



Munich Personal RePEc Archive

What do we know about Housing Supply? The case of Hong Kong

Charles Ka Yui Leung and Joe Cho Yiu Ng and Edward Chi Ho Tang

City University of Hong Kong, City University of Hong Kong, Hong Kong Shue Yan University

26 April 2019

Online at <https://mpra.ub.uni-muenchen.de/93510/>
MPRA Paper No. 93510, posted 1 May 2019 16:27 UTC

What do we know about Housing Supply? The case of Hong Kong[^]

Charles Ka Yui LEUNG, City University of Hong Kong

Joe Cho Yiu NG, City University of Hong Kong

Edward Chi Ho TANG, Hong Kong Shue Yan University[®]

This version: April 2019

Abstract

The house price in Hong Kong is well-known to be "unaffordable." This paper relates the macroeconomy and the housing market of Hong Kong and argues that the housing supply plays a vital role in explaining the phenomenon. This paper also shows that there are some practical challenges in understanding the housing supply of Hong Kong, including the potentially complicated ownership structure of real estate development. While the discussion centers on the situation of Hong Kong, its lesson may also apply to the housing markets in other small open economies.

Keywords: new housing supply, oligopolistic market structure, ownership structure of real estate development, real estate developers

JEL Classification Numbers: L10, R30, R31

[^] Acknowledgement: We are grateful to Nan-Kuang Chen, Terence Chong, Qing He, Fred Kwan, Tommy Leung, Shane Su, Byron Tsang, Matthew Yiu, an anonymous referee, and for helpful discussion, and City University of Hong Kong and Hong Kong Shue Yan University for financial support. Part of the research is conducted when Leung visits the Hoover Institution, whose hospitality is gratefully acknowledged. Part of the work described in this paper was supported by a grant from the Research Grants Council of the Hong Kong Special Administrative Region, China (Project No.: UGC/FDS15/B01/18). The usual disclaimer applies.

[®] Correspondence: Leung and Ng, Department of Economics and Finance, City University of Hong Kong, Kowloon Tong, Hong Kong, kyleung@cityu.edu.hk, joecyng-c@my.cityu.edu.hk; Tang, Department of Economics and Finance, Hong Kong Shue Yan University, North Point, Hong Kong, chtang@hksyu.edu.

1. Introduction

This paper attempts to enrich our understanding of housing supply, based on our preliminary analysis of the Hong Kong data. According to the conventional wisdom of economics, when the demand for some goods increases, the price would increase as long as the supply is not perfectly elastic. The supply, however, would catch up later, bringing the price down. The Hong Kong housing market seems to be at odds with conventional wisdom. While the housing price in Hong Kong has stayed expensive for some years (Demographia, 2019), the housing supply does not increase proportionally. In fact, according to Kwan et al. (2015), Leung and Tang (2015), among others, the ratio of new housing supply to the existing stock of housing virtually stays constant after Hong Kong returns to China. Thus, one would wonder why the housing supply does not increase. While the case of Hong Kong is extreme, several cities in the world face a similar problem (Demographia, 2019). Unfortunately, existing housing market research concentrates on the demand side. DiPasquale (1999, p.9~11) summarizes the earlier literature this way, "Virtually every paper written on housing supply begins with some version of the same sentence: while there is an extensive literature on the demand for housing, far less has been written about housing supply... Second, housing supply is the outcome of complicated decision making by builders and the owners of existing housing... In the case of new supply, there is no standard data set that permits us to observe the behavior of builders of new housing..." While there are changes since then, the majority of housing market research is still on the demand side. It is partly because most real estate developers in North America are private firms and hence information disclosure is conducted voluntarily.

Despite such difficulties, some authors have made important contributions to our understanding of the housing supply.¹ For instance, Somerville (1999) observes that "National Association of Homebuilders (NAHB) surveys indicate that between 1985 and 1992 the 50 largest U.S. builders had less than a 10% share of total national single family starts. Because most builders construct units in a single market, national measures are unlikely to show any evidence of concentration. The story is quite different if we look at individual MSA housing markets. Among the 40 MSA markets surveyed by the NAHB..., the share of 1992 single-family closing belonging to the

¹ In this paper, we focus on the empirical research on housing market. There are theoretical attempts to understand the housing supply. It is beyond the scope of this paper to review that literature. Among others, see Wang and Zhou (2006), and the reference therein.

largest four builders in a MSA (equivalent to a four-firm concentration ratio) ranged from a low of 4.2% in Boston, MA to a high of 43.9% in San Diego, CA. These metropolitan area statistics are at odds with the perfect-competition paradigm.” DiPasquale and Wheaton (1996), Green and Malpezzi (2003), among others, compare the difference between national versus city level housing markets. Green et al. (2005) show that the city-level housing supply elasticities vary significantly across different MSA. Saiz (2010) find that while nature and geography play some role in those difference of city-level housing supply elasticities, policy decisions seem to magnify the cross-city differences. Leung et al. (2011) provide clear evidence that both the city-level housing demand and housing supply functions are very different even among the major cities in China.² All these studies point to the direction that the level of aggregation matters for our understanding of the housing supply.³

Based on all these contributions, this paper focuses on the housing market of Hong Kong, paying particular attention to the apparent inelastic housing supply. The structure of this paper, therefore, is straightforward. The next section provides a simple overview of the Hong Kong market. Then we examine the Hong Kong housing supply through a series of examples. The last section concludes.

2. Hong Kong Housing Market and the Macroeconomy

It is well known that the housing market and the macroeconomy are closely related (Leung, 2004, 2017; Leung and Chen, 2017; Leung and Ng, forthcoming). Thus, to explain how the Hong Kong housing market operates as a whole, it is necessary to present some basic stylized facts of the Hong Kong macroeconomy along the way. We mainly employ data from official sources.⁴ Figure 1 shows that the population, the life expectancy, and the per capita GDP (in real terms) all increase over time in Hong Kong. Therefore, it is reasonable to expect that the housing demand will increase over time and if the housing supply does not increase proportionally, the house price could only increase in equilibrium. And that is indeed the case of Hong Kong. Figure 2a displays two lines in one graph. The solid line (which uses the left-hand scale) is the ratio of new

² See also Huang et al. (2015), Wu et al. (2012, 2016) for more discussion on the city-level Chinese housing markets.

³ For more general discussion of aggregation bias, see Hanushek et al. (1996), among others.

⁴ The website of the Census and Statistics Department of the Hong Kong SAR Government is <https://www.censtatd.gov.hk/home/>

housing supply relative to the existing stock. It clearly decreases over time from over 5% in 1985, reaching its bottom in 2009, and always stays below 2% till the end of our sampling period. The dotted line is the Hong Kong housing price in real terms. It reaches one peak in 1997, and then declines as the Asian Financial Crisis (AFC) hits Hong Kong. It starts to rebound after the Chinese government declares “individual travel,” which allows Chinese citizens in selected cities to visit Hong Kong as individuals. At the same time, more Chinese students come to Hong Kong to study. All these policies stimulate the demand for Hong Kong housing and the real house price reaches a new peak, which is well above the pre-AFC one (Chong and Yiu, 2019; Leung and Tang, 2012, 2015).

(Figure 1, 2a about here)

Many explanations have been proposed to explain why the Hong Kong new housing supply does not increase even when the house price (in real terms) increase so much for so many years. First, there may be some "market distortions" issues. Notice the Hong Kong government provides a large amount of public rental buildings, which shelters about one-third of the total population. Since the rental rates of these government housing are typically below the market rate and also adjust slower than the market rate, these public rental units are over-subscribed, and the queue for those units only extends over time. Since the private real estate developers cannot compete with these subsidized units, they may, therefore, be discouraged to provide low-tier housing and turn to provide the medium and high-tier housing units (Wong, 1998, Chow et al., 2002).

Moreover, land ownership in Hong Kong is public. Unlike the private real estate developers in the United States who can acquire land from farmers, real estate developers may need to wait for the Hong Kong government to sell the right of usage. Figure 2b shows that the share of residential land is somehow bounded at 7% of the total in Hong Kong, while the population continues to increase throughout the sampling period. Notice further that, unlike many cities in the world, the boundary of Hong Kong has been fixed by the Basic Laws and hence it is difficult for Hong Kong to expand geographically. Therefore, the limited land supply explanation is sensible. However, this explanation may not be sufficient to explain the irresponsive new housing supply in Hong Kong, because the Hong Kong government does improve the land auction system.

For instance, in response to the weak housing market after the Asian Financial Crisis (AFC), the government adopted an “application list system” in 1999.⁵ It is a market-oriented mechanism where the developers could propose a price for purchasing a site that interests them. When it is above 80% of the assessed Open Market Value from the government, the application will be accepted, and an open land auction will then be initiated. However, if the highest bidding price in the auction does not exceed or reach the un-disclosed reservation price, the land will not be sold. Such design allows real estate developers to take the initiative for acquiring the area from the government and the new housing supply can become more responsive to the market.

Nevertheless, the application list system has two loopholes. First, the un-disclosed reservation price induces information asymmetry between developers and government, in which the developers find difficulties in proposing a reasonable land purchasing price to the government for consideration, and thus it may not be effective in increasing the land supply under different market conditions. Second, the mechanism allows the land supply to be controlled by large oligopolistic developers, while the government can only take a passive role. On February 28, 2013, the Development Bureau announced that the Application List System was abolished, and the government will take a leading role in putting up sites for sale.⁶ Also, the Task Force on Land Supply was established in September 2017, with primary focuses on the current land shortage and forecasting land demand and supply in the next 30 years. It facilitates the discussions in the community and attempts to narrow the differences among stakeholders. Based on public engagement exercise, it also provides a clear blueprint to the government regarding increasing land supply.⁷

(Figure 2b about here)

The third explanation is that due to the scarcity of residential land in Hong Kong, developers would mostly build high-rise buildings. Many newly built condominium buildings have more than 30 stories. Thus, developing housing units at this scale introduces an implicit entry barrier for small-size and in-experienced real estate developers to enter the market. The new housing supply may, therefore, deviate from

⁵ For more details, please refer:

https://www.devb.gov.hk/filemanager/en/content_69/press20080222_appendix2.pdf

⁶ The press release can be found at

<https://www.info.gov.hk/gia/general/201302/28/P201302280598.htm>

⁷ The full report can be downloaded at [https://www.landforhongkong.hk/pdf/Report%20\(Eng\).pdf](https://www.landforhongkong.hk/pdf/Report%20(Eng).pdf)

the level that would be implied by the perfectly competitive paradigm. Unfortunately, most of the existing studies presume a perfectly competitive market for new housing supply (Leung and Wang, 2007; Leung and Wong, 2004; Leung et al., 2011). Therefore, to understand the new housing supply, we may need to keep an open mind about the market structure.

One merit of the Hong Kong market is that the major developers are all listed companies. Therefore, we can take advantage of the information disclosure of these public companies. In particular, the attributable gross floor area is provided by all listed real estate developers. We can also obtain the total attributable gross floor area from the official source. Hence, we can efficiently compute the share of the listed developers in the market. Figure 3a shows clearly that most residential housing areas are provided by the listed developers. The finance literature has educated us that listed firms are typically much more substantial than unlisted counterparts. Hence, Figure 3 suggests that the market for new housing units is dominated by large developers.

(Table 1, Figure 3 about here)

However, the fact that large listed developers develop most of the new housing units does not necessarily imply that those developers have much market power in the market of new housing units. Theoretically, it is possible that among the significant developers, there is intense competition and hence although a finite number of suppliers dominates the market, the market equilibrium price is still approximately close to the (ideal) perfectly competitive equilibrium counterpart.⁸ Another possibility follows from the contestable market theory that there are always some non-local developers that are ready to enter the market.⁹ The incumbents, therefore, would not charge a price level that significantly deviates from the marginal cost, leading the markup in equilibrium being small or even zero. In the current context, both the average cost and marginal cost are not directly observed, making it difficult to test these hypotheses directly.

Table 1 tabulates the listed developers, and the Urban Renewal Authority,

⁸ For more discussion, see Tirole (1988), among others.

⁹ The contestable market theory can be traced back to Baumol et al. (1982). It quickly becomes very controversial, both theoretically and empirically. Among others, see Baumol and Willig (1986), Brander and Zhang (1990), Martin (1989), Morrison and Clifford (1987), Spence (1983), and the reference therein. This paper has no intention to take a side in this debate. It merely mentions such a theoretical possibility.

which also participate actively in providing new housing units. It is a long list and hence to establish the case that the market of new housing units significantly deviates from the perfectly competitive ideal, we need to measure the degree of market concentration formally. In Hong Kong, listed real estate developers only provide information about the total area of residential property they complete in each period. Therefore, we will measure the “market share” in the market of new housing supply by the amount of area of residential property each developer completes as a percentage of the total amount of area all developers complete during the same period.¹⁰ Following the industrial organization (IO) literature, we adopt the Herfindahl Index (HI), which is bounded between zero and unity.¹¹ The higher the value of HI, the higher the market concentration is. HI attains the value of unity if the market is occupied by a monopoly. Constrained by the data availability, we can only provide quarterly HI. Figure 3b shows that there are indeed periods when the market is very concentrated, such as the period between 2007 to 2011, which roughly coincides the period of the Global Financial Crisis (GFC).¹² While a simple plot of HI is not enough to sustain the claim that the market of a new housing unit is oligopolistic, it seems reasonable to further investigate such a possibility in future research.¹³

3. The Empirical Challenges of Studying the Market of New Housing Units in Hong Kong

In this section, we illustrate some practical challenges in studying the market of new housing supply in Hong Kong. The first challenge is the potentially complicated ownership structure of the development. First, it is well-known that the major developers in Hong Kong are all family business. Some researches indicate that family business in Hong Kong may moderate the monitoring function of the board and may be

¹⁰ The market capitalization of each listed developer has been suggested to us as an alternative measure. In the context of Hong Kong, it may not be a desirable empirical strategy. We will return to this point later.

¹¹ Formally, $HI = \sum_{i=1}^n (s_i)^2$, where s_i is the market share of the i^{th} developer. Since $0 \leq s_i \leq 1$, it can be proved that $0 \leq HI \leq 1$.

¹² Most studies date the GFC with the collapse of the Lehman Brothers. However, some studies demonstrate empirically that the U.S. housing market started the downturn in 2016. See Chang et al. (2015, Appendix I), among others, for a review of the literature.

¹³ It is a difficult job to formally establish the degree of competition in a market without a structural model. For instance, see Brander and Zhang (1990) for more discussion.

associated with bad corporate governance and potentially inferior performance (Cheung et al., 2010, Jaggi et al., 2009, Lee and Barnes, 2017).

In the context of the new housing supply, Figure 4a shows that only a tiny share of real estate projects is completed by MTR (where the government owns around 75% of the Company) or Urban Renewal Authority (a quasi-governmental body), and the rest is built by the private sector. There are many possible arrangements for the private sector to complete a project. Unlike the textbook case, a real estate development may be jointly developed by a large, listed developer with some non-listed companies, which are daughter companies of other listed developer, or even the collaborated developer.¹⁴ We also find cases where listed developers would jointly develop a project through the creation of a non-listed company. There may be good economic reasons behind such arrangements, including internal monitoring, risk-sharing, etc.¹⁵ Since those arrangements have been studied extensively in the literature, we only present the facts in this paper. And throughout this paper, we treat all the new units directly developed by the mother company or her subsidiaries as the same.

We now present some real cases. In Figure 4b, two daughter companies of Sun Hung Kai, which is a listed developer, jointly develop a development. Notice that in this case, Sun Hung Kai does not involve directly. Figure 4c presents the case where the Citic Pacific and HKR International limited have an equal share in a company, which in turn solely develop Discovery Bay.

Figure 4d and 4e provide some representative cases of Hong Kong. In Hong Kong, the railway was under the management of a company named KCRC and the subway was under the supervision of another company named MTR. The two companies then "merge" under the government command and both the railway and subway are now under the management of MTR. Since the building and maintenance of railway and subway are costly and yet the fares are subject to severe regulations, the government often provides a piece of land near the station, or the right of development on top of a station, to "compensate" MTR. Figure 4d presents the case where the KCRC and a subsidiary of Sino Land, which is a listed developer to jointly develop Palazzo, which is near one of the train stations. Figure 4e presents a case where MTR and a

¹⁴ Throughout the paper, "daughter company" will be used interchangeably with "subsidiary."

¹⁵ For instance, see Williamson (1975, 1996), among others.

subsidiary of New World Development, which is a listed developer, and jointly develop a project near another station.

(Figure 4 about here)

The second challenge is that the primary developers do not only operate in the local market but also China or other places. Hence, the fluctuations of their revenues and profits could be de-coupled from the local housing market. Figure 5 shows the geographical composition of revenues of the major developers. It is clear that except Sun Hung Kai, all are somehow “geographically diversified” in the sense that the income from Hong Kong (including housing units sale and other revenue) constitutes no more than two-thirds of their total revenues. In the case of Cheung Kong, the income from Hong Kong is about 40% of the total. Hence, the market capitalization of a real estate developer may reflect not only the anticipated profit from the local market but also that from the overseas markets. Therefore, it may not be an excellent empirical strategy to use the market capitalization to measure the domestic market share of the listed developers in Hong Kong.

(Figure 5 about here)

Thus, combining the geographical diversification and the potentially complicated ownership structure of different real estate development projects that we discussed earlier, it follows that the firm-level profit rate and the leverage ratio may not be very informative about the sale of their new housing units. Our experience is that the empirical challenges can be overcome with hard work. We just need to proceed with extra cautions when we analyze these listed real estate developers.

4. Concluding Remarks

It is well-known that for small open economies like Hong Kong or Singapore, the domestic house price movements would be affected by the global economic environment, including the fluctuations of the U.S. interest rate and stock market (Chang et al., 2012, 2013, Kwan et al., 2015). By its very nature as durable goods, the total stock of housing adjusts sluggishly. Therefore, it is not surprising that much research efforts have been devoted to the housing demand, especially in the case of small open economies. On the other hand, complete ignorance of the housing supply would not deliver us the full picture of the housing market dynamics. This paper focuses

on the housing supply in Hong Kong. It provides an overview of the relationship between the macroeconomy and the housing market in Hong Kong. It also explains the empirical challenges that we need to overcome to fully understand the housing supply in Hong Kong. We believe that while the efforts of this paper concentrate on Hong Kong, the lessons can apply to other cities. We are therefore very optimistic about the future of housing supply research.

Figures and Tables

Figure 1a: Hong Kong Population and Life Expectancy is increasing over time

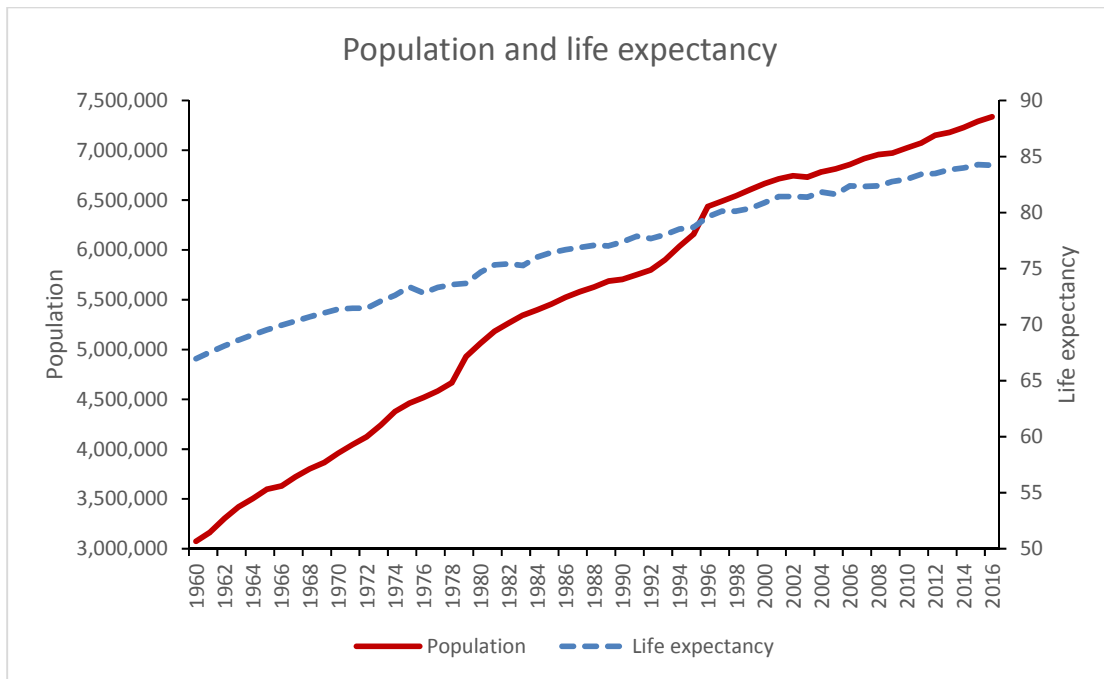


Figure 1b: Hong Kong per capita GDP (real terms) is increasing over time

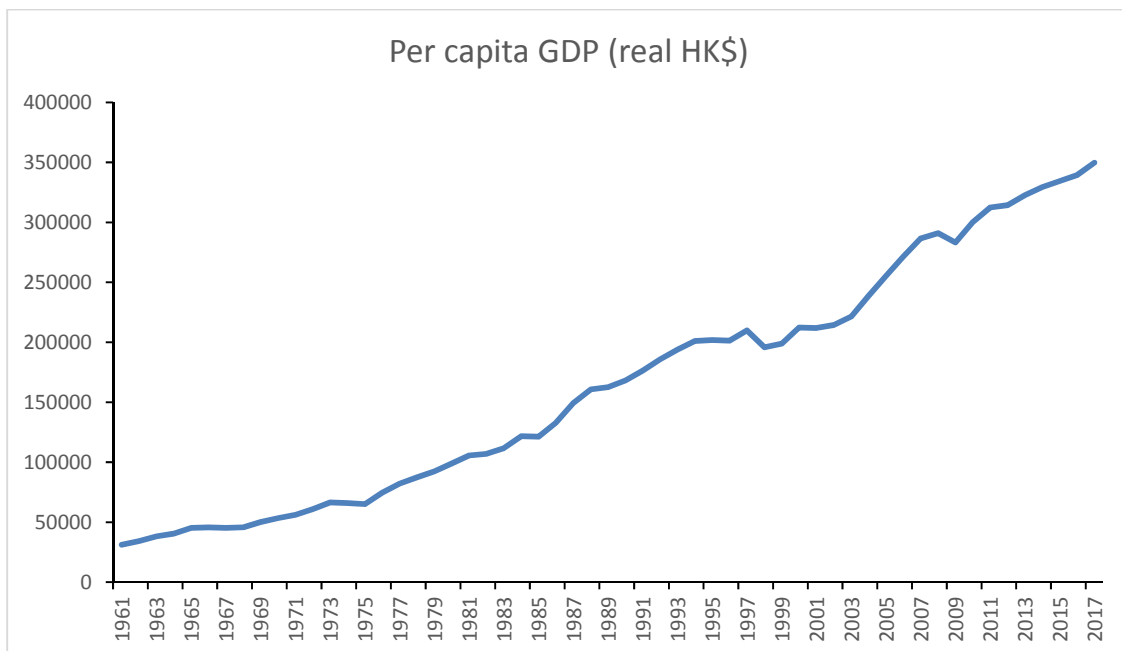


Figure 2a: Hong Kong New Housing Supply-to-Stock ratio and Housing Price (in real terms)

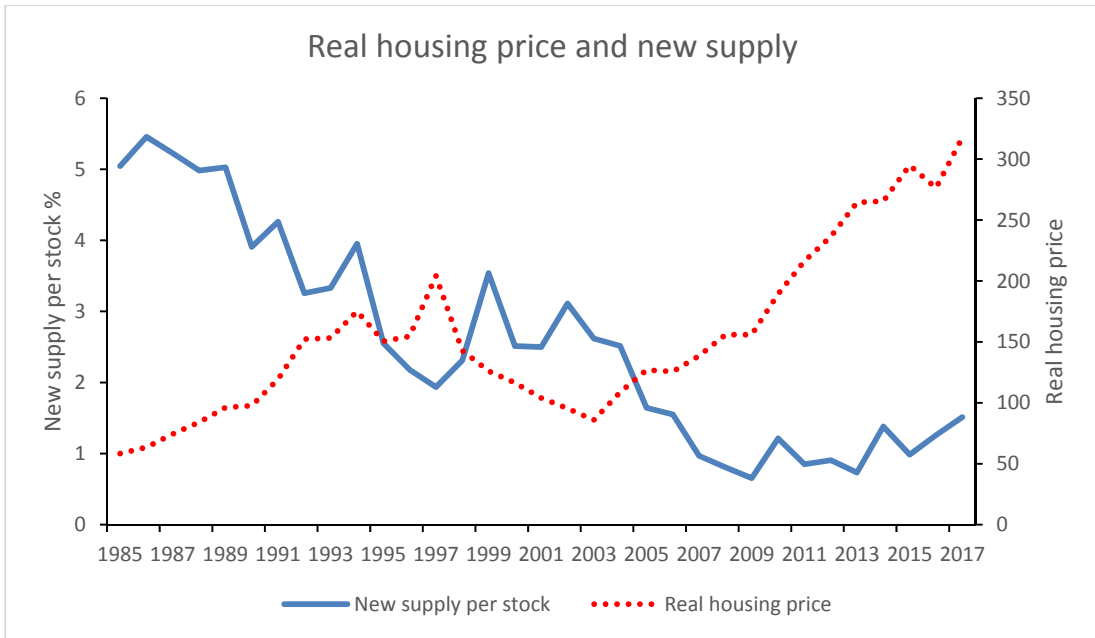


Figure 2b: Share of land used for residential purpose and population

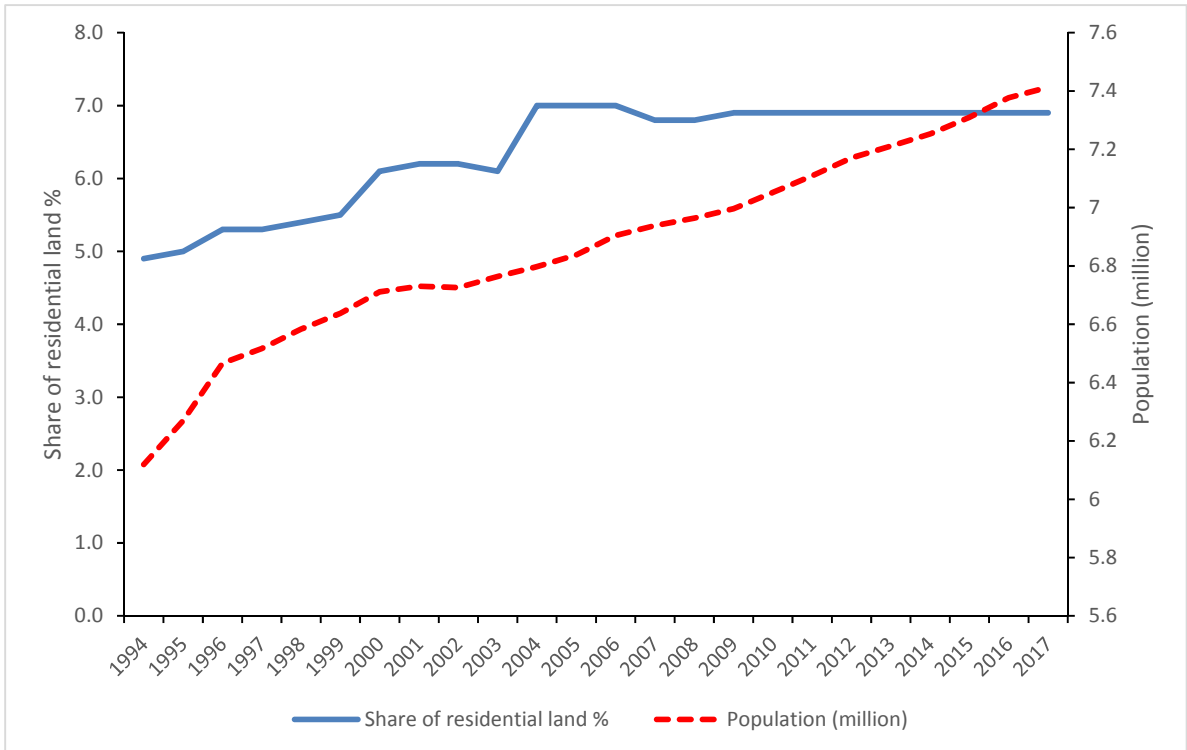


Figure 3a: Market share of the listed developers

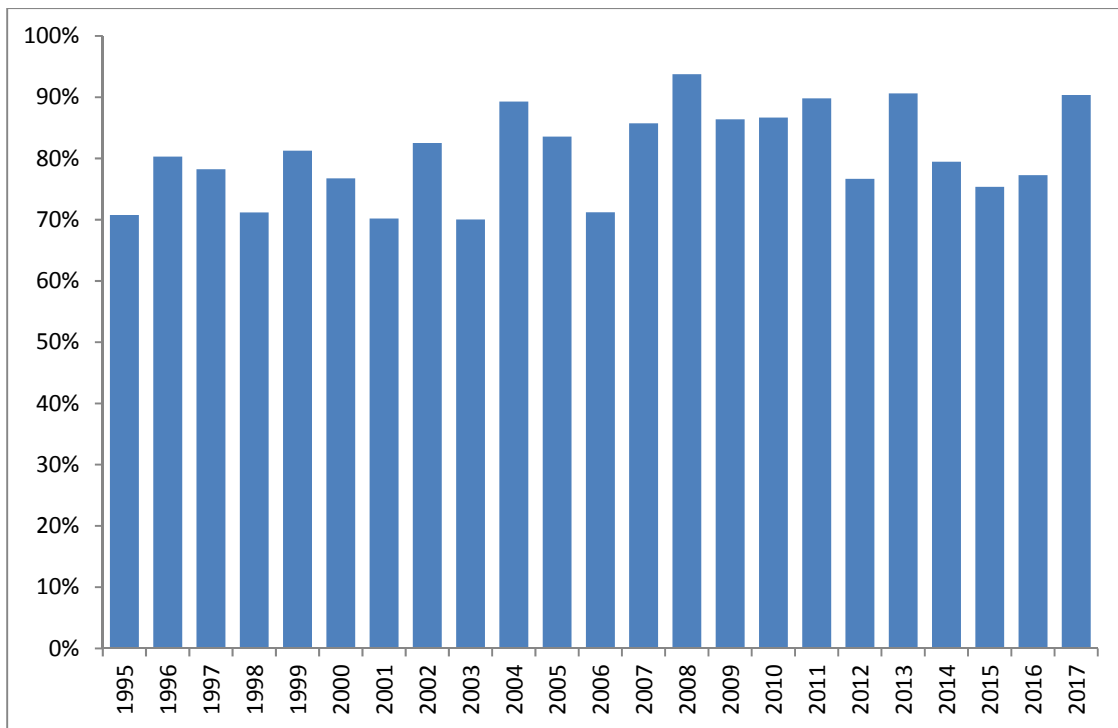


Figure 3b: Herfindahl Index (quarterly)

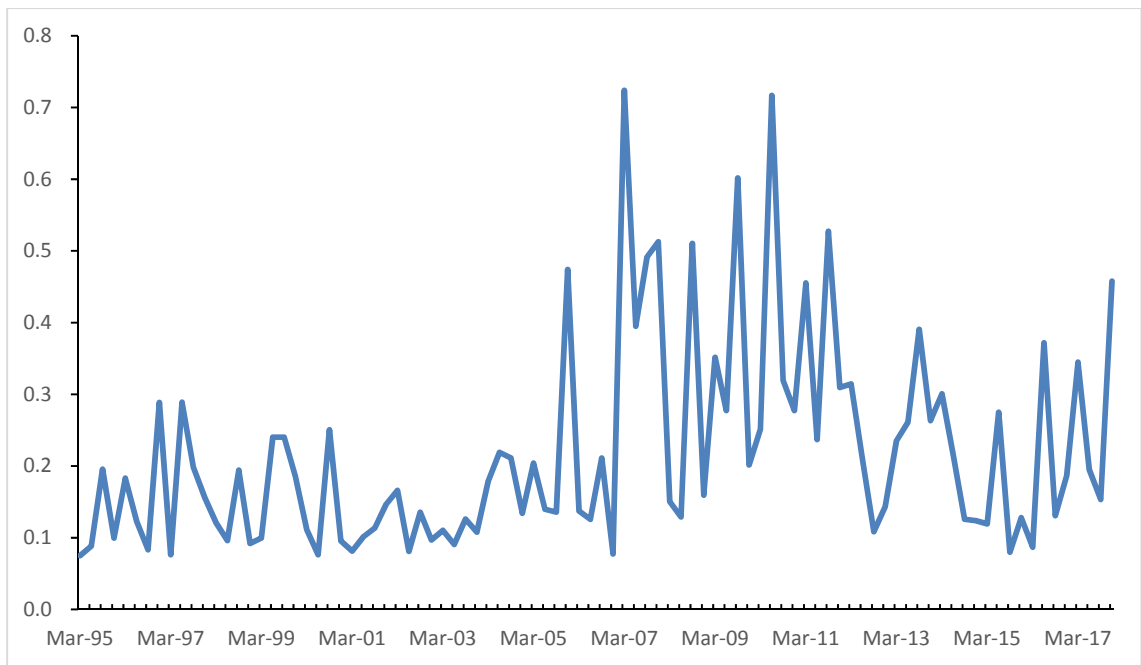


Figure 4a Number of housing projects completed

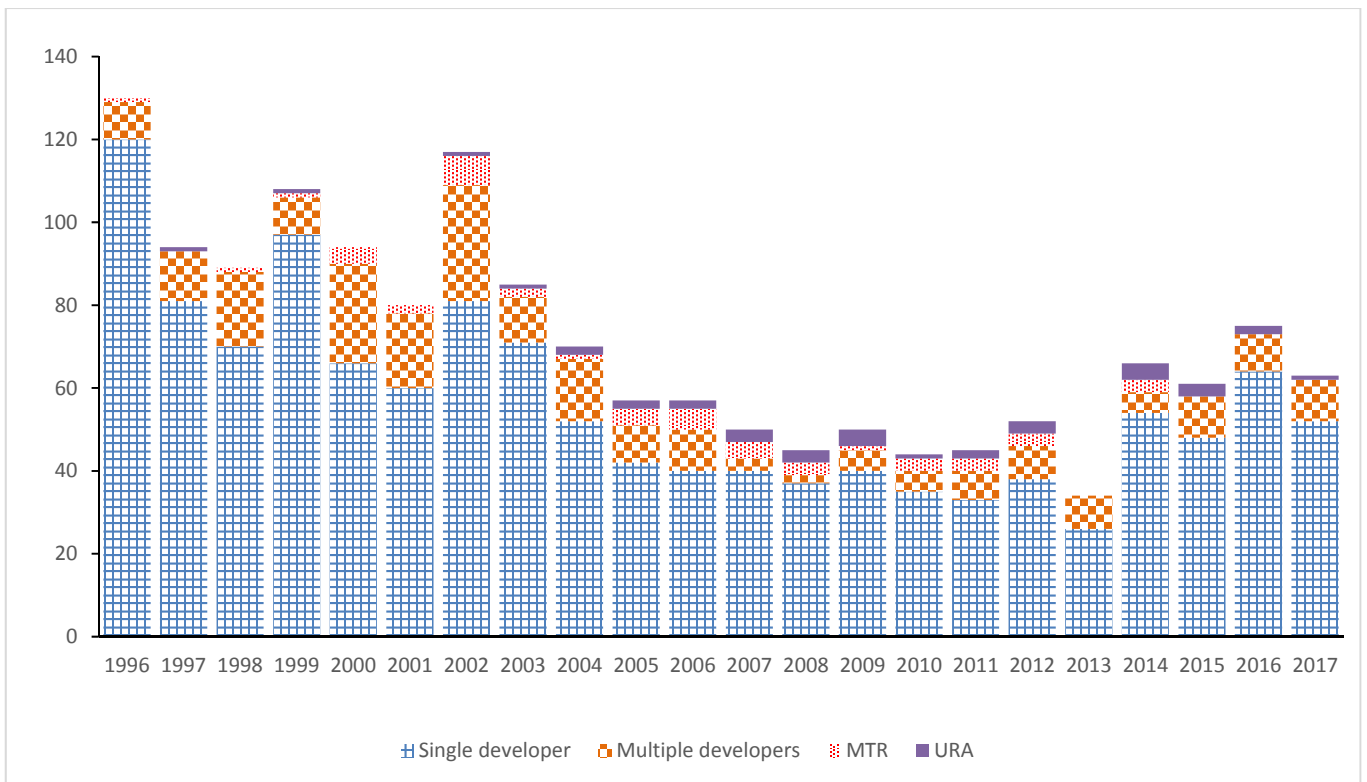
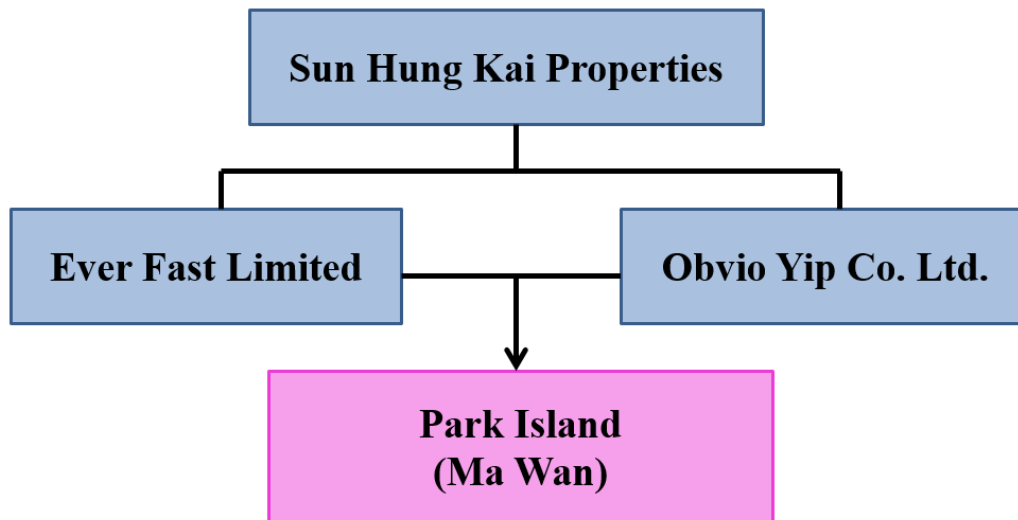


Figure 4b: Two daughter companies of Sun Hung Kai jointly develops Park Island



The real estate development was developed in several stages. "M1" means January, "M2" means February, and so on.

phase 1 2002M8; number of units = 1,741; Gross floor area = 106,809.0 m²

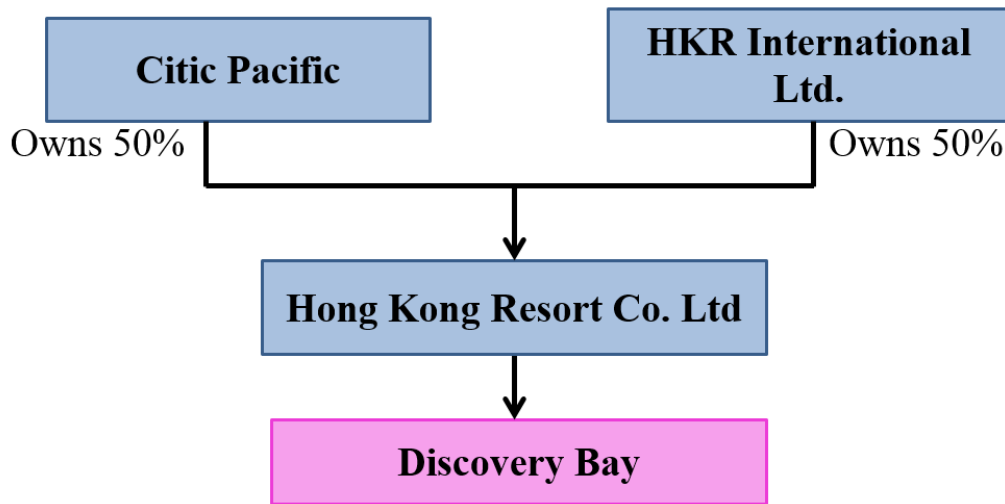
phase 2: 2002M8; number of units = 828; Gross floor area = 57,096.8 m²

phase 3: 2004M11; number of units = 1,446; Gross floor area = 93,768.3m²

phase 5: 2006M6; number of units = 1,212; Gross floor area = 74,522.6m²

phase 6: 2009M6; number of units = 65; Gross floor area = 7,947.1m²

Figure 4c: Citic Pacific and HKR International Ltd. Jointly develop Discovery Bay



Phase 1: 1982M6, 1982M7, 1982M8, 1982M9, 1982M10, 1982M11, 1982M12, 1983M1, 1987M9; number of units =1,073; Gross floor area = 95,335m²

Phase 2: 1985M9, 1986M11; number of units = 381; Gross floor area = 38,881m²

Phase 3: 1987M9, 1987M10, 1988M1, 1988M4, 1988M5, 1988M6, 1988M12, 1989M3, 1989M5; number of units = 1,197; Gross floor area = 109,594.4m²

Phase 4: 1990M4, 1991M3, 1992M4, 1994M10, 1996M4; number of units =1,342; Gross floor area = 181,726.9m²

Phase 5: 1990M5, 1991M12, 1994M3; number of units = 1,344; Gross floor area = 101,192.5m²

Phase 6: 1991M11; number of units =; Gross floor area = 9,868.5m²

Phase 7: 1994M9; number of units = 238; Gross floor area = 21,721.1m²

Phase 8: 1995M5; number of units = 319; Gross floor area = 24,360.0m²

Phase 9: 2000M2; number of units = 181; Gross floor area = 16,979.4m²

Phase 10: 2000M1; number of units = 219; Gross floor area = 15,998.7m²

Phase 11: 2002M1, 2002M4; number of units = 298; Gross floor area = 31,036.4m²

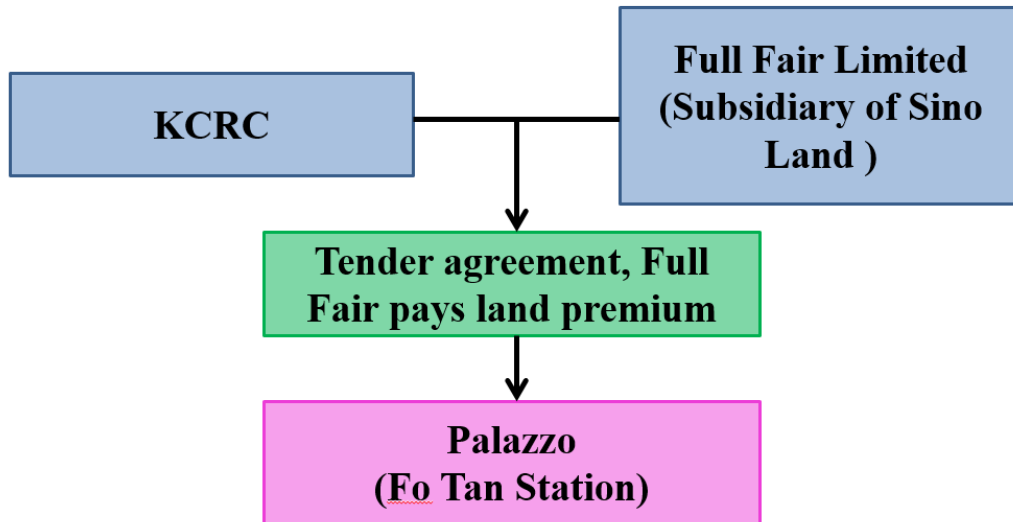
Phase 12: 2002M7; number of units = 757; Gross floor area = 59,901.2m²

Phase 13: 2006M4; number of units = 541; Gross floor area = 49,658.1m²

Phase 14: 2011M2; number of units = 164; Gross floor area = 15,600.2m²

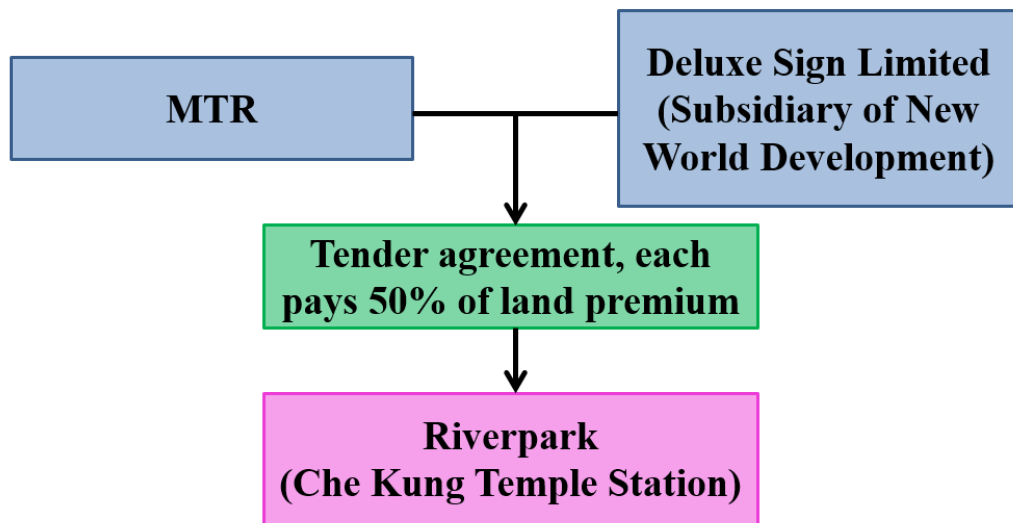
Phase 15: 2011M2; number of units = 102; Gross floor area = 17,437.5m²

Figure 4d: KCRC and a subsidiary of Sino Land jointly develop Palazzo



2008M12; number of units = 1,375; Gross floor area = 120,915m²

Figure 4e: MTR jointly develop Riverpark with a subsidiary of New World Development



2012M9; number of units = 981; Gross floor area = 89,816.9m²

Figure 5a: Geographical revenue decomposition of Cheung Kong Holdings

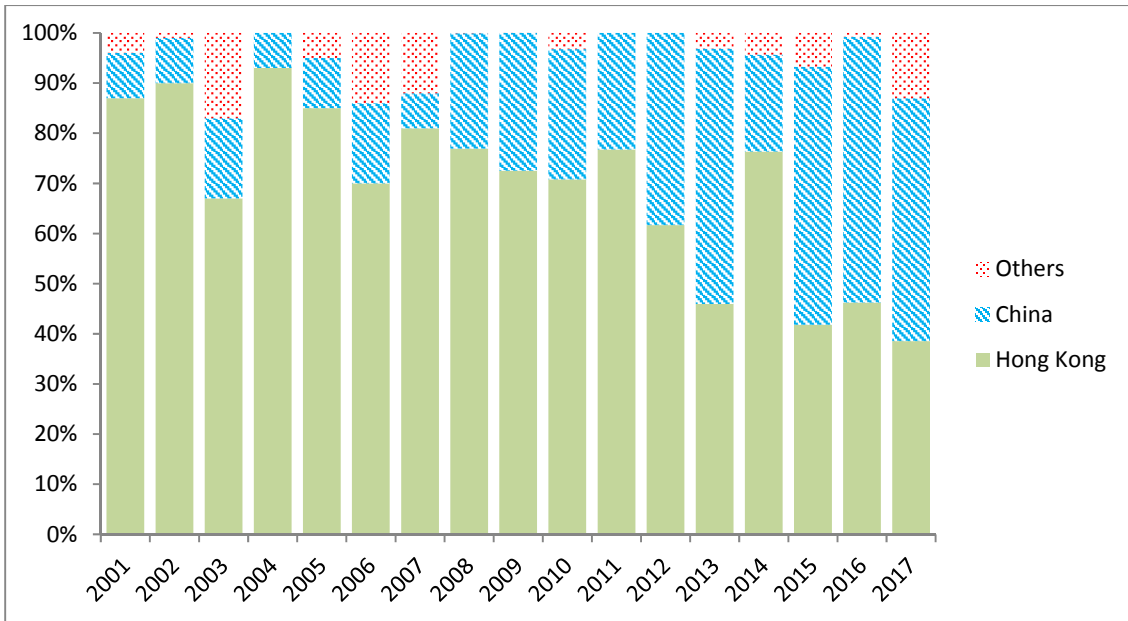


Figure 5b: Geographical revenue decomposition of New World Development



Figure 5c: Geographical revenue decomposition of Sun Hung Kai Properties

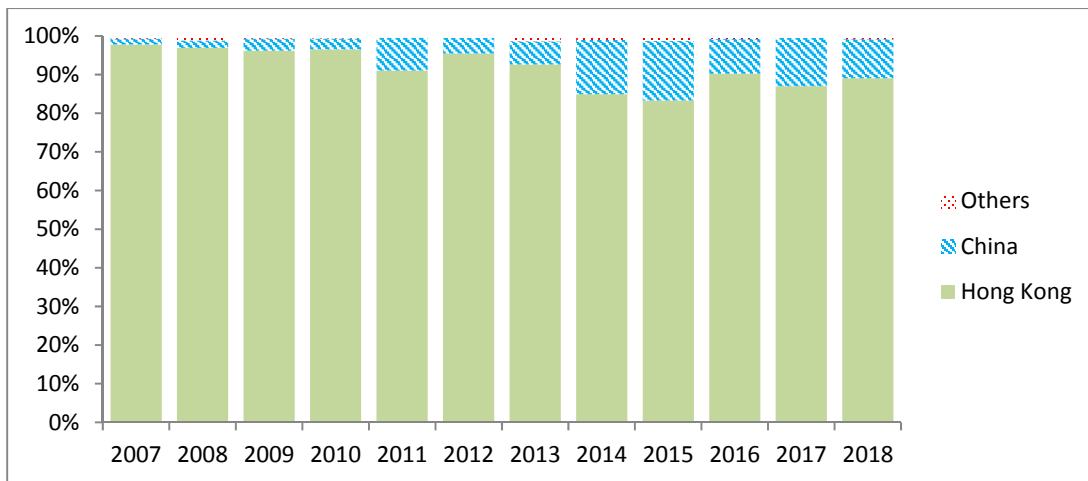


Figure 5d: Geographical revenue decomposition of Henderson Land Development

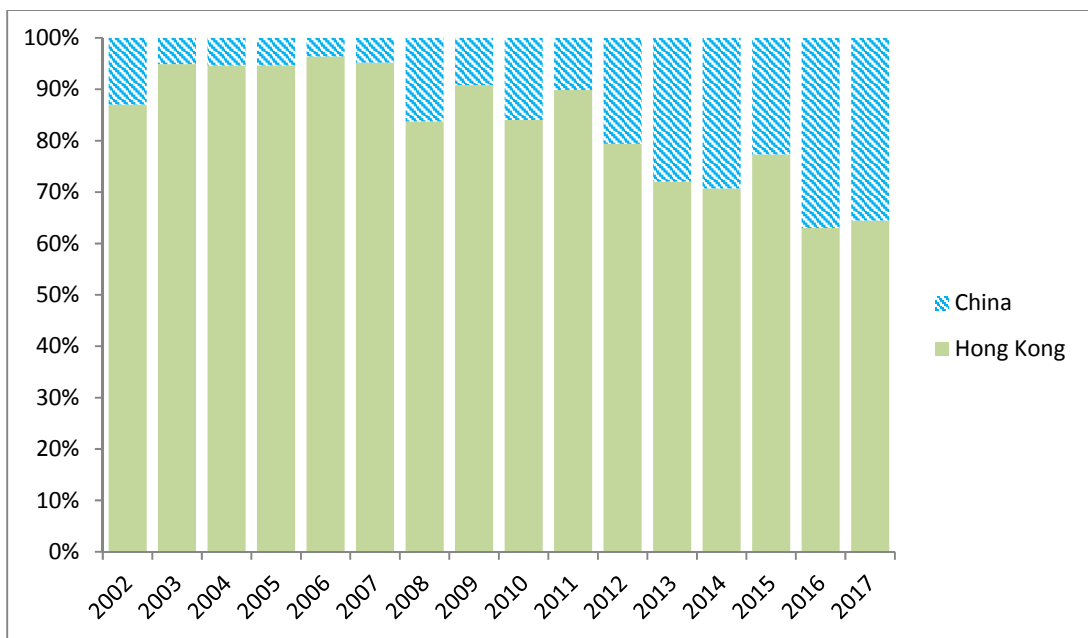


Table 1: List of major developers

Property Developers	Abbreviations	Stock Code
Asia Standard International	ASI	129
Cheung Kong (Holdings) Limited / CK Asset Holdings Limited	CKH	0001 /1113
China Overseas Land and Investment Ltd.	COL	688
China Resources	CR	291
Chinese Estates Holdings Limited	CEH	127
Chuang's Consortium International Ltd.	CCI	367
CITIC	CITIC	267
Emperor International	EMP	163
Hang Lung Group	HLG	10
Hang Lung Properties Limited	HL	101
Henderson Land Development Co Ltd	HEN	12
Hong Kong Ferry (Holdings) Co Ltd	HKF	50
Hong Kong International Limited	HKR	480
Hopewell Holdings Limited	HOPE	54
Hutchison Whampoa Property	HUT	13
Hysan Development Company Limited	HYS	14
K. Wah International	KW	173
Kerry Properties Limited	KP	683
Kowloon Development Company Limited	KDC	34
Lai Sun Development	LSD	488
MTR Corporation	MTR	66
New World China Land Limited	NWCL	917
New World Development	NWD	17
PCCW	PCCW	8
SEA Holdings	SEA	251
Shun Tak Holdings Limited	STH	242
Sino Land	SINO	83
Sun Hung Kai Properties Limited	SHK	16
Swire Pacific A	SW	19
Tai Cheung Holdings Limited	TCH	88
Tai Sang Land Development	TSLD	89
Urban Renewal Authority	URA	---
Wharf Holdings Limited	WH	4
Wheelock Properties	WHEEL	20
Y. T. Realty	YTR	75

Reference

- Baumol, W. J., Panzar, J. C. and Willig, R. D., 1982, **Contestable Markets and the Theory of Industrial Structure**, San Diego. CA: Harcourt Brace Jovanovich.
- Baumol, W. J., and Willig, R. D., 1986, Contestability: Developments since the Book, *Oxford Economic Papers*, 38 (Nov., Supplement issue), 9-36.
- Brander, J. A., and Zhang, A., 1990, Market Conduct in the Airline Industry: An Empirical Investigation, *RAND Journal of Economics*, 21(4), 567-583.
- Chang, K. L., Chen, N. K. and Leung, C. K. Y., 2012, The Dynamics of Housing Returns in Singapore: How Important are the International Transmission Mechanisms?, *Regional Science and Urban Economics*, 42, 516-530.
- Chang, K. L., Chen, N. K. and Leung, C. K. Y., 2013, In the shadow of the United States: The International Transmission Effect of Asset Returns, *Pacific Economic Review*, 18(1), 1-40.
- Chang, K. L., Chen, N. K. and Leung, C. K. Y., 2015. Losing track of the asset markets: the case of housing and stock, ISER Discussion Paper 0932, Institute of Social and Economic Research, Osaka University.
- Cheung, Y. L., Stouraitis, A. and Tan, W., 2010, Does the quality of corporate governance affect firm valuation and risk? Evidence from a corporate governance scorecard in Hong Kong, *International Review of Finance*, 10, 403-432.
- Chong, T. T. L. and Yiu, A. W. H., 2019, The Nexus between Visitor Arrivals and Residential Property Rents in Hong Kong, *Pacific Economic Review*, forthcoming.
- Chow, Y. F., Wong, N., Leung, C. K. Y., Cheng, E. H. F. and Yan, W. H., 2002, **Hong Kong Real Estate Market: Facts and Policies**, Hong Kong: Ming Pao Publisher (*In Chinese*).
- Demographia, 2019, 15th Annual Demographia International Housing Affordability Survey: 2019, mimeo.
- DiPasquale, D., 1999, Why don't we know more about housing supply? *Journal of Real Estate Finance and Economics*, 18(1), 9-23.
- DiPasquale, D. and Wheaton, W., 1996, **Urban Economics and Real Estate Markets**. Englewood Cliffs, NJ: Prentice-Hall.
- Green, R. and Malpezzi, S., 2003, **A Primer on U.S. Housing markets and Housing Policy**, Washington, D.C.: Urban Institute Press.
- Green, R., Malpezzi, S. and Mayo, S., 2005, Metropolitan-Specific Estimates of The Price Elasticity of Supply of Housing, and Their Sources. *American Economic Review*, 95(2): 334-339.
- Hanushek, E., Rivkin, S. and L.L. Taylor, L., 1996, Aggregation and the estimated effects of school resources, *Review of Economics and Statistics*, 78 (4), 611-627.
- Huang, D., Leung, C. K. Y. and Qu, B., 2015, Do Bank Loans and Local Amenities Explain Chinese Urban House Prices? *China Economic Review*, 34: 19-38.

- Jaggi, B., Leung, S. and Gul, F., 2009, Family control, board independence and earnings management: evidence based on Hong Kong firms, *Journal of Accounting and Public Policy*, 28, 281-300.
- Kwan, Y. K., Leung, C. K. Y. and Dong, J., 2015, Comparing consumption-based asset pricing models: the case of an Asian city, *Journal of Housing Economics*, 28, 18-41.
- Lee, K. and Barnes, L., 2017, Corporate governance and performance in Hong Kong founded family firms: Evidence from the Hang Seng Composite Industry Index, *Journal of Developing Areas*, 51, 401-410.
- Leung, C., 2004, Macroeconomics and Housing: a review of the literature, *Journal of Housing Economics*, 13, 249-267.
- Leung, C. K. Y., 2017, Special issue on housing and financial stability: an introduction, *Pacific Economic Review*, 22, 273-275.
- Leung, C. K. Y. and Chen, N. K., 2006, Intrinsic cycles of land price: a simple model, *Journal of Real Estate Research*, 28(3), 293-320.
- Leung, C. K. Y. and Chen, N. K., 2017, A special issue on housing, credit markets, and the marcoeconomy: an introduction, *Taiwan Economic Review*, 45 (1), 1-3.
- Leung, C. K. Y., Chow, K. K., Yiu, M. S. and Tam, D. C., 2011, House Market in Chinese Cities: Dynamic Modeling, In-Sampling Fitting and Out-of-Sample Forecasting, *International Real Estate Review*, 14(1), 85-117.
- Leung, C. K. Y. and Ng, J. C. Y. (forthcoming), Macroeconomic Aspects of Housing, in the *Oxford Research Encyclopedia of Economics and Finance*, Oxford University Press. doi: 10.1093/acrefore/9780190625979.013.294
- Leung, C. K. Y. and E. C. H. Tang, 2012, Comparing two financial crises: the case of Hong Kong Real Estate Markets, in **Global Housing Markets: Crises, Institutions and Policies**, eds. by A. Bardhan, R. Edelstein and C. Kroll, New York: John Wiley & Sons, 377-398.
- Leung, C. K. Y. and E. C. H. Tang, 2015, Availability, affordability and volatility: the case of Hong Kong housing market, *International Real Estate Review*, 18 (3), 383-428.
- Leung, C. K. Y. and Wang, W., 2007, Chinese Housing Market through the lens of DiPasquale-Wheaton model: a graphical attempt, *International Real Estate Review*, 10(2), 131-165.
- Leung, C. K. Y. and Wong, K. S., 2004, The construction and related industries in a changing socio-economic environment: the case of Hong Kong, *International Real Estate Review*, 7, 139-176.
- Martin, S., 1989, Sunk cost, financial markets, and contestability, *European Economic Review*, 33(6), 1089-1113.
- Morrison, S. A. and Clifford, W., 1987, Empirical implications and tests of the contestability hypothesis, *Journal of Law and Economics*, 30(1), 53-66.
- Saiz, A., 2010, The Geographic Determinants of Housing Supply. *Quarterly Journal of Economics*, 125(3): 1253-1296.
- Somerville, C. T., 1999, The Industrial Organization of Housing Supply: Market Activity, Land Supply and the Size of Homebuilder Firms. *Real Estate Economics*, 27(4), 669-694.

Spence, M., 1983, Contestable Markets and the Theory of Industry Structure: A Review Article, *Journal of Economic Literature*, 21(3), 981-990.

Tirole, J., 1988, **The Theory of Industrial Organization**. Cambridge: MIT Press.

Wang, K. and Zhou, Y., 2006, Equilibrium Real Options Exercise Strategies with Multiple Players: The Case of Real Estate Markets. *Real Estate Economics*, 34(1), 1-49.

Williamson, O. E., 1975, **Markets and Hierarchies: Analysis and Antitrust Implications**. New York, The Free Press.

Williamson, O. E., 1996, **The Mechanisms of Governance**. New York, NY, Oxford University Press.

Wong, R.Y.C., 1998, **On Privatizing Public Housing**. Hong Kong: City University of Hong Kong Press.

Wu, J., Gyourko, J. and Deng, Y., 2012, Evaluating Conditions in Major Chinese Housing Markets, *Regional Science and Urban Economics*, 42(3) 531-543.

Wu, J., Gyourko, J. and Deng, Y., 2016, Evaluating The Risk of Chinese Housing Markets: What We Know and What We Need to Know, *China Economic Review*, 39: 91-114.

Appendix

Figure A1: Profit rate of developers

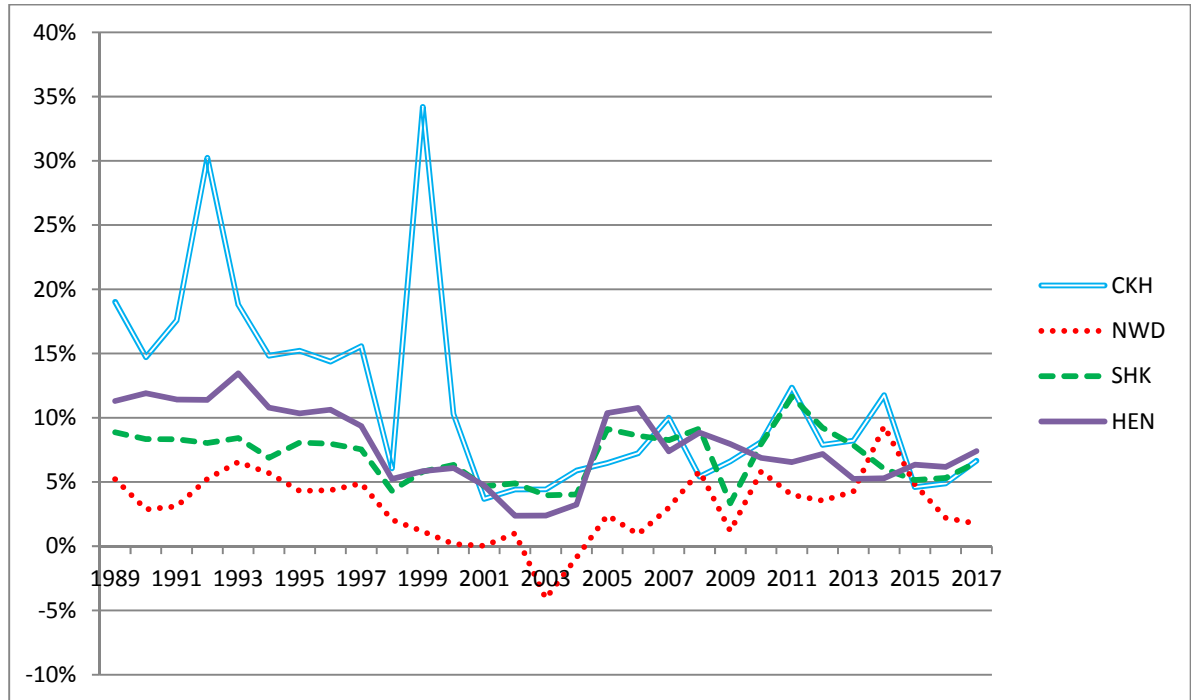


Figure A2: Leverage ratio of developers

