INTERNATIONAL REAL ESTATE REVIEW

Speculating China Economic Growth through Hong Kong? Evidence from Stock Market IPOs and Real Estate Markets

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This paper argues that since China closes her asset markets, investors turn to Hong Kong instead. The initial public offerings (IPOs) of Chinese firms in the Hong Kong stock market and the local housing market of Hong Kong improve the prediction of each other, as they may serve as a coordinator of herds among investors. Alternative explanations such as the "production conjecture" and "underlying factor conjecture" are found to be inconsistent with the data. Our results are also consistent with the increasing importance of Chinese tourists in the world. Directions for future research are also discussed.

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"… But if we look up *confidence* in the dictionary, we see that it is more than a prediction. The dictionary says that it means "trust" or "full belief." The word comes from the Latin *fido*, meaning "I trust." The confidence crisis that we are in at the time of this writing is also called a *credit crisis*. The word *credit* derives from the Latin *credo*, meaning "I believe."… In good times, people trust. They make decisions spontaneously. They know instinctively that they will be successful… Asset values will be high and perhaps also increasing…. When people are confident they go out and buy; when they are unconfident they withdraw, and they sell. Economic history is full of such cycles of confidence followed by withdrawal."

George Akerlof and Robert Shiller, Animal Spirits, 2009.

1.   Introduction

The emergence of China as a great economic power has been widely recognized. For instance, according to the World Development Indicators, the aggregate GDP for China, Germany, Japan, U.K. and the U.S. were approximately (all in constant 2000 dollars) 1198, 1886, 4731, 1477 and 9899 billion respectively. In 2011, these figures increased to 3541, 2131, 5059, 1756 and 11,744 billion respectively. These figures show that China has indeed overtaken some major economies in terms of the aggregate GDP. If China has appreciated her currency (renminbi) as much as some commentators have suggested, the GDP figures of China in the recent decade could be even more pronounced.

Empirical research suggest that *on average*, a high economic growth is associated with a high return in the stock market.[1] Thus, it would be natural to suggest that one should invest in the China stock market. On the other hand, it may not be easy for individual investors to financially "capture" such phenomenal growth. For one thing, China does not open her asset markets. Information flows in China are under severe monitoring and very often non-local investors can only make "guesses". Foreigners have limited participation in the Chinese real estate and stock markets. Foreign financial intermediations are only allowed to provide limited services to Chinese customers in restricted areas. In fact, renminbi, the currency of China, is not even convertible.

Since investors do not have full access to the Chinese asset markets, some would choose to invest in *correlated markets*. Among those markets, Hong Kong is often highlighted for a variety of reasons. On top of the geographical and cultural proximities, there may also be some sound economic reasons. Trade in goods and services, as well as the mobility of factors between Mainland China and Hong Kong began in the 1970s, and have since continued to grow (Sung, 1991). Due to the large flow of visitors between Hong Kong and Mainland China, Hong Kong has access to more updated information about China. In addition, many authors (see Genberg and He, 2008 and the reference therein) have shown evidence that the economic activities between China and Hong Kong are closely related. Therefore, if there is some good news in China (including productivity growth, favorable economic policies, etc.), the Hong Kong economy will typically benefit. The good news would also be "capitalized" in the Hong Kong asset markets. In addition, some Chinese corporations are listed in the Hong Kong stock market and investors can trade them directly. In fact, some studies demonstrate that there are indications of increasing integration between the stock markets of China and Hong Kong (for instance, see Cheng and Glascock, 2005).

This paper attempts to contribute to the literature by considering a *special segment of the stock market*, which are the initial public offerings (IPOs), i.e.

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[1] Among others, see Levine (2002), and Levine and Zervos (1998).

the first sale of stock of a private company to the public. The activities of IPOs have received increasing attention in both the media and the academic circle. Clearly, it is beyond the scope of this paper to review this literature.[2] It seems fair to summarize that the previous literature focuses on the *microeconomic aspect* of IPOs. To complement the literature, this paper attempts to focus on a *macroeconomic issue*, namely, how IPO activities interact with the real estate market. In previous research (for instance, Case and Quigley, 2007; Case, Quigley and Shiller, 2005), the emphasis was on the wealth effects of both the stock and the real estate markets on consumption. However, this paper finds that the IPO value relative to total market capitalization is typically negligible. Thus, the movement of IPOs should have *no significant wealth effect*, and may therefore *identify a separate channel* through which the stock and the real estate markets can be related. The following figure shows the case of Hong Kong and graphically confirms this statement.

Figure 1   Ratio of IPO Value to Total Market Capitalization against Time
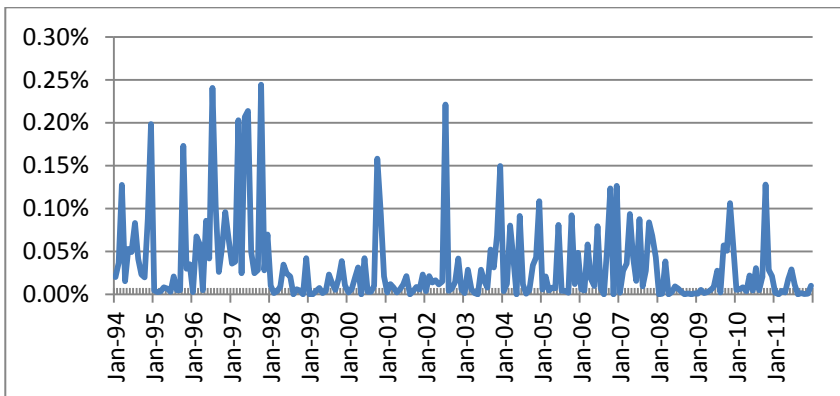
Source: Hong Kong Exchanges and Clearing Limited (www.hkex.com.hk)

The case of Hong Kong is selected in this paper with good reasons. Despite its small geographical size, Hong Kong is an important financial market in the region. Hong Kong is the second largest Asian financial market (Newell et al., 2007). According to a recent study, out of the 20 largest IPOs in Asia for the period of 1997-2011 (in terms of the current year nominal value), 10 of them are held in Hong Kong.[3] The Wall Street Journal (2012) even states that "for

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[2]For instance, different aspects of IPOs, including issuing activity, under-pricing, long-run performance, etc. have been widely discussed in the literature. Among others, interested readers can refer to survey papers such as those by Ritter and Welch (2002) and Yong (2007), among others.

[3] See Appendix 1C for details.

the third year in a row the world's leading exchange for new stock offerings was located not in New York, but in Hong Kong".[4] In terms of the real estate market, Hong Kong has a very good legal system (Newell et al., 2007). Leung, Wong and Cheung (2007) show that in terms of the average number of transactions per unit of housing, the Hong Kong housing market is several times more "liquid" than that of the U.S. In addition, the boundary of Hong Kong is fixed by the Basic Law. The fixed boundary and constrained supply of land also facilitate comparison across different time periods. Moreover, Hong Kong has a simple tax system, maintains a constant exchange rate throughout the sampling period, and provides equal treatment to foreign investors. All of these features contribute to our choice of using Hong Kong as the case study.

How can IPO activities be related to the real estate markets? One possible channel is that an increase (decrease) in IPO activities may *reflect* an improvement (or deterioration) of the "market sentiment" (among others, Baker and Wurgler, 2007; Cornelli, Goldreich, and Ljungqvist, 2006; Helwege and Liang, 2004). In fact, stock market IPOs are included in the list of variables which is used to construct the "market sentiment" variable (Brown and Cliff, 2004), and *indeed IPO activities are the only time series available for Hong Kong during our sampling period* (see Appendix 2). Alternatively, IPOs might reflect that the business people are *confident* of the economic future, and thus raise funds through IPOs for investments and further expansion (Akerlof and Shiller, 2009). Investors express their *trust* to these business people by subscribing to the IPOs. Thus, the IPOs of Chinese firms help to coordinate the "herd" of investors in HK.[5]

This hypothesis seems to be consistent with the previous literature as well as the particular situation of Hong Kong.[6] Among others, Hong, Kubik, and Stein (2004) find that social interactions affect stock market participation. It should be noted that while the IPOs in the U.S. are mainly marketed to institutional investors, individual investors have a much larger share in Hong Kong. This is partly due to the fact that the underwriters in Hong Kong will typically make the minimum amount of stock IPO subscription very affordable which hence allows the participation of many more individual investors.[7] Furthermore,

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[4] Clearly, the literature on IPOs is too large to be reviewed here. The Appendix provides a summary of some of the selected papers.
[5] We are very grateful to Paul Anglin for suggesting this interpretation.
[6] For instance, Lee, Wong, and Yuen (2007) find that, among others factors, investor experience, media reports, margin and electronic applications, and recommendations from family and friends are significant factors that positively relate to the frequency that individual investors subscribe to IPOs in Hong Kong.
[7] This seems to be a general practice in Hong Kong. For instance, while the Lehman Brother bonds are typically sold to institutional investors and private equity in the U.S. and Europe, Lehman Brother mini-bonds are marketed in Hong Kong and Singapore. When Lehman bankrupted, many individual investors lost their life-time savings which led to a series of political protests and demonstrations. For more details, see

since the Chinese economy is not completely transparent, the "market sentiment" may play an even larger role.

Another feature which distinguishes Hong Kong from the Western countries is the lack of channels for individuals to invest in commercial real estate. For instance, Hong Kong did not have any real estate investment trusts (REITs) until very recently.[8] Thus, for individual investors who hold an "optimistic" view, they can only invest in the housing market or subscribe to IPOs in the stock market. Note that as the housing units in Hong Kong are mainly owned by individual households, which are similar to the case in the U.S., households may play a more important role than institutional investors and developers. Moreover, since households would arguably be more vulnerable to "market sentiment" and "social interactions", the "market sentiment channel" may appear more significantly in the housing market than the commercial real estate market. In fact, Wang et al. (2000) and Leung et al. (2013) have proposed that "over-confidence" on the household side may explain a significant portion of the housing market dynamics in Hong Kong. This paper can be understood as an indirect test of that class of "conjecture". If the "market sentiment" is indeed the driving force, we would observe a positive and significant relationship between IPOs and the housing market, but not necessarily the commercial real estate markets. For future reference, we label this possible channel as "the animal spirits conjecture", or "speculation conjecture".

Another merit for choosing Hong Kong to "test" the animal spirits conjecture is related to the government policy. Companies from all over the world are welcome to list their stocks in Hong Kong, with neither discrimination nor favouritism. Thus, the IPOs listed in Hong Kong include those from Hong Kong domestic firms, Mainland China firms, as well as foreign firms. Furthermore, since the major operations and income sources of the Mainland and foreign firms are outside of Hong Kong, a comparison of the cases of domestic, Chinese and foreign firms would shed further light on the validity of the "animal spirits conjecture". We will get back to this point later.

Can the IPO activities be related to the real estate markets for *other reasons*? One possibility is that the funds generated from IPOs are used for business growth, which would lead to a significant amount of trading in the commercial real estate market. Brau, Ryan and DeGraw (2006) suggest that 82% of the CFOs responded that the issuance of IPOs is to gain additional financing for immediate and long-term growth. On the other hand, Pagano,

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http://www.stockbrokerfraudblog.com/2008/11/protestors_in_asia_decrying_le_1.html.
[8] REITs were introduced to Hong Kong in 2005, and hence for most of the sampling period, they are not an option for investors. Even now, the share of commercial real estate owned by REITs is very small in Hong Kong. The size of REITs is generally very small in Hong Kong. For more details, see Appendix 3, and Leung and Tang (2012), among others.

Panetta and Zingales (1998) find that the primary reason for going public is to rebalance their accounts. Needless to say, the funds allocation strategies may vary from firm to firm, and country to country. One of our conjectures is that when firms obtain funds through IPOs, they will invest in commercial real estate, among other things.[9] Thus, when the number or the real value of IPOs increases, more funds will be channeled to the commercial real estate market. As a result, the commercial real estate price would also increase. We label this as our "production conjecture".

Alternatively, the IPO activities may also be a signal of the conditions of the overall economy. It may be that there are variables that are "seen by agents but not the econometrician" (Hamilton and Whiteman, 1985). In other words, some important variables are left out from the system and the regression model is essentially mis-specified. Recent research also indicates the importance of "news shock" (shocks that will affect the future but not the current period productivity) in accounting for aggregate business cycles (for instance, see Beaudry and Portier, 2006, 2007; Jaimovich and Rebelo, 2007). Thus, when those "good signals" appear, the economy is expected to improve. More companies will issue IPOs to raise capital from the market.[10] At the same time, there will be more business expansion, including more investment in the commercial real estate markets. As a result, both IPO issues and commercial real estate prices will increase. In fact, the same underlying factor that can drive both the IPO activities and commercial real estate market could potentially drive the housing market as well. For instance, Kan et al. (2004) and Leung (2007) show in a dynamic equilibrium model that a productivity shock can lead to an increase in output, the stock price, as well as the prices of both commercial and residential real estates, and find support from U.S. city level data. Thus, we could observe co-movements among all real estate markets and the stock market activities (including IPOs) driven by some "omitted variable". For future reference, we will label this class of explanation as our "underlying factor conjecture".

It may be instructive to summarize the discussion up to this point. The "animal spirits conjecture" and "underlying factor conjecture" would predict the relationship between the housing market and IPOs, while the "production

[9] Note that even foreign and Mainland China firms have investments in the Hong Kong real estate market. For firm-level evidence of commercial real estate investment of Chinese firms, see Dong et al. (2012), among others.

[10] At the micro-level, there are many studies that suggest the signaling effect of IPO issuance activities. Among others, Chen, Jhou and Yeh (2007) suggest that the IPO underwriter retention rate can serve as a signal of the firm value to investors, which can reduce the information asymmetry between issuers and investors. Allen and Faulhaber (1989) prove that under-pricing of IPOs is a credible signal to investors, because only good firms can recoup losses after their performances are realized. In the aggregate, therefore, if the number of IPO issuance increases, it may mean that there are many good firms that are raising capital from the market and the aggregate output is expected to be high.

conjecture" and "underlying factor conjecture" are used to determine the relationship between the commercial real estate market and IPOs. Since all of these theories on the relationship between the IPO activities and the real estate market are logically plausible, an empirical investigation is required to verify which is quantitatively more significant. To put it in another way, the degrees of co-movement among the IPO activities, commercial real estate, and residential housing provide an indirect test (or confirmation) for alternative conjectures. Clearly, if all these conjectures fail, then we will not find any relationship between the IPO activities and the real estate markets. Furthermore, this seems to be the "priors" of many economists, as reflected in many seminars and conferences when this paper was presented. On the other hand, any statistically significant relationship identified between the IPO activities and real estate markets would constitute a "new stylized fact" to be explained. Table 1 summarizes the discussion.

Table 1   Summary of the Implication of Different Conjectures

	Housing ←→ IPOs	Commercial Real Estate ←→ IPOs
Animal spirits conjecture	✓	X
Production conjecture	X	✓
Underlying factor conjecture	✓	✓

The organization of this paper is as follows. The next section will briefly discuss the data construction. The methodology applied in this research will then be described. The following section presents the empirical results, and their economic interpretation. The Appendix will follow the concluding section.

2.   Data

The study collects the time series of stock market indices, housing prices and macro-economy indicators from government websites and the CEIC, which cover the period from January 1994 to December 2011 [Table 2]. We proceed with several steps. First, all nominal variables have to be deflated by the consumer price index[11], so that real variables are used throughout the analysis. Second, we check the stationarity of the series. It is instructive to take a look at the time plots of each variable, and then confirm the ordering by an augmented Dickey Fuller (ADF) test.[12] Third, we will perform some statistical testing, which will be explained in the next section.

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[11] In Hong Kong, the government produces several consumer price indices. CPI (A) represents the consumption bundle of most of the population. In the case of the best lending rate, the real rate is equal to the nominal rate minus the inflation rate.
[12] Details are available upon request.

Table 2   Data Description and Summary Statistics

Sampling Period: 1994M1 – 2011M12

	Symbol	Mean	SD	Max	Min	Order	Source
Number of Initial Public Offerings	NO_IPO	4.13	3.38	18.00	0.00	I(0)	Hong Kong Exchange and Clearing Limited (http://www.hkex.com.hk)
Real Dollar Value of Initial Public Offerings (HKD mn)	RD_IPO	21.50	35.66	234.81	0.00	I(0)	
Real Trading Value in Stock Market (HKD mn)	TV	5428.16	5819.27	32958.69	405.18	I(1)	
Real Hang Seng Index	HSI	139.54	44.10	297.46	63.82	I(1)	
Real Office Price Index	OP	1.48	0.61	2.79	0.57	I(1)	Rating and Valuation Department (www.rvd.gov.hk)
Real Retail Price Index	RP	1.43	0.53	3.02	0.79	I(1)	
Real Housing Price Index	HP	1.03	0.26	1.63	0.60	I(1)	
Real Best Lending Rate	BLR	5.04%	4.01%	13.68%	-5.12%	I(1)	Hong Kong Monetary Authority (www.info.gov.hk/hkma)
China Real GDP (seasonally adjusted)	CGDP	42926.89	29247.46	117888.3	8632.49	I(1)	CEIC
Real Retail Sales Value (CNY mn, seasonally adjusted)	RRSV	180.60	39.34	304.71	124.94	I(1)	
Number of Visitors from China (seasonally adjusted)	VFC	822432.8	651224.2	2526836	102996	I(1)	
Number of Visitors from Foreign Countries (seasonally adjusted)	VFF	841960.1	188803.9	1176794	128599	I(1)	

Let us briefly explain the movements of each variable. Clearly, as shown in Figures 2 and 3, the number and real value of IPOs do not exhibit any trend for the sampling period. Particularly, there are three peaks to be noted. The first is the "asset bubble period" in 1997 (for instance, see Barton, 2007), where the adverse selection problem may be serious in the market; the second peak is the recovery of the Severe Acute Respiratory Syndrome (SARS)[13] in 2004, where the firm profits were (temporarily) suppressed by the SARS disease and they chose to raise funds from the stock market, hoping that it would catch the attention of long-term investors. The last peak is the recovery from the collapse of the Lehman Brothers in 2009. When we further disaggregate the data, it is found that IPO activity mainly originated from Chinese firms (Figures 4 and 5), which treat the Hong Kong financial market as a platform to promote their brand name to international investors.

**Figure 2   Number of IPOs against Time**
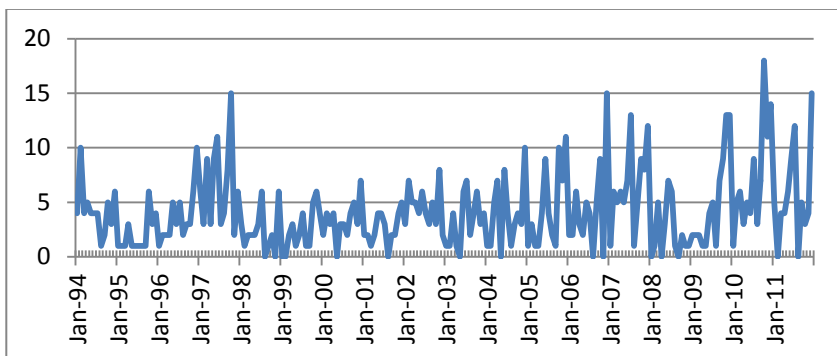
Source: Hong Kong Exchanges and Clearing Limited (www.hkex.com.hk)

As in the case of many other economies, stocks and real estates are the two most common investment vehicles in Hong Kong. In the early 1990s, Asian countries, including Hong Kong, experienced rapid economic growth. The speculations in the stock and the real estate markets raised prices to a peak and created an asset bubble (among others, see Barton, 2007). During the Asian Financial Crisis, there was a significant withdrawal of international funds, which induced a "fire sale" and consequently, the collapse of asset prices (Chen and Leung, 2008; Leung and Tang, 2012). After the SARS infection in 2003, the Beijing government allowed people from Mainland China to visit and invest in Hong Kong through the "individual travel" scheme. Since then, real estate prices have "regained momentum", so to speak, and have started to catch up with the stock prices. On the other hand,

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[13] The virus appears to have originated from Guangdong, China in November 2002. In total, 1755 people in Hong Kong suffered from this virus. Two hundred and ninety nine citizens died from this virus, which represent a 17% death rate, the highest proportion of deaths around the world.

the discrepancy between the Hang Seng Index and the Hang Seng China Enterprise Index (HSCEI) may reflect the relative economic development of Hong Kong and China. As shown by Figure 6, the former used to stay above the latter. However, in 2003, because of the rapid development in China, Chinese stocks became an attractive investment to investors, and the HSCEI rose sharply. This resulted in a narrowing of the dispersion of the two curves in 2006 [Table 6]. We test their correlations and find that a detrended financial market and detrended real estate market variables have little correlation with each other. Instead, strong correlations exist among the detrended HSI and HSCEI, as well as detrended office price (OP) with detrended housing price (HP)[14] and detrended retail price (RP), both representing a 1% statistical significance in the whole sampling [Table 3].

Figure 3   Real Value of IPOs against Time
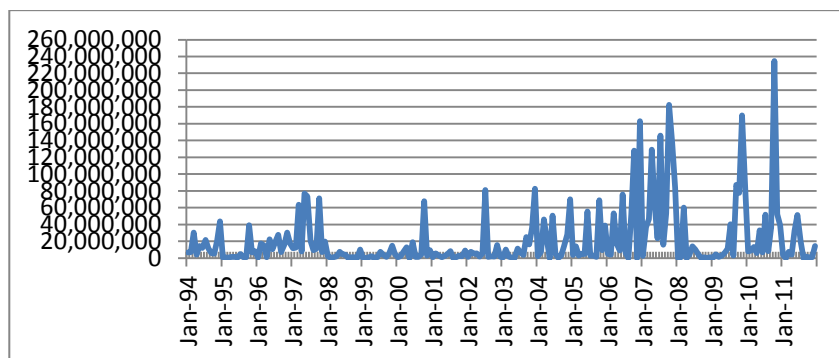
Source: Hong Kong Exchanges and Clearing Limited (www.hkex.com.hk)

Figure 4   Composition of IPOs (by number of IPO companies)
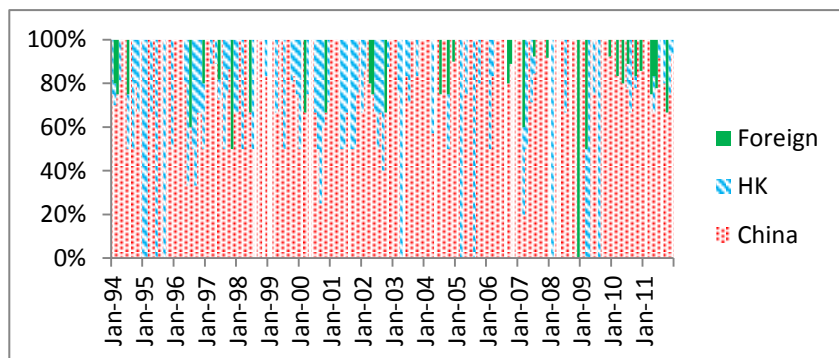
Source: Hong Kong Exchanges and Clearing Limited (www.hkex.com.hk)

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[14] Some of the figures are calculated from less than 20 transactions in a certain month. Hence, it is sensitive to some particular transactions. For example, the sudden drop in the real office prices in 2006 is mainly due to unexpectedly high prices in November and December 2005.
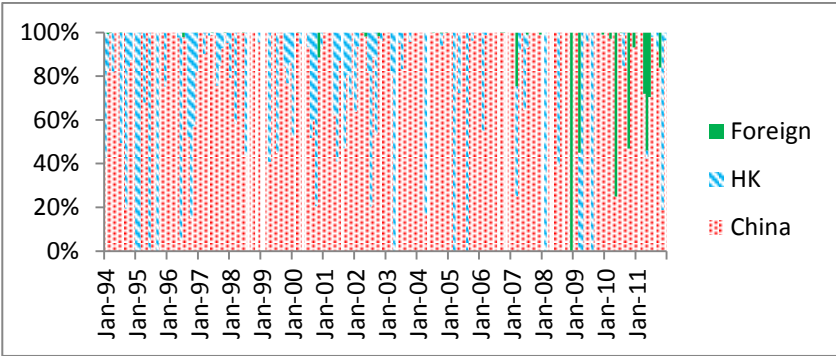
Figure 5   Composition of IPOs (by value of IPO companies)

Source: Hong Kong Exchanges and Clearing Limited (www.hkex.com.hk)

Figure 6   Time Plot of Real Hang Seng Index (HSI), Real Hang Seng China Enterprise Index (HSCEI), Real Office Price Index (OP), Real Retail Price Index (RP) and Real Housing Price Index (HP) (rebased at 100 in Jan 1994)
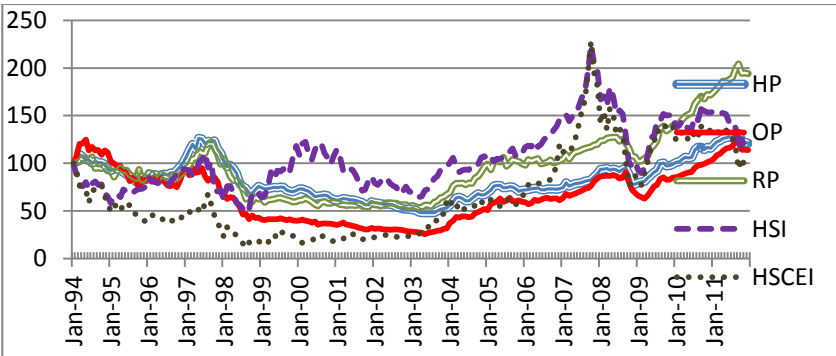
Sources: Hong Kong Exchanges and Clearing Limited (www.hkex.com.hk) and Rating and Valuation Department (www.rvd.gov.hk)

Table 3   Correlations between Real Estate and Stock Markets

	DOP	DRP	DHP	DHSI	DHSCEI
DOP	1				
DRP	0.34***	1			
DHP	0.56***	0.47***	1		
DHSI	0.06	0.08	0.05	1	
DHSCEI	-0.04	0.05	-0.01	0.77***	1

Note: *** denotes 1% statistical significance

On top of the stock market price, its real trading volume (TV) is also used as recent research suggests that it contains important information which is not

revealed by prices.[15] As shown in Figure 7, TV had two peaks over the past 14 years. In 1997, a "bubble" was created in the hi-tech stocks, which pushed the TV to nearly 6 billion. In 2006, increased participation in the primary and secondary markets raised the TV to 10 billion.

Figure 7   Real Trading Value in Hong Kong Stock Exchange
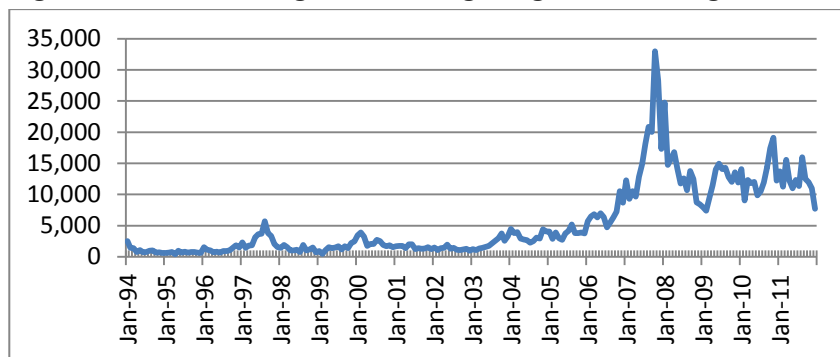
Source: Hong Kong Exchanges and Clearing Limited (www.hkex.com.hk)

The best lending rate (BLR) is the rate of interest that banks lend to their favored customers. Since Hong Kong is dominated by an adjustable rate mortgage, a reduction in the BLR encourages more investment in the housing market. Figure 8 plots the movement of the HSBC BLR, which is very representative of the Hong Kong economy. It ranges between -5% to more than 13% during the sampling period (a *negative* real interest rate means that the nominal interest rate is below the inflation rate).

Figure 8   Best Lending Rate

Source: Hong Kong Monetary Authority (www.info.gov.hk/hkma)

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[15] Clearly, the literature on the importance of trading volume is too large to be discussed here. Among others, see Lo and Wang (2000), and Leung and Feng (2005) for a review of the literature.

3.   Empirical Results

3.1   Vector Auto-regressive Analysis

In many previous studies on IPOs, the focus was on individual stock IPOs and hence, take the market as given. Our study, on the other hand, allows interactions between the stock and the real estate markets to take place. An appropriate tool to study such interactions is a vector auto-regressive (VAR) model because it *does not presume any "exogenous" variables*. We first apply VAR modeling on our monthly data series in order to maximize the number of data points. Table 4 describes in detail the variables included in each of the VAR models and their optimal lags.[16] Note that all of the models include the trading value of the stock market, stock market index (Hang Seng Index) and the interest rate (all in real terms). Clearly, the inclusion of these variables provides control for economic fundamentals. These variables perhaps reflect some of the "market sentiments" as well.

On top of them, Model 1 includes *real office price* (as a proxy for commercial real estate) as well. When we introduce the IPO activities (number and real value of IPOs) in Model 1, we obtain Models 2 and 3. Hence, by comparing Model 1 vis-à-vis Models 2 and 3, we can highlight the importance of IPO activities. Next, we produce Models 6 to 8 by replacing the real office prices in Models 1 to 3 with the prices of real retail property or *real retail prices*. A similar method is applied to *real housing prices* in Models 9 to 11. Implicit in these formulations is the notion that the behavior of different real estate prices can differ. We will verify this conjecture in the empirical analysis in a later part. Finally, in Models 4 and 5, we only include the variables for economic fundamentals and IPO activities, and exclude real estate prices. Therefore, by comparing Model 4 vis-à-vis Models 2, 7 and 10, it is possible to highlight the importance of real estate prices.[17]

We begin by examining the case of commercial real estate prices. Recall that statistically speaking, a better model means that there is a smaller Akaike information criterion (AIC). Panel A in Table 5 shows that introducing IPOs as an additional variable into the models does *not* improve the prediction of office prices. In addition, Panel B indicates that the model *without the IPO variables* gives the *best* prediction of retail property prices. In other words, no empirical support is found for the "production conjecture".

On the other hand, Panel C of Table 5 shows that introducing IPO activities will improve the prediction of housing price. This is consistent with the "animal spirits conjecture" or "underlying factor conjecture". An increase in

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[16] We run Lags 1 to 6 for all the VAR models, and the model with the smallest AIC gives the best fit.
[17] By the same token, the importance of real estate prices can be highlighted by comparing Model 5 vis-à-vis Models 3, 8 and 11.

the amount of funds raised from IPOs reflects either an improvement of the economic environment or market sentiment, and this motivates investors to participate in the housing market.

Now, we turn to the prediction on IPOs. Two interesting points are highlighted in Panels D and E of Table 5. First, the adding of housing price could significantly reduce the AIC, which is consistent with the "animal spirits conjecture" or "underlying factor conjecture". Second, the adding of office price does not show improvement in the prediction, which is in contrast to the "production conjecture".

In summary, the results show that at least marginally, housing price always plays a more important role than commercial real estate prices in predicting IPOs. This is somewhat surprising because capital raised from IPOs will typically remain with large corporations. Typically, they do not re-invest in the Hong Kong housing market which is dominated by a large number of individual occupiers-investors. In other words, we do not find any evidence for the "production conjecture". However, the evidence can be consistent with the "animal spirits conjecture" or "underlying factor conjecture". To further differentiate the two conjectures, we now turn to a more disaggregated analysis.

3.2   Granger Causality Analysis

In the previous section, we applied VAR modeling on the aggregate IPO data and find that IPOs help to predict the housing price, and vice versa, while commercial real estate price does not seem to have much interaction with the IPO market (neither the number nor the real value). To improve our understanding, we now disaggregate the IPO data by company origin and employ the Granger causality test for the analysis.[18] Since the test for some of the variables is very sensitive to the selected number of lags, we choose the lags from 1 to 6 for the monthly data set. The majority rule would decide whether X Granger causes Y. For robustness, we also apply AIC criteria to choose the optimal lag, and based on this lag, decide on the causality relationship of the variables.

Let us first focus on the housing market. As summarized in Table 6, based on AIC criteria, Chinese IPOs (in terms of number or real value) and the housing market *do Granger cause each other*. There is *no consistent pattern* between the other IPOs and the housing market. This is very interesting because the activities of Chinese firms are *mainly operated in Mainland China*. Intuition might suggest that the IPOs of Chinese firms should *not* exert any direct effect on the Hong Kong housing market, but in fact, they do. Previously, we have also shown that IPOs constitute a tiny component of the total market

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[18] See Hamilton (1994) for more details.

capitalization and hence the "wealth effect" is unlikely to be the explanation. This apparently "puzzling" phenomenon can however be consistent with the "animal spirits conjecture". IPOs of Chinese firms may signal a continuation or even further improvement of the Chinese economy. Since some of the economic growth would "spillover" into the Hong Kong economy, the housing demand is expected to increase. Alternatively, the IPOs of Chinese firms may reflect an improvement of the "market sentiment" and hence stimulate investment in the housing market and hence the real housing price. With such anticipation, people would buy the housing today speculatively, in an attempt to capture the benefit of the expected economic growth of China. As well, the additional fact that the IPOs of Hong Kong firms do *not* Granger cause or are caused by the Hong Kong housing market seems to pose a challenge for the validity of the "production conjecture" in this sample.

Needless to say, there is always an alternative explanation. In the current context, this is the "underlying factor conjecture". In that case, the IPOs of Chinese companies serve as a leading indicator of the economic boom in the subsequent periods, which will also lead to an increase in the housing price. To further differentiate these two competing hypotheses, we examine the interactions between the office price and the IPO market.

Table 7 reveals a striking pattern in which the Hong Kong and Chinese IPOs (whether measured in terms of number or real value) do *not* Granger cause office and retail property prices. This is clearly at odds with the "production conjecture" because at least some funds that are raised by Hong Kong company IPOs should be invested into Hong Kong, including commercial real estate. In addition, this presents a challenge to the "underlying factor conjecture" because it is not clear why the "unobservable underlying factor" stimulates *only the housing market but not the office and retail property markets.*

One may argue that the lack of evidence of interactions between IPO activities and the commercial real estate market is related to the company financing method. It may be that companies prefer to use internal financing instead of external financing for expansion (Gaud, Hoesli and Bender, 2007), and if they choose external financing, bank financing is always preferable to the listing of stocks (Jebjerg and Kyhl, 1999). While this may be true, it makes the relationship between the IPOs and the housing market even *more puzzling*, because *individual households do not finance their home purchase with IPOs either*.

Table 4   Summary of Variables Used in VAR

Models	Model #1	Model #2	Model #3	Model #4	Model #5	Model #6	Model #7	Model #8	Model #9	Model #10	Model #11
OP	✓	✓	✓								
RP						✓	✓	✓			
HP									✓	✓	✓
TV	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
HSI	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
BLR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
NO_IPO		✓		✓			✓			✓	
RD_IPO			✓		✓			✓			✓
Optimal lag	5	4	4	4	4	4	4	4	4	4	3

Table 5   AIC of Monthly VAR models
          (Sampling period: 1994M1 to 2011M12)

Panel A

	Prediction of OP without IPO (Model #1)	Prediction of OP with NO_IPO (Model #2)	Prediction of OP with RD_IPO (Model #3)
AIC	**-2.5819**	-2.4781	-2.5028

Panel B

	Prediction of RP without IPO (Model #6)	Prediction of RP with NO_IPO (Model #7)	Prediction of RP with RD_IPO (Model #8)
AIC	**-2.9579**	-2.9460	-2.9561

Panel C

	Prediction of HP without IPO (Model #9)	Prediction of HP with NO_IPO (Model #10)	Prediction of HP with RD_IPO (Model #11)
AIC	-4.2193	**-4.2428**	**-4.2687**

Panel D

	Prediction of NO_IPO without OP, RP & HP (Model #4)	Prediction of NO_IPO with OP (Model #2)	Prediction of NO_IPO with RP (Model #7)	Prediction of NO_IPO with HP (Model #10)
AIC	5.2439	5.2403	**5.1995**	**5.1984**

Panel E

	Prediction of RD_IPO without OP, RP & HP (Model #5)	Prediction of RD_IPO with OP (Model #3)	Prediction of RD_IPO with RP (Model #8)	Prediction of RD_IPO with HP (Model #11)
AIC	37.4645	37.4697	37.4437	**37.3926**

Note: * Details of the VAR results can be made available upon request.

Table 6   Granger Causality Test in Housing Market

      (Sampling period: 1994M1 to 2011M12)

Panel A

Number of IPOs of the corresponding companies	Using majority rule		Using AIC criteria	
	Granger causes housing price	Granger caused by housing price	Helps to predict housing price	Helps to be predicted by housing price
1. Hong Kong company	X	X	X	X
2. China company	✓	✓	✓	✓
3. Foreign company	X	✓	X	X

Panel B

Real IPO value of the corresponding companies	Using majority rule		Using AIC criteria	
	Granger causes housing price	Granger caused by housing price	Helps to predict housing price	Helps to be predicted by housing price
1. Hong Kong company	X	X	X	X
2. China company	✓	✓	✓	✓
3. Foreign company	X	X	X	✓

Note: * Details of the results are available upon request.

Table 7   Granger Causality Test in Commercial Real Estate Market
            (Sampling period: 1994M1 to 2011M12)

Panel A

Number of IPOs of the corresponding companies	Using majority rule		Using AIC criteria	
	Granger causes office / retail property price #	Granger caused by office / retail property price ^	Helps to predict office / retail property price #	Helps to be predicted by office / retail property price ^
1. Hong Kong company	X / X	X / X	X / X	X / X
2. China company	X / X	✓ / ✓	X / X	✓ / ✓
3. Foreign company	X / ✓	X / X	✓ / X	X / X

Panel B

Real IPO value of the corresponding companies	Using majority rule		Using AIC criteria	
	Granger causes office / retail property price #	Granger caused by office / retail property price ^	Helps to predict office / retail property price #	Helps to be predicted by office / retail property price ^
1. Hong Kong company	X / X	X / X	X / X	X / X
2. China company	X / X	✓ / ✓	X / X	✓ / ✓
3. Foreign company	X / X	X / X	X / X	X / X

Note: # In each cell of this column, the first entry represents whether IPO variable Granger causes offices, while the second entry represents whether IPO variable Granger causes retail property.

^ In each cell of this column, the first entry represents whether IPO variable is Granger caused by offices, while the second entry represents whether IPO variable is Granger caused by retail property.

** Details of the results are available upon request.

3.3   Out of Sample Forecasting

Thus far, we have used VAR models and Granger causality analysis to evaluate competing theories. In a sense, these are all "in-sample-fitting". In the literature, there are discussions about whether one should use in-sample-fitting (ISF) or out-of-sample-forecasting (OSF) as a criterion to evaluate models, including Cheung, Chinn and Pascual (2005), Inoue and Kilian (2004), Meese and Rogoff (1983), among others. It seems that there is no consensus on the issue. In this section, we will provide some simple OSF as an alternative assessment for competing theories.

To perform OSF, our first step is to re-estimate all of our VAR models for the sample 1994M1 to 2006M12. We find that the point estimates are similar to the full sample version, except that the "optimal numbers of lags" may change in some of the models.[19] We then take those VAR models to predict the values of different variables during the period of 2007M1 to 2011M12, and then confront with the data. By following the literature, we use two metrics to measure the performance of the models. They are the mean absolute error (MAE) and root mean square error (RMSE):

$$MAE = \left(T-h\right)^{-1}\sum_{i=1}^{T-h}\left|y_i - \hat{y}_i\right|;\ RMSE = \left[\left(T-h\right)^{-1}\sum_{i=1}^{T-h}\left(y_i - \hat{y}_i\right)^2\right]^{1/2},$$

where T is the sample size, h is the forecast horizon (i.e. the number of periods ahead that we need to predict, y_i is the true value, and $\hat{y}_i = E(y_{i+h} \mid \Omega_i)$ is the h-period ahead forecast given period i information set, Ω_i. Clearly, the RMSE tends to "punish big mistakes more heavily" than the MAE. Apparently, there is no consensus on which measure is better, so we use both measures in our evaluation.

Table 8 displays the OSF results of different models. As usual, our first column (counting from the left to the right) always represents the model with only the basic set of variables. Panels A and B show that the adding of IPOs does not improve the forecast of office price and retail price respectively. However, as shown in Panel C, the adding of IPOs improves the forecast of housing price. To some extent, these results are consistent with our earlier findings in that the "animal spirit conjecture" holds while the other two conjectures fail.

More encouraging results can be found in Panels D and E. Relative to the "basic model", the adding of retail property price helps to predict IPO activities. This is consistent with the conjecture in that an increase in China economic growth would encourage more firms to launch IPOs in the Hong Kong stock market and at the same time, stimulate the demand of retail

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[19] Details can be made available upon request.

property, probably through investors and tourists. At the same time, since there is no channel for individuals to invest in the Hong Kong office market, office price is not affected by the number of IPOs.

Table 8   Out-of-Sample Forecasting Results

(In-sample period: 1994M1 – 2006M12; out-of-sample period: 2007M1 – 2011M12)

Panel A: Out-of-Sample Forecasting of Office Price

	Model 1	Model 2	Model 3
Mean absolute error	0.0629	0.0688	0.0694
Root mean square error	0.0792	0.0868	0.0875

Panel B: Out-of-Sample Forecasting of Retail Property Price

	Model 6	Model 7	Model 8
Mean absolute error	0.0524	0.0528	0.0532
Root mean square error	0.0691	0.0694	0.0700

Panel C: Out-of-Sample Forecasting of Housing Price

	Model 9	Model 10	Model 11
Mean absolute error	0.0389	0.0383	0.0363
Root mean square error	0.0469	0.0459	0.0429

Panel D: Out-of-Sample Forecasting of Number of IPO

	Model 4	Model 2	Model 7	Model 10
Mean absolute error	3.6946	3.7356	3.5284	3.7029
Root mean square error	4.7706	4.9773	4.6309	4.9642

Panel E: Out-of-Sample Forecasting of Real Value of IPO

	Model 5	Model 3	Model 8	Model 11
Mean absolute error	3.33E+07	3.11E+07	3.30E+07	3.02E+07
Root mean square error	5.32E+07	5.09E+07	5.31E+07	5.04E+07

3.4   Robustness Check

In this section, we confirm our main findings by carrying out a sub-period analysis. Since Hong Kong was significantly affected by the Asian Financial Crisis in 1997, the market fundamentals may have changed thereafter[20], and this motivates us to check whether the same results hold for the two sub-samples. Specifically, throughout the robustness check, we divide the sample into two sub-periods: the first sub-period is from Jan 1994 to Dec 1999 and the second sub-period is from Jan 2000 to Dec 2011.

Table 9 present the results of the VAR analysis, which are revealing. In the first sub-sample, it is shown that the prediction of office price is significantly improved with the introduction of IPOs [Panel A1, Table 9]. In addition, the prediction of the house price is the best without any IPO variables [Panel C1, Table 9]. At the same time, the prediction of the number of IPOs is significantly improved with the inclusion of house price [Panel D1, Table 9]. Thus, it seems that there is some evidence for each of the conjectures. In the second (i.e. Jan. 2000 and after), the picture is very different. The introducing of IPO variables does not significantly improve the prediction of office and retail property prices [Panels A2 and B2, Table 9]. On the other hand, IPO variables help to improve the prediction of house price [Panel C2, Table 9]. In addition, the inclusion of office price or retail property price would actually worsen the prediction of the number of IPOs, whereas the inclusion of house price can improve the prediction [Panel D2, Table 9]. The inclusion of house price also leads to the greatest improvement to the prediction of the real value of IPOs, among all different property prices [Panel E2, Table 9]. Clearly, the second sub-period provides very clear support of the "animal-spirit conjecture" only. Thus, our findings are consistent with the observation that China has enjoyed significant economic growth since 2000, and therefore more active China IPOs mean more confident investors.

Table 9   **Robustness Check: AIC of Monthly VAR Models in Two Sub-sample Periods**

(Sub-sample 1: 1994M1 – 1999M12)

Panel A1

	Prediction of OP without IPO (Model #1)	Prediction of OP with NO_IPO (Model #2)	Prediction of OP with RD_IPO (Model #3)
AIC	-1.5685	**-1.7165**	-1.5401

(Continued…)

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[20] Refer to Leung and Tang (2011) for details.

(Table 9 Continued)

Panel B1

	Prediction of RP without IPO (Model #6)	Prediction of RP with NO_IPO (Model #7)	Prediction of RP with RD_IPO (Model #8)
AIC	-2.3511	-2.3226	-2.3250

Panel C1

	Prediction of HP without IPO (Model #9)	Prediction of HP with NO_IPO (Model #10)	Prediction of HP with RD_IPO (Model #11)
AIC	**-3.6474**	-3.2924	-3.4594

Panel D1

	Prediction of NO_IPO without OP, RP & HP (Model #4)	Prediction of NO_IPO with OP (Model #2)	Prediction of NO_IPO with RP (Model #7)	Prediction of NO_IPO with HP (Model #10)
AIC	4.8372	4.8285	4.8680	**4.6340**

Panel E1

	Prediction of RD_IPO without OP, RP & HP (Model #5)	Prediction of RD_IPO with OP (Model #3)	Prediction of RD_IPO with RP (Model #8)	Prediction of RD_IPO with HP (Model #11)
AIC	36.3205	36.3442	36.2974	36.3393

(Sub-sample 2: 2000M1 – 2011M12)

Panel A2

	Prediction of OP without IPO (Model #1)	Prediction of OP with NO_IPO (Model #2)	Prediction of OP with RD_IPO (Model #3)
AIC	-3.2378	-3.1975	-3.2434

(Continued…)

(Table 9 Continued)

Panel B2

	Prediction of RP without IPO (Model #6)	Prediction of RP with NO_IPO (Model #7)	Prediction of RP with RD_IPO (Model #8)
AIC	-3.3439	-3.3492	-3.2815

Panel C2

	Prediction of HP without IPO (Model #9)	Prediction of HP with NO_IPO (Model #10)	Prediction of HP with RD_IPO (Model #11)
AIC	-4.7437	**-4.8026**	**-4.7538**

Panel D2

	Prediction of NO_IPO without OP, RP & HP (Model #4)	Prediction of NO_IPO with OP (Model #2)	Prediction of NO_IPO with RP (Model #7)	Prediction of NO_IPO with HP (Model #10)
AIC	5.3293	5.3537	5.3447	**5.3210**

Panel E2

	Prediction of RD_IPO without OP, RP & HP (Model #5)	Prediction of RD_IPO with OP (Model #3)	Prediction of RD_IPO with RP (Model #8)	Prediction of RD_IPO with HP (Model #11)
AIC	37.7537	37.6956	37.6863	**37.5925**

Note: * Details of the VAR results can be made available upon request.

In the robustness check on the relationship between the disaggregate level of IPOs and real estate markets, it is revealed that Chinese IPOs and the housing market Granger cause each other in the second sub-sample, which provides further supporting evidence of the "animal spirits conjecture" [Table 10]. In addition, the possibilities of "production conjecture" and "underlying factor conjecture" can be eliminated because IPO activities and commercial real estate market do not Granger cause each other [Table 11].

Table 10   Robustness Check: Granger Causality Test in Housing Market in Two Sub-samples

(Sub-sample 1: 1994M1 – 1999M12)

Panel A1

Number of IPOs of the corresponding companies	Using majority rule		Using AIC criteria	
	Granger causes housing price	Granger caused by housing price	Helps to predict housing price	Helps to be predicted by housing price
1. Hong Kong company	X	X	X	X
2. China company	X	✓	X	X
3. Foreign company	X	✓	X	✓

Panel B1

Real IPO value of the corresponding companies	Using majority rule		Using AIC criteria	
	Granger causes housing price	Granger caused by housing price	Helps to predict housing price	Helps to be predicted by housing price
1. Hong Kong company	X	X	X	X
2. China company	✓	✓	✓	X
3. Foreign company	X	X	X	X

(Continued…)

(Table 10 Continued)

(Sub-sample 2: 2000M1 – 2011M12)

Panel A2

Number of IPOs of the corresponding companies	Using majority rule		Using AIC criteria	
	Granger causes housing price	Granger caused by housing price	Helps to predict housing price	Helps to be predicted by housing price
1. Hong Kong company	X	X	X	X
2. China company	✓	✓	✓	✓
3. Foreign company	✓	X	✓	X

Panel B2

Real IPO value of the corresponding companies	Using majority rule		Using AIC criteria	
	Granger causes housing price	Granger caused by housing price	Helps to predict housing price	Helps to be predicted by housing price
1. Hong Kong company	X	X	X	X
2. China company	✓	✓	✓	✓
3. Foreign company	X	✓	✓	✓

Note: * Details of the results are available upon request.

Table 11   Robustness Check: Granger Causality Test in Commercial Real Estate Market in Two Sub-samples
(Sub-sample 1: 1994M1 – 1999M12)

Panel A1

Number of IPOs of the corresponding companies	Using majority rule		Using AIC criteria	
	Granger causes office / retail property price #	Granger caused by office / retail property price ^	Helps to predict office / retail property price #	Helps to be predicted by office / retail property price ^
1. Hong Kong company	X / X	X / X	X / X	X / X
2. China company	✓ / X	X / ✓	✓ / X	X / ✓
3. Foreign company	X / X	X / X	X / X	X / X

Panel B1

Real IPO value of the corresponding companies	Using majority rule		Using AIC criteria	
	Granger causes office / retail property price #	Granger caused by office / retail property price ^	Helps to predict office / retail property price #	Helps to be predicted by office / retail property price ^
1. Hong Kong company	X / X	X / X	X / X	X / X
2. China company	✓ / ✓	X / ✓	✓ / ✓	X / ✓
3. Foreign company	X / X	X / X	✓ / X	X / X

(Continued…)

(Table 11 Continued)

(Sub-sample 2: 2000M1 – 2011M12)

Panel A2

Number of IPOs of the corresponding companies	Using majority rule		Using AIC criteria	
	Granger causes office / retail property price #	Granger caused by office / retail property price ^	Helps to predict office / retail property price #	Helps to be predicted by office / retail property price ^
1. Hong Kong company	X / X	X / X	X / X	X / X
2. China company	✔ / X	✔ / ✔	X / ✔	✔ / ✔
3. Foreign company	X / ✔	X / X	X / ✔	X / X

Panel B2

Real IPO value of the corresponding companies	Using majority rule		Using AIC criteria	
	Granger causes office / retail property price #	Granger caused by office / retail property price ^	Helps to predict office / retail property price #	Helps to be predicted by office / retail property price ^
1. Hong Kong company	X / X	X / X	X / X	X / X
2. China company	X / X	✔ / ✔	X / X	✔ / ✔
3. Foreign company	X / X	X / X	X / X	X / X

Note: # In each cell of this column, the first entry represents whether IPO variable Granger causes offices, while the second entry represents whether IPO variable Granger causes retail property.

^ In each cell of this column, the first entry represents whether IPO variable is Granger caused by offices, while the second entry represents whether IPO variable is Granger caused by retail property.

** Details of the results are available upon request.

4.   Conclusions

IPO activities and real estate prices could be related through the "production conjecture", "underlying factor conjecture", or "animal spirits conjecture" (or "speculation conjecture"). In this paper, we attempt to determine which conjecture is more consistent with the data. We employ different econometric tools in our investigation.

The results from the VAR models on an aggregate basis show that the prediction of the housing market can be improved by the introduction of IPO variables, and vice versa, thus validating the "animal spirits conjecture". On the other hand, the prediction of the office and retail markets cannot be improved by adding IPO variables, and vice versa, which seem to be at odds with both the "production conjecture" and "underlying factor conjecture".

Granger causality testing is then applied on more disaggregate IPO data. Consistent results are found. Commercial real estate market and the IPO market do *not* Granger cause each other. In addition, even IPOs by Hong Kong firms do *not* Granger cause or are caused by the Hong Kong housing market. These results seem to be at odd with the "production conjecture" and "underlying factor conjecture". On the other hand, the "animal spirits conjecture" is confirmed by the causality relationship between housing market and IPOs of Chinese firms.

The analysis is extended to OSF. Particularly, the introduction of IPO activities does not improve the forecasting of commercial real estate prices, but reduces the forecasting error of housing prices, and thus provides strong evidence to support our findings.

Finally, we perform a robustness check by dividing the data into two subsamples. Interestingly, while there is evidence consistent with each of the conjectures in the first sub-period, the second sub-period, which spans from Jan 2000 to Dec 2011 when China experienced substantial economic growth, provides support *only* to the "animal spirits conjecture".

The robustness check also confirms that our "animal spirits conjecture" is consistent with the observation that an improvement in the Chinese economy will lead to more tourism activities in Hong Kong and hence stimulate the retail property price. In fact, the United Nations World Tourism Organization recently reports that the number of international trips made by Chinese travellers grew from 10 million in 2000 to 83 million in 2012. Furthermore, the spending by Chinese tourists in 2012 was $102 billion.[21] If the Chinese economy and related tourism continue to expand, the findings of this paper

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[21] For more details, see UPI (2013).

may also be relevant to other countries. Future research should investigate the impact of Chinese tourists and investors on the real estate markets.

Future research can be extended in other directions as well. First, this study and other work have confirmed the importance of "animal spirits" or the "market sentiment" in both the financial and the real estate markets. More efforts should be devoted to further investigate the mechanism behind such sentiments. Secondly, many research efforts suggest the inclusion of real estate to achieve diversification benefits.[22] In light of the results here, it would be interesting to determine the optimal portfolio as well as the optimal trading rules. Thirdly, there is increasing attention paid towards Chinese economies. More efforts are needed to study investor preferences in investing in China. Last but not least, more research efforts should be devoted into investigating if there are other segments of the stock market that interact with the real estate market, and if so, the related mechanisms.

Acknowledgement

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[22] The literature is too large to be reviewed here. Among others, see Chun, Sa-Aadu and Shilling (2004).

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Appendix

Appendix 1

This appendix attempts to summarize some of the previous related literature in tables.

A: Previous Literature on Relationship between Variables of Stock Market and Performance of Initial Public Offerings

	Loughran and Ritter (2004)	Alvarez and Gonzalez (2005)	Buttimer, Hyland, and Sanders (2005)	Jain and Kini (2006)
NAREIT index	N.A.	N.A.	Positive and significant	N.A.
Excess monthly return	N.A.	N.A.	Positive and significant	N.A.
Market adjusted return	N.A.	Positive and significant	N.A.	N.A.
Small minus big	N.A.	N.A.	Positive and significant	N.A.
High minus low	N.A.	N.A.	Positive and significant	N.A.
Cahart's (1997) momentum variable	N.A.	N.A.	Negative	N.A.
Bond interest rate	N.A.	N.A.	Positive	N.A.
Bond default rate	N.A.	N.A.	Positive	N.A.
Assets before listing	Negative and significant	Negative	N.A.	N.A.
Offering size	N.A.	Positive	N.A.	Positive
ROA in previous year	N.A.	Positive	N.A.	N.A.
Fraction of shares retained by original owners	Positive and significant	Positive	N.A.	Positive
Online subscription	Positive and significant	N.A.	N.A.	N.A.
Investor banker prestige	Positive and significant	N.A.	N.A.	Positive and significant
Risk of offering	N.A.	N.A.	N.A.	Negative

B: Previous Literature on Factors That Affect Frequency of Applying IPO Share in Hong Kong

	McGuinness (1993)	Vong (2006)	Lee, Wong, Yuen (2007)
Education level of investors	N.A.	N.A.	Negative and significant
Investor experience	N.A.	N.A.	Positive and significant
Media information	N.A.	N.A.	Positive and significant
Online subscription	N.A.	N.A.	Positive and significant
Margin subscription	N.A.	N.A.	Positive and significant
Investment horizon	N.A.	N.A.	Negative and significant
Reading prospectus	N.A.	N.A.	Positive and significant
Family recommendations	N.A.	N.A.	Positive and significant
Friends recommendations	N.A.	N.A.	Positive and significant
Weighted P/E ratio	N.A.	Positive and significant	N.A.
Average % change of HSI in the last three months	Positive	Positive and significant	N.A.
Earnings / Assets	Positive and significant	N.A.	N.A.
Net assets	Positive and significant	N.A.	N.A.
Age of the firm	Positive and significant	N.A.	N.A.

C: Twenty Largest IPOs in Asia

The following table shows that Hong Kong has been involved in several large scale IPOs.

Rank	Issuing date	Issuer	Funds raised (US billion)	Nation / Country	Industry	Stock Exchange
1	July 2010	Agricultural Bank of China	19.228	China	Banking	Hong Kong / Shanghai
2	Oct 2006	Industrial and Commercial Bank of China	19.092	China	Banking	Hong Kong / Shanghai
3	Oct 1998	NTT Mobile	18.099	Japan	Telecommunications	Tokyo
4	Oct 2010	AIA	17.816	Hong Kong	Insurance	Hong Kong
5	May 2006	Bank of China	11.186	China	Banking	Hong Kong / Shanghai
6	Mar 2010	Dai-ichi Mutual Life Insurance	10.986	Japan	Insurance	Tokyo
7	Nov 1997	Telstra Corp	9.819	Australia	Telecommunications	New York
8	Oct 2005	China Construction Bank	9.227	China	Banking	Hong Kong / Shanghai
9	Jul 2009	China Engineering	7.592	China	Capital goods and services	Shanghai

(Continued…)

(Table C Continued)

Rank	Issuing date	Issuer	Funds raised (US billion)	Nation / Country	Industry	Stock Exchange
10	Apr 2007	Citic Bank	5.946	China	Banking	Hong Kong
11	Nov 2007	China Railway	5.877	China	Construction	Hong Kong
12	Oct 2007	China Telecom	4.225	China	Telecommunications	New York
13	Dec 2007	China Pacific Insurance	4.071	China	Insurance	Shanghai
14	Oct 1997	Indosat	3.970	Indonesia	Telecommunications	New York
15	Jan 2006	Lotte Department Store	3.739	South Korea	Retail	London
16	Dec 2003	China Life	3.475	China	Life insurance	New York
17	Oct 2000	Sinopec Corp	3.462	China	Oil & natural gas	Hong Kong
18	June 2005	China Shenhua	3.276	China	Coal	Hong Kong
19	Mar 2000	Petrochina	2.891	China	Oil & natural gas	New York
20	Nov 2005	The Link REIT	2.790	Hong Kong	Real estate investment trust	Hong Kong

Source: Renaissance Capital, www.renaissancecapital.com

Appendix 2: IPOs and Market Sentiment

This appendix shows that for Hong Kong during the sampling period, IPOs are indeed the only data series that is available for formal analysis.

Table A2-1   Summary of Availability of "Market Sentiment Variables" Used by Brown and Cliff (2004)

Close-fund funds	Not available
IPO	1994 – present; monthly; HKEX; *employed by this paper*
Liquidity	HKEX takes surveys in 1999 and 2004 about the liquidity of stock market.
Percentage change in margin borrowing	*Not available*
Percentage change in short interest	*Not available*
Ratio of short sales to total sales	1999 – present; monthly; HKEX
Odd-lot sales to purchases	*Not available*
Put-to-call trading volume	1996 - 2008; 1996-1999 yearly; 2000 – 2008 monthly; HKEX
Activity by non-commercial traders	*Not available*
Activity by small traders	*Not available*
Expected volatility / current volatility	*Not available*
Net purchases of mutual funds	Market and trading values for exchange-traded fund available from 2005 (HKEX).
SMB	*Not available*

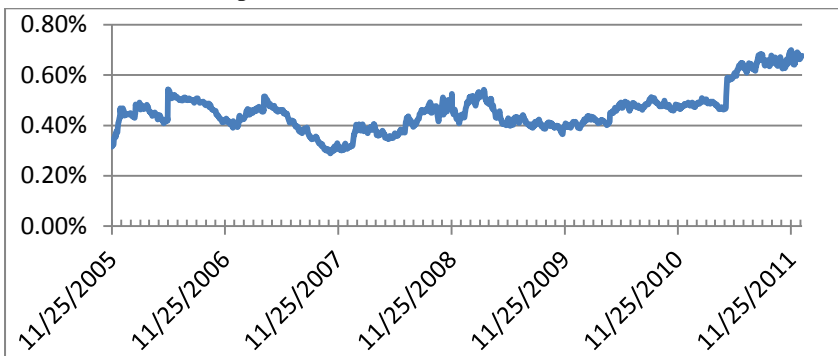## Appendix 3: Real Estate Investment Trusts (REITs) in Hong Kong

The history of REITs in Hong Kong can be traced back to 25 November 2005, where Link (00803), the first REIT, was introduced. Link holds retail facilities and carparks acquired from the Hong Kong Housing Authority, and these properties are all located near public housing. The market capitalization of Link was 64.377 billion in December 2011, which is the largest REIT in Hong Kong. Other than Link, seven REITs with relatively small market capitalization were launched in the market, which made up a total eight REITs in 2011 [Table A3-1]. In terms of market capitalization, Link overall shares nearly half of the REIT market in Hong Kong [Figure A3-1], and the whole REIT market constitutes less than 1% of the total [Figure A3-2].

Figure A3-1   Share of REIT Market in Hong Kong
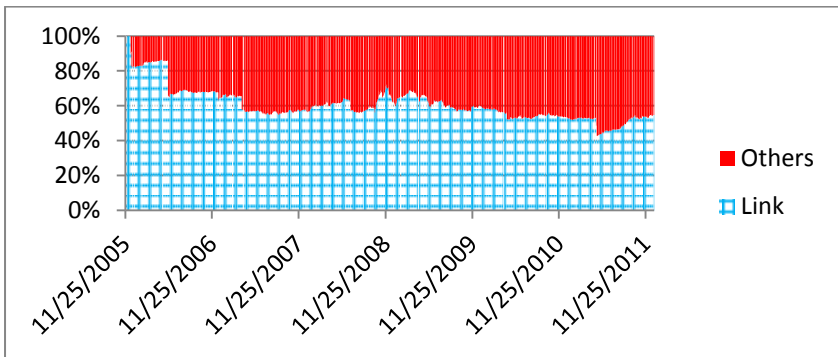
Source: Datastream

Figure A3-2   Market Capitalization of REITs relative to Total Market Capitalization

Sources: Datastream and Hong Kong Exchanges and Clearing Limited

Table A3-1   Real Estate Investment Trusts in Hong Kong

Stock Code	Name of REIT	Starting date of trading	Market capitalization (HKD billion) (as of 30 December 2011)	Share of stock market capitalization (%)
00823	Link Real Estate Investment Trust	25 November 2005	64.337	0.369
00808	Prosperity Real Estate Investment Trust	16 December 2005	2.041	0.012
00405	GZI Real Estate Investment Trust	21 December 2005	3.656	0.021
02778	Champion Real Estate Investment Trust	24 May 2006	14.473	0.083
00435	Sunlight Real Estate Investment Trust	21 December 2006	3.551	0.020
01881	Regal Real Estate Investment Trust	30 March 2007	5.830	0.033
87001	Hui Xian Real Estate Investment Trust	29 April 2011	17.834	0.102
00778	Fortune Real Estate Investment Trust	20 Apr 2010	6.370	0.036

Note: Stock Market Capitalization (as of 30 December 2011 = 17.452 billion HKD).
Sources: Datastream and Hong Kong Exchanges and Clearing Limited