2 is true, a_6 should be negative.

DU captures some unique implications that arise from the liquidation problem:

$$\boldsymbol{DU} = b_1 DEVS + b_2 MKTS + b_3 VOL \quad (4)$$

where *DEVS* is the development scale, measured by the total number of units that a developer has to sell with unit *i*; *MKTS* is market sentiment, measured by the past 12-month change in market price in log scale before the first-hand sale takes place; *VOL* is the trading volume in the second-hand market at the time the first-hand sale takes place; and b_1-b_3 are their coefficients. Hypothesis 2 predicts a lower first-hand premium when the holding cost is high. A large development with more units to sell is an indication of a high holding cost, whereas a positive market sentiment (a growing price trend) and high liquidity (more transactions) tend to reduce the cost to wait. For example, in a growing and thick market, developers have less pressure to sell all units in one go and are more willing to wait and discover the market price. As a result, we expect b_1 to be negative, and b_2 and b_3 to be positive.

5.3 Measurement of Similarity

Hypothesis 3 assumes that the first and second-hand markets are substitutable. It is therefore necessary to measure substitutability. We simplify the atypicality measure in Haurin (1988) and develop a few similarity measures in terms of property attributes. The first measure is location similarity – buyers would consider any properties around a new development as substitutes. We define a catchment zone, within which we count the total supply of units (*S*). Since Hong Kong is a compact city, we set 1.5 km (about a 15-minute walk) as the radius of the catchment zone. We also try a smaller area with a 1 km radius as a robustness check. This is our first albeit crudest similarity measure.

Within the catchment zone, buyers might not consider all units as substitutes. They may look further to their quality attributes. In Hong Kong, three important attributes are building age, unit size, and floor level. For building age, a unit has to be within five years old in order to qualify as a substitute of a new

development.[12] For unit size, units are considered substitutable if their size difference is less than 100 square feet. For high-rise condominiums, the vertical location of a unit is often an important consideration as it affects the view and environmental quality (Wong *et al.* 2011). Units are considered substitutable only if their floor level difference is less than 10 stories. Our second similarity measure is the number of units that jointly satisfy the above three criteria (*S3*).

We further divide *S3* into market segments. Buyers who have targeted a first-hand unit may consider other first-hand units as closer substitutes than second-hand units. Other first-hand units may come from other developments or within the same development, and these will have different degrees of substitutability. We thus divide *S3* into the three components: 1) the number of second-hand units ($S3_s$), 2) the number of first-hand units from other developments ($S3_f$), and 3) the number of first-hand units within the same development ($S3_w$). They form our third similarity measure.

Now we can define the ***SIM*** variable in Eq (3) in three ways:

$$\boldsymbol{SIM} = c_1 S \tag{5a}$$

$$\boldsymbol{SIM} = c_1 S + c_2(S3/S) \tag{5b}$$

$$\boldsymbol{SIM} = c_1 S + c_3(S3_s/S) + c_4(S3_f/S) + c_5(S3_w/S) \tag{5c}$$

where c_1-c_5 are coefficients to be estimated. In Eqs (5b) and (5c), *S3*, $S3_s$, $S3_f$, and $S3_w$ are entered as a ratio to *S* because they are a subset of *S*. Hypothesis 3 predicts that all the *c*s are negative. In particular, a first-hand unit should face a stronger substitution effect from other first-hand units than second-hand units, so c_4 should be more negative than c_3. Whether c_4 should be more negative than c_5 is an empirical question. First-hand units from the same development should be a closer substitute than those in other buildings (i.e. $c_4 > c_5$), but a developer could use sale strategies to reduce the effect of self-competition (i.e. $c_4 < c_5$).

5.4 Data

We use a database of all condominium sales in Hong Kong from the Economic Property Research Centre (EPRC). The data include price, sale date, building age, floor level, and unit size. We cleaned or removed transactions that are duplicate, incomplete, or erroneous.[13] To measure FP_i, we focus on new properties completed between 1995 and 2012. The first transaction of a unit is classified as a first-hand sale and the rest as second-hand sales. We cut off in

[12] As of 2012, about 50% of the condominium units in Hong Kong are younger than 25 years old (Rating and Valuation Department).

[13] The raw data could contain transactions recorded 1) twice, 2) with an incomplete address, or 3) with an overly low price (including zeros). We removed these before our analysis.

2012 to allow sufficient time (five years) for repeat sales to occur. This results in 88,983 pairs of repeat sales that involve a developer in the first sale and a reseller in the second sale within five years of completion to minimize the effects of depreciation.

Table 3 summarizes the characteristics of the units in our sample statistics. As shown in Panel A, the first-hand price is lower than the second-hand price of the same unit by 6% (*FP*), simply because market prices have been rising (with average *SP* being negative). The *BIG5* variable requires data on the market share of developers. We manually compile this with raw data from the Rating and Valuation Department, Lands Department and Buildings Department of The Government of the Hong Kong Special Administrative Region, and annual reports of developers. We find that 75% repeat sales pairs in the sample come from the five largest developers.

We collect the total number of units in each development (*DEVS*) from the monthly reports of the Buildings Department. The average development has 2302 units, which suggests high holding costs. This partly explains why presales have been a dominant sale strategy in Hong Kong (67% of the repeat sales involve presales). Developers try to sell before completion in order to reduce inventory costs on the one hand and exposure to market risk on the other hand.

To calculate the similarity measures, we created a residential stock database for all of Hong Kong by using data from EPRC and Centamap (an online service that shows maps of Hong Kong based on data obtained from the Survey and Mapping Office of The Government of the Hong Kong Special Administrative Region). We collected the coordinates, building age, floor level, and size of each unit in the district, regardless whether the unit was sold or not.

Panel B in Table 3 presents the summary statistics of our similarity measures. We vary the radius of the catchment zone from 1.5 km to 1 km for robustness check. On average, there are 28,800 units within 1.5 km of a subject first-hand unit; within them, 1764 meet the three criteria based on building age, unit size, and floor level. More than half the potential substitutes come from the second-hand market, another 23% from the first-hand development itself, and the rest from other first-hand developments. $S3_w$ remains the same regardless of the change of the catchment zone area because it captures only the units within the subject development.

Table 3 Summary Statistics for Dependent and Independent Variables (Before Demeaning)

Panel A

	Mean	Min	Max	Std.Dev.	Obs.
FP	-0.060	-1.118	1.160	0.307	88,050
SP	-0.105	-1.150	1.224	0.317	88,050
DAGE	2.136	0.003	4.997	1.415	88,050
PRE	0.668	0	1	0.471	88,050
BIG5	0.753	0	1	0.431	88,050
DEVS	2,302	3	9,813	2001	88,050
MKTS	0.125	-0.610	1.823	0.389	88,050
VOL	7,049	5,808	20,604	4036	88,050

Panel B

	Radius=1.5 km				**Radius=1.0 km**			
	Mean	Min	Max	S.D.	Mean	Min	Max	S.D.
S	28,800	79	102,722	16,206	17,814	61	81,059	11,570
S3	1,764	1	11,024	1,858	1,374	1	11,024	1,565
$S3_s$	996	0	8,558	1,304	724	0	8,558	1,091
$S3_f$	368	0	5,201	658	251	0	4,571	487
$S3_w$	399	1	2,952	405	399	1	2,952	405

Note: The definition of the variables is provided in Table 2. *S3* is a subset of *S*. The sum of $S3_s$, $S3_f$, and $S3_w$ is *S3*. Radius means the radius of the catchment zone.

6. Results

Table 4 presents the results of our empirical models. In the baseline model (Column 1), we control for district-level price changes of second-hand units (*SP*), depreciation (*DAGE*), and presales (*PRE*). Both *SP* and its square show significantly positive signs; on average, one percentage change in *SP* leads to approximately 0.8% change in first-hand prices (*FP*). We also obtain a significantly positive *DAGE* while its square term is negative. This means a larger age difference between the first and second sales is associated with greater price depreciation, and the depreciation rate is higher for newer properties. As expected, *PRE* has a negative sign. The presale discount results from the rental income forgone before completion.

After controlling for market change, depreciation, and presales, the constant term is consistently negative. This is evidence of a first-hand price discount. Developers sell a statistically identical property for 4.5% less on average than second-hand owners. The finding of a discount suggests that the liquidation constraint of the developers (*Hypothesis 2*) outweighs their market power (*Hypothesis 1*).

Table 4 Regression Results (Radius for *S* =1.5 km)

Variable	1	2	3	4	5
	Coefficient (t-Stat.)				
Constant	-0.045* (-32.59)	-.048* (-34.09)	-.048* (-34.43)	-.051* (-36.27)	-0.051* (-36.14)
SP	.777* (404.12)	.761* (393.41)	.763* (392.57)	.769* (396.64)	.771* (395.41)
SP²	.144* (33.28)	.054* (11.81)	.053* (11.61)	.044* (9.49)	.043* (9.46)
DAGE	.038* (22.83)	.043* (26.08)	.043* (26.04)	.044* (26.49)	.044* (26.70)
DAGE²	-.004* (-11.90)	-.004* (-11.71)	-.004* (-11.61)	-.004* (-11.70)	-.004* (-11.84)
PRE	-.006* (-4.77)	-.005* (-4.09)	-.005* (-3.55)	-.008* (-6.33)	-.008* (-6.35)
BIG5	-.012* (-8.49)	-.009* (-6.29)	-.009* (-6.20)	-.003*** (-1.85)	-.003** (-1.99)
DEVS	/	-5.7E-06* (-18.09)	-6.0E-06* (-18.89)	-3.1E-06* (-9.47)	-3.2E-06* (-9.84)
MKTS	/	.043* (24.60)	.041* (23.24)	.055* (30.79)	.051* (27.96)
VOL	/	6.0E-06* (35.26)	6.0E-06* (35.24)	5.3E-06* (31.48)	5.3E-06* (31.42)
S	/	/	-2.4E-07* (-6.30)	-5.2E-07* (-13.44)	-5.4E-07* (-13.17)
S3/S	/	/	/	-.288* (-34.37)	/
$S3_s$/S	/	/	/	/	-.219* (-17.37)
$S3_f$/S	/	/	/	/	-.524* (-19.11)
$S3_w$/S	/	/	/	/	-.318* (-16.36)
Obs.	88,050	88,050	88,050	88,050	88,050
Adjusted R^2	.661	.672	.677	.677	.677

Notes: The dependent variable is *FP*, the log price change of the property sold by the developer in the first-hand market and resold by the first-hand buyer in the second-hand market within five years after building completion. All continuous variables are demeaned, so that the constant term can tell if the first-hand premium is positive (Hypothesis 1) or negative (Hypothesis 2). *BIG5*, *DEVS*, *MKTS*, and *VOL* are variables related to the two hypotheses too. *S*, *S3*, $S3_s$, $S3_f$, and $S3_w$ are our similarity measures for testing Hypothesis 3.

*, **, and *** denote significance at the 1%, 5%, and 10% levels, respectively; t-statistics are in parentheses.

Moreover, the top five developers who occupy most of the market share sell at an added 1% discount compared to other smaller developers. This finding again rejects market power (*Hypothesis 1*) in favor of the liquidation argument (*Hypothesis 2*) that developers who are holding hundreds or even thousands of units should sell at a lower price to reduce holding costs. Any sale delay in one project could have brought huge adverse impact to the big developers who have many other units to sell in the pipeline.

In Column 2, we include another three variables to further test the liquidation argument through variations in holding cost. Suggested by the negative sign of *DEVS*, a larger development scale is associated with a lower first-hand price relative to second-hand price (i.e. a larger first-hand discount). The high holding cost caused by having more units in a development forces developers to lower the price for a faster sale, rather than strengthening their market power due to greater uniqueness of the product or tendency to form joint ventures between developers.[14] Both market sentiment (*MKTS*) and trading volume (*VOL*) exert strong positive impact on first-hand price relative to second-hand price. With the signal of rapid historical price increase and high liquidity in the second-hand market, the holding cost of developers is reduced and they do not have to cut their prices that much.

The other columns report the results that include our similarity measures. They all support *Hypothesis 3*. The number of units within the catchment zone (*S*) has a significantly negative coefficient, which means that the presence of more units nearby gives developers pressure to lower first-hand prices (Column 3). The degree of similarity also matters, as *S3/S*, which measures the portion of close substitutes, further exerts a significantly negative impact on the first-hand price relative to second-hand price (Column 4).

We further compare the negative effect from different types of substitutes in Column 5. *S3s* represents Type 1 substitutes from the second-hand market and has a negative coefficient. $S3_f$ and $S3_w$ measure Types 2 and 3 substitutes from the first-hand market, respectively. Both have a more negative coefficient than Type 1 substitutes, which means that first-hand substitutes have a stronger impact on the first-hand price than second-hand substitutes.

Quality-wise, Type 3 should be the closest substitute since they are produced by the same developer at the same time and should exert the strongest negative impact on the first-hand price. However, $S3_w$ has a smaller negative coefficient than $S3_f$. This suggests that a developer may be able to use some sale strategies, such as phased sales, to reduce the impact of self-competition. Nevertheless, they do not eliminate the discount.

[14] DEVS could also proxy for cost efficiency. However, this is not a sufficient condition for developers to sell at lower prices because if they knew that prices would be adjusted to the market level upon resale, they would not have offered a discount in the first place.

Appendix Table 1 presents the results of the robustness checks by using a different distance criterion to construct our similarity measures. The results do not differ substantially from the previous results.

7. Conclusion

Housing policies that place burdens for community benefits or affordable housing on developers are increasingly common in the United States. Animus towards developers and development and the perception of ill-gotten gains likely animate the popularity of this approach (Monkkonen and Manville, 2018). The relative dearth of research on the real estate industry, especially in regards to market concentration and market power, limits the debate over this type of policy and other efforts to improve efficiency in housing production and reduce corruption at the local level.

This paper tackles one aspect of market power in housing production. We address the question of how developers price new housing, and whether their market power allows them to set prices above that of a competitive market. In comparing the first and second-hand condominium markets in Hong Kong, we systematically examine two inter-related issues. First, since market concentration and high prices characterize the first hand housing market, it seems that first-hand sellers have market power. This, however, ignores the quality differences between the two markets, as well as the theoretical proposition that market power over durable goods is difficult to attain.

Second, the market power explanation ignores the liquidation constraints faced by sellers. However concentrated a market, first-hand sellers do not know the highest price they can obtain for their goods. This demand uncertainty affects first-hand sellers most because they have a larger quantity of goods to sell. Developers must charge less to maintain the same speed of sales and reduce their market risk.

Abundant data from the condominium market in Hong Kong enable us to examine these issues by using a repeat-sales approach. We track the first and second-hand prices of the same condominium unit over time and compare them with corresponding sales in the second-hand market. We therefore control for unobservable qualities of the units such as the reputation of the developers. We find that the first-hand market is highly concentrated, but that first-hand unit prices are lower than second-hand prices after controlling for quality differences.

More importantly, we also find that the first-hand discount is higher for larger developments and lower when market liquidity is high. These findings collectively support the liquidation argument more than market power. Moreover, we find that developers are more sensitive to substitutes than

resellers. We define substitutes as the number of units with similar attributes within a catchment zone. In particular, we show that developers are competing with their own product once they have sold some of their units. Developers cannot fully offset this self-competition effect with the use of sale strategies such as phased sales.

From a policy perspective, our findings show how the second-hand market can serve as a self-regulating instrument to constrain the market power of developers. Whenever developers overprice their first-hand units, buyers have the choice to turn to the second-hand market. The presence of such a 'threat' automatically forces developers to set a more competitive price, without the need for government intervention. This implies that governments should promote transparency (e.g. by making sales data more available) and liquidity (e.g. by shifting away from transaction taxes towards property taxes) in the second-hand market to maintain a competitive check on the price of new units.

Although we do not find evidence of market power when developers sell their units in the product market, they might still have market power in other stages of the development process. In the market for land, major infrastructure services, or permits required to build large buildings, there might be a quasi-monopsony. This is an important question for future anti-trust research in Hong Kong and abroad. Additionally, this paper suggests an important path for further research on how market conditions – especially the concentration of housing development and the relative importance of new housing in the overall market – shape the impact of market power and demand uncertainty on the pricing of new housing.

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Appendix Table 1. Robustness Test (Radius for *S* =1.0 km)

Variable	1	2	3	4	5
	Coefficient (t-Stat.)				
Constant	-0.045* (-32.59)	-.048* (-34.09)	-.060* (-38.49)	-.065* (-41.63)	-0.063* (-40.43)
SP	.777* (404.12)	.761* (393.41)	.764* (394.34)	.769* (396.45)	.770* (396.15)
SP²	.144* (33.28)	.054* (11.81)	.053* (11.52)	.046* (10.09)	.044* (9.53)
DAGE	.038* (22.83)	.043* (26.08)	.043* (26.10)	.043* (26.25)	.044* (26.87)
DAGE²	-.004* (-11.90)	-.004* (-11.71)	-.004* (-11.65)	-.004* (-11.59)	-.004* (-11.97)
PRE	-.006* (-4.77)	-.005* (-4.09)	-.004* (-3.83)	-.006* (-4.95)	-.005* (-4.10)
BIG5	-.012* (-8.49)	-.009* (-6.29)	-.008* (-5.77)	-.004* (-2.77)	-.005* (-3.38)
DEVS	/	-5.7E-06* (-18.09)	-6.2E-06* (-19.69)	-3.5E-06* (-10.68)	-4.1E-06* (-12.24)
MKTS	/	.043* (24.60)	.040* (23.08)	.049* (27.65)	.045* (25.17)
VOL	/	6.0E-06* (35.26)	6.0E-06* (35.42)	5.6E-06* (33.10)	5.7E-06* (33.63)
S	/	/	-9.2E-07* (-17.82)	-1.3E-06* (-23.76)	-1.1E-06* (-20.02)
S3/S	/	/	/	-.176* (-26.21)	/
$S3_s/S$	/	/	/	/	-.168* (-16.40)
$S3_f/S$	/	/	/	/	-.464* (-21.77)
$S3_w/S$	/	/	/	/	-.093* (-8.25)
Obs.	88,050	88,050	88,050	88,050	88,050
Adjusted R^2	.661	.672	.674	.676	.677

Notes: Robustness test of the results in Table 4 by imposing an additional distance criterion on both *S* and *S3*: the distance of a unit has to be within 1 km (instead of 1.5 km) of the subject first-hand unit in order to be counted in *S*, *S3* and the *S3* components.

* denotes significance at the 1% level; t-statistics are in parentheses.