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The Effect of Land Supply Restriction on the Risk of Hong Kong Indirect Real Estate

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Our study examines the role of restrictions on the new land supply in changing the sources of risk of investing in Hong Kong property companies (indirect real estate). In particular, we investigate whether development oriented property company had higher idiosyncratic (unexplained) risk during the period when supply of new land through auction by the government was restricted (1984-1997). We utilized quarterly data from 2Q1978 to 4Q2005 to estimate the multifactor variance decomposition models. Our empirical results show that there was a significant increase in idiosyncratic risk for the all listed property companies from 1984 to 1997. This supports the prediction of our hypothesis that restrictions on the supply of new developable land will result in an increase in the indirect real estate idiosyncratic risk, the major source of which is the uncertainty in obtaining approvals before development, which does not exist for newly supplied land. We also found that development oriented property companies, as opposed to investment oriented property companies, experienced a larger increase in idiosyncratic risk from 1984 to 1997. These findings are also applicable to any changes in policy/legislation, physical constraints, or other factors that resulted in a decline in the ratio of new developable land (free of pre-development risk) to all sources of land for development.

Keywords:

Indirect real estate, land supply restriction, pre-development risk, variance decomposition, volatility,

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Introduction

Previous studies of land supply restrictions mainly concern its effects concentrate on land and housing price. (Rose, 1989; Hannah et al., 1993; Peng and Wheaton, 1994; Cheshire, 2004) Land supply restrictions do not only affects home buyers, but also real estate developers as they need to look for alternative sources of developable land. The development of these other source of land may company may also encounter a hindrance, causing the volatility of its indirect real estate listed in the stock exchange, due to the role of land as a crucial factor in property development.

The issue of indirect real estate, either listed real estate (securitized real estate) or REITs, has been an extensive concern. Its function in alleviating the drawbacks of direct real estate has been questioned by academics and practitioners. (Seck, 1996; Seiler et al., 2001) The link between direct and indirect real estate has been comprehensively examined. (Barkham and Geltner, 1995, Ziering et al., 1997; Goodman, 2003) A number of studies have conducted the analysis of its role in a mixed-asset portfolio. (Kuhle, 1987; Mueller et al., 1994, Glascock et al., 2000; Anderson, et al., 2005; Lee and Stevenson, 2005) Some researchers examined the volatility of indirect real estate returns and observed whether it can be explained by common stock, bond or direct real estate markets. (Giliberto, 1990; Ross and Zisler, 1991) Gyourko and Keim (1992) indicated that the differences in risk characteristics across different types of listed real estate companies could be explained in part by focusing on the real estate fundamental relating to the degree of dependence of the real estate company upon rental income. This implies that some fractions of risks are influenced by the underlying business of the real estate company. Considering the different business nature, the real estate companies can be classified into development companies and investment companies, initiating the different risks and uncertainties involved (Newell and Chau, 1996; Hoesli and Macgregor, 2000; Brounen and Eichholtz, 2004)

The Hong Kong market draws our attention for a number of reasons. First, Hong Kong is an international center in Asia. Hong Kong has successively ranked the world's freest economy for 13 years. (The Fraser Institute, 2006) Its stock exchange, Stock Exchange of Hong Kong (SEHK), ranked the 7th largest in the world and the 3rd largest in Asia-Pacific, in terms of total market capitalization. (World Federation of Exchange, 2007) Its real estate transparency has even improved from rank 7 in 2004 to rank 6 in 2006, reflecting the market maturity of its listed real estate. (Jones Lang LaSalle, 2006) In fact, Hong Kong listed real estate also gains an international recognition. Its two largest real estate companies, Cheung Kong (Holdings) and Sun Hung Kai Properties, successfully ranked the 3rd and 6th respectively, in the top 10 companies of S&P Global Property 40 Index by 30 June 2007 in terms of floated adjusted market capitalization. Its listed real estate effectively ranked the 4th in the world, according to S&P/Citigroup BMI World Property Index by 6th April 2007, in terms of equity market capitalization. In the SEHK, 10 real estate companies were successfully positioned as the 50 leading companies. Besides, its property sector took up 10.78% of the total market capitalization of Hong Kong securities markets at the end of year 2006. Second, due to the Annex III of Sino British Joint Declaration, the issue of land supply restrictions occurred in Hong Kong from 1984-1997. This artificial constraint and the dynamic of

Hong Kong listed real estate provide an excellent opportunity to test how restrictions on supply of new developable land affects the risk of listed real estate companies, the most common form of indirect real estate in Hong Kong.

This study attempts to examine the role of new land supply restrictions in changing the sources of risk of Hong Kong indirect real estate and to investigate whether development oriented real estate company had higher idiosyncratic (unexplained) risk during period of new land supply restrictions. In any case, the examination of the idiosyncratic (unexplained) variance will be the focus of our study. The remaining paper is laid out as follows. First, the research issues will be identified. Second, the modeling framework will be presented. Third, the empirical findings will be discussed. Lastly, this paper will be ended with conclusion.

Predevelopment risk and land supply restriction

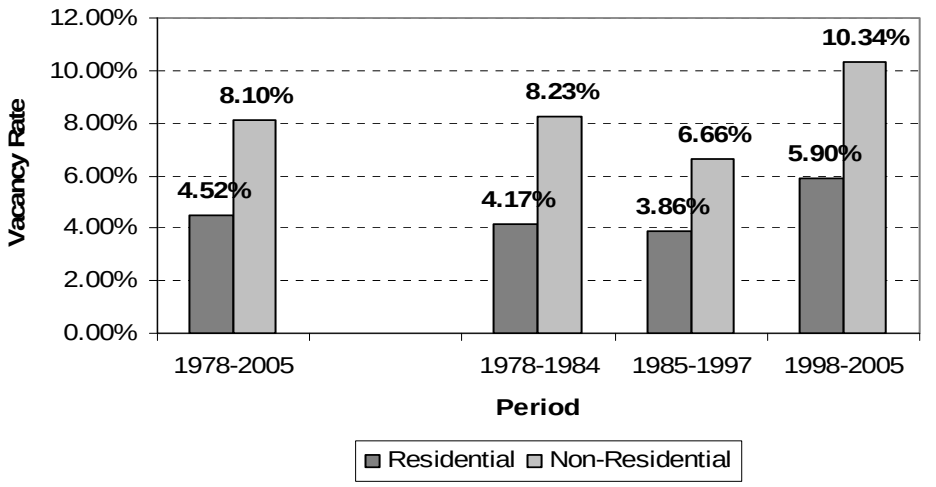
Hong Kong's land tenure system is a leasehold system, in which the government is the ultimate owner of all lands in Hong Kong, except for a parcel of land that situated the St. John's Cathedral. The developers who "purchased" a piece of land form the government usually pay most of the land premium (land price) outright in exchange for a defined bundle of rights over the land for a defined period of years. This system has been carried over from its Colonial Government (which ruled Hong Kong over the period of 1842-1997) to the current administration. To date, the current Hong Kong SAR Government continues administer this system as only new land supplier in Hong Kong (Li, 1997; Haila, 2000, Hui and Soo, 2002).

The Annex III of Sino British Joint Declaration, a joint declaration between the British Government and the Chinese Government, which was signed between the two governments in 1983, specifically placed a cap on the maximum supply of new land to 50 hectares per annum from enforcement date of the Joint Declaration until 30 June 1997. It implies that the Colonial Government was restricted to supply more than 50 hectares new land per annum during the period of 1984-1997. The restrictions excluded the land to be granted to Hong Kong Housing Authority for public rental housing. The reason behind these stringent restrictions was due to the Chinese Government's worry that the British Government might sell as much developable land as possible and spend the land sales proceeds before the handover in 1997 (Wong et al., 1999). One significant impact of the Annex III of Sino British Joint Declaration was rapid reduced vacancy rate during the land supply restriction period during 1984-1997 (See Exhibit 1)

Developers in Hong Kong rely on two types of land for development: new vacant land sold by the government (usually through auctions) and existing land which could be vacant or occupied and zoned for various uses. Development of existing land is highly uncertain, due to the complicated processes of obtaining approvals from various government department; the difficulties in assembling smaller pieces of land into larger plot of developable land; and acquiring old properties with sub-divided ownership. This uncertainty is referred as the *pre-development risk*. In contrast, development on new land supplied by the government is free of pre-development risk. The terms and conditions of the new land purchased from the government are clearly stipulated in the "Particulars and Conditions of Sale" in the lease agreement, which has little rooms for

change. Buyers of new land know exactly what they can or cannot do with the land and the land must be developed within a predefined period.

Exhibit 1
The Vacancy Rate - Hong Kong's Residential & Non-Residential



Source: Hong Kong Property Review, Rating and Valuation Department, 1978-2005

Pre-development risk is unique for each project and not related to the risk arising from shocks to real estate market, stock market or capital market. It is priced in the indirect real estate market and manifests itself as a source of volatility that is not explained by market factors in the variance decomposition model. Hence, our first hypothesis is that new land supply restrictions will increase the idiosyncratic risk of indirect real estate companies.

Real estate companies in Hong Kong can be broadly classified into development (oriented) company and investment (oriented) company. A development company acquires land, constructs new property and then disposes of the developed units. Its profit depends on the price of the units sold and the cost of development. The latter varies significantly across projects, especially when the land is not "new land" acquired from the government. The risk developing alternative sources of land is unique or idiosyncratic.

A restriction on new land supply which forces development companies to rely on alternative source of land for development and thus increase its predevelopment risk. Its profit depends on the level of rental income which is affected by real estate market factors. Therefore, our second hypothesis is that compared to real estate investment companies, real estate development companies will experience a sharper increase in idiosyncratic risk during the period of new land supply restrictions.

Modeling Framework

Our study was divided into two stages: the analysis of the overall indirect real estate in Hong Kong (first stage; sector-wide analysis) and the analysis of the individually listed real estate companies (second stage; individual company analysis). Both stages adopted the multifactor variance decomposition model of Clayton and Mackinnon (2003). The individual company analysis further utilized the linear regression model to test the relative increase in idiosyncratic (unexplained) variance on the degree of importance of development orientation real estate companies.

The observation period was from the second quarter of 1978 to the fourth quarter of 2005. Considering the issue of new land supply restrictions, we also sub-divided the observation into three sub-periods: 1) before the signing of the Sino-British Joint Declaration (2Q1978-3Q1984); 2) the period when the Sino-British Joint Declaration took effect (4Q1984-2Q1997), during which new land supplies were restricted; and 3) after the handover (3Q1997-4Q2005).

Empirical Data

Quarterly return data of different asset classes were collected for the period 2Q1978-4Q2005. The availability of time-series data in Hong Kong's direct real estate dictates the frequency and the beginning of the study period.

The data colleted for the sector-wide analysis are the Datastream's Real Estate Sub-sector Index (indirect real estate), Hang Seng Index (local stock), Interest rates (3-month HIBOR) and the Rating and Valuation Department's Property Price Indices (direct real estate). In this stage analysis, we further added the data of the Morgan Stanley Capital International (MSCI) World Market Index, which measured the contribution of international stock, to test if geographical diversification can explain the increase in the idiosyncratic risk during 1984-1997. The reason behind the use of these data was that they are the transaction-based data, so that the data consistency could be maintained. Besides, we used the data of the publicly traded real estate companies, as measured by Datastream, instead of REITs (Real Estate Investment Trusts), because Hong Kong REITs lack a long-term historical data. On the other hand, the publicly traded real estate data have a three-decade history in the city, with solid and sufficient historical data.

The data collected for the individual company analysis are rather similar with the sector-wide analysis. However, this indirect real estate was the index of the individually listed real estate companies. We started our analysis with the blue chip real estate companies (constituents of the Hang Seng Index) that had the comprehensive figure of income turnover. These companies are Cheung Kong, Hang Lung Group, Henderson Land Development, Hysan, New World Development, and Sun Hung Kai.

Two primary reasons behind the selection were that these large (major) real estate companies commanded substantial market shares in the real estate industry and had preserved meticulous data for the profit and loss accounts in their annual reports, which can facilitate the analysis of turnover-based indicator. We then expanded the individual

company analysis into 20 listed real estate companies as a complete sample to observe the changes and to validate the findings of blue chip real estate companies. The consideration of choosing these companies was due to the data availability, in which the data at least covered the years prior to 1984 for three sub-periods separation purposes. (See Exhibit 2)

We further collected the data of each real estate company's revenue (as a measure of turnover-based indicator) and each real estate company's assets (as a measure of asset-based indicator) from each company's annual report to measure the orientation of the real estate company, whether development oriented or investment oriented. (See Liusman, 2007 for the comprehensive figure) This indication was required because, in reality, almost all real estate companies are involved in both real estate development and investment; the difference is how they split their efforts between both activities.

Exhibit 2
20 Individually Listed Real Estate Companies (Complete Sample)

No.	Listed Real Estate Companies	Market Cap. (HK$Billion)*	Data Availability
1	Allied Properties (HK)	7.87	1Q1981 – 4Q2005
2	Capital Estate	1.71	1Q1983 – 4Q2005
3	**Cheung Kong (Holdings)**	**247.13**	**1Q1978 – 4Q2005**
4	Far East Consortium International	4.7	1Q1978 – 4Q2005
5	Great Eagle Holdings	15.36	1Q1978 – 4Q2005
6	**Hang Lung Group**	**46.68**	**1Q1978 – 4Q2005**
7	Hang Lung Properties	110.41	1Q1983 – 4Q2005
8	Henderson Investment	36.87	1Q1978 – 4Q2005
9	**Henderson Land Development**	**101.60**	**3Q1981 – 4Q2005**
10	Hong Kong Ferry (Holdings)	2.89	1Q1978 – 4Q2005
11	Hopewell Holdings	30.59	1Q1978 – 4Q2005
12	**Hysan Development**	**20.35**	**3Q1981 – 4Q2005**
13	**New World Development**	**65.72**	**1Q1978 – 4Q2005**
14	Shun Tak Holdings	24.36	1Q1978 – 4Q2005
15	Sino Land Company	78.86	2Q1981 – 4Q2005
16	**Sun Hung Kai Properties**	**244.08**	**1Q1978 – 4Q2005**
17	Tai Cheung Holdings	3.09	1Q1978 – 4Q2005
18	Wharf (Holdings)	76.13	1Q1978 – 4Q2005
19	Wheelock and Company	40.60	1Q1978 – 4Q2005
20	Wheelock Properties	16.76	1Q1978 – 4Q2005

*Note: *Data for market capitalization obtained from stock information of HSBC, as of 22nd August 2007.*
Source: Datastream Advance database

Sector-wide analysis

The function of multifactor variance decomposition model, adopted from the model of Clayton and Mackinnon (2003), is to decompose the total risks into different components attributable to different factors. This model has been increasingly used in the recent literature. (Anderson et al., 2005; Newell, 2005; Hoesli and Moreno, 2007; Newell et al., 2007) We applied this model to analyze the sources of risk for the sector-wide Hong Kong indirect real estate and for individual listed real estate companies.

The three-factor model was used in both stages analyses. However, as mentioned, the sector-wide analysis also expanded its analysis into four-factor model, in which the MSCI World market index was added, to investigate the political uncertainty occurred during the similar period of new land supply restrictions.

Three-factors included are the returns on local stocks, direct real estate, and interest rates. The model can be written as follows:

$$r_{IRE\,t} = \beta_0 + \beta_1 r_{HSI\,t} + \beta_2 r_{DRE\,t} + \beta_3 r_{IR\,t} + \upsilon_t \qquad (1)$$

Where r_{IREt}, r_{HSIt}, r_{DREt}, and r_{IRt} are indirect real estate returns, local stock returns, direct real estate returns, and interest rates respectively, while β_0, β_1, β_2, and β_3 are the indirect real estate sensitivities to the respective local stocks, direct real estate and bond factors. υ is the remaining unexplained variance, referred as idiosyncratic factor.

Clayton and Mackinnon (2003) noted that the variances of those three-factors might be correlated to each other. Therefore, the orthogonalization method should be developed to obtain the pure factors which are not correlated. Hence, the "pure" direct real estate factor is the residual of the regression of direct real estate returns on local common stock returns and interest rate. The "pure" interest rate factor is the residual of regression on interest rates on local stock returns and "pure" direct real estate. With these "pure" direct real estate and interest rates, the local stock variable (HSI) acted as a base for the variance decomposition model, indicating that those risks which are not either "pure" direct real estate or "pure" interest rate will be classified as the risks of local stocks.

By replacing their returns with "pure" direct real estate and "pure" interest rate, the new equation can be written as follows:

$$r_{IRE\,t} = b_0 + b_{HSI}\, r_{HSI\,t} + b_{DRE}\, \hat{\varepsilon}_t + b_{IR}\, \hat{\mu}_t + \upsilon_t \qquad (2)$$

Where $\hat{\varepsilon}$ and $\hat{\mu}$ are the "pure" factor of direct real estate and interest rate, respectively. The relative contributions to indirect real estate volatility by each factor are as follows:

Local stock factor contribution $= \dfrac{b_{HSI}^2\, \sigma_{rHSI}^2}{\sigma_{IRE}^2}$ (3)

Direct real estate factor contribution $= \dfrac{b_{DRE}^2 \sigma_{\varepsilon}^2}{\sigma_{IRE}^2}$ (4)

Interest rate factor contribution $= \dfrac{b_{IR}^2 \sigma_{\mu}^2}{\sigma_{IRE}^2}$ (5)

Idiosyncratic factor contribution $= \dfrac{\sigma_{\upsilon}^2}{\sigma_{IRE}^2}$ (6)

Clayton and Mackinnon (2003) also mentioned that the order of orthogonalization would slightly influence the results of those factors, due to some common risks shared by local stocks, direct real estate and interest rates. Hence, we developed two versions of the relative contribution, in which local stocks and direct real estate performed as a base in the first and second versions, respectively. We kept interest rate factor in the middle and did not use as a base due to its small variability. The order of orthogonalization will affect relative contribution of each factor but will not affect the idiosyncratic factor.

The four-factor model was further developed and used in the sector-wide analysis. The reason behind the creation of four-factor model is to further examine whether the political uncertainty, which occurred during the similar period of 1984-1997 and caused the likelihood of geographical diversification, has an effect to the changes of the risk of indirect real estate in Hong Kong. The four-factors included are the returns on local stocks, international stocks, direct real estate, and interest rates. Similar to the three-factor model, the "pure" factors were also derived in the four-factor model. Hence, three versions of relative contribution were developed, where local stocks, international stocks, and direct real estate performing as a base for the first, second, and third versions, respectively. In fact, similar to the three-factor model, the order of orthogonalization is neither the main issue. The four-factor model is particularly developed to observe the relative increase or decrease of the idiosyncratic factor's contribution in order to understand the political uncertainty which stemmed from the volatility of Hong Kong's indirect real estate.

Analysis of Individual Companies

In the second stage of the analysis, we regress the relative increase in idiosyncratic variance, derived from the three-factor variance decomposition model of individually listed real estate companies, on the degree of importance of development orientation real estate companies.

As mentioned, almost all real estate companies are involved in both real estate development and investment and thus two indicators, turnover-based and asset-based indicators, were developed to measure the orientation, whether development oriented or investment oriented. The *turnover-based indicator* indicates the ratio of revenue from the sale of developed properties to total revenue, implying that the more a company obtains its turnover from the selling of property units, the higher its property sales percentage would be. A higher percentage of property sales denote a greater involvement in real estate development and is thus classified as a development oriented real estate company. The *asset-based indicator* indicates the ratio of the value of the land or property for/under development to the value of the total assets, implying that the more development assets a company has, the higher its development assets percentage would be. A higher percentage of development asset denote that a company has a greater involvement in real estate development and is thus categorized as a development oriented real estate company. In fact, the turnover-based indicator would be a superior indices measurement than the asset-based. However, due to a small number of companies provided a meticulous income turnover data, the asset-based indicator was further required.

With these two indicators, two regression models for each listed real estate company were developed and shown in Equation 7 and 8. Equation 7, classified as *turnover-based regression*, reveals the effect of development orientation indices (as measured by the turnover-based indicator) on the idiosyncratic risk ratio, holding other factors constant. Equation 8, classified as *asset-based regression*, reveals the effect of development orientation indices (as measured by the asset-based indicator) on the idiosyncratic risk ratio, holding other factors constant.

$$IDIOSYNCRATIC = \beta_0 + \beta_1 TURNOVER + \varepsilon \quad (7)$$

$$IDIOSYNCRATIC = \beta_0 + \beta_1 ASSETS + \varepsilon \quad (8)$$

where β_0 is the intercept parameter and β_1 is the change in the idiosyncratic ratio when the percentage of property sales or development assets increases or decreases (slope coefficient). The idiosyncratic risk ratio (dependent variable) was derived from the ratio of idiosyncratic variance of each listed real estate company during the period of land supply restriction (1984-1997) and the entire observation period (1978-2005). If the ratio was more than 1, it would indicate that the idiosyncratic risk, which the listed real estate company dealt with, was higher during the period of new land supply restrictions than during the entire observation period. This would also imply that the development oriented real estate companies experienced higher idiosyncratic risk than investment oriented real estate companies during the period of new land supply restrictions.

Empirical Findings

Sector-wide Analysis

The sector-wide analysis examined indirect real estate variable as measured by the Datastream's real estate sub-sector indices, representing all of Hong Kong's publicly traded real estate market. The three-factor model was firstly examined to observe the change of sources of risk due to the issue of new land supply restrictions, with the focus on the idiosyncratic (unexplained) factor. The variance decomposition model of Clayton and Mackinnon (2003) enabled us to break down the proportion of Hong Kong's indirect real estate volatility contributed by the local stocks, direct real estate, interest rates, and idiosyncratic factors.

The entire observation period for Version 1 shows that the factors of local stocks contributed 30.26%, direct real estate 11.94%, interest rates 0.02% and idiosyncratic 57.78% to the volatility of Hong Kong's indirect real estate; while Version 2 shows the factors of local stocks contributed 12.16%, direct real estate 30.04%, interest rates 0.02% and idiosyncratic 57.78%. (See Exhibit 3) Considering the figures of local stocks (30.26%) and direct real estate (11.94%) in Version 1 and figures of local stocks (12.16%) and direct real estate (30.04%) in Version 2, it shows that there are some common risks shared by these two factors. The outcomes of idiosyncratic factor in both versions are similar (57.78%), illustrating that this factor is not influenced by the

order of orthogonalization. This figure implies that the remaining 57.78% of the volatility cannot be explained by the factors of local stocks, direct real estate and interest rates.

The sub-period results of Version 1 indicate that the contribution of local stocks factor to Hong Kong's indirect real estate has been decreasing, while the direct real estate factor has been emerging. (See Exhibit 3) The Version 2 results also show the declining pattern of the contribution of local stocks, while the contribution of direct real estate shows a relatively odd pattern for period 1978-1984. This might be due to the issue of orthogonolization order and the strong correlation between local stocks and direct real estate over the period 1978-1984 that implied a large number of common risks to be shared. The key argument behind the declining contribution of local stocks and increasing contribution of direct real estate is the market maturity. In the past, the stock analyses in Hong Kong were less informative due to high information costs and less stringent listing regulations, and thus causing less transparency. As a result, the investor's decisions to trade the shares of listed real estate companies tended to be based more on the publicly available information that affect the whole stock market (as indicated by the Hang Seng Index) rather than a specific sector. This tendency was a sign of market immaturity. Nowadays, due to the tightening up of listing regulations, the more reliable information could be used to produce an informative stock analysis. Evaluating the performance of underlying business of listed real estate companies became gradually more relevant when the investors formulated their investment strategies, which is a sign of market maturity. The maturity of indirect real estate is manifested by the increasing impact of direct real estate and the decreasing influence of local stocks on indirect real estate performance.

Exhibit 3
Estimates of Contribution of Local Stocks, Direct Real Estate, Interest Rates and Idiosyncratic Factors to Indirect Real Estate Volatility (Three-Factor)

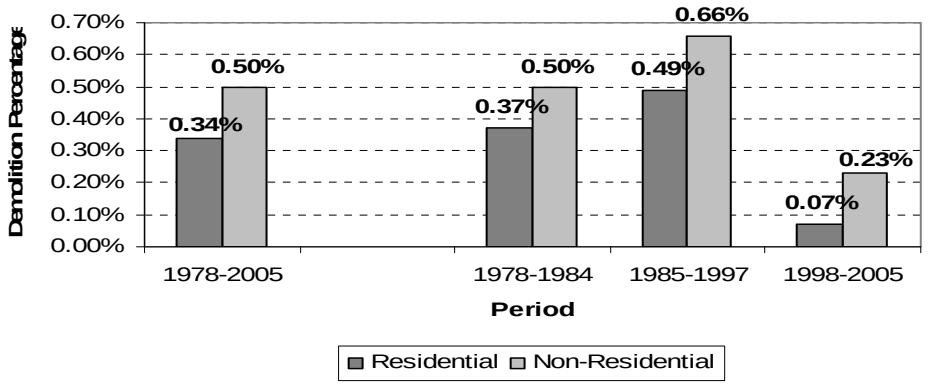
Factor	Entire Period	Sub-Period		
	1978 Q2 – 2005 Q4	1978 Q2 – 1984 Q3	1984 Q4 – 1997 Q2	1997 Q3 – 2005 Q4
Version 1: Local stocks as a base				
Local Common Stocks	30.26%	70.23%	17.15%	13.05%
Direct Real Estate	11.94%	4.49%	6.82%	34.74%
Interest Rates	0.02%	0.11%	0.00%	3.64%
Idiosyncratic	**57.78%**	**25.16%**	**76.03%**	**48.58%**
Version 2: Direct real estate as a base				
Local Common Stocks	12.16%	31.54%	10.77%	0.76%
Direct Real Estate	30.04%	41.56%	13.08%	45.06%
Interest Rates	0.02%	1.73%	0.12%	5.60%
Idiosyncratic	**57.78%**	**25.16%**	**76.03%**	**48.58%**

The sub-period results of Version 1 and Version 2 show the unusual trend of idiosyncratic (unexplained) factor. (See Exhibit 3) Compared to 1978-1984 and 1997-2005, the contribution of idiosyncratic factor was significantly higher for the period 1984-1997. During these 13 years, the risks affecting the factors of local stocks, direct real estate, and interest rates could merely explain 23.97% to the volatility of Hong

Kong's indirect real estate. The remaining 76.03% idiosyncratic risk could not be explained by the factors of local stock, direct real estate, and interest rates. The argument behind the higher idiosyncratic risk during 1984-1997 is due to the new land supply restrictions, as instructed by the Annex III of Sino British Joint Declaration.

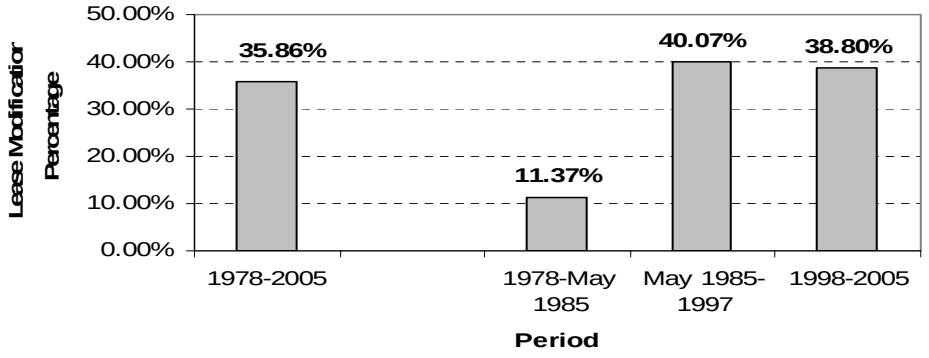
As aforementioned, when the new land supplies were restricted, the real estate companies faced more pre-development uncertainty. This pre-development risk, reflected in the idiosyncratic factor, is unique and not related to the shocks to real estate market, stock market and capital market. Consequently, the pre-development risk is the argument behind the high idiosyncratic risk faced by the real estate companies during the period of new land supply restrictions. Instinctively, with the existence of pre-development risk, the idiosyncratic risk should be higher during the period of new land supply restrictions than that for the two "control" sub-periods, because in general, the real estate companies were not likely to bear the pre-development risk during the period in which new land supplies were not restricted.

Exhibit 4
The Rate of Redevelopment
Hong Kong's Residential & Non-Residential



Source: Hong Kong Property Review, Rating and Valuation Department, 1978-2005

Exhibit 5
The Application for Lease Modifications



Source: Accounts of the Government, Treasure Department, 1978-2005

Two pieces of supplementary evidences, which are the rate of redevelopment and the rate of lease modification application, were collected to support these arguments. The figure of demolition as a percentage of total stock is as a good proxy for the rate of redevelopment. We assumed that it took, on average, one year to obtain approval and demolish a building. Exhibit 4 shows that both residential and non-residential rate of redevelopment were higher during the period of new land supply restrictions, compared to the entire observation period and the two "control" sub-periods. The lease modification percentage was derived from the ratio of the modified existing leases, exchanges, extensions, and the land premium; where the land premium is the sum of sales by public auctions and tenders and the modification of existing leases, exchanges, and extensions. The lease modification evidence also demonstrates a higher percentage of lease modification applications during the period of new land supply restrictions, compared to the entire observation period and the two "control" sub-periods. (See Exhibit 5) These supplementary evidences illustrate the developers' reliance on the alternative sources of land, either redevelopment the old building or the change of land use, during the period of new land supply restrictions, causing them to encounter a higher pre-development risk. However, Peng and Wheaton (1994) mentioned that the imposition of land supply restrictions caused higher housing prices, but not lower housing output due to a relaxation of development density (plot-ratio). Nevertheless, Wong et al. (1999) indicated that the relaxation of development density and the possibility of increasing new land supplies, subject to the approval of the Sino-British Land Commission, did not increase new land supplies to the optimal level. Obtaining the approval to change the development density is complicated and full of uncertainties. In spite of this relaxation, the developers still faced the pre-development risks, and thus experienced higher idiosyncratic risk, due to the complicated process of obtaining approvals from various government departments and the difficulties in land assembly. It confirms our first hypothesis, which stated that with other things being equal, the new land supply restrictions will increase the idiosyncratic risk of indirect real estate.

As mentioned earlier, the period of 1984-1997 was both the period of new land supply restrictions and the period of political uncertainty. During these 13 years, many people in Hong Kong, including the Hong Kong's real estate companies, worried about the political uncertainty, especially after the Tiananmen Square Incident of 4th June 1989. Such uncertainty caused the real estate companies to diversify their investments to other regions/countries. We also attempted to observe whether geographical diversification could explain the increase in the idiosyncratic risk from 1984 to 1997 by developing the four-factor variance decomposition model. The MSCI World Market Index was employed as an additional factor to observe the relative contribution of international stocks factor to the volatility of Hong Kong's indirect real estate and to scrutinize whether the idiosyncratic risk decreased after the inclusion of this factor. Exhibit 6 shows the relative contribution of international stocks factor to the indirect real estate volatility and the lower contribution of idiosyncratic factor compared to the three-factor model for both entire observation period and sub-period, indicating the existence of political risk for the period 1978-2005.

The sub-period results show the higher contribution of international stocks during the period 1984-1997. The outcomes of Version 1, 2, and 3 slightly vary, due to overlapping risk among those factors. Accordingly, a different approach was developed to measure the significance of the higher international stocks contribution

from 1984 to 1997. We compared the relative increase of idiosyncratic risk (76.03%) from 1984-1997 to the entire observation period (57.78%) of the three-factor model and the relative increase of idiosyncratic risk (66.69%) from 1984 to 1997 to the entire observation period (52.40%) of the four-factor model. The outcomes showed a slight decrease of these ratios from 1.316 (three-factor model) to 1.273 (four-factor model). This decrease signifies that some uncertainty during the period 1978-1997 could be explained by the international stocks factor. However, the ratio of 1.273 was the evidence that there were still some uncertainty that could not be attributed to the political climate at the time. The ratio of 1984-1997 idiosyncratic risk to the entire observation period's idiosyncratic risk should be trimmed down to 1.000 if the political uncertainty were the only factor causing the increase of 1984-1997 idiosyncratic risk. This confirms that the political uncertainty was not the only factor which caused to an escalation in the idiosyncratic risk from 1984-1997.

Exhibit 6
Estimates of Contribution of Local Stocks, International Stocks, Direct Real Estate, Interest Rates and Idiosyncratic Factors to Indirect Real Estate Volatility (Four-Factor)

Factor	Entire Period	Sub-Period		
	1978 Q2 – 2005 Q4	1978 Q2 – 1984 Q3	1984 Q4 – 1997 Q2	1997 Q3 – 2005 Q4
Version 1: Local stocks as a base				
Local Common Stocks	30.26%	70.23%	17.15%	13.05%
International Stocks	5.37%	0.48%	9.35%	2.90%
Direct Real Estate	11.94%	4.49%	6.82%	34.74%
Interest Rates	0.02%	0.11%	0.00%	3.64%
Idiosyncratic	**52.40%**	**24.68%**	**66.69%**	**45.68%**
Version 2: International stocks as a base				
Local Common Stocks	13.92%	20.50%	15.59%	1.52%
International Stocks	2.28%	9.35%	4.73%	0.08%
Direct Real Estate	30.99%	34.64%	12.99%	45.61%
Interest Rates	0.40%	10.84%	0.00%	7.11%
Idiosyncratic	**52.40%**	**24.68%**	**66.69%**	**45.68%**
Version 3: Direct real estate as a base				
Local Common Stocks	12.16%	31.54%	10.77%	0.76%
International Stocks	5.37%	0.48%	9.35%	2.90%
Direct Real Estate	30.04%	41.56%	13.08%	45.06%
Interest Rates	0.02%	1.73%	0.12%	5.60%
Idiosyncratic	**52.40%**	**24.68%**	**66.69%**	**45.68%**

Individual Company Analysis

The individual company analysis is to further confirm the findings of sector-wide analysis and to verify the second hypothesis by analyzing the pre-development risk in relation to the nature of individually listed real estate companies. Due to the lack of a proxy in explaining the pre-development risk, the method utilized is relatively different

from the previous analysis. Besides employing the variance decomposition model to derive the idiosyncratic factor, the linear regression model was also developed to test the effect of relative increase in the idiosyncratic variance on the degree of importance of real estate development compared to real estate investment companies. By reason of the incapability of political uncertainty to explain the idiosyncratic portion, we simply concentrated on the three-factor model in obtaining the outcome of idiosyncratic risk. The idiosyncratic risk is the center analysis of the second hypothesis.

Exhibit 7
Estimates of Contribution of the Idiosyncratic Factor to the Individually Listed Real Estate Companies

Company	Entire Period	Sub-Period		
	1978 Q2 – 2005 Q4	1978 Q2 – 1984 Q3	1984 Q4 – 1997 Q2	1997 Q3 – 2005 Q4
Allied Properties	80.49%	42.62%	93.31%	64.79%
Capital Estate	68.60%	12.58%	60.96%	68.37%
Cheung Kong	**58.30%**	**23.95%**	**77.42%**	**54.62%**
Far East Consortium	70.40%	21.88%	93.17%	50.20%
Great Eagle	63.67%	34.25%	86.50%	51.07%
Hang Lung Group	**69.47%**	**47.07%**	**82.54%**	**56.75%**
Hang Lung Properties	90.32%	37.19%	91.73%	77.62%
Henderson Investment	70.86%	44.94%	82.72%	62.53%
Henderson Land	**34.72%**	**4.04%**	**53.54%**	**31.37%**
Hong Kong Ferry	72.44%	54.82%	78.31%	51.96%
Hopewell Holdings	73.05%	36.15%	89.13%	56.33%
Hysan	**67.72%**	**73.36%**	**67.28%**	**62.19%**
New World Development	**63.69%**	**25.59%**	**70.80%**	**57.44%**
Shun Tak Holdings	85.43%	82.48%	93.67%	58.45%
Sino Land	64.14%	12.91%	79.88%	59.95%
Sun Hung Kai Properties	**63.13%**	**35.38%**	**77.65%**	**54.09%**
Tai Cheung Holdings	63.23%	36.65%	77.41%	58.41%
Wharf	59.39%	27.66%	74.64%	62.70%
Wheelock and Company	62.90%	43.30%	70.37%	63.24%
Wheelock Properties	78.11%	32.62%	82.57%	76.34%

Note:
The highlighted companies represent the blue chip real estate companies possessing the detailed turnover data.

The contribution of the idiosyncratic factor to the volatility of individually listed real estate companies is shown in Exhibit 7. All listed real estate companies, but Hysan, reveal the higher idiosyncratic factor from 1984 to 1997, compared to two "control" sub-periods. In addition, all listed real estate companies, except Capital Estate and Hysan, show a higher idiosyncratic risk from 1984 to 1997, compared to the entire observation period's idiosyncratic risk. This implies that these companies likely experienced more uncertainty from 1984-1997 than for the whole 1978-2005 period.

The risk encountered by the development company and investment company may varies. Most Hong Kong's real estate companies engage in both development and investment. It is hardly discovered either "pure" development company or "pure" investment company. Therefore, two indicators (turnover-based and asset-based) were

built to indicate the development orientation index of each company. The turnover-based indicator may be superior. However, due to a small number of companies provided the detailed turnover data in the early years, the asset-based indicator was also developed, so that more data sample can be included in the regression analysis. Two types of regression were then developed: turnover-based regression and asset-based regression. The turnover-based regression measures the effect of development orientation indices, as measured by turnover-based indicator, on the idiosyncratic risk ratio. The asset-based regression measures the effect of development orientation indices, as measured by asset-based indicator, on the idiosyncratic ratio.

Exhibit 8
The Idiosyncratic Ratio and Development Orientation Indices of the Individually Listed Real Estate Companies

Company	Idiosyncratic Ratio[1]	Development Orientation Indices	
		Turnover-based Indicator[2]	Asset-based Indicator[3]
Allied Properties	1.159274	NA	17.88%
Capital Estate	0.888630	NA	16.67%
Cheung Kong	**1.327959**	**81.08%**	**18.09%**
Far East Consortium	1.323438	NA	8.05%
Great Eagle	1.358568	NA	19.69%
Hang Lung Group	**1.188139**	**54.37%**	**14.55%**
Hang Lung Properties	1.015611	NA	2.86%
Henderson Investment	1.167372	NA	34.00%
Henderson Land	**1.542051**	**76.22%**	**40.30%**
Hong Kong Ferry	1.081033	NA	6.98%
Hopewell Holdings	1.220123	NA	20.05%
Hysan	**0.993503**	**0.00%**	**0.00%**
New World Development	**1.111634**	**23.59%**	**17.11%**
Shun Tak Holdings	1.096453	NA	12.02%
Sino Land	1.245401	NA	18.45%
Sun Hung Kai Properties	**1.230002**	**59.96%**	**26.22%**
Tai Cheung Holdings	1.224261	NA	40.27%
Wharf	1.256777	NA	21.32%
Wheelock and Company	1.118760	NA	2.31%
Wheelock Properties	1.057099	NA	21.04%

Note:
1. The idiosyncratic ratio was obtained by dividing the idiosyncratic risk for the 1984-1997 period (as the numerator) by the idiosyncratic risk for the entire observation period (as the denominator).
2. The development orientation indices of the turnover-based indicator are the percentage of property sales to total revenue. Only six blue chip real estate companies the detailed turnover data in the early years. See Liusman (2007) for the comprehensive figure derived.
3. The development orientation indices of the asset-based indicator are the percentage of development assets to total assets. See Liusman (2007) for the comprehensive figure derived.

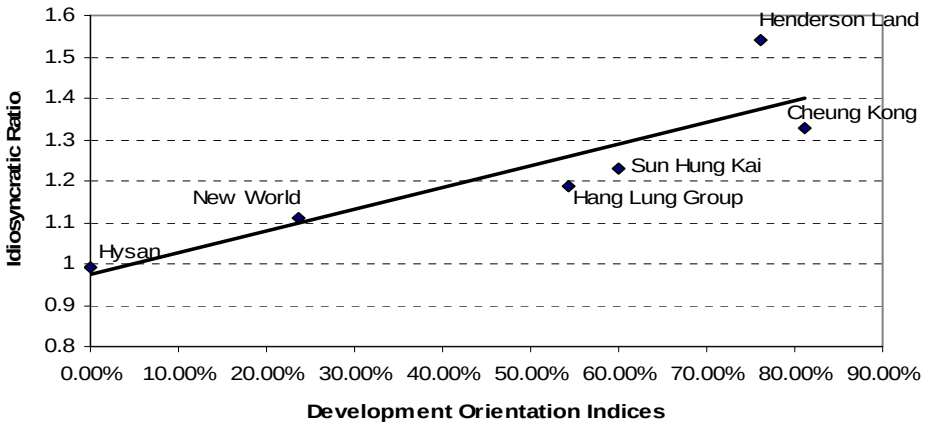
Analysis of Blue Chip Real Estate Companies

The blue chip real estate companies in our analysis, six companies altogether, were the companies which have maintained the meticulous data for the profits and losses in their annual reports. (See Exhibit 8) We firstly utilized the turnover-based regression, followed by the asset-based regression to examine whether the development oriented

real estate company had higher idiosyncratic risk during the period of new land supply restrictions.

Exhibit 9 clearly plots the idiosyncratic ratio against the development orientation indices as measured by the *turnover-based indicator*. Unlike Hysan, the income of development oriented companies like Cheung Kong, Henderson Land, and Sun Hung Kai is more unstable, due to the more uncertainties encountered during the pre-development process. The graph shown in Exhibit 9 demonstrates a positive uptrend, implying the development oriented companies experienced a sharper increase in their idiosyncratic risk from 1984 to 1997. To test the validity of this upward sloping curve, the regression analysis was conducted. The slope parameter of the development orientation indices was positive, suggesting the development oriented companies had higher idiosyncratic ratio. (See Exhibit 12) The p-value of this coefficient (0.0231) shows a sufficient evidence to reject the null hypothesis, on which the development orientation indices had an effect on the idiosyncratic ratio during the period of new land supply restrictions. The *R*-squared was 76.24%, signifying that the development orientation indices explained about 76.24% of the variation in the idiosyncratic ratio for these six blue chip real estate companies. These results confirmed the second hypothesis. The companies that had more development activity, characterized by a high rate of property sales, experienced sharper increases in their idiosyncratic variances than did investment oriented companies.

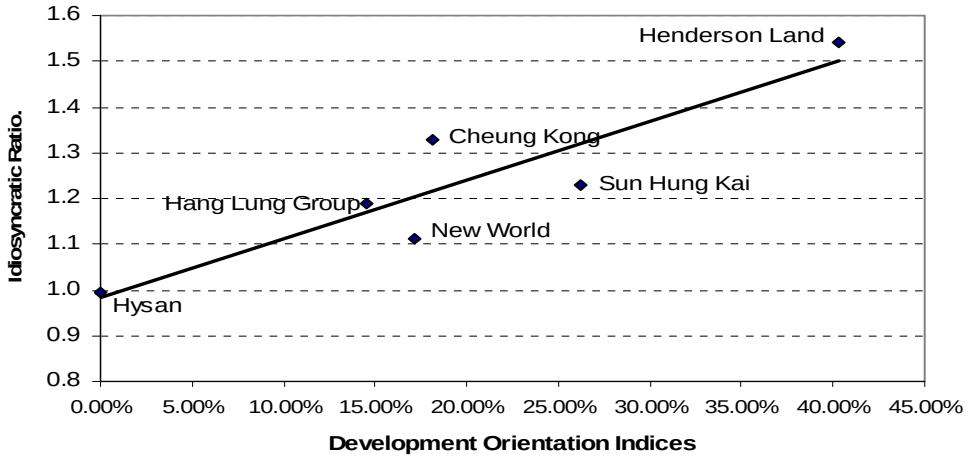
Exhibit 9
The Scatter-Plot and OLS of Idiosyncratic Ratio and Development Orientation Indices (as measured by the *turnover-based indicator*)
Blue Chip Real Estate Companies



To confirm above results, we further test these six blue chip real estate companies with the asset-based regression. Exhibit 10 plots the scatter-diagram and OLS regression line of idiosyncratic ratio against the development orientation indices as measured by the *asset-based indicator*, in which the graph shows a positive uptrend. The slope parameter demonstrated a positive sign and the p-value (0.012) of the regression showed strong evidence against the null hypothesis at 5% level. (See Exhibit 12) The *R*-squared was 82.53%, illustrating the development orientation indices explained about

82.53% of the variation in the idiosyncratic ratio. The results also verified that a company which holds more development assets, and thus is involved more in development activities, faces more pre-development risk, which increased the 1984-1997 idiosyncratic risk. Both regressions, turnover-based and asset-based, confirmed that the pre-development risk played a role in capturing some degree of the 1984-1997 idiosyncratic risk.

Exhibit 10
The Scatter-Plot and OLS of Idiosyncratic Ratio and Development Orientation Indices (as measured by the *asset-based indicator*)
Blue Chip Real Estate Companies



Analysis of 20 Listed Real Estate Companies (complete sample)

We further expanded our data sample into all listed property companies that maintained the historical data covering the three sub-periods to observe any discrepancy in the results of the blue chip real estate companies. Our complete sample analysis merely dealt with the asset-based analysis. The turnover-based analysis could not be conducted as the comprehensive figure of profit and loss accounts of most companies, particularly small and medium firms, was not available in the past.

The development orientation indices as measured by the asset-based indicator and the idiosyncratic risk ratio of the complete sample were calculated. (See Exhibit 8) These indices were then plotted against the idiosyncratic ratio. (See Exhibit 11) The slope shows the upward drift, indicating the development orientated companies experienced an increase in their idiosyncratic risk from 1984-1997. Nevertheless, the diagram demonstrates a dispersal of certain companies. The regression analysis was then developed to examine the significant of the OLS regression line. The results show the positive parameter which is statistically different from zero at 5% level. These signify strong evidence against the null hypothesis and the degree of development asset in the company had an effect on the variability of the idiosyncratic risk ratio. On the other hand, the *R*-squared demonstrates the poor outcome, indicating the development orientation indices coefficient could only explain about 29.14% of the variation. The poor upshot might be due to the less accurate financial report of these companies during

their early years. The lenient listing regulations in the past might initiate the listed companies to make less detailed and less accurate financial statements, characterizing by their thin annual reports. At the present time, the stringently listed regulations established by the Hong Kong Securities and Futures Commission have stimulated the listed companies to maintain detailed and more accurate financial statements, corresponded to their ever thickening annual reports. Nonetheless, these findings also confirmed the second hypothesis.

Exhibit 11
The Scatter-Plot and OLS of Idiosyncratic Ratio and Development Orientation Indices (as measured by the *asset-based indicator*)
Complete Sample

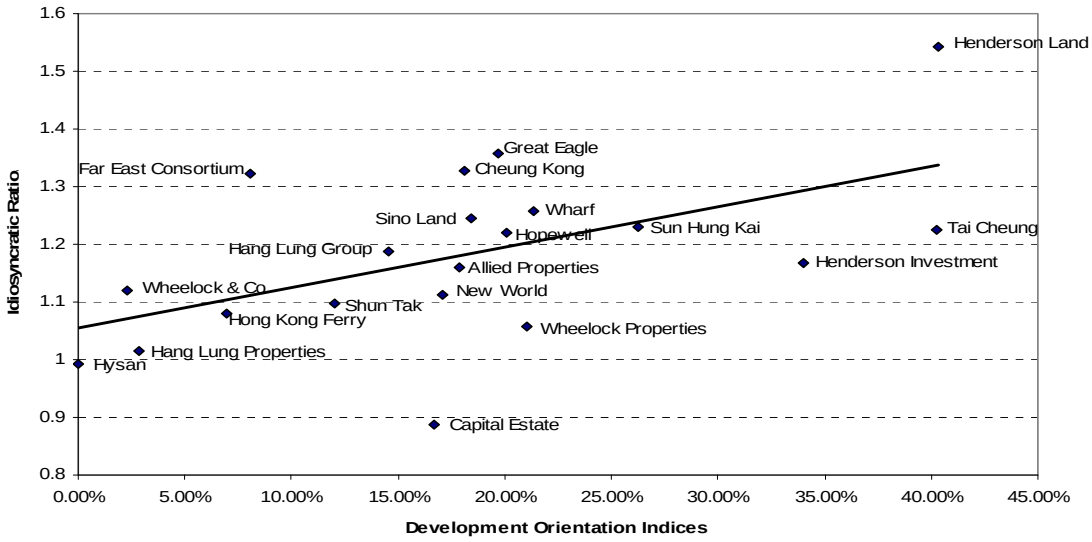


Exhibit 12
Summary of the Regression Results of the Individual Company Analysis

	Coeff.	Standard Error	t-stats	p-value	R^2	Adjusted R^2
Blue Chip RE Companies						
Turnover-based regression	0.0052	0.0015	3.5827	0.0231	0.7624	0.7030
Asset-Based Regression	0.0129	0.0030	4.3474	0.0122	0.8253	0.7817
20 Listed RE Companies (Complete Sample)						
Complete Sample	0.0070	0.0026	2.7207	0.0140	0.2914	0.2520

The empirical implication is that the development oriented real estate companies experienced more pre-development risk due to the imposition of new land supply restrictions. Hence, the development oriented real estate companies encountered higher idiosyncratic risk, some portion of which is captured by the pre-development risk, than the investment oriented real estate companies, which are unlikely to bear pre-development risk. This analysis also strengthened the sector-wide analysis, the

hypothesis of which denoted that the new land supply restrictions would increase the indirect real estate idiosyncratic risk. This confirms that there is a certain degree of pre-development risk in capturing the increase in idiosyncratic risk. Nevertheless, the degree of this portion cannot be measured due to the one-time off nature of each development and the uniqueness of each plot of land and development. The amount of compensation for land assembly and change of land use and/or development density, as well as the time required, will vary. By the reason of this uniqueness, it was not viable to determine the certain percentage of pre-development risk which can be universally applied to all types of land and development. In spite of this limitation, the pre-development risk had an effect on the increased risk for Hong Kong's indirect real estate during the period of new land supply restrictions.

Conclusion

The volatilities in local stocks, international stocks, direct real estate and interest rates contributed to the risk of Hong Kong indirect real estate, even though the major component is the idiosyncratic (unexplained) risk. This risk was much higher during the period of new land supply restrictions, which is consistent with our first hypothesis "The new land supply restrictions will increase the idiosyncratic risk of indirect real estate companies". We also discovered an increase in risk contributed by the international stocks for the same period, when many companies diversified the business geographically due to the political uncertainty. We further discovered that, compared to the investment oriented real estate companies, the development oriented real estate companies experienced a higher increase in idiosyncratic risk, in which some portion captured by the pre-development risk, during the period of new land supply restrictions, and thus, confirmed our second hypothesis.

Our hypotheses are directly applicable to the markets with similar land tenure system, such as China or Singapore (to a lesser extend). The hypotheses are also applicable to the development on existing stock of land that is not readily developable without pre-development activities. Any changes in the social, political, and legal environment which increased uncertainty of success for the pre-development activities will increase the idiosyncratic risk of development oriented indirect real estate companies. Other empirical implication is that if there is a change in land policy/regulation or simply physical constraints that limit the amount of new land that is readily developable without the approval from the various authorities, the developers will have to rely more on developing existing stocks of land, in which will increase the idiosyncratic risk of those development oriented real estate companies. Our findings are useful for policy makers, investors and decision makers of real estate companies.

References

Anderson, R., Clayton, J., Mackinnon, G. and Sharma, R. (2005). "REIT returns and pricing: the small cap value stock factor", *Journal of Property Research,* **22**(4), 267-286.

Barkham, R. and Geltner, D. (1995). "Price discovery in American and British property markets", *Real Estate Economics*, **23**(1), 21-44.

Brounen, D. and Eichhotz, P (2004). "Development involvement and property share performance: international evidence", *Journal of Real Estate Finance and Economics*, **29**(1), 79-97.

Cheshire, P. (2004). "The British housing market: contained and exploding", *Urban Policy and Research*, **22**(1), 13-22.

Clayton, J. and Mackinnon, G. (2003). "The relative importance of stock, bond and real estate factors in explaining REIT returns", *Journal of Real Estate Finance and Economics*, **27**(1), 39-60.

Giliberto, S.M. (1990). "Equity real estate investment trusts and real estate returns", *The Journal of Real Estate Research*, **5**(2), 259-263.

Glascock, J.L., Lu, C.L., and So, R.W. (2000). "Further evidence on the integration of REIT, bond, and stock returns, *Journal of Real Estate Finance and Economics*, **20**(2), 177-194.

Goodman, J. (2003). "Home ownership and investment in real estate stocks", *Journal of Real Estate Portfolio Management*, **9**(2), 93-105.

Gyourko, J. and Keim D.B. (1992). "What does the stock market tell us about real estate returns?", *Journal of the American Real Estate and Urban Economics Association*, **20**(3), 457-485.

Haila, A. (2000). "Real estate in global cities: Singapore and Hong Kong as property states", *Urban Studies*, **37**(12), 2241-2256.

Hannah, L., Kim, K.H. and Mills, E.S. (1993). "Land use controls and housing price in Korea", *Urban Studies*, **30**(1), 147-156.

Hoesli, M. and Macgregor, B.D. (2000). *Property Investment: Principles and Practice of Portfolio Management*. England: Pearson Education.

Hoesli, M. and Moreno, C.S. (2007). "Securitized real estate and its link with financial assets and real estate: an international analysis", *Journal of Real Estate Literature*, **15**(1), 59-84.

Hui, E.C.M. and Soo, J.A. (2002). "Development conditions and supply of housing: evidence from Hong Kong", *Journal of urban planning and Development*, **128**(3), 105-138.

Jones Lang LaSalle (2006). 2006 Real Estate Transparency Index, Jones Lang LaSalle IP, Inc., www.joneslanglasalle.com

Kuhle, J. L. (1987). "Portfolio diversification and return benefits – common stock vs real estate investment trusts (REITs)", *The Journal of Real Estate Research*. **2**(2), 1-9

Lee, S. and Stevenson, S. (2005). *The Substitutability of REITs and Value Stocks*, working paper, Centre for Real Estate Research, University of Reading.

Li, L.H. (1997). *Development Appraisal of Land in Hong Kong*, Hong Kong: Chinese University Press.

Liusman, E. (2007). *The Effect of Land Supply Restriction on the Risk of Hong Kong Indirect Real Estate*. Unpublished PhD Thesis. The University of Hong Kong.

Mueller, G.R., Pauley, K.R. and Morrill, W.K. (1994). "Should REITs be included in a mixed-asset portfolio?" *Real Estate Finance*, **11**(1), 23-28

Newell, G. (2005). "Factors Influencing the Performance of Listed Property Trusts", *Pacific RIM Property Research Journal*, **11**(2), 211-227.

Newell, G. and Chau, K.W. (1996). "Linkages between direct and indirect property performance in Hong Kong", *Journal of Property Finance*, **7**(4), 9-29.

Newell, G., Chau, K.W. and Wong, S.K., McKinnell, K. (2007). "Factor Influencing the Performance of Hong Kong Real Estate Companies", *Journal of Real Estate Portfolio Management*, **13**(1), 75-86.

Peng, R.J. and Wheaton, W.C. (1994). "Effects of restrictive land supply on housing in Hong Kong: an econometric analysis", *Journal of Housing Research*, **5**(2), 263-291.

Rating and Valuation Department. *Hong Kong Property Review*. Hong Kong Government Printer.

Rose, L.A. (1989). "Urban land supply: natural and contrived restrictions", *Journal of Urban Economics*, **25**(3), 325-345.

Ross, S.A. and Zisler, R.C. (1991). "Risk and return in real estate", *The Journal of Real Estate Finance and Economics*", **4**(2), 175-190.

Seck, D. (1996). "The substitutability of real estate assets", *Real Estate Economics*, **24** (1), 75-95.

Seiler, M.J., Webb, J.R. and Myer, F.C.N. (2001). "Can private real estate portfolios be rebalanced/diversified using equity REIT Shares?", *Journal of Real Estate Portfolio Management*, **7**(1), 25-41.

The Fraser Institute. (2006). *Economic Freedom of the World: 2006 Annual Report*, Canada.

Treasury Department. *Accounts of the Government*. Hong Kong Government Printer.

Wong, K.C., Chau, K.W. and Ma, S.M. (1999). "The disposal of the Hong Kong land stock under the Sino-British Joint Declaration", *Journal of Property Research*, **16**(4), 323-337.

World Federation of Exchanges, www.world-exchanges.org

Ziering, B., Winograd, B. and McIntosh, W. (1997). *The Evolution of Public and Private Market Investing in the New Real Estate Capital Markets*, New Jersey: Prudential Real Estate Investors.