

The Impact of Real Estate Market Transparency on the Linkages between Indirect and Direct Real Estate

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Chapter One Introduction

Past literature has reflected that international real estate serves as an effective way of risk diversification in both mixed-asset and real-estate-only portfolios. (Giliberto (1990),Giliberto and Testa (1990), Gordon (1991),Liu and Mei (1998), Eichholtz (1996), Eichholtz, Huisman et al. (1998)). Perhaps that is why over the past decades, international real estate attracts more and more attention from various types of investors, such as pension fund, sovereign wealth, high net individuals as well as private equity, especially after the Global Financial Crisis. By the end of December 2012, global real estate securities investment has increased to a market capitalization of 1147 billion US dollars, according to FTSE EPRA/NAREIT Global Real Estate Index Factsheet. Table 1-1 presents the top 20 securitized real estate market around the world.

Table1-1 Top 20 securitized real estate market

Rank	Country	Securitized Real Estate Net Market Capitalization (USD million)	Global Share	Cumulative Share	Developed Country	Emerging Country
1	USA	451744	39.36%	39.36%	√	
2	Hong Kong	118295	10.31%	49.67%	√	
3	Japan	109798	9.57%	59.24%	√	
4	Australia	81725	7.12%	66.36%	√	
5	Canada	54431	4.74%	71.10%	√	
6	UK	52078	4.54%	75.64%	√	
7	Singapore	51884	4.52%	80.16%	√	
8	China	43577	3.80%	83.96%		√
9	France	35512	3.09%	87.05%	√	
10	Brazil	28148	2.45%	89.50%		√
11	South Africa	16670	1.45%	90.95%		√
12	Germany	12250	1.07%	92.02%	√	
13	Switzerland	12065	1.05%	93.07%	√	
14	Sweden	10336	0.90%	93.97%	√	
15	Philippines	8963	0.78%	94.75%		√
16	Indonesia	8276	0.72%	95.47%		√
17	Netherlands	7615	0.66%	96.13%	√	
18	Thailand	6483	0.56%	96.69%		√
19	Malaysia	4562	0.40%	97.09%		√
20	Russia	4545	0.40%	97.49%		√

Sources: FTSE/EPRA NAREIT Global Real Estate Index

It is worth to notice that among the top 20 securitized real estate market, eight countries are classified as emerging countries(China(No.8), Brazil(No.10), South Africa(No.11), Philippines(No.15), Indonesia(No.16), Thailand(No.18), Malaysia(No.19), Russia(No.20)). This reflects the trend that global investors are having a strong appetite to invest the capitals in new emerging markets for abnormal returns.

Traditionally, global investors enjoy using indirect real estate securities to get exposure to direct real estate with the extra benefits of low initial capital requirement, high liquidity as well as low transaction cost. The notion behind the substitution strategy is that market price for a stock essentially reflect the market value of the underlying assets (Martin and Cook (1991)). However, academic researches question the substitution performance. For example, Eichholtz (1996)pointed out that the return on real estate securities are combination functions of the returns of the stock markets and of those on the direct real estate markets. Seck (1996)examined the information sets for direct and indirect real estate and found low similarity between these two information sets, indicating that these two assets are not perfectly substitutable. This urges the academic and industry practitioners to investigate the dynamics between indirect and direct real estate and vast literature has focused on this area. Generally, the past literature indicated a low contemporaneous correlation between indirect real estate and direct real estate, but a strong correlation between lagged indirect real estate and direct real estate. However, the lag periods vary indifferent countries and through different periods.

This attracts me to investigate what factors will affect the linkages. One possible reason is the level of real estate market transparency. Transparency helps to link dispersed markets and improve the price discovery mechanism between indirect and direct real estate. As the increased transparency reduces the risk premium demanded by investors to compensate for asymmetric information, it encourages more investors to join in the market. With greater participation, the market liquidity in turns increases and stimulates more traded in the market, which helps enhance the market efficiency. In a fully efficient market, the securities price should reflect the underlying assets completely and instantly. However, in reality, not all information is disclosed to all market participants and the information asymmetry problem cause noise trading, which deviate the securities price with the underlying asset values. As the market transparency enhances the market efficiency by eliminating the information asymmetry problems, it reduces the fraction of noise traders and increases that of rational traders, resulting in a stronger linkage between indirect and direct real estate markets.

Based on the above assumption, the hypothesis of this thesis is as follows:

The real estate market transparency has positive impact on the linkages between indirect and direct real estate.

The remainder of the paper is structured as follows. Chapter Two will provide relevant literature addressed on two key themes of this paper. Chapter Three will summarize the methodology.

Data is discussed in Chapter Four. Empirical Results will be provided in Chapter Five while Chapter Six provides a conclusion and discussion of limitation.

Chapter Two Literature Review

This chapter first discusses two key themes that significantly related to this paper: linkages between indirect and direct real estate as well as real estate market transparency. The following hypothesis will be developed based on the past literature.

Linkages between indirect and direct real estate

Vast literature has accumulated the knowledge on the linkages between indirect and direct real estate. Giliberto (1990) indicated that there was a link between equity REIT and direct real estate after controlling for financial market effects and lagged values of equity REITs residuals could explain the direct real estate residuals. The results implied that there were common factors that only influence in both these two markets but not shared by other financial assets. Gyourko and Keim (1992, 1993) showed that the lagged equity REITs return could predict the Russell-NCREIF direct real estate returns in United States. The predictive power remained even after controlling for persistence in the appraisal series. The results showed that indirect real estate returns contain economically important and timely information about the changing real estate market fundamentals. Myer and Webb (1993, 1994) extended the result of Giliberto and found that REITs returns were much more strongly related to direct real estate returns compared to stocks or close-end funds. In addition, they found equity REITs index returns were Granger cause of the direct commercial real estate returns. Barkham and Geltner (1995) conducted a research in United States and United Kingdom and found the prices were lags of up to one year in United Kingdom and up to two years in United States after correcting for appraisal smoothing in the direct real estate series as well as accounting for leveraging in the real estate companies series. Acton and Poutasse (1997) reexamined the correlation between public and private real estate and found the correlation became much stronger after removing the stock market effect on the REITs return. Similar results were found in Brounen and Eichholtz (2003)'s research. Pagliari, Scherer et al. (2005) claimed that the difference of returns and risk between the indirect and direct real estate return has substantially narrowed during 1993 to 2001 and suggested a synchronicity between these two markets.

Similar studies are conducted in Asia Pacific market as well (Ong (1995), Fu (1994), Cheung, Tsang et al. (1995), Newell and MacFarlane (1995), Newell and Chau (1996)). Ong (1995) conducted a co-integration test to investigate the relationships between real estate stocks and direct real estate in Singapore. Despite failing to find any evidence of a long-term contemporaneous relationship, Ong (1995) found evidence that real estate stocks led the direct real estate marker by one quarter. Liow (1996) investigated the lead/lag relationship between indirect and direct real estate on the property type level and he found evidence that the change in

real estate companies rating led the direct real estate returns up to six months among different property types. The result was similar to Ong(1995)'s. Liow (1998) also studied the commercial real estate and found the indirect real estate market and commercial real estate market were segmented, nevertheless, the long performance of indirect real estate were linked to commercial real estate market and the former led the latter one by a quarter. Newell and MacFarlane (1995)indicated that Listed Property Trust (LPT) led direct real estate market by one to two years. Newell and Chau (1996)found the price of indirect real estate lead direct real estate by a shorter lag of one quarter in Hong Kong. They claimed that the shorter information transmission time was strong evidence of structural and informational efficiency of Hong Kong property markets. Newell, Chau et al. (2005)also examined the indirect-direct real estate linkages in Mainland of China and concluded that unlike other developed Asia market such as Hong Kong and Singapore, there was no evidence of Granger causality between the Chinese real estate companies and the Chinese office markets, indicating weak linkages between these two markets.

In general, the indirect real estate market and direct real estate show a long-term relationship to some extent after adjusting for property type composition, leverage and appraisal smoothing. The difference in trading mechanism causes significant short-term variation in market performance between these markets (Brounen, Veld et al. (2007)). However, whether other factors that weaken the contemporaneous correlation exist remain unknown. In addition, the past real estate literature often adopt the Granger Causality test to investigate the indirect-direct real estate linkages on the first moment of returns. However, due to the low frequency of data, the lead/lag relationship cannot precisely quantify and describe the linkages, let alone conducting comparisons between different countries. To better understanding the dynamics between indirect and direct real estate, this paper will adopt new approaches to quantify the linkages. In addition, this paper extends the relationship examination to the second moment of volatility to see whether the indirect-direct real estate linkages differentiate in the long run.

Real estate market transparency

Another theme of this thesis focuses on the real estate market transparency. Though the term transparency has been often used, the definition has not been clearly defined in the real estate literature. For the equity market, O'hara (1995) refers transparency as “the ability of market participants to observe the information in the trading process”. SEC (2000) defined it as “the extent to which trading information is made publicly available promptly after either the entry of a quotation or completion of a transaction”. While the trading mechanism may be different in different markets, one thing in common is that the transparency is strongly related to formation. In this thesis, I adopted Schulte, Rottke et al. (2005)'s definition and regarded transparency as information equivalency, in which the extent that real estate provide information for all market participants and therefore minimize the information advantages of other market participants. A transparent real estate market should have a clear market mechanism that shows how variables

work behind the mechanism. Information should be available in time and transmit smoothly in rental market, investment market, property and construction market as well as the capital market.

Despite of fruitful literature discussing on the advantages and disadvantages of equity market transparency, very little study shed light on the real estate transparency market. Besides the investigation of transparency in real estate regarding to real estate investment (Eichholtz, Gugler et al. (2011)), REITs (Capozza and Seguin (1999)) private equity funds (Linneman (2002)) and European non-listed real estate funds market(Brounen, Veld et al. (2007)), a series of literature addresses on the local real estate market transparency examination. Schulte, Rottke et al. (2005) examined the recent state of German real estate market in four aspects. They claimed that the level of real estate transparency significantly improved in the above areas compared to the beginning of the 1990s but still lag behind United States and United Kingdom.

Razali and Adnan (2012) investigated the Malaysia real estate companies transparency using the customized transparency matrix and claimed the companies were within a good level ranges of transparency. However, no correlation relationship between real estate companies ranking and transparency index ranking was found.

Another main stream will investigate whether information transparency have a positive impact on the listed real estate companies performance. Brounen, Schweitzer et al. (2001) tested whether information transparency improve real estate company stock performance and found a positive and statistically significant correlation between the transparency scores and the Jensen's alpha (proxy of the companies' risk-adjusted outperformance). Based on the research of Brounen, Schweitzer et al. (2001), Newell, Liow et al. (2005) enhanced the information transparency score methodology to assess the level of information transparency and conducted similar research in Asia. Their empirical results showed a positive correlation between information transparency and the company out-performance. However, the correlations became insignificant after accounting for market capitalization, which is contrast to Brounen, Schweitzer et al. (2001)'s European study.

While past literature has demonstrated that real estate market transparency has a positive impact on the real estate investment performance, there is no empirical evidence to examine whether real estate market transparency will help eliminate the discrepancy between indirect and direct real estate. It is generally believed that in a real estate market with higher level of transparency, more information is available and accessible to all market participants. The enhanced information should help assist market participants to price their indirect real estate securities more rationally based on the underlying real estate asset values. Another benefit of transparency is that the time required for information transmitted among different markets will be shorter with a higher level of market transparency. These two advantages will finally cloud a stronger linkage between indirect and direct real estate.

Chapter Three Methodology

Style analysis approach (Sharpe (1992)) will be used to examine the first-moment linkage between indirect and direct real estate. The style analysis model is similar to the multi-factor model, but some additional constraints are imposed to allow additional interpretation and make it realistic in the investment market. To investigate the first moment linkage between indirect and direct real estate, This thesis construct an implied investment portfolio that decompose the indirect real estate returns into direct real estate return, stock return and cash return. That's because indirect real estate have real estate characteristic since the underlying assets are direct real estate, stock-like characteristics since they are securities and cash features as real estate operating companies generate a fix income from the generally long term lease. The baseline model can be written as:

$$R_{IDE} = \beta_1 R_{DRE} + \beta_2 R_{STOCK} + \beta_3 R_{CASH} + \varepsilon \quad (3-1)$$

Where the subscripts used above are:

R_{IDE} : return on indirect real estate securities sector

R_{DRE} : return on direct real estate securities sector

R_{STOCK} : return on stock sector

R_{CASH} : return on cash

β_i : coefficient that represents financial or stock market factors weighting in the implied asset allocation portfolio

ε : residual component

To meet the investment reality, I impose some constraints on the Equation 3-1:

$$\beta_1 + \beta_2 + \beta_3 = 100\% \quad (3-2)$$

$$\beta_1 \geq 0 \quad (3-3)$$

$$\beta_2 \geq 0 \quad (3-4)$$

Equation 3-2 guarantees that the weights in the implied portfolio sum to 100%. Equation 3-3 and 3-4 indicates that no short sale of direct real estate and stock is allowed due to reality. The reason why β_3 is not subjected to the same constraint is that a negative result represents the situation that real estate operating companies take the leverage strategies. By releasing the constraint, leverage is shown as a negative coefficient in the implied portfolio. This approach is also adopted by Chau, Wong et al. (2003) and Chau, McKinnell et al. (2010).

Specifically, β_1 in Equation 4-1 represents the weight of direct real estate exposed in the implied portfolio constructed to decompose the indirect real estate returns, which can be regarded as the linkage between indirect and direct real estate on the first moment of linkage.

Variance decomposition approach (Clayton and MacKinnon (2003)) will be used to examine the second-moment linkage between indirect and direct real estate. First, a multifactor model to decompose the returns of indirect real estate into different asset factors will be adopted. A based multifactor model is as follows:

$$R_{IDE} = \beta_0 + \beta_1 R_{DRE} + \beta_2 R_{STOCK} + \beta_3 R_{CASH} + \varepsilon \quad (3-5)$$

where the subscripts used are:

R_{IDE} : return on indirect real estate securities sector

R_{DRE} : return on direct real estate sector

R_{STOCK} : return on stock sector

R_{CASH} : return on cash

β_0 : the idiosyncratic factors

β_1 : coefficient that represents financial or stock market factors weighting in the multifactor model

ε : residual component

Equation 3-5 cannot be used directly as, to some extent; the financial sectors in the right-hand side of the equation may suffer from some common underlying drivers or macroeconomic factors. Under this circumstance, there is a possibility of high degree of correlation among the above explanatory sectors in the base model. The high correlation will result in the multicollinearity problem and make it difficult to use standard linear regression to assess the separate contribution of individual asset class accurately because common drivers between these three factors would be accounted for more than once. To solve this problem, a “pure factor” approach is adopted to meet the requirement of uncorrelated financial sectors in Equation 3-5. Instead of using the returns of each financial class directly, I first orthogonalize the variables on the right hand side in Equation 3-5 using stock as the numeraire. The regression is as follows:

$$R_{DRE} = \delta + \eta R_{STOCK} + \varphi R_{CASH} + \varepsilon_t \quad (3-6)$$

$$R_{CASH} = \xi + \lambda R_{STOCK} + \gamma R_{\varepsilon_t} + \omega_t \quad (3-7)$$

Where ε and ω are mean zero term that, by construction, are orthogonal to the stock regressor in respective equations. Direct real estate returns are first orthogonalized in Equation 3-6, and after that, the residuals from the OLS estimation of Equation 3-6 will be included on the right-hand side of Equation 3-7. The residuals of Equation 3-6 and Equation 3-7 are respectively used as

proxy of “pure” direct real estate factor and “pure” cash factor, which are uncorrelated with the stock asset return. By replacing the direct real estate and cash returns with their respective orthogonalized error terms in Equation 3-5, this thesis yields the indirect real estate generating process based on uncorrelated stock, cash and indirect real estate as the following Equation 3-8:

$$R_{IDE} = \beta_0 + \beta_1 \hat{\varepsilon}_t + \beta_2 R_{STOCK} + \beta_3 \hat{\omega}_t + v_t \quad (3-8)$$

After the orthogonalization and the decomposition using the multifactor model, the total volatility of indirect real estate returns would be broken down into the relative components of stock, “pure” direct real estate and “pure” cash as Equation 3-9:

$$Var[R_{IDE}] = \sigma^2 R_{IDE} = \beta_1^2 \sigma^2 \varepsilon_t + \beta_2^2 \sigma^2 R_{STOCK} + \beta_3^2 \sigma^2 \omega_t + \sigma^2 v_t \quad (3-9)$$

From Equation 3-9, the contribution of each asset factors to indirect real estate volatility can be inferred by calculating the respective proportion of indirect real estate variance as the following Equation 3-10 to Equation 3-13:

$$\text{Directreal estate} = \beta_1^2 * \frac{\sigma^2 \varepsilon_t}{\sigma^2 R_{IDE}} \quad (3-10)$$

$$\text{Stock} = \beta_2^2 * \frac{\sigma^2 R_{STOCK}}{\sigma^2 R_{IDE}} \quad (3-11)$$

$$\text{Cash} = \beta_3^2 * \frac{\sigma^2 \omega_t}{\sigma^2 R_{IDE}} \quad (3-12)$$

$$\text{Idiosyncratic factors} = \frac{\sigma^2 v_t}{\sigma^2 R_{IDE}} \quad (3-13)$$

The result of Equation 3-10 represents the second moment volatility linkage between direct and indirect real estate.

One potential problem of the “pure factor” approach is the possibility of “overpurging” in the first stage regression. For instance, when stock is taken as the numeraire in the first stage orthogonalization, the common factors shared by these three factors will be entirely ascribed to stock factor, “overpurging” the stock’s contribution to the indirect real estate volatility. To overcome this potential problem, stock, direct real estate and cash will used respectively as the numeraire for the first stage orthogonalization to create an upper and lower bound of the contribution of direct real estate in explaining the indirect real estate volatility.

As state before, real estate market transparency is an abstract concept and, unlike the GDP, hard to quantify. Fortunately, Jones Lang LaSalle launches Global Transparency Index (GRETI) to solve the quantification issue, with further discussion in the next chapter. The correlation analysis will be conducted on two steps. A correlation analysis between the overall real estate market transparency scores and the first and second moment indirect-direct real estate linkages will be first conducted to test the hypothesis. After that, this paper decomposes the overall

transparency into five aspects and reexamines the correlation to further understand the impact of transparency.

Chapter Four Data

Due to the availability of the data, sixteen countries are involved in the empirical studies: Australia, Austria, Canada, Finland, France, Germany, Hong Kong, Italy, Japan, Netherlands, Norway, Singapore, Sweden, Switzerland, United Kingdom (UK) and United States (US). Quarterly data from 1998Q1 to 2012Q2 of indirect real estate, direct real estate, stock and cash will be employed in this paper. All data are obtained from Datastream.

S&P Property indices are used as the measurement of indirect real estate. In the past literature, REITs in United States is often regarded as the indirect real estate asset class due to data solidity. However, Muhlhofer (2012) claimed that due to the dealer rule¹, the REITs can only reflect the income component of direct real estate return and cannot reflect the appreciation part, which was possibly a reason why there existed short-term disparity between direct and indirect real estate. As dealer rule is not applicable to the real estate operating companies, the property indices should be able to reflect both income and appreciation component of direct real estate return, which is confirmed in his research. In addition, as some countries have relatively weak markets of REITs or REITs-like investment tools, it will be more consistent to use real estate companies' securities for the second stage examination. The S&P Property Indices are comprised of the publicly traded real estate companies in the respective country. To be included in the index, companies have to get involved in a wide range of real estate related activities, such as property management, development, rental, and investment².

House Price Indices provided by Oxford Economics are used to measure the direct real estate performance. A consistent direct real estate performance measurement will be helpful to omit the unnecessary bias, which is beneficial to the second stage country linkages comparison.

Local dominant stock price indices are adopted as the performance proxy of stock markets. Table 4-1 provides a brief description of the stock price indices used in the empirical study.

¹In order to retain a tax-free status, a REIT has to hold each property in the portfolio for four years. In addition, the regulations only allow the REITs to sell 10% of the asset base at a time. More details are provided in Muhlhofer(2011)

²More details can be obtained from *S&P Dow Jones Indices: S&P Property Indices Methodology*: <http://www.standardandpoors.com>

Table 4-1: Stock sector indicators used in the empirical studies

Countries	Stock sector indicator	Description
Australia	All Ordinaries Index (AOI)	A market capitalization-weighted index, comprised of the largest 500 securities listed on Australia Stock Exchange
Austria	Austrian Trade Index(ATI)	A market capitalization-weighted index, comprised of the most heavily traded 20 securities listed on Vienna Stock Exchange
Canada	S&P/TSX Composite Index	A market capitalization-weighted index, which has approximately 95% coverage of the Canadian equity market
Finland	OMX Helsinki 25 Index(OMXH25)	A modified market capitalization-weighted index , comprised of the most heavily traded 25 securities listed on Helsinki Stock Exchange
France	CAC 40 Index	A market capitalization-weighted index, comprised of 40 most significantly value securities in Euronext Paris
Germany	DAX 30Performance Index	A total return index, comprised of 30 majored German blue chip companies listed on Frankfurt Stock Exchange
Hong Kong	HANG SENG Index(HSI)	A free-floated market capitalization-weighted index, comprised of 48 largest securities listed on Hong Kong Stock Exchange
Italy	FTSE MIB Index	A market capitalization-weighted index, comprised of 40 highly liquid and leading securities listed on BorsaItaliana, representing approximately 80% of domestic market capitalization
Japan	NIKKEI Stock Average Price Index(NIKKEI 225)	An adjusted price index, comprised of 225 stocks listed on the first section of Tokyo Stock Exchange.
Netherlands	AEX Index(AEX)	a free-float adjusted market capitalization-weighted index, comprised of up to 25 leading Dutch securities traded in Euronext Amsterdam
Norway	Oslo Stock Exchange OBX Price Index(OBXP)	A market capitalization-weighted index, comprised of the largest companies traded on Oslo Stock Exchange
Singapore	Straits Times Index(STI)	A market capitalization-weighted index, comprised of the top 30 securities listed on Singapore Exchange
Sweden	OMX Stockholm 30 Index(OMXS30)	A market value-weighted index, comprised of 30 most actively traded securities listed on Stockholm Exchange
Switzerland	Swiss Market Index(SMI)	A market capitalization-weighted index, comprised of 20 largest and most liquid blue-chip equities of Swiss Performance Index (SPI),representing approximately 85% of free-float capitalization of Swiss equity market
UK	FTSE 100 Index	A market capitalization-weighted index, comprised of 100 largest blue-chip companies listed on London Stock Exchange, representing 84.35% of capitalization of UK stock market
US	S&P 500 Composite Index	A free-floated market capitalization-weighted index, comprised of 500 leading companies listed in US stock market, providing 75% coverage of the US equity market

As the trading of bond market is relatively immature and thin in some countries, to make the country-level linkages comparable among 16 countries, three-month interbank offered rates are

used instead as the indicators of returns in cash sector, due to the consistency of the quarter analysis. Table 4-2 provides a brief summary of interbank offered rate used in the empirical studies.

Table 4-2: Cash sector indicators used in the empirical studies

Countries	Cash sector indicators	Sources
Australia	Australia three-month Interbank Rate	Reserve Bank of Australia
Austria	Three-month VIBOR(Vienna Interbank Offer Rate)	OECD
Canada	Canada three-month Interbank Rate	OECD
Finland	Three-month HELIBOR(Helsinki Interbank Offered Rate)	OECD
France	Three-month PIBOR(Paris Interbank Offered Rate)	OECD
Germany	Three-month FIBOR(Frankfurt Interbank Offered Rate)	OECD
Hong Kong	Three-month HIBOR(Hong Kong Interbank Offered Rate)	Hong Kong Monetary Authority
Italy	Italy three-month Interbank Rate on Deposits	OECD
Japan	Japan three-month Interbank Rate	British Bankers' Association
Netherlands	Three-month AIBOR(Amsterdam Interbank Offered Rate)	OECD
Norway	Three-month NIBOR(Norway Interbank Offered Rate)	OECD
Singapore	Singapore three-month Interbank Rate	Singapore Monetary Authority
Sweden	Sweden three-month Interbank Rate	SverigesRiksbank
Switzerland	Three-month Swiss Franc (CHF) LIBOR	OECD
UK	Three-month LIBOR(London Interbank Offered Rate)	Financial Times
US	United States three-month Interbank Rate	OECD

Note: OECD is short of Organization for Economic Co-operation and Development

This thesis follows the past literature (Newell, Liow et al. (2005), Eichholtz, Gugler et al. (2011)) and adopts the Jones Lang LaSalle Global Real Estate Index(GRETI) to quantify and measure the local real estate market transparency. The GREIT consists of 83 separate factors to determine the relative real estate transparency around the world based on a combination of quantitative market data and qualitative survey in 13 topic areas for each country. For each factor, a score will be given on a continuous scale from 1.00 highly transparency to 5.00 opaque. After that, a composite score will be given according to the weights of each topic, with the same score scaling as 1.00 highly transparency to 5.00 opaque. In addition, Jones Lang LaSalle groups the 13 topics into five broad sub-indices, enriching our understanding of the real estate market transparency performance. Table 4-3 gives a description of those five broad sub-indices.

Table 4-3: Description of five broad sub-indices of Jones Lang LaSalle Global Transparency Index

Sub-indices	Topics	Examples
Performance Measurement	Direct Property Indices	♦ Market coverage of direct property index
	Listed Real Estate Securities Indices	♦ Value of public real estate companies as percentage of GDP
	Unlisted Fund Indices	♦ Existence and quality of unlisted fund indices
	Valuation	♦ Frequency of third party real estate appraisals
Market Fundamentals	Market Fundamentals Data	♦ Existence of comprehensive database
Governance of Listed Vehicles	Financial Disclosure	♦ Availability of financial reports in English
	Corporate Governance	♦ Manager compensation and role of outside directors
Regulatory and Legal	Regulation	♦ Level of contract enforceability
	Land and Property Registration	♦ Completeness and availability of title records
	Eminent Domain	♦ Fairness of eminent domain property acquisition
	Debt Regulation	♦ Quality and stringency of bank regulator oversight of real estate leading
Transaction Process	Sales Transaction	♦ Availability and quality of pre-sale information
	Occupier Services	♦ Clarity and Alignment of Interests in Facilities Management Contracts

Sources: Jones Lang LaSalle Real Estate Transparency Back on Track

Descriptive statistics of the returns on indirect real estate, stock, direct real estate and cash for the sixteen countries from 1998Q1 to 2012Q2 are displayed in Table 4-4. The mean indirect real estate return varies from -3.26% (Norway) to 2.77% (Sweden). Austria, Norway and UK experience a negative return respectively of -0.36%, -3.26% and -0.17%. For the direct real estate sector, only Italy (-0.92%), Japan (-0.97%) and Netherlands (-0.53%) experience a negative return these years, while other countries have a positive return from 0.16% to 1.83%. Among the best performing stock markets are Norway (1.93%), UK (1.75%), Sweden (1.67%), France (1.59%) and Finland (1.38%). Nine out of sixteen countries show higher mean returns on indirect real estate than those on stock (Canada, France, Germany, Hong Kong, Italy, Japan, Singapore, Sweden and Switzerland). Interestingly, returns on indirect real estate and direct real estate show a much higher standard deviation compared to those on stock and cash.

Table 4-4: Summary statistics for indirect real estate, stock, direct real estate and cash returns in 16 countries

Country	Asset Class	Mean	Median	Maximum	Minimum	Std. Dev.
Australia	<i>Indirect Real Estate</i>	0.11%	1.42%	34.53%	-54.40%	13.71%
	<i>Stock</i>	0.92%	2.24%	16.47%	-35.07%	7.85%
	<i>Direct Real Estate</i>	1.83%	1.94%	5.88%	-2.65%	2.14%
	<i>Cash</i>	5.26%	4.98%	8.02%	3.35%	0.97%

Austria	<i>Indirect Real Estate</i>	-0.36%	1.15%	62.42%	-92.64%	22.58%
	<i>Stock</i>	0.65%	0.34%	8.20%	-11.48%	3.71%
	<i>Direct Real Estate</i>	0.62%	4.56%	25.21%	-43.18%	13.82%
	<i>Cash</i>	2.83%	2.80%	5.02%	0.66%	1.30%
Canada	<i>Indirect Real Estate</i>	1.57%	3.32%	28.92%	-58.38%	12.55%
	<i>Stock</i>	0.97%	0.97%	3.58%	-1.68%	0.93%
	<i>Direct Real Estate</i>	1.01%	2.29%	15.60%	-33.10%	8.78%
	<i>Cash</i>	3.15%	2.95%	5.87%	0.38%	1.63%
Finland	<i>Indirect Real Estate</i>	0.44%	1.58%	41.87%	-37.43%	17.48%
	<i>Stock</i>	1.38%	1.45%	6.76%	-4.20%	2.24%
	<i>Direct Real Estate</i>	0.47%	2.06%	46.14%	-27.48%	13.54%
	<i>Cash</i>	2.80%	2.69%	5.02%	0.66%	1.31%
France	<i>Indirect Real Estate</i>	2.65%	2.45%	36.03%	-31.83%	13.41%
	<i>Stock</i>	1.59%	1.88%	5.10%	-4.45%	2.04%
	<i>Direct Real Estate</i>	0.20%	2.71%	31.67%	-36.30%	12.56%
	<i>Cash</i>	2.82%	2.80%	5.02%	0.66%	1.30%
Germany	<i>Indirect Real Estate</i>	0.53%	1.59%	44.33%	-36.54%	16.29%
	<i>Stock</i>	0.11%	0.15%	3.99%	-2.52%	1.28%
	<i>Direct Real Estate</i>	0.71%	4.08%	30.09%	-45.91%	14.66%
	<i>Cash</i>	2.82%	2.80%	5.02%	0.66%	1.30%
Hong Kong	<i>Indirect Real Estate</i>	0.84%	0.63%	46.50%	-44.87%	17.16%
	<i>Stock</i>	0.35%	0.43%	13.40%	-18.55%	6.21%
	<i>Direct Real Estate</i>	1.18%	2.14%	33.82%	-48.69%	14.26%
	<i>Cash</i>	2.80%	2.17%	9.50%	0.07%	2.40%
Italy	<i>Indirect Real Estate</i>	2.28%	-0.04%	232.48%	-67.41%	37.53%
	<i>Stock</i>	1.10%	1.48%	2.68%	-1.28%	1.20%
	<i>Direct Real Estate</i>	-0.92%	-0.06%	34.76%	-30.80%	12.93%
	<i>Cash</i>	2.92%	2.80%	5.95%	0.66%	1.41%
Japan	<i>Indirect Real Estate</i>	0.97%	-0.54%	33.68%	-36.01%	15.44%
	<i>Stock</i>	-0.12%	0.13%	12.01%	-11.70%	4.03%
	<i>Direct Real Estate</i>	-0.97%	-0.55%	18.27%	-25.58%	10.95%
	<i>Cash</i>	0.31%	0.20%	0.96%	0.05%	0.29%
Netherlands	<i>Indirect Real Estate</i>	0.35%	-1.05%	31.20%	-34.28%	12.76%
	<i>Stock</i>	1.14%	1.08%	5.29%	-2.27%	1.68%
	<i>Direct Real Estate</i>	-0.53%	2.76%	33.51%	-38.19%	13.65%
	<i>Cash</i>	2.82%	2.80%	5.02%	0.66%	1.29%
Norway	<i>Indirect Real Estate</i>	-3.26%	0.09%	64.07%	-101.19%	25.72%
	<i>Stock</i>	1.93%	2.17%	7.70%	-7.27%	2.96%
	<i>Direct Real Estate</i>	0.99%	4.85%	21.27%	-47.48%	14.79%
	<i>Cash</i>	4.47%	4.06%	8.04%	1.89%	2.05%
Singapore	<i>Indirect Real Estate</i>	1.20%	1.66%	66.96%	-55.01%	21.35%
	<i>Stock</i>	0.54%	0.48%	14.63%	-15.16%	5.35%
	<i>Direct Real Estate</i>	1.02%	1.89%	33.88%	-41.75%	12.51%

Sweden	<i>Cash</i>	1.76%	1.44%	6.25%	0.25%	1.26%
	<i>Indirect Real Estate</i>	2.77%	4.00%	39.28%	-29.29%	14.87%
	<i>Stock</i>	1.67%	1.76%	5.24%	-3.67%	1.84%
	<i>Direct Real Estate</i>	0.87%	4.68%	37.23%	-34.81%	13.62%
Switzerland	<i>Cash</i>	3.03%	3.02%	5.48%	0.48%	1.25%
	<i>Indirect Real Estate</i>	2.75%	2.79%	25.33%	-15.87%	8.52%
	<i>Stock</i>	0.63%	0.60%	2.32%	-0.91%	0.75%
	<i>Direct Real Estate</i>	0.16%	3.09%	26.64%	-38.20%	10.76%
UK	<i>Cash</i>	1.32%	1.12%	3.50%	0.05%	1.08%
	<i>Indirect Real Estate</i>	-0.17%	1.67%	27.64%	-63.98%	15.77%
	<i>Stock</i>	1.75%	1.94%	6.63%	-4.29%	2.23%
	<i>Direct Real Estate</i>	0.29%	1.17%	11.98%	-21.22%	7.03%
US	<i>Cash</i>	4.17%	4.61%	7.60%	0.63%	2.05%
	<i>Indirect Real Estate</i>	0.72%	2.61%	28.43%	-51.96%	12.71%
	<i>Stock</i>	0.75%	1.51%	2.59%	-2.89%	1.53%
	<i>Direct Real Estate</i>	0.58%	1.56%	18.95%	-25.56%	9.47%
	<i>Cash</i>	3.01%	2.80%	6.63%	0.21%	2.18%

Inter-asset correlation matrices of asset class used in the empirical studies are presented in Table 4-5. Eleven out of sixteen countries show a positive correlation between indirect and direct real estate from 4.22%(Japan) to 39.48%(Australia), with six countries show a significant correlation(Australia, Canada, Finland, Hong Kong, Norway, UK). Surprisingly, five countries show an insignificant negative correlation (Austria (-4.78%), Germany (-9.45%), Netherlands (-3.68%), Sweden (-4.21%), Switzerland (-6.35%)). Another thing worth to point out is that direct real estate, stock and cash, which are the three asset classes in right side of the Equation 3-6, do show a certain extent of inter-asset correlation. The statistics results reaffirm the necessity of “pure factor” approach to avoid the bias caused by multicollinearity problem in the multifactor models. Surprisingly, there are some inter-asset correlation results out of expectation: Four countries show negative correlations between stock and direct real estate sector (Austria, Germany, Japan and Switzerland), though the correlation is small and insignificant. In addition, six countries show positive correlations between cash and direct real estate sectors (Canada, Italy, Netherlands, Sweden, UK and US).

Table 4-5: Inter-asset correlation matrices of indirect real estate, stock, direct real estate and cash returns in 16 countries

	Indirect Real Estate	Direct Real Estate	Stock	Cash
Australia				
Indirect Real Estate	100.00%			
Direct Real Estate	39.48% ^{***}	100.00%		
Stock	67.32% ^{***}	33.32% ^{**}	100.00%	
Cash	-26.43% ^{**}	-21.98% [*]	-7.09%	100.00%

Austria				
Indirect Real Estate	100.00%			
Direct Real Estate	-4.78%	100.00%		
Stock	23.56%*	-2.12%	100.00%	
Cash	-34.02%***	-4.26%	-20.40%	100.00%
Canada				
Indirect Real Estate	100.00%			
Direct Real Estate	26.22%**	100.00%		
Stock	53.57%***	23.91%*	100.00%	
Cash	-21.90%*	14.85%	-0.50%	100.00%
Finland				
Indirect Real Estate	100.00%			
Direct Real Estate	38.24%***	100.00%		
Stock	37.73%***	61.74%***	100.00%	
Cash	-23.55%*	-11.16%	-31.04%**	100.00%
France				
Indirect Real Estate	100.00%			
Direct Real Estate	21.73%	100.00%		
Stock	0.61%	28.71%**	100.00%	
Cash	-22.21%*	-3.10%	-16.50%	100.00%
Germany				
Indirect Real Estate	100.00%			
Direct Real Estate	-9.45%	100.00%		
Stock	44.79%***	-8.83%	100.00%	
Cash	-35.10%***	-13.82%	-23.28%*	100.00%
Hong Kong				
Indirect Real Estate	100.00%			
Direct Real Estate	26.37%**	100.00%		
Stock	45.00%***	44.95%***	100.00%	
Cash	-13.42%	-54.55%***	5.54%	100.00%
Italy				
Indirect Real Estate	100.00%			
Direct Real Estate	11.97%	100.00%		
Stock	35.17%***	10.71%	100.00%	
Cash	8.15%	37.22%***	-9.47%	100.00%
Japan				
Indirect Real Estate	100.00%			
Direct Real Estate	4.22%	100.00%		
Stock	27.36%**	-0.20%	100.00%	
Cash	-31.79%**	-6.41%	-32.35%***	100.00%
Netherlands				
Indirect Real Estate	100.00%			

Direct Real Estate	-3.68%	100.00%		
Stock	7.05%	18.97%	100.00%	
Cash	-13.23%	56.52% ^{***}	-16.16%	100.00%
Norway				
Indirect Real Estate	100.00%			
Direct Real Estate	29.96% ^{**}	100.00%		
Stock	27.01% ^{**}	50.11% ^{***}	100.00%	
Cash	-23.13% [*]	-23.01% [*]	-36.66% ^{***}	100.00%
Singapore				
Indirect Real Estate	100.00%			
Direct Real Estate	20.00%	100.00%		
Stock	76.53% ^{***}	39.49% ^{***}	100.00%	
Cash	-16.50%	-20.01%	-15.53%	100.00%
Sweden				
Indirect Real Estate	100.00%			
Direct Real Estate	-4.21%	100.00%		
Stock	8.72%	33.51% ^{**}	100.00%	
Cash	-27.64% ^{**}	6.77%	-27.14% ^{**}	100.00%
Switzerland				
Indirect Real Estate	100.00%			
Direct Real Estate	-6.35%	100.00%		
Stock	7.22%	-7.36%	100.00%	
Cash	-21.06%	-16.08%	-6.19%	100.00%
UK				
Indirect Real Estate	100.00%			
Direct Real Estate	33.08% ^{**}	100.00%		
Stock	50.16% ^{***}	22.67% [*]	100.00%	
Cash	-14.79%	27.21% ^{**}	-6.97%	100.00%
US				
Indirect Real Estate	100.00%			
Direct Real Estate	17.89%	100.00%		
Stock	62.08% ^{***}	10.99%	100.00%	
Cash	-16.08%	21.62%	-6.01%	100.00%
Note: [*] Statistical significance at the 10% level				
^{**} Statistical significance at the 5% level				
^{***} Statistical significance at the 1% level				

Chapter Five Empirical Results

Table 5-1 shows the result of mean implied asset portfolios of indirect real estate for sixteen countries using the style analysis approach. Besides Singapore and Italy, the other fourteen countries show positive weightings of direct real estate in the implied asset portfolios for the

indirect real estate from 19.6% to 232.8%, indicating that indirect real estate does provide substitution for direct real estate. All countries except France show positive weightings in stock from 6.03% to 130.42%. Despite four countries(Hong Kong, Italy , Japan and Switzerland), twelve countries show negative weightings in the cash sector, representing the debt financing strategies that real estate operating countries adopt. Finally, ten out of sixteen countries demonstrate higher weights of direct real estate than other two asset sectors, suggesting a strong proportion of direct real estate in explaining indirect real estate and closer linkages between indirect and direct real estate.

Table 5-1: Mean implied asset portfolios of indirect real estate for sixteen countries

Country	Direct real estate	Stock	Cash
Australia	57.57%	105.20%	-62.77%
Austria	85.23%	55.19%	-40.43%
Canada	85.29%	73.10%	-58.38%
Finland	197.31%	24.36%	-121.67%
France	156.06%	0.00%	-56.06%
Germany	73.81%	51.15%	-24.96%
Hong Kong	37.64%	48.92%	13.45%
Italy	0.00%	91.93%	8.07%
Japan	19.60%	38.45%	41.95%
Netherland	105.67%	6.47%	-12.14%
Norway	232.80%	18.18%	-150.98%
Singapore	0.00%	130.42%	-30.42%
Sweden	94.53%	7.35%	-1.88%
Switzerland	66.71%	6.03%	27.25%
UK	118.72%	87.97%	-106.69%
US	66.88%	80.21%	-47.09%

Variance decomposition approach is used to examine the second-moment volatility linkages. To overcome the “overpurging” and “underpurging” problems, three asset classes are used as the numeraires separately to create an upper and lower bound of the contribution of individual asset class in explaining the indirect real estate volatility. Table 5-2 – Table 5-7 shows the variance decomposition results in three different numeraires and Table 5-8 shows a comparison of direct real estate contribution. The difference among the three models confirms the notion that direct real estate, stock and cash do share some common factors. Previously I thought that direct real estate would account for a larger portion of the volatility when it was treated as the numeraire than treated as “pure” residual. However, it is not the case in the empirical results as five out of sixteen countries show a smaller portion when direct real estate is served as numeraire (Austria, France, Germany, Netherland and Switzerland). One possible reason is that the some of the common factors may affect the asset classes with opposite effects. To better depict the volatility linkage between indirect and direct real estate, focus will be shed on the regression model when stock is used as numeraire. This is because despite some common factors shared by direct real estate will be credited to stock sector, the remaining contribution of direct real estate shown in

the model reflects the factors only shared between indirect and direct real estate, which is more accurate to describe the second moment volatility linkages.

Idiosyncratic factors remain the dominant factors as their impacts on the volatility of indirect real estate ranges from 48.04% to 94.33%. The contribution of direct real estate, however, ranges from 0.09% to 7.21%, showing a minor role by direct real estate in contributing the indirect real estate volatility. These results support the previous empirical evidences (Clayton and MacKinnon (2003), Newell and Tan (2005), Hoesli and Serrano (2007)) that a large part of the volatility is left unexplained even if stock, cash and real estate related factors are adopted.

Table 5-2: Pure factor beta coefficients (stock numeraire)

Country	Direct real estate	Stock	Cash	R-squared
Australia	0.96	1.18 ^{***}	-3.08 ^{**}	51.96%
Austria	-0.35	0.38 [*]	-5.31 ^{**}	14.78%
Canada	2.43	0.77 ^{***}	-1.67 [*]	36.38%
Finland	2.04	0.49 ^{***}	-1.75	19.97%
France	1.57 [*]	0.01	-2.35 [*]	10.27%
Germany	-1.28	0.50 ^{***}	-3.28 ^{**}	27.46%
Hong Kong	-0.17	0.54 ^{***}	-1.14	22.98%
Italy	1.41	1.02 ^{***}	3.08	13.87%
Japan	0.10	0.39 ^{**}	-13.81 [*]	13.43%
Netherland	0.30	0.07	-1.23	2.09%
Norway	1.83	0.47 ^{**}	-1.92	12.63%
Singapore	-0.53	1.31 ^{***}	-0.80	60.22%
Sweden	-0.26	0.10	-3.25 ^{**}	7.74%
Switzerland	-1.08	0.06	-1.64	5.67%
UK	2.04 ^{**}	1.12 ^{***}	-0.87	33.65%
US	1.23	0.83 ^{***}	-0.72	42.11%

Note: ^{*} Statistical significance at the 10% level

^{**} Statistical significance at the 5% level

^{***} Statistical significance at the 1% level

Table 5-3: Indirect real estate's variance decomposition (stock numeraire)

Country	Direct real estate	Stock	Cash	Idiosyncratic factors
Australia	1.92%	45.33%	4.72%	48.04%
Austria	0.21%	4.33%	6.65%	88.81%
Canada	3.01%	28.70%	4.68%	63.62%
Finland	4.18%	14.24%	1.55%	80.03%
France	5.24%	0.00%	5.02%	89.73%
Germany	0.96%	20.06%	6.44%	72.54%
Hong Kong	0.19%	20.25%	2.54%	77.02%
Italy	0.17%	12.37%	1.33%	86.13%
Japan	0.07%	7.49%	5.88%	86.57%

Netherland	3.49%	25.25%	3.69%	67.57%
Norway	3.31%	7.29%	2.02%	87.37%
Singapore	1.44%	58.57%	0.22%	39.78%
Sweden	0.09%	0.76%	6.89%	92.26%
Switzerland	0.88%	0.52%	4.26%	94.33%
UK	7.21%	25.16%	1.28%	66.35%
US	2.04%	38.54%	1.53%	57.89%

Table 5-4: Pure factor beta coefficients (direct real estate numeraire)

Country	Direct real estate	Stock	Cash	R-squared
Australia	2.53 ^{***}	1.06 ^{***}	-2.64 [*]	51.96%
Austria	-0.29	0.28	-5.97 ^{***}	14.78%
Canada	3.52 ^{**}	0.70 ^{***}	-2.03 ^{**}	36.39%
Finland	2.99 ^{***}	0.22	-2.60	19.97%
France	1.43 [*]	-0.11	-2.23	10.27%
Germany	-1.21	0.42 ^{***}	-4.67 ^{***}	27.46%
Hong Kong	0.73 ^{**}	0.59 ^{***}	0.10	22.98%
Italy	3.76	1.03 ^{***}	1.14	13.87%
Japan	0.16	0.27	-17.06 ^{**}	13.43%
Netherland	-0.28	0.04	-1.62	2.09%
Norway	2.61 ^{**}	0.20	-2.16	12.63%
Singapore	0.80 ^{**}	1.38 ^{***}	-2.20	60.22%
Sweden	-0.34	0.03	-3.27 ^{**}	7.74%
Switzerland	-0.72	0.04	-1.79 [*]	5.67%
UK	2.34 ^{***}	0.95 ^{***}	-1.98 ^{**}	33.65%
US	1.49 [*]	0.80 ^{***}	-1.22 [*]	42.11%

Note: ^{*} Statistical significance at the 10% level

^{**} Statistical significance at the 5% level

^{***} Statistical significance at the 1% level

Table 5-5: Indirect real estate's variance decomposition (direct real estate numeraire)

Country	Direct real estate	Stock	Cash	Idiosyncratic factors
Australia	15.58%	33.06%	3.31%	48.04%
Austria	0.14%	2.19%	8.82%	88.85%
Canada	6.87%	22.71%	6.80%	63.61%
Finland	14.63%	1.58%	3.76%	80.03%
France	4.72%	0.90%	4.64%	89.73%
Germany	0.89%	13.05%	13.51%	72.54%
Hong Kong	6.95%	16.01%	0.01%	77.02%
Italy	1.43%	12.28%	0.16%	86.13%
Japan	0.18%	3.28%	9.97%	86.57%

Netherland	0.14%	0.13%	1.83%	97.91%
Norway	8.98%	0.87%	2.78%	87.37%
Singapore	4.00%	54.59%	1.63%	39.78%
Sweden	0.18%	0.05%	7.52%	92.26%
Switzerland	0.40%	0.26%	5.00%	94.33%
UK	10.94%	16.59%	6.11%	66.35%
US	3.20%	34.73%	4.18%	57.89%

Table 5-6: Pure factor beta coefficients (cash numeraire)

Country	Direct real estate	Stock	Cash	R-squared
Australia	0.96	1.15 ^{***}	-3.74 ^{***}	51.96%
Austria	-0.35	0.28	-5.92 ^{***}	14.78%
Canada	2.43	0.76 ^{***}	-1.69 ^{**}	36.39%
Finland	2.04	0.43 ^{**}	-3.14 [*]	19.97%
France	1.57 ^{***}	-0.03	-0.03 [*]	10.27%
Germany	-1.28	0.43 ^{***}	-4.42 ^{***}	27.46%
Hong Kong	-0.17	0.55 ^{***}	-0.96	22.98%
Italy	1.41	1.05 ^{***}	2.17	13.87%
Japan	0.10	0.27	-17.14 ^{**}	13.43%
Netherland	0.30	0.05	-1.31	2.09%
Norway	1.83	0.37	-2.91 ^{**}	12.63%
Singapore	-0.53	1.29 ^{**}	-2.79 ^{***}	60.22%
Sweden	-0.26	0.01	0.01 ^{**}	7.74%
Switzerland	-1.08	0.05	-1.67	5.67%
UK	2.04 ^{**}	1.11 ^{***}	-1.14	33.65%
US	1.23	0.82 ^{***}	-0.94	42.11%

Note: ^{*} Statistical significance at the 10% level

^{**} Statistical significance at the 5% level

^{***} Statistical significance at the 1% level

Table 5-7: Indirect real estate's variance decomposition (cash numeraire)

Country	Direct real estate	Stock	Cash	Idiosyncratic factors
Australia	1.92%	43.05%	6.99%	48.04%
Austria	0.33%	2.88%	11.58%	85.22%
Canada	3.01%	28.58%	4.80%	63.61%
Finland	4.18%	10.24%	5.55%	80.03%
France	5.24%	0.10%	0.00%	94.66%
Germany	0.96%	14.18%	12.32%	72.54%
Hong Kong	0.19%	20.99%	1.80%	77.02%
Italy	0.17%	13.04%	0.66%	86.13%
Japan	0.07%	3.26%	10.10%	86.57%

Netherland	0.09%	0.25%	1.75%	97.91%
Norway	3.31%	3.97%	5.35%	87.37%
Singapore	1.44%	56.06%	2.72%	39.78%
Sweden	0.09%	0.02%	0.00%	99.89%
Switzerland	0.88%	0.35%	4.43%	94.33%
UK	7.21%	24.25%	2.19%	66.35%
US	2.04%	37.48%	2.59%	57.89%

Table 5-8: Comparison of variance contribution of direct real estate in indirect real estate

Country	Stock numeraire	Direct real estate numeraire	Cash numeraire
Australia	1.92%	15.58%	1.92%
Austria	0.21%	0.14%	0.33%
Canada	3.01%	6.87%	3.01%
Finland	4.18%	14.63%	4.18%
France	5.24%	4.72%	5.24%
Germany	0.96%	0.89%	0.96%
Hong Kong	0.19%	6.95%	0.19%
Italy	0.17%	1.43%	0.17%
Japan	0.07%	0.18%	0.07%
Netherland	3.49%	0.14%	0.09%
Norway	3.31%	8.98%	3.31%
Singapore	1.44%	4.00%	1.44%
Sweden	0.09%	0.18%	0.09%
Switzerland	0.88%	0.40%	0.88%
UK	7.21%	10.94%	7.21%
US	2.04%	3.20%	2.04%

Next, this paper will conduct the correlation analysis between the GRETI and the indirect-direct real estate linkages both on the first and second moment. Table 5-9 Panel A shows the results of overall real estate market transparency impact.

As shown in Table 6-9 Panel A, the overall GRETI scores have negative correlations with the indirect-direct real estate linkages on both return and volatility level. The results confirm the hypothesis, indicating that in a more transparent real estate market, the indirect real estate does better reflect the underlying direct real estate fundamentals. In addition, the real estate market transparency seems have a stronger impact on the indirect-direct real estate linkages on the volatility level compared to return level (a correlation of -56.51% in 5% significant level of volatility linkages versus -21.21% of return linkages). As for the results for dynamics between

real estate market transparency and volatility linkages, a stronger correlation is seen when stock is used as numeraire(a correlation of -56.51%) while the weakest correlation is seen when direct real estate is used as numeraire(a correlation of -40.98%). That is not surprising, as the weights of direct real estate in the indirect real estate volatility do not reflect common driving factors shared by other asset classes when stock (cash) is used as numeraire. Therefore, no noise will be contained in the second stage correlation analysis, and therefore, a stronger correlation is here.

As real estate market transparency includes many perspectives, next, this paper will further examine the real estate market transparency impact by decomposing the overall real estate market transparency scores into five specific aspects according to Jones Lang LaSalle’s classification.

Table 6-9 Panel B shows the correlations results between real estate market transparency sub-indices and indirect-direct real estate linkages. Like the overall transparency correlation result, Correlations between real estate market transparency sub-indices and first-moment indirect-direct real estate linkages are stronger than that between transparency and second-moment ones. Generally, Transaction Process sub-indices have the highest impact on the indirect-direct real estate linkages and all correlations are at least 5% significant. As one of the main components in the Transaction Process category is the availability and quality of pre-sale information, here I propose one possible reason why it has strong impact on the indirect-direct real estate linkages. Pre-sales of direct real estate can be regarded as forward contracts because contracting parties have agreed on the price, but the underlying assets are still under construction and will be delivered to the buyers after completion(Chau, Wong et al. (2003)). It serves as a way for public to observe the future direct real estate movement, adjust their expectation on the earning ability of real estate operating companies and price the securities based on the pre-sale information. Therefore, pre-sale becomes a price discovery mechanism and its quality matters as low quality or even forged information will deviate the securities price from the underlying fundamentals values.

Table 6-9: Correlation between transparency index and indirect-direct real estate linkages

	Style Analysis	Variance Decomposition		
		Stock Numeraire	Real Estate Numeraire	Cash Numeraire
Panel A: Overall Real Estate Market Transparency				
2012 Composite Score	-21.21%	-56.51%**	-40.98%	-44.48%*
Panel B: Sub-Indices				
Investment Performance	-5.13%	-55.31%**	-29.86%	-42.53%
Market Fundamentals	3.07%	-34.93%	-43.00%*	-24.24%
Listed Vehicles	-7.12%	-31.99%	-24.43%	-24.90%
Regulatory and Legal	-30.49%	-44.72%*	-25.01%	-43.12%*

Transaction Process	-67.50% ^{***}	-61.86% ^{**}	-32.52%	-49.84% ^{**}
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Note: * Statistical significance at the 10% level

** Statistical significance at the 5% level

*** Statistical significance at the 1% level

Chapter Six Conclusion

This paper aims to provide an empirical study on whether real estate market transparency has a positive impact on the linkages between indirect and direct real estate on return and volatility level. The study involves two stages. First, style analysis approach and variance decomposition approach are used to quantify the first and second moment indirect-direct real estate linkages. Second, a correlation analysis between real estate market transparency index and indirect-direct real estate linkages is conducted. The results show that there is a negative correlation between the real estate market transparency scores and the indirect-direct real estate linkage on both first moment of return and second moment of volatility, indicating that in a more transparent market, the linkages between indirect and direct real estate are stronger. In addition, Transaction Process transparency has the strongest impact on the indirect-direct real estate linkages compared to other four categories. This study provides empirical evidence for the global investors as well as policy makers. As global investors try to earn abnormal real estate returns in emerging markets, the results of this study provide evidence that the substitution of indirect real estate to direct real estate is not the same in every country. For the policy makers, as the results may lead to bigger concerns for global investors about real estate market transparency, the policy makers should spare more efforts to enhance the transparency level. The efforts will pay off. Recent research from Jones Lang LaSalle 2012 Global Real Estate Transparency Index (2012) show that real estate market transparency has a positive association with the market capital of direct commercial real estate investment. Lieser and Groh (2011) demonstrated that high transparency of transaction process is positively associated with the real estate investment volume.

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