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Housing price dispersion in the presale market

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ABSTRACT

Sale before completion (i.e. presale) is a common practice that real estate developers use to sell residential units. Since presale buyers are unable to inspect uncompleted units, developers may take advantage of asymmetric information and release information about quality to the market selectively. The search theory also suggests that incomplete pricing information, especially for new products, will induce a less competitive market that is characterised by dispersed presale prices. Would price dispersion be reduced if developers were required to provide more quality and pricing information? In this study, we argue that this is not necessarily the case. We conducted a natural experiment using a new information disclosure ordinance governing first-hand residential sales in the Hong Kong SAR, China. We found that the ordinance reduced the price dispersion of presale units with asymmetric information about property quality, but increased their price dispersion when limited pricing information (e.g. thin trading volume) was available in the neighbourhood. As a critical test, we further showed that the ordinance increased price dispersion even more after the units are completed. This suggests that the ordinance has indeed made presale pricing more difficult because developers are no longer allowed to use different strategies to test market demand.

KEYWORDS

Price dispersion; presale housing market; pricing information; quality information; natural experiment

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Introduction

Sale before completion (i.e. presale) is a common practice for real estate developers seeking to sell residential units. Since presale buyers are unable to inspect uncompleted units, developers may take advantage of asymmetric information and release information to the market selectively. In most theoretical literature, price dispersion is argued to result from spatial differences and the existence of significant search costs (Read 1991). The search theory suggests that incomplete information, especially for new products, will induce a less competitive market that is characterised by price dispersion. Intuitively, reductions in (or the elimination of) buyers' research costs will reduce (or eliminate) price dispersion. However, would price dispersion necessarily be reduced when sellers are mandated to release more information? Specifically, will releasing different types of information result in different impacts on price dispersion? In this study, we argue that not all types of information reduce price dispersion.

For the release of quality information, the implication is straightforward. If developers are required to provide more information about presale units' quality, the law of one price tells us that there is only one price for a particular quality, so no price dispersion results. As regards pricing information, the implication may be less trivial. If we assume, for the moment, that there is no quality information asymmetry, that only the developer knows the 'true' price and is forced to reveal it, then certainly price will be less dispersed. But two issues are worth our further consideration. First, even for developers, it may be costly to know the 'true' price as they are price searchers. When pricing strategies cannot be used to learn the market demand, price may be more dispersed. Second, if a developer is the only person who knows the 'true' price of the units, no one is able to verify the developers' pricing. In this case, a mandated release of pricing information should have no effect on price dispersion. That means more pricing information does not necessarily reduce price dispersion.

Nevertheless, there is a paucity of literature providing direct evidence to dissect the impacts on price dispersion attributable from different information types. We fill this research gap by investigating the effect of an exogenous policy intervention, namely the Residential Properties (First-hand Sales) Ordinance (Cap. 621) in the Hong Kong SAR in 2013 (hereinafter referred to as the 'Ordinance'), on the price dispersion of the presale housing market. This policy intervention forms a natural experiment that enables us to examine the impacts of a mandated release of both quality and pricing information to a presale residential market.

To develop our hypotheses, we first apply the 'information clearinghouse' model (Baye, Morgan, and Scholten 2006) to the presale market. We argue that when developers are mandated to release more quality and price information, there will be two major effects on the price distribution $F(p)$. One is the impact on the fraction of 'informed' consumers on the market. The other is the impact on the costs of

firms to discover their product prices.[1] This provides us with a basis to develop our hypotheses and test them with empirical evidence. Our theoretical predictions suggest that the impacts of information disclosure may be subject to the marginal impacts of quality information versus pricing information.

Our natural experiment is novel for several reasons. First, the Ordinance is an exogenous policy change that allows us to disentangle the different impacts of 'quality' and 'pricing' information on price dispersion. Second, the Ordinance is only imposed on the first-hand market, not the second-hand market. Using the second-hand transaction in the neighbourhood (i.e. within a 400m radius) as the counterfactual, we can use a difference-in-differences approach to reveal the Ordinance's impacts on price dispersion with respect to quality information and pricing information. Third, we can further conduct a critical test to evaluate our pricing information argument in the spot sale market where all residential units have been completed and quality can be inspected by buyers. Since quality information is more symmetric, we can carefully isolate the impact of pricing information from that of quality information in the spot market.

The rest of the paper is structured as follows. We first describe the background of the Ordinance. Next is a review of the price dispersion literature, followed by our testable hypotheses based on the information clearinghouses model formulated by Baye, Morgan, and Scholten (2006). In the following section, we describe the data used for the design and hypotheses testing of our natural experiment. Then, the empirical results are presented. The last section concludes.

Background of the Ordinance as a natural experiment

In Hong Kong, first-hand residential properties are commonly offered for sale before the development project is completed. Usually, the market for uncompleted projects is referred to as 'presale', and the market for completed projects as 'spot-sale' (Yiu, Wong, and Chau 2009). Under the presale arrangement, many prospective buyers can rely only on limited information in the marketing materials and price lists supplied by developers, whose primary objective is to make profits. Therefore, developers might press home buyers to make quick purchase decisions, offer only a small batch of units at a time to create an impression of oversubscription, and release limited (sometimes misleading) information to potential buyers – these practices largely characterised the first-hand residential property market in Hong Kong.

To put an end to any malpractices and to enhance the transparency of the first-hand residential market, the Hong Kong Government introduced the Ordinance in April 2013. The Ordinance aims to

[1] The separation of 'informed' and 'uninformed' sellers in the real estate market can be found in Deng et al. (2012).

ensure that adequate information is provided to prospective purchasers of first-hand residential properties, thus facilitating a rational and informed purchase decision. The primary focus of the Ordinance is to promote the accuracy of marketing information and to make contravention of the Ordinance criminal offences. For example, Sections 25 and 32 of the Ordinance require developers to make sales brochure (quality information) and price lists (price information) available to the general public seven days and three days, respectively, before sales. Developers could no longer seek expression of purchase intent from prospective buyers (Section 34). Furthermore, on each date of sales, all transaction records of a development project have to be disclosed to the public on a designated website (Section 60). Contravention of the provisions could lead to a criminal liability up to imprisonment of seven years (Sections 76 and 78).

One critical implication of the new statutory requirements on information disclosure is that insider trading strategies (Brody et al. 2010) are no longer available on the market. In the past, developers might set aside certain numbers of units for internal sales. The purpose of having such internal sales was to provide developers with a way to 'test the water' of the market so that they could obtain more accurate pricing information to use in the launch of their projects. In some cases, developers even made use of the rapid sell-outs of internal sales to frame a bullish presale market. The Ordinance essentially prohibited such pricing strategies. Regardless of its policy outcomes, the implementation of the Ordinance enabled a natural experiment to test the existence of informed trades (and specifically insider trades) in the first-hand residential property market, and, more importantly, the impact of the informed trades on housing price dispersion.

Presale market as 'information clearinghouse'

In the price dispersion literature, there are two main approaches to rationalising price dispersion as an equilibrium, namely the search-theoretic model and the information clearinghouse model. The search-theoretic model assumes that a positive cost is incurred for consumers in their gathering of additional information about prices (Stigler 1961; Reinganum 1979; MacMinn 1980; Burdett and Judd 1983). When the search is costly, firms will charge different prices. 'Information clearinghouse' is an alternative approach to modelling price dispersion. The clearinghouse model assumes that consumers access price information by consulting an 'information clearinghouse' (e.g. an Internet price comparison website, a newspaper or the developer's price list website in our study), and that equilibrium price dispersion stems from *ex-ante* heterogeneities in consumers or firms.

Baye, Morgan, and Scholten (2006) point out that there is no universal model of equilibrium price dispersion, and that different models are appropriate for analysing different market environments. For

instance, search-theoretic models are more appropriate for analysing environments where consumers must visit different sellers' websites to gather price information; whereas clearinghouse models are appropriate when consumers are able to access a list of prices (e.g. in a newspaper or at a price comparison site). In the case of clearinghouse models, information gatekeepers determine the distribution of prices. Reductions in search costs may lead to either more or less price dispersion, depending on the market environment. Furthermore, the elimination of consumer search costs needs not eliminate price dispersion.

Varian's (1980) sales model is a special case of such information clearinghouse environments – price dispersion arises because some consumers choose to access the clearinghouse to obtain price information, while others do not. In Rosenthal's (1980) model, price dispersion is due to some 'loyal' consumers buying from a particular firm even if the firm does not charge the lowest price. Spulber (1995) shows that equilibrium price dispersion arises even when all consumers can costlessly access the clearinghouse. Baye and Morgan (2001) offer a clearinghouse model that endogenises not only the decisions of firms and consumers to utilise the information clearinghouse, but also the fees charged to consumers and firms who wish to access or transmit price information from the information gatekeeper (i.e. owner of the clearinghouse).[2] They show that a dispersed price equilibrium exists even when the consumers or firms are homogenous.

Consider a generalised 'Information Clearinghouse' Model that covers a variety of price dispersion models (Baye, Morgan, and Scholten 2006). There is a finite number of price-setting firms (n) competing in a market selling homogeneous products. Firms have the capacity to supply a product at a constant marginal cost (m). Different consumers, both informed and uninformed, are interested in purchasing the product. A price information clearinghouse serves this market. Firms must decide what price to charge for the product and whether to list this price in the clearinghouse. Let p_i denote the price charged by firm i: it costs a firm an amount $\emptyset \geq 0$ if it chooses to list its price. All consumers have unit demand with a maximum willingness to pay of v, which is greater than the privately observed marginal costs of firms m, i.e. $v > m$. On the one hand, a mass of 'informed' consumers are called price-sensitive 'shoppers', $S > 0$, who will consult the clearinghouse and buy at the lowest price listed there, provided that this listed price does not exceed v. If no prices are advertised in the clearinghouse, or if all listed prices exceed their maximum willingness to pay v, then these shoppers will randomly purchase at a firm whose price does not exceed v. On the other hand, a mass of 'uninformed' (or loyal) consumers, $L > 0$, will purchase from a firm if its price does not exceed their maximum willingness to pay: otherwise, they will not buy the product at all.

[2] In the previous clearinghouse models, firms' listing decisions are exogenous.

Baye and Morgan (2006) show that if $L > 0$ or $\emptyset \geq 0$, equilibrium price dispersion arises as long as $\emptyset$ is not so large that the firms refuse to list prices at the clearinghouse at all. More precisely, when $\emptyset$ is between 0 and $\frac{n-1}{n}(v-m)S$, a symmetric equilibrium of the general clearinghouse model can be expressed as follows:[3]

- Each firm lists its price at the clearinghouse with probability $\alpha = 1 - \left(\frac{\emptyset \frac{n-1}{n}}{(v-m)S}\right)^{\frac{1}{n-1}}$.
- If a firm lists its price at the clearinghouse, it charges a price drawn from the distribution $F(p) = \frac{1}{\alpha}\left(1 - \left(\frac{\frac{n}{n-1}\emptyset + (v-p)L}{(p-m)S}\right)^{\frac{1}{n-1}}\right)$ $on\ [p_0, v]\ where\ \ p_0 = m + (v-m)\frac{L}{L+S} + \frac{\frac{n}{n-1}}{L+S}\emptyset.$
- If a firm does not list its price at the clearinghouse, it charges a price equal to v.
- Each firm earns equilibrium expected profits equal to $E\pi = (v-m)L + \frac{1}{n-1}\emptyset$.

Following this general information clearinghouse model, our study argues that the Ordinance will have two major implications on the price distribution $F(p)$, through its impacts on the fraction of 'informed' consumers (S) and on the costs for firms to list their products' prices on the clearinghouse ($\emptyset$).

Intuitively, when the Ordinance mandated the seller to release more information regarding the quality of housing units on the market, one might have expected that more 'informed' consumers (S) would be on the market. But one should be aware that price dispersion is not a monotonic function of consumers' information costs. That can be inferred from the following two extreme cases. If the costs of obtaining quality information are sufficiently high, no consumers choose to become informed, and all firms will charge a 'monopoly price (v)'. When consumers' information costs are zero, all consumers choose to become informed, and all firms will price at a marginal cost in a symmetric equilibrium. Thus for sufficiently high or low information costs, there is no price dispersion, whereas for moderate information costs, prices will be dispersed on the price interval $[p_0, v]$. As previously stated, the Ordinance aims to significantly reduce buyers' costs of obtaining quality information about the units. On the quality dimension alone, the information costs are approaching zero, and that price dispersion is consequently reduced.[4] Therefore, we hypothesise that:

[3] Proof of these properties for this generalised information clearinghouse model can be obtained from Baye, Morgan, and Scholten (2006, 22-23)

[4] This argument follows Varian (1980) in which price dispersion is mainly driven by the variation in consumers' information access costs.

Hypothesis 1: *Ceteris paribus*, the Ordinance is more effective in reducing the price dispersion of new developments with more asymmetric quality information.

However, as discussed in previous sections, the Ordinance also mandates sellers to release pricing information to the market. This could be very costly for developers who are price searchers and have yet to determine an appropriate price for their new units. One may interpret this as a significant increase in firms' costs to list their products on the information clearinghouse ($\emptyset$). This argument largely follows Baye and Morgan's (2001) 'gatekeeper' concept where the equilibrium price dispersion is mainly driven by the costs of firms to transmit price information. If a clearinghouse sets its fees sufficiently low, all consumers will rationally access the clearinghouse to obtain information. However, as a result of the Ordinance, the use of marketing strategies to 'test the water' becomes impossible. It is more costly for developers to price their units, and a higher $\emptyset$ would lead to higher price dispersion. Thus, we hypothesise that:

Hypothesis 2: *Ceteris paribus*, the Ordinance is more likely to increase the price dispersion of new developments with less pricing information (e.g. comparables) available.

Research design

Our empirical analysis involves several stages. First, we compare the price dispersion between the first-hand and second-hand residential markets by using the Ordinance implemented in 2013 in Hong Kong as the policy treatment. Specifically, we make use of the Ordinance to dissect the marginal effects of disclosing more 'quality information' and 'pricing information' respectively. As a critical test, we further examine the impact of the Ordinance on the price dispersion in the presale market versus the spot-sale market (Yiu, Wong, and Chau 2009). In the spot-sale market (i.e. where the residential unit is completed), the quality information becomes much more symmetrical even for first-hand sales, so that the marginal effect of releasing more pricing information will dominate. Thus, the adverse effect of the Ordinance on price dispersion is expected to be more pronounced in the spot-sale market.

Data

The data used for this study are sourced from the Economic Property Research Centre (EPRC) database, which tracks all property transactions lodged with the Hong Kong Land Registry. Our source of data provides detailed property-level information on each transaction. The data are geocoded so that newly launched development (i.e. treatment group) and their corresponding second-hand transactions within a 400-metre radius neighbourhood (i.e. the counterfactual group) during the period can be identified.

To avoid any 'thinly traded' properties that may distort the price dispersion computation, our sample excludes small-scale new property developments with fewer than 30 transactions. It also excludes transactions observed six months before and after the Ordinance was implemented to avoid any expectation or learning effect between the announcement and operation of the legislation. Therefore, all the new developments selected for analysis during the sample period are listed in Table 1.

[Table 1 Inserted]

The resultant sample consists of more than 251,000 transactions lodged between January 2010 and December 2015, i.e. before and after the implementation of the Ordinance. For each transaction record, we observe the transaction date, transaction price, property attributes, and development attributes. To control for market conditions, we also obtain the repeat-sale property price indices applicable to the district of each development.

Some stylised facts about the first and second-hand residential market in Hong Kong are shown in Table 2. The inflation-adjusted prices for first-hand sales are higher than second-hand sales. This difference can be attributed to the quality difference between these two types of housing. That is the reason why we had to employ the hedonic pricing model, in order to make these two housing types quality-equivalent. By definition, the age of first-hand sales, which include the 'presales' (i.e. sale before completion), shows a negative value as compared to second-hand sales. In addition, in Hong Kong the average unit size of the first-hand sales is usually larger, and their floor level is generally higher than those of second-hand sales.[5]

[Table 2 Inserted]

The motivation: first versus second-hand market

Before formal analysis, we start with a seemingly counter-intuitive observation from a simple comparison: after the implementation of the Ordinance prices of the first-hand market became more dispersed than those of the second-hand market. This observation is made by first regressing the log-transformed real hedonic-adjusted price variance of each new development on a policy dummy (*POLICY*), its age, and its average price. The policy dummy equals 1 for the post-Ordinance period and 0 for the pre-Ordinance period. The regression is then repeated for transactions in the second-hand

[5] For more details about the linkage between housing price dispersion and macroeconomic factors in Hong Kong, see Leung, Leong, and Wong (2006)

market. In both regressions (Table 3), the policy dummy showed a significantly positive effect, and the Ordinance's impact on the first-hand market is stronger than that on the second-hand market.

Apparently, the Ordinance is designed to make the property buyers on the market more 'informed', and it should therefore help reduce price dispersion in the first-hand market, at least relative to the second-hand market. However, this striking observation suggests otherwise and triggers us to develop our hypotheses that the Ordinance can actually exert opposing effects.

[Table 3 Inserted]

Hypothesis testing: impacts of the Ordinance on presale market

We estimate price dispersion based on transaction prices. To get rid of price variation due to heterogeneous property attributes, we first adjust the natural logarithm of transaction price for district-specific fixed effects, market-specific trends[6], and property quality attributes using the hedonic model (Rosen 1974). The regression residuals ε_{ijt} represent the quality- and market condition-adjusted prices for a property unit *i* specific to a development *j* in month *t*. We estimate the price dispersion of development *j* in a period by the variance[7] of $\{\varepsilon_{ijt}\}$. To identify the Ordinance's effects, the presale price dispersion is benchmarked against second-hand counterfactual through difference-in-differences analyses. Here is the regression specification:

$$\gamma_i = \alpha + \beta_1 \boldsymbol{I} + \varepsilon \quad (1)$$

where the dependent variable γ_i is the price dispersion of a new project *i* relative to the price dispersion of second-hand units within a 400-metre neighbourhood, and $\boldsymbol{I}$ consists of the marginal change of the quality and pricing information in the first-hand-market due to the Ordinance as shown below:

$$\boldsymbol{I} = POLICY \times (1 + \mu_1 ASYM_i + \mu_2 ILLIQ_i) \quad (2)$$

[6] The adjustment is made by deflating the transaction price with the district specific repeated-sales prices indices (Chau et al. 2005). More specifically, a semi-log form of OLS equation of $lnP_{it} = \sum_{j=1}^{J} \beta_j X_{jit} + \varepsilon_{ijt}$ is specified, where lnP_{it} denotes the natural logarithm of the deflated transaction price of property *i* at time *t* ($i = 1,\dots,n;\ t = 1,\dots T$), β_j represents the implicit prices for the *j* th property attributes X_{jit} of which $j = 1,\dots,J$; and ε_i denotes the error term with mean zero and variance σ^2. This error term represents the deviation of the implicit price of a particular property *i* from its shadow price.

[7] In the probability theory, the geometric coefficient of variation (GCV) is a more standardised measure of dispersion of a frequency distribution given the data are log-normally distributed. We will further discuss that in our empirical setup. For the time being, variance is used for our preliminary analysis.

ASYM and *ILLIQ* are a proxy of quality and pricing information problems, respectively. As illustrated by Wong, Yiu, and Chau (2012), quality information asymmetry comes largely from latent defects of the building structure, the importance of which would diminish in districts with a higher land price. Therefore, quality information asymmetry, *ASYM*, is approximated by the reciprocal of the average price of the second-hand market in the neighbourhood. New developments in a high-priced district should be less vulnerable to quality information asymmetry. *ILLIQ* is the trading volume of the second-hand market within the 400-metre radius neighbourhood – a higher volume in the surrounding (i.e. more comparables) gives the developer more pricing information. *POLICY* can have a positive or negative coefficient (β_2), depending on whether the marginal effects of quality information or pricing information dominate. Table 4 shows the definition of variables used in the empirical model.

[Table 4 Inserted]

Based on the quality information argument, we hypothesised in Hypothesis 1 that the presale prices of new developments with more asymmetric quality information (i.e. higher *ASYM*) would become less dispersed after the policy treatment. This was tested by the interaction term of *POLICY* and *ASYM*, the coefficient of which is expected to be negative ($\beta_2\mu_1 < 0$). Likewise, we hypothesised in Hypothesis 2 that the presale prices of new developments with a more illiquid second-hand market in the neighbourhood (i.e. higher *ILLIQ*) would become more dispersed after the Ordinance. Assuming stable trading activities within a neighbourhood, the interaction term of *POLICY* and *ILLIQ* is expected to have a positive coefficient ($\beta_2\mu_2 > 0$). Figures 1 and 2 graphically demonstrate our strategy to identify the marginal effect of more quality information (i.e. Hypothesis 1) and more pricing information (i.e. Hypothesis 2), respectively.

[Figures 1 and 2 Inserted]

Regarding the measurement of price dispersion, some studies use sample variance to measure price dispersion (e.g. Pratt, Wise, and Zeckhauser 1979; Ancarani and Shankar 2004). The advantage of using sample variance is that researchers can make use of all available data. However, one major drawback of this measure is that when comparing dispersion across products over time, price variance could change even though the underlying real economic factors remain the same (Baye, Morgan, and Scholten 2006). Therefore, to compare levels of price dispersion either across different products or across time, researchers prefer to standardise the data. One method is to use the coefficient of variation. Like other methods of standardisation, the coefficient of variation will preserve the comparative static predictions under the model of interest. Yet, if our OLS model is in log-form (hence the residuals from OLS are log-normal), it is advisable to use a non-biased measure of the variation of these residuals (Kirkwood 1979). One such measure is the geometric coefficient of variation: $e^s - 1$, where e is the exponential function, and s is the sample standard deviation of the data after a natural log transformation. In this

study, we therefore define price dispersion using the geometric coefficient of variation. In other words, in Equation (1), the relative price dispersion, γ_i, is the geometric coefficient of variation of the presale prices (after adjusting for market conditions and quality using the hedonic model) minus the geometric coefficient of variation of the second-hand prices within a 400-meter radius of the new project (i.e. counterfactual).[8]

Since price variations due to market changes as well as differences in property-level attributes have already been removed, any price dispersion should come from changes in information availability. The use of second-hand price dispersion as a benchmark (control) also reinforces that our focus is the change in price dispersion specific to the first-hand market; if an external shock makes both first and second-hand prices more dispersed, the relative price dispersion should remain unchanged. By its very nature, the Ordinance only applies to the first-hand market (i.e. both presale and spot-sale market) but not to the second-hand market. As a result, any price dispersion change after the Ordinance in the treatment group (i.e. first-hand sales), relative to the price dispersion change in the unaffected control group (i.e. second-hand sales in a similar neighbourhood), can be attributed to the changes in quality and pricing information availability.

Empirical results

First-hand versus second-hand markets

The main results are presented in Table 5. Column (1) in Table 5 confirms our Hypothesis 1 and Hypothesis 2. As predicted in Hypothesis 1, the interaction term *POLICY* × *ASYM* has a significantly negative coefficient. This means when quality information is more asymmetric (i.e. higher *ASYM*), first-hand prices will become less dispersed relative to second-hand prices after the policy treatment. The Ordinance has therefore brought more quality information to the market. Likewise, Hypothesis 2 is supported by the significantly positive coefficient of the interaction term *POLICY* × *ILLIQ*. When there is a more illiquid second-hand market in the neighbourhood (i.e. higher *ILLIQ*), first-hand prices will become more dispersed relative to second-hand prices after the Ordinance. Taking away developers' flexibility to 'test the water' actually reduces pricing information in the market.

One may argue that the marginal effects of the Ordinance on price dispersion could merely be an ad hoc phenomenon in the early stage of the sale process rather than a steady-state equilibrium because sellers will rationalise their selling strategy (e.g. supplying in different stages) to get rid of mispricing.

[8] Some other studies used standard deviation or coefficient of variation to measure price variation. Our results are robust to such conventional price dispersion measures.

To address such concerns, we further estimate Equation (1) using different stages of sales. Each new development project is divided into subsamples, from the sale of the first unit to (1) the 25th percentile unit of a project (stage 1), (2) the 50th percentile unit (stage 1 to 2) and (3) the 75th percentile unit (stage 1 to 3). The results in Columns (2) to (4) of Table 5 confirm that the predictions of Hypothesis 1 and Hypothesis 2 are robust. For all subsamples, we still witness a significantly negative coefficient of the interaction term *POLICY* × *ASYM* and a significantly positive coefficient of the interaction term *POLICY* × *ILLIQ*, as manifested in our full sample.

[Table 5 Inserted]

Presales versus spot sales: a critical test

Similar to many Asian residential property markets, the first-hand market in Hong Kong can be further divided into the presale and spot-sale stages (Wong et al. 2007). Presales refer to transactions before the development project is completed, while spot sales take place after completion. This distinction allows us to draw a further testable implication regarding the release of quality and pricing information.

Specifically, by requiring developers to disclose accurate quality information through marketing materials, the Ordinance should help presale buyers more than spot-sale buyers. This is because once a new project is completed, quality information about the units will be readily available for inspection. Every spot-sale buyer can inspect the physical quality of the completed units without relying on developers' description in their marketing materials. Quality information in the spot-sale stage is therefore much more symmetric such that any pricing information effect of the Ordinance will be more pronounced in the spot-sale stage. This unique case provides us with a clean identification strategy to tease out the impact of pricing information on the first-hand market. Thus, we can further predict that:

Hypothesis 3**:** *Ceteris paribus,* among all the first-hand sales, the Ordinance increases price dispersion in the spot-sale stage more than price dispersion in the presale stage.

This hypothesis is tested using new developments with first-hand sales in the spot-sale stage, while first-hand sales in the presale stage are the benchmark. Similar to testing Hypothesis 1 and Hypothesis 2, the dependent variable is relative price dispersion: price dispersion of first-hand sales minus price dispersion of neighbouring second-hand sales. Since quality information in the spot-sale stage is more symmetric, the *POLICY* dummy will be the independent variable to directly capture any pricing information effect of the Ordinance. Other control variables include the average real price (*AVG_PR*) of each development and age (*AGE*; i.e. a negative age for presale units) of each transacted unit are used.

Regression is done separately for first-hand presales and first-hand spot sales. The results, shown in Columns (1) and (2) of Table 6, support Hypothesis 3. Comparing the effect of the Ordinance on presale price dispersion with that on spot-sale price dispersion, the latter is clearly more pronounced, as the *POLICY* dummy has a larger positive coefficient for spot sales (0.029) than presales (0.011). Columns (3) and (4) further show that the coefficients of the *POLICY* dummy remain robust after taking into account the age differences of the units in these two different sale stages[9].

[Table 6 Inserted]

Conclusion

To the best of our knowledge, this is the first study to distinguish how different types of information affect price dispersion. As evident in our study, attempts to make buyers better informed by mandating sellers to disclose more information do not necessarily reduce (or eliminate) price dispersion. The outcome actually depends on the types of information released. Our study took advantage of a new information disclosure regulation in Hong Kong that requires property developers to release more quality and pricing information to the market. Since the regulation only applies to first-hand sales, not second-hand ones, we conducted a natural experiment with the second-hand market as a control. We found that the regulation has two opposite effects. On the one hand, it reduced price dispersion when the new developments were located in areas with lower land value (i.e. more asymmetric in quality information); on the other hand, it increased price dispersion when the new developments were located in areas with thin trading volume (i.e. limited pricing information). The latter arose because the regulation has made pricing of new properties more difficult. Developers are no longer allowed to use different strategies to test market demand; they can only offer units in the open market and wait for buyers to take. As a critical test, we further demonstrate that the regulation indeed increased the price dispersion of first-hand sales more after a new development has completed (i.e. spot sales), because the adverse impact due to pricing information remains, while the benefit of disclosing quality information of completed units diminishes. Buyers can go and inspect the completed units without solely relying on marketing materials.

The message from our results is clear: mandating developers to disclose more quality information tends to reduce price dispersion while mandating developers to release more price information tends to make prices more dispersed, especially after their units have been completed. This refutes the presumption that developers necessarily know the price better than the collective wisdom of buyers.

[9] It might be argued that higher price dispersion can be interpreted as price discrimination, but there is no reason to believe that the ability to discriminate is strengthened after developers are more restrained by the ordinance.

Developers need to learn from the market, but regulation somehow impedes such a learning process. The results of this study also highlight the complexity of information effects on price dispersion – prior mixed empirical findings on price dispersion could be caused by different types of information being studied. A new perspective to further develop the knowledge and theory of price dispersion is needed.

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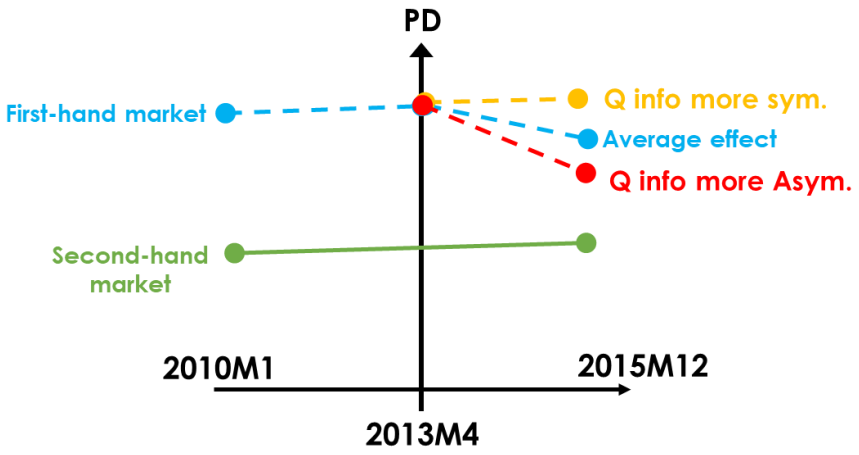
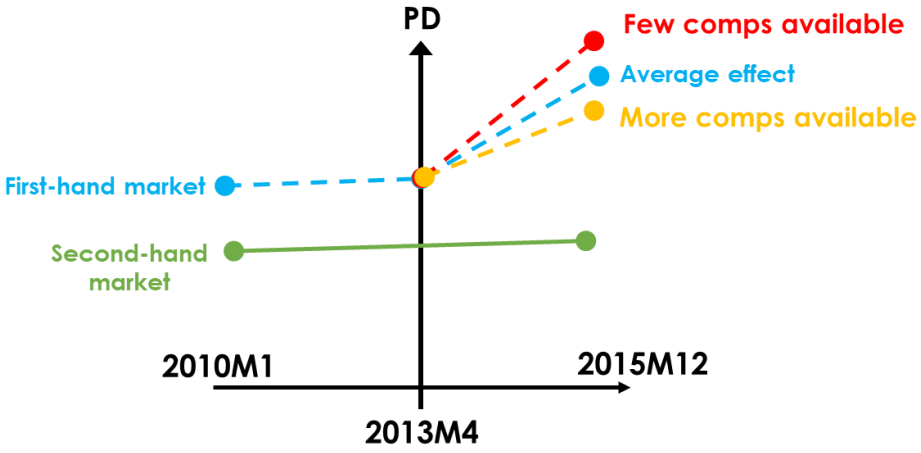
Figure 1. Strategy to identify the marginal effect of disclosing more quality information.



Notes: Among the new developments, the regulation is more effective in reducing price dispersion (PD) of those with more asymmetric quality information (Hypothesis 1). This paper follows Wong et al. (2012) to use the structure-to-property value ratio (ASYM) as a proxy of the degree of information asymmetry.

Figure 2. Strategy to identify the marginal effect of releasing more pricing information.



Notes: Among the new developments, the regulation is more likely to increase price dispersion (PD) of those with less comps available (Hypothesis 2). We use reciprocal of second-hand units' turnover rate (ILLIQ) within 400m as a proxy of the unavailability of comps (i.e. illiquidity).

Table 1. The selected new developments.

Developments	Address	Developments	Address
18 Upper East	Shing On St 18	*Laguna Verde*	Laguna Verde Ave 8
8 Lasalle	La Salle Rd 8	*Larvotto*	Ap Lei Chau Praya Rd 8
Altitude	Shan Kwong Rd 20	*Latitude*	Prince Edward Rd E 638
Arch	Austin Rd W 1	*Le Billionnaire*	Sa Po Rd 83
Arezzo	Seymour Rd 33	*Le Chateau*	Alnwick Rd 8
Aria	Fung Shing St 51	*Le Riviera*	Shau Kei Wan Main St E 23
Austin	Wui Cheung Rd 8	*Lexington Hill*	Belcher's St 44A-46
Ava 128	Des Voeux Rd W 124-128	*Lions Rise*	Muk Lun St 8
Avenue	Queen's Rd E 200	*Long Beach*	Hoi Fai Rd 8
Avignon	Kwun Chui Rd 1	*Maison Rose*	Cheung Sha Wan Rd 270
Azura	Seymour Rd 2A	*Manhattan Hill*	Po Lun St 1
Baker	Baker Court 8	*Marinella*	Welfare Rd 9
Bayview	Yuk Yat St 9	*Masterpiece*	Hanoi Rd 18
Broadwood	Broadwood Rd 12	*Met. Delight*	Camp St 142
Cadogan	Cadogan St 37A-B	*Met. Focus*	Pak Kung St 8
Celestial Hts	Sheung Shing St 80	*Met. Sublime*	Kwai Heung St 1
Centrepoint	Staunton St 72	*Metro6*	Bulkeley St 121
Chatham Gate	Chatham Rd N 388	*Mount East*	Ming Yuen Western St 28
Coronation	Yau Cheung Rd 1	*Mount Parker*	Sai Wan Terr 1
Cullinan	Austin Rd W 1	*Ocean One*	Shung Shun St 6
Diva	Electric Rd 133-139	*One Mayfair*	Broadcast Drive 1
Dunbar Place	Dunbar Rd 23	*One Silversea*	Hoi Fai Rd 18
Eight South	South Lane 8-12	*One South Lane*	South Lane 1
Eivissa Crest	Hill Rd 100	*One Victory*	Victory Ave 1-3
Festival City	Mei Tin Rd 1	*One Wanchai*	Wan Chai Rd 1
Florient Rise	Cherry St 38	*Pacifica*	Sham Shing Rd
Gardenia	Sai Yeung Choi St N 468	*Park Haven*	Haven St 38
Gloucester	Gloucester Rd 212	*Park Ivy*	Ivy St 8
Grand	Tai Hong St 38	*Park*	Yuet Wah St 8
Harbour One	Des Voeux Rd W 458	*Park Nara*	Hung Yuen Rd 88
Harbour	Minden Ave 8	*Park Summit*	Beech St 88
Harbour Place	Oi King St 8	*Parkes*	Parkes St 101
Harbourside	Wharf Rd 10-18	*Pavilia Hill*	Tin Hau Temple Rd 18A
Hemispheres	Gordon Rd 3	*Pierre*	Coronation Terr 1
Hermitage	Hoi Wang Rd 1	*Prince Place*	Prince Edward Rd W 398
High One	Fuk Wa St 571	*Residence 228*	Fuk Wing St 228-232
High One Grand	Fuk Wing St 188	*Residence Bel-*	Cyber Port Rd
High Park	Boundary St 51	*Serenade*	Tai Hang Rd 11
High Point	Tai Po Rd 188	*Sevilla Crest*	Sai Yeung Choi St N 289
High West	Clarence Terr 36	*Sham Wan Twrs*	Ap Lei Chau Drive 3
Hudson	Davis St 11	*Signature*	Chun Fai Terr 8
Iíduniq Grand	Shau Kei Wan Rd 157	*Soho 189*	Queen's Rd W 189
Iíduniq	Shau Kei Wan Rd 305	*Sorrento*	Austin Rd W 1
Imperial	Hoi Fai Rd 10	*Sparkle*	Tung Chau St 500
Imperial	Belcher's St 68	*Spectacle*	Cho Yuen St 8
Island Crest	First St 8	*Star Ruby*	San Wai St 1
Island Resort	Siu Sai Wan Rd 28	*Summa*	Hing Hon Rd 23
Kadoorie Hill	Prince Edward Rd W 211	*Trinity Twrs*	Lai Chi Kok Rd 339
Kellet Court	Baker St 18	*Warren*	Warren St 9
Kennedy Park At	Kennedy Rd 4	*Yoho Midtown*	Yuen Lung St 9
Kensington Hill	High St 98	*Yoo Residence*	Tung Lo Wan Rd 33
L Harbour 18	Chi Kiang St 18		

Table 2. Descriptive statistics.

Statistic	Mean	St. Dev.	Min	Max	N
Panel A: First-hand Sales (i.e. Treatment group)					
Real price (HK$ in Mn)	4.5	3.5	0.5	100.6	34,915
Age (in months)	-11.5	6.5	-51.0	-1.0	34,918
Unit size (sq ft)	670	267	165	3083	34,918
Floor level	20.6	12.5	1.0	76.0	34,918
Panel B: Second-hand transaction <400m radius (i.e. Counterfactuals)					
Real price (HK$ in Mn)	2.2	2.3	0.0	138.0	184,978
Age (in months)	304.8	158.2	-22.0	774.0	185,102
Unit size (sq ft)	466.7	260.0	135.0	10035.0	185,102
Floor level	13.5	10.7	1.0	79.0	185,102

Table 3. The Ordinance impact on first-hand versus second-hand price dispersion.

	Logarithm of real quality-adjusted price variance	
	First-hand market	Second-hand market
	(1)	(2)
POLICY	0.181**	0.127**
	(0.083)	(0.061)
AVG_RP	0.063***	0.046**
	(0.011)	(0.020)
AVG_AGE	-0.006	0.003***
	(0.005)	(0.0003)
Constant	-3.288***	-2.392***
	(0.121)	(0.131)
N	102	102
Adjusted R^2	0.218	0.467
Residual Std. Error	0.375	0.298
F Statistic	10.402***	30.531***

Notes: The dependent variable is the logarithm of real quality-adjusted price variance. *, **, and *** mean that the coefficient is significant at the 10%, 5%, and 1% level respectively. *AVG_PR* represents the average real price, and *AVG_AGE* is the average age of the developments transacted in the respective market (first-hand/second-hand) in a particular sales year. These variables are used to further take into account the quality difference apart from any deflated hedonic-adjusted prices.

Table 4. Definitions of the variable in the empirical model.

Variable	Definition	Exp. sign	Remarks
POLICY	Policy indicator variable for the First-hand Sales Ordinance (i.e. 2013M4:2015M12 = 1; 2011M1:2013M3 = 0)	+ / –	Depending on Hypothesis 1 and Hypothesis 2
ASYM	The reciprocal of the average price of the second-hand market in the neighbourhood	+	Main effect of asymmetric quality info.
ILLIQ	Trading volume of second-hand sales within a 400-meter radius of a new project *i* ; averaged over 2011 to 2015	+	Main effect of illiquid pricing info.
POLICY × *ASYM*	*POLICY* indicator interacted with the counterfactual, i.e. the impact of the Ordinance on the housing price dispersion	–	Prediction of Hypothesis 1
POLICY × *ILLIQ*	*POLICY* indicator interacted with counterfactuals	+	Prediction of Hypothesis 2

Table 5. Marginal effects of disclosing more quality and pricing information.

	Dep. var.: relative price dispersion (benchmarked with the second-hand market)			
	Full Sample	25% tile	50% tile	75% tile
	(1)	(2)	(3)	(4)
POLICY	-0.059	-0.110	-0.106	-0.092
	(0.107)	(0.120)	(0.122)	(0.112)
ASYM	0.011***	0.012***	0.012***	0.012***
	(0.004)	(0.004)	(0.004)	(0.004)
ILLIQ	0.005**	0.002†	0.003†	0.004†
	(0.002)	(0.003)	(0.003)	(0.003)
POLICY × *ASYM*	-0.010**	-0.012**	-0.011*	-0.009*
	(0.005)	(0.005)	(0.006)	(0.005)
POLICY × *ILLIQ*	0.010**	0.020**	0.020**	0.010**
	(0.010)	(0.010)	(0.010)	(0.010)
Constant	-0.432***	-0.432***	-0.430***	-0.435***
	(0.070)	(0.079)	(0.082)	(0.073)
N	104	78	81	93
R^2	0.272	0.342	0.302	0.280
Adjusted R^2	0.235	0.296	0.256	0.239
Residual Std. Error	0.086	0.088	0.090	0.087
F Statistic	7.317***	7.477***	6.499***	6.767***

Notes: This table presents the impacts of the Ordinance on the projects' price dispersion. The relative price dispersion is defined as the difference of the geometric coefficient of variation of transaction prices (after adjusting for market and hedonics) between the first-hand and second-hand sales (within a 400m radius of new development). We require the number of transactions in the project to be at least 30 for the dispersion to be well defined. The 25%, 50% and 75% tiles of total stocks being sold within a project are tested separately to ensure the results are consistent regardless of the developers' pricing strategies in different phases. For the description of other variables, please refer to Table 3. Standard errors are in parentheses. *, **, and *** mean that the coefficient is significant at the 10%, 5%, and 1% level respectively. † represents a marginal significance level at 10%. Total numbers of observation are 119 new developments derived from their corresponding 66,000 first-hand transactions and their neighbouring 230,000 second-hand transaction.

Table 6. The Ordinance's impact on presales versus spot sales price dispersion.

Dep. var.: relative price dispersion (benchmarked with the second-hand market)				
	Presales	Spot sales	Presales	Spot sales
	(1)	(2)	(3)	(4)
POLICY	0.011**	0.029**	0.012**	0.027*
	(0.005)	(0.014)	(0.005)	(0.014)
AVG_RP	0.004***	0.003*	0.004***	0.003*
	(0.001)	(0.002)	(0.001)	(0.002)
AGE			-0.0003	0.0001
			(0.0003)	(0.0003)
Constant	0.039***	0.057***	0.034***	0.055***
	(0.006)	(0.016)	(0.008)	(0.017)
N	103	141	103	141
R^2	0.260	0.042	0.266	0.042
Adjusted R^2	0.246	0.028	0.244	0.021
Residual Std. Error	0.025	0.074	0.025	0.075
F Statistic	17.607***	2.998*	11.962***	2.023

Notes: The dependent variable is relative price dispersion, which is defined as the difference of the geometric coefficient of variation of transaction prices (after adjusting for market and hedonics) between the first-hand and second-hand sales (within a 400m radius of new development). *, **, and *** mean that the coefficient is significant at the 10%, 5%, and 1% level respectively. *AVG_PR* represents the average real price, and *AGE* is the average age of the developments in a particular sales year. These variables are used to further take into account the quality difference apart from the deflated hedonic-adjusted prices, if any.