International Diversification Opportunities for Real Estate Investment Portfolios: A Fresh Look Focusing on Private Real Estate After the Great Crash

by

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Submitted to the Program in Real Estate Development in Conjunction with the Center for Real Estate in Partial Fulfillment of the Requirements for the Degree of Master of Science in Real Estate Development

at the

Massachusetts Institute of Technology

September, 2010

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ABSTRACT

This thesis explores the topic of diversification opportunities in international real estate, with focus on private real estate markets in developed countries. In examining the characteristics of returns and interrelatedness between international real estate, stocks and bonds markets from the time period spanning 2000 to 2009, we find that 2008 was the only year within the past decade in which several countries saw synchronized negative returns on a calendar year basis in the stocks and real estate markets, and even so the synchronized negative returns was only experienced by half of the countries within the 10-country opportunity set. The amplitude of the peak to trough drop in the cumulative value of the assets was small in real estate on average relative to that of stocks. These findings suggest that investors’ should benefit from holding international real estate within their portfolios, even in an extreme down market.

Modern portfolio theory is used to analyze and compare ex-ante diversification opportunities in international real estate, stocks and bonds and domestic diversification opportunities for the three asset classes from the perspectives of U.S. and European investors. We project expected returns for each of the markets and used historical risks (volatility) from the 2000-2009 period as estimates for volatility. When returns are calculated in local currencies, international diversification in the real estate portfolio (diversified within a 10-country opportunity set) should help U.S. investors substantially improve their portfolio risk-return efficiency relative to domestic diversification (within a 6-metropolitan area opportunity set), as the markets within the U.S. domestic opportunity set provide unattractive risk-return efficiency and their movements are highly correlated. By contrast, European investors will benefit less from the same international diversification strategy relative to domestic diversification (within 5 Eurozone countries) as several Eurozone markets are able to provide considerable risk-return efficiency and low correlations can be found in some pairs of markets.

Applying home bias and limits on exposure to any single country i.e. country caps to the portfolio allocation helps to balance the allocation weights for the investor’s portfolio but also significantly limits the investor’s ability to take advantage of diversification opportunities provided by the international markets. When returns are calculated in the investors’ domestic currencies, additional currency risk increases the portfolio volatility without providing additional expected return, reducing diversification benefits of international real estate. Even so, international diversification potential to U.S. investors should still be considerable, while that to European investors’ should be minimal.

Thesis Supervisor: David Geltner
Title: Professor of Real Estate Finance
ACKNOWLEDGMENTS

I would like express my sincere appreciation to Professor David Geltner for his teaching of “cutting-edge” knowledge and prudent practice in real estate finance and investments, and all his invaluable guidance, support and encouragement throughout this thesis process.

I would like to thank Jani Venter of IPD for her support with the data and ideas to develop this thesis topic as well as every industry professional that I have interviewed who have been important resources for this research.

I am grateful to all my former employers, real estate professionals and peers I have met throughout my career who inspired me to keep learning and expanding my boundaries, and for being the source of my interest in the topic of international real estate investment.

Lastly, I would like to thank my family and friends who have shown their warm support from afar.
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Investors have long recognized the role of diversification in portfolio risk reduction. International diversification has been a commonly deployed strategy to achieve greater risk-return efficiency for investments in liquid assets such as stocks and bonds. The real estate asset class, once perceived to be a localized sector with higher barrier to international diversification, has seen an unprecedented surge in cross-border investment activities over the past decade. The increase in investors’ appetite for international real estate is largely driven by globalization of the capital markets, increased level of exposure to the real estate asset class in pursuit of risk reduction benefits from low correlation with other financial asset classes, and global capital’s flight to investments that provide attractive risk-adjusted return.

The size of global universe of institutional grade-real estate markets in 2009 was $22.3 trillion.\(^1\) Cross-border investing peaked at $419 billion in 2007, in which it accounted for 31% of the combined transaction volume in North America, Europe and Asia Pacific. Following a sharp decline in 2008 to 2009, the total cross-border investing stood at $102 billion in 2009, representing 19% of the total global real estate transaction volume.\(^2\)

In 2009, developed markets around the world accounted for 81% of the global universe of institutional-grade real estate. Europe holds the largest share at 38% or $8.4 trillion in dollar value while U.S./Canada and Asia Pacific hold 31.5% and 23.6% share respectively. Asia Pacific is expected to lead the rest of the world in economic growth, driving its market share of investment real estate up to a projected 41.3% in 2029.\(^1\) The more mature markets of Europe and U.S./Canada are expected to grow at a much slower pace, leading to decrease in the regions’ market shares. Cross-border real estate investment is expected to trend upwards as global capital markets become increasingly integrated and expansion in transaction volume improve transparency and liquidity, and alleviate barriers and restrictions in various international markets.

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\(^2\) Real Capital Analytics.
Figure 1.1 Estimated Size of Institutional Grade Real Estate Markets (in U.S.$ billions)

![Graph showing estimated size of institutional grade real estate markets with estimated values for 2009, 2019, and 2029 for Europe, US/Canada, Asia Pacific, Latin America, and GCC.]

Source: Prudential Real Estate Investors

Figure 1.2 Cross-Border Real Estate Transaction Volume and Capital Sources

![Graph showing cross-border real estate transaction volume and capital sources with values for 2007, 2008, 2009, and 2010* for different regions including Asia, Australia, Europe, Africa, Middle East, South America, and North America.]

Source: Real Capital Analytics
Note: * H1 2010
Globalization and capital markets integration exemplify the interdependence of various countries’ economies. Past studies have shown that correlations between international stock markets have increased substantially in recent years following the globalization trend. The increase in co-movements between markets highlights the fact that diversification opportunities from cross-border investments in liquid assets have become scarcer as the financial markets become more integrated.

While performance of real estate is driven by local economic factors, such that the real estate market may be less susceptible to global capital market influences than the more liquid asset classes, the surge in cross-border real estate investments and the synchronized market downturns driven by the global financial crisis of 2008 to 2009 have led investors to question whether international real estate may still provide as attractive diversification benefits as previously believed. To what extent are the real estate markets performances interrelated, and whether or not real estate can still provide attractive diversification benefits to an internationally diversified investment portfolio is an interesting topic of study. The rapid growth in demand for cross-
border investment as well as the occurrence of the global financial crisis has also made the past decade a particularly interesting period to examine.

This thesis examines various aspects concerning international real estate portfolio diversification opportunities through literature review and secondary research, quantitative analysis, interviews with industry practitioners and the author’s own observation and interpretation. The body of the thesis shall attempt to answer or at least address and discuss key questions as follows:

- What are the relevant issues, considerations and trends with regards to international real estate portfolio diversification?
- What were the characteristics of the risk, returns and interrelations between international real estate, stock and bond markets in the past decade from 2000 to 2009?
- What were the impacts of the surge in cross-border real estate investment and recent global financial crisis on diversification opportunities in international direct real estate?
- Does international direct real estate offer superior diversification benefits to U.S. and European investors relative to international stocks or bonds, or domestic real estate? Can investors expect to achieve attractive diversification benefits from international real estate investing in the near future?

The following chapter presents an overview of the issues relevant to the topic of international real estate diversification. The data and methodology used in this thesis is explained in details in Chapter III, followed by a quantitative study on diversification opportunities in international real estate, stocks and bonds markets in Chapter IV. We first examine the interrelations between asset markets in the past decade that is characterized by extreme upward and downward movements, then make further attempt to project diversification benefits that may be achievable through investing in international asset markets in the future following the global financial crisis of 2008 to 2009. Much of focus of this quantitative study is on opportunities in private real estate markets from the point of view of U.S. and European investors. International real estate diversification opportunities are analyzed both with and without the effects of currency risks. Lastly, we end this thesis with a conclusion and closing notes that include a brief discussion on market practice in international real estate diversification in Chapter V.
CHAPTER II
OVERVIEW OF RELEVANT ISSUES

This thesis shall attempt to present a comprehensive discussion on international diversification opportunities in the real estate asset class from theoretical and practical perspectives. As a starting point, we briefly review in this chapter the issues relevant to international real estate diversification.

Before we begin to quantitatively analyze the benefits of international real estate diversification, we must first understand the purpose of portfolio diversification and the types of risks involved with investments in risky assets. The concept of diversification and risk reduction is explained in the next section, followed by a brief discussion on additional risks unique to cross-border investing. Next, we discuss the role of real estate in portfolio risk reduction in a mixed-asset context, and end this chapter with a review of research methodologies used in past studies on international real estate diversification to lay groundwork for the quantitative study in this thesis, which is presented in Chapter III and IV.

2.1 Diversification and Portfolio Risk Reduction

Diversification benefits from investing in multiple assets can be measured by the reduction in portfolio risks. Less than perfect correlations between the assets returns help to improve the overall portfolio mean-variance efficiency compared to holding a single asset. When analyzing the risk reduction benefits of diversification, it is important to make a clear distinction between two types of risk: idiosyncratic and systematic risk. Idiosyncratic or specific risk is the risk that affects each individual asset, examples of which include those that pertain to the location, types of tenants and lease structures of any given property. This type of risk can be mitigated through holding within the portfolio a large number of assets that are not perfectly correlated. The degree in which the specific risk can be reduced varies based on the number of assets and the co-

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movement between the assets returns. On the contrary, systematic or market risk is caused by a common source and affects all assets within the portfolio, thus is non-diversifiable.

Clearly one key reason why investors seek to diversify their portfolios is to gain protection against synchronized poor performance in a bear market. However, as became apparent in the recent international financial crisis, the contribution of systematic risk may increase during the market downturn, dragging all investments down together and curtailing the benefits of holding a diversified portfolio of assets. While realistically the possibility of such widespread financial crisis does not entirely defeat the purpose of diversification, the recent experiences understandably have caused investors to question the effectiveness of international diversification in providing risk reduction benefits in a down cycle. With this in mind, understanding the risk reduction achievable in a down market is of great interest these days, and the 2008 to 2009 financial crisis presents a significant historical case to examine.

Several past studies on international stocks have found that correlation between international stock markets increase when stock market volatility increases, suggesting that international diversification with stocks is least effective when investors need it most. This is mainly attributed to the fact that the global stock markets are highly integrated and investments are liquid, thus global capital’s flight to safety during a global shock may augment the synchronized downward movements across all markets. However, even in studies of the real estate asset class, prior research has primarily focused on securitized investment i.e. REITs and other publicly listed property companies, and the published work to date has largely pre-dated the recent financial crisis. This suggests that it would be very interesting to examine direct real estate investment from an international diversification perspective, and to include and focus in particular on the performance during the recent financial crisis to understand how international real estate diversification affected private real estate investment portfolios. A quantitative study of this issue is one of the main focuses of Chapter IV.

2.2 Additional Risk Factors in International Investments
There are two unique risk factors associated with international investing that investors must consider in assessing international investment opportunities. These factors are currency risk and country-specific risk\(^4\), as described below.

**Currency Risk**

Currency risk is a key factor that affects the performance of a cross-border investment to a domestic investor when valuing their wealth in their home currency. Assuming that the investor is exposed to currency risks, exchange rates will affect the portfolio risk-return on two levels. First, exchange rates determine the actual returns realized by the investors in their domestic currency. Second, the aggregate variance, and subsequently volatility i.e. risk of an internationally diversified domestic currency denominated portfolio reflects not only the variance of the real estate returns, but also that of the currency returns, as well as the covariance between the currency and real estate returns. This relationship shall be further illustrated in Chapter III: Research Methodology.

Several studies have examined the significance of currency risk in the context of financial and real estate investments. Eun and Resnick (1988) found that approximately 50% of the volatility in U.S. dollar returns on stock investments in Germany, Japan and the U.K. during the period of 1980 through 1985 can be attributed to exchange rate volatility. The presence of exchange rate fluctuations introduces another significant risk factor to international investment portfolios as exchange rate movements were found to reinforce rather than offset the stock market movements. Correlations between different currencies exchange rates are also high. Similarly, Liu and Mei (1998), examining stocks and real estate securities returns data for Australia, France, Japan, South Africa, the U.K. and U.S., found that exchange rate volatility account for a substantial portion of the U.S. dollar return volatility for both asset classes, suggesting that internationally diversified investors should actively hedge away currency risks to the extent possible, unless investors intend to speculate against their home currency. However, the study did not incorporate hedging costs into the analysis.

In an internationally well-diversified portfolio, currency risks are hedged through holding investments in varied local currencies which movements are not perfectly correlated. Thus, active currency management may provide only marginal additional benefits. For smaller, less diversified portfolios, certain portions of the currency risks may be hedged away through various techniques and instruments, although perfect hedging is impossible given the uncertainty of the expected returns and inability to exactly match maturities or immunize a long-term risky-asset investment portfolio. This points to the question of the effectiveness of currency hedging in the real estate context. Froot (1993) examined the effectiveness of currency hedging over long horizons and concluded that using currency hedges as a tool to reduce real-return variance of stocks, bonds and real estate investments is less effective the longer the investment horizon. Using 200-year data set for U.S. stocks and bonds returns and focusing the analysis on the perspective of a British pound denominated investor, Froot found that full currency hedge is only effective as a means to reduce return volatility over short horizons. For long-term horizons of 5 years or more for stocks and 8 years or more for bonds, the hedged returns provided higher return volatility than unhedged returns. The study demonstrated that the minimum-variance hedge ratios i.e. the ratio of hedged to total exposure that minimize the return variance to the investments ranged from nearly 100 percent for short horizon to 35 percent for longer horizons of 5 to 10 years. Hedging with the minimum-variance hedge ratio for the long horizon yielded higher volatility compared to the unhedged case. Transaction costs and counterparty risks associated with currency hedging will further reduce the optimal hedge ratio to zero for long horizon hedging.

In examining currency options as a hedging alternative, Ziobrowski and Ziobiowski (1995) suggested that currency options behave like an insurance policy to foreign investors investing in U.S. real estate. Through continuous use of the instrument, the investors are insured against sudden large currency losses while costs are spread over time. Empirical study of investment in U.S. assets from the perspectives of British and Japanese investors from 1973 to 1987 revealed that currency options were unreliable over the long horizon, as their effectiveness would depend on the magnitude and direction of currency fluctuations. In the case of depreciation in foreign investment’s local currency, the options helped to substantially reduce the currency risks but over the long term could not significantly restore the loss in returns due to currency loss. Many
practitioners also believe that using options over a long horizon of several years is not a viable strategy due to high cost of options that may cancel out any potential benefits and suggest that futures and forwards may be more appropriate hedging instruments for real estate investments.

**Country Risk**

Investors are faced with greater challenges and higher costs in obtaining quality and accurate information about foreign markets and investments relative to when pursuing domestic opportunities. Country risk analysis serves as a guide in assessing the risk associated with international markets and cross-border investments. Independent rating organizations such as the Political Risk Services Group (PRS) publishes the International Country Risk Guide (ICRG) that ranks countries by composite risk measures comprising of political, financial and economic risks. Jones Lang Lasalle produces the Global Real Estate Transparency Index that rates countries real estate markets transparency with sub-indices that score countries on 5 dimensions relating to private and listed real estate investments. Table 2.1 compares the country risk and real estate transparency rankings of top 15 largest commercial real estate markets (Jones Lang Lasalle Real Estate Transparency Sub-Indices are provided in Appendix B):

<table>
<thead>
<tr>
<th>Size Rank</th>
<th>Country</th>
<th>Market Size (in billion USD)</th>
<th>Market Type</th>
<th>Real Estate Composite Risk Rank</th>
<th>Classification</th>
<th>Rating (in %)</th>
<th>Real Estate Transparency Rank</th>
<th>Level*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>United States</td>
<td>6,414</td>
<td>Developed</td>
<td>29</td>
<td>Low Risk</td>
<td>77.3</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Japan</td>
<td>2,285</td>
<td>Developed</td>
<td>18</td>
<td>Very Low Risk</td>
<td>80.8</td>
<td>26</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Germany</td>
<td>1,483</td>
<td>Developed</td>
<td>11</td>
<td>Very Low Risk</td>
<td>81.8</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>United Kingdom</td>
<td>1,239</td>
<td>Developed</td>
<td>38</td>
<td>Low Risk</td>
<td>74.8</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>France</td>
<td>1,211</td>
<td>Developed</td>
<td>40</td>
<td>Low Risk</td>
<td>74.3</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>China</td>
<td>1,168</td>
<td>Emerging</td>
<td>33</td>
<td>Low Risk</td>
<td>76.0</td>
<td>45/54**</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Italy</td>
<td>963</td>
<td>Developed</td>
<td>50</td>
<td>Low Risk</td>
<td>72.8</td>
<td>21</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>Spain</td>
<td>650</td>
<td>Developed</td>
<td>70</td>
<td>Moderate Risk</td>
<td>69.0</td>
<td>14</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>Canada</td>
<td>605</td>
<td>Developed</td>
<td>6</td>
<td>Very Low Risk</td>
<td>83.5</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Brazil</td>
<td>474</td>
<td>Emerging</td>
<td>43</td>
<td>Low Risk</td>
<td>74.0</td>
<td>38</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>Australia</td>
<td>448</td>
<td>Developed</td>
<td>23</td>
<td>Low Risk</td>
<td>78.8</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>Russia</td>
<td>389</td>
<td>Emerging</td>
<td>47</td>
<td>Low Risk</td>
<td>73.3</td>
<td>31/35**</td>
<td>3</td>
</tr>
<tr>
<td>13</td>
<td>Netherlands</td>
<td>360</td>
<td>Developed</td>
<td>12</td>
<td>Very Low Risk</td>
<td>81.5</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>South Korea</td>
<td>328</td>
<td>Emerging</td>
<td>18</td>
<td>Very Low Risk</td>
<td>80.8</td>
<td>42</td>
<td>3</td>
</tr>
<tr>
<td>15</td>
<td>Mexico</td>
<td>265</td>
<td>Emerging</td>
<td>46</td>
<td>Low Risk</td>
<td>73.5</td>
<td>46</td>
<td>3</td>
</tr>
</tbody>
</table>

Source: Pudential Real Estate Investors, March 2010; PRS Group, June 2010; Jones Lang Lasalle, 2010
Note: * Level: 1=High, 2=Transparent, 3=Semi-Transparent
** 1st-Tier City/ 2nd-Tier City
These types of ratings may be useful as guidelines to analyze markets on a comparative basis and may help investors in estimating the risk premium and expected returns for investing in foreign real estate markets. It is interesting to note that JLL Real Estate Transparency Index ranks the real estate markets of most developed countries higher than those of their emerging counterparts, while the non-industry specific PRS International Country Risk Guide rankings for developed markets do not appear to be distinctly more favorable than those of emerging markets.

2.3 Real Estate in a Mixed-Asset Portfolio

Investors favor the real estate asset class for its perceived ability to improve the mean-variance efficiency of a mixed-asset portfolio of stocks and bonds. Several earlier studies including Burns and Epley (1982), Miles and McCue (1982), Ennis and Burik (1991) and Gilberto (1993) confirmed that including domestic real estate REITs improves the risk and return tradeoffs for U.S. domestic investment portfolios. Liu and Mei (1998) found that international real estate securities offered incremental diversification benefits above those offered by international stocks in a stocks and real estate securities portfolio regardless of whether currency risks are hedged. Chua (1999) studied diversification benefits achievable through the inclusion of international real estate in an internationally diversified U.S. dollar denominated mixed-asset portfolio and concluded that real estate reduced the portfolio standard deviation by up to 16.1%. On the other hand, Ziobrowski and Curcio (1991) did not find any diversification benefits from including U.S. real estate into British or Japanese mixed asset portfolios. They concluded that extreme volatility in exchange rates magnified the riskiness of U.S. asset returns to the foreign investors.

Theoretically, diversification benefits or risk reduction potential to an investor should be determined on an overall mixed-asset portfolio level as interactions and co-movements occur between all assets rather than merely between asset classes. Thus asset type, geographic, sector and other category allocations should be considered holistically. In practice, the top down approach to asset allocation decisions often dictate investors to predetermine the allocation weights for each asset class. Category diversification within the real estate asset class is strategically determined at the single asset-class level. This thesis will take that perspective, determining future geographic diversification opportunities provided by international
diversification within the a single-asset class level with the assumption that the asset class allocation for the investor’s entire wealth portfolio is given exogenously. International real estate diversification benefits in the context of a mixed-asset portfolio is briefly examined in this thesis, although quantifying these diversification benefits is outside the scope of study.

2.4 Real Estate Diversification Study Methodologies

Two main methodologies have been used in past quantitative research on diversification opportunities achievable through international real estate investments. The first uses multi-factor regression models to analyze the co-movements between returns and other factors that explain the performance in each market, yielding results that could potentially help in strategically determining the international markets that may provide the best diversification opportunities to a domestic investor. The second involves determining potential efficient frontier enhancement offered by a mean-variance optimized portfolio through the use of Markowitz’s Modern Portfolio Theory (MPT). The followings summarize the key findings from past research using these two approaches.

The Market Co-Movement Analyses

Several studies have followed this approach to examine real estate markets and relevant factors on a country as well as regional levels. Case, Goetzmann and Rouwenhorst (1999) studied factors influencing correlations among international real estate markets using international direct property returns estimated through yields and cap rates of industrial, office and retail properties from 21 mature and emerging markets in North America, Europe and Asia. They found that a substantial degree of international correlation among real estate markets is attributable to global and country-specific GDPs, measures of economic fundamentals that are highly correlated across countries. Their findings suggest that while the real estate markets are segmented by nature, performance of each market i.e. demand for physical space is highly influenced by the global economy. This study also finds that although cross-border real estate diversification within any single property type does reduce portfolio variance, only the industrial property type offered higher diversification benefits i.e. lower portfolio variance than did international stocks.
Ling and Nanjaro (2002) studied returns on international real estate securities in 20 markets from 1984 to 1999 and similarly found strong evidence of a global risk factor influencing international real estate returns. In addition, they found that country-specific risk factors are also significant in most markets studied. Furthermore, results suggest that there is also significant firm specific risk in the international public real estate markets, suggesting that diversification opportunities may be available even when investors diversify into a limited number of countries. This strategy may prove effective to smaller scale investors seeking international diversification in that they may be able to save on up front costs associated with gaining familiarity with a new market while still benefiting from diversification opportunities within a small number of markets. Bond, Karolyi and Sanders (2003) examined returns data from 1990 to 2001 for 14 international public real estate markets in North America, Europe and Asia Pacific and reached similar conclusions with regards to global and local factors’ influence on real estate securities returns. They also found that country-specific risks are substantially more prevalent in the Asia-Pacific markets than they are in the North American and European markets, suggesting that Asia-Pacific markets may provide greater diversification benefits to international real estate investors.

Eichholtz, Huisman, Koedijk and Schuin (1996), analyzing real estate securities returns data from 1984 to 1995 for 30 countries in 3 continents, found that real estate returns in the Asia-Pacific region are not driven by continental factors, thus suggesting that the region provides attractive diversification opportunities for North American, European as well as regional investors. This study reveals that real estate returns of most European countries are positively and significantly influenced by one another, thus European domiciled investors should seek to diversify outside of the continent to optimize diversification benefits. Returns of the U.S. and Canada are positively influenced by one another and by returns of the Asia-Pacific region while not significantly correlated with returns of the European region, therefore North American investors should diversify mainly in Europe. By contrast, returns of the Asia Pacific countries are not positively and significantly influenced by one another, but rather by European and North American returns, therefore Asian investors can find good diversification opportunities within the continent. In addition, time-series analysis indicates that level of dependence among European markets trends upwards over time, corresponding with the increase economic and
institutional integration in the region while Asia-Pacific did not show the same dependence trend. It is worth noting that the time period under this study did not cover the period of synchronized Asian economic crisis that occurred in 1997 in which the level of dependence between the Asian countries may have been affected.

Findings from each of the studies under this market co-movement analysis approach present a rather broad view of relationships between markets and regions, and may pertain somewhat idiosyncratically to a particular past period of history that may not be relevant as a general or abiding principle. This research approach does not help to determine whether a given international real estate opportunity set may provide attractive diversification benefits relative to a domestic opportunity set, which is the focus of the quantitative section of this thesis. For these reasons, the direction of these studies is not one that this thesis will take.

**The Optimal Real Estate Portfolio Analyses**

Earlier studies using the portfolio mean-variance optimization approach have found diversifying with international real estate to be beneficial. Examples include Sweeney (1989) using international office markets rent growth, Wozala (1992) using U.S. and U.K. direct real estate returns, Liu and Mei (1998) using real estate related securities. Rather comprehensive later studies under this approach include those of Eichholtz (1996) and Stevenson (2000), and are summarized below.

Eichholtz (1996) compared efficient frontiers and country correlations of international real estate, stocks and bonds single asset class portfolios, using historical returns data from 9 international markets in North America, Europe and Asia from 1985 to 1994. LIFE Global Real Estate Securities Indices that comprised of returns for publicly listed companies that earn over 75% of their revenues through equity real estate investments were used as proxy for the real estate markets. He found that correlations in returns between country markets are substantially lower in the real estate asset class as compared to the within stocks and bonds asset classes, and the minimum variance real estate portfolio offered a better risk adjusted return i.e. higher Sharpe ratio than that of common stocks or bonds portfolios. He therefore concluded that international diversification provide better risk reduction opportunities with a public real estate portfolio than
with stocks or bonds portfolios. However, Eichholtz analysis was based on local returns, thus assuming that investors can perfectly hedge currency risks at no cost.

Stevenson (2000) examined the topic with a similar methodology to that of Eichholtz but using hedged indices and real estate stocks as proxies for real estate returns. The data set covered 10 international markets, also in North America, Europe and Asia, and spanned from 1980 to 1997. He found that international diversification benefits to real estate portfolios are statistically significant only when there are no constraints on the portfolio allocation to international real estate, and only if local returns are used. Currency fluctuations and constraining the maximum allocation to international assets reduce the effectiveness of the diversification as a means to achieve risk reduction for the international real estate portfolios. However, this study used an arbitrary 20% as the upper limit for non-domestic exposure, which is arguably a rather low number.

Performance of indirect real estate vehicles such as those of property companies and real estate investment trusts (REITs) are generally influenced by the equity market in which the vehicles are traded. Returns and volatility of publicly traded real estate vehicles therefore do not purely reflect the actual performance of the underlying properties. The use of hedged indices as seen in Stevenson’s research presents an attempt to remove the effects of the equity markets from the returns of the indirect real estate vehicles by adjusting for autocorrelation in measures of the direct market to arrive at the performance of the real estate held by the vehicles. This methodology also introduces additional complexity that may cause biases in the derived real estate returns as it is very difficult to determine accurately the extent to which the stock markets influence the performance of these publicly traded vehicles. Perhaps the fact that the correlation between the different real estate markets as suggested by the hedged indices in Stevenson’s study appear to be substantially lower than those found in direct real estate is an indicator of the biases present in this methodology.

Most past studies using the portfolio optimization methodology have used realized returns i.e. historical mean returns from the sample data set as proxy for expected returns when computing the mean-variance efficient frontier. However, the use of such data can be rather misleading, as the future asset prices are difficult to predict with any certainty, thus historical
returns may not be good estimates of future returns. These studies were in fact analyzing past diversification benefits during the time period of the sample data that investors ideally could have achieved in the past rather than attempting to present a case for future diversification opportunities that may be available to international real estate investors going forward.

The quantitative analysis section of this thesis in Chapter IV adopts the portfolio mean-variance optimization methodology as described earlier as a tool to attempt to determine international diversification benefits relative to the investors’ domestic opportunity sets. Three major updates to past studies are incorporated. First, this study uses direct real estate returns data, which has never been used in full scale in past research. The gradual expansion in number of countries for which appraisal-based real estate indices are produced and the considerable length of the available time-series data have made this type of study possible. Second, the sample period in this study spans from 2000 to 2009, in which a surge in volume of international real estate investments and extreme peaks and trough in the global economy as a result of the 2008 to 2009 global financial crisis have occurred. Most past studies are dated thus have not included this time period, which is arguably one of the most interesting periods to analyze. Third, this study examines the issue of international real estate diversification from both an ex-post and ex-ante standpoint. We first examine the broad level relationships between international real estate, equities and fixed-income markets in the past decade. We then attempt to project ex-ante diversification opportunities in international investments as compared to those in domestic investments. Expected returns are used instead of realized returns for each of the markets covered in this study, while second moment data from the 2000 to 2009 sample period is used.

The data and methodology for the qualitative and quantitative studies for this thesis are presented in the next chapter.

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6 Bodie, Kane and Marcus argue that recent realized returns can be used in reasonably estimating the prospective risk but not the future expected returns of the markets for two reasons. First, asset process will be difficult to predict due to market efficiencies, rendering the realized return useless as a measure in predicting future returns. Second, the second moment standard deviation and correlation data are statistically of a lower order of magnitude, thus any error that arise from using realized returns will not exaggerate the potential diversification benefits by as much.
CHAPTER III
RESEARCH METHODOLOGY

The research methodology adopted for this thesis is a combination of qualitative and quantitative research on the topic of international real estate portfolio diversification.

The qualitative research includes both secondary and primary research. The secondary research includes reviews of previous academic literature, industry research reports and articles, which are conducted to obtain background information on key considerations, trends and outlook for cross border investments that are discussed throughout this paper. The primary research includes structured interviews with key industry professionals that represent real estate investors and investment managers (refer to Appendix A for list of interviewees). Interview responses are used to further examine the issues relating to international real estate diversification from a market’s perspective. Information obtained through interviews are also used as reference for some of the quantitative analysis in Chapter IV, and is presented collectively as a general discussion in the closing chapter. Much of the analysis and discussion focus on direct real estate investments, although past research involving indirect real estate (publicly-traded securities) alternatives are reviewed.

The major focus of the quantitative study is to examine the investment benefit of diversification within international direct real estate as compared to those achievable within the equities and fixed-income asset classes, as well as that compared to domestic real estate diversification benefits. We begin with an analysis of the international private real estate investment climate, relationships between markets and diversification opportunities available in the past decade between 2000 and 2009. The analysis then examines whether investors can expect to achieve attractive diversification benefits in the near future relative to those offered by domestic-only real estate, as well as stocks or bonds. This study takes the views of U.S.-based and European-based investors when comparing diversification benefits between those offered by international and their respective domestic opportunity sets.

The followings describe the data and methodology used for the quantitative analysis.
3.1 Data

The time period that is the focus of this study spans between 2000 and 2009. Annual time-series index data for real estate, stocks and bonds is used.

Investment Property Databank (IPD) Multinational Indices are used to represent direct real estate markets for all but the U.S. market, in which the National Council of Real Estate Investment Fiduciary (NCREIF) NPI Indices are used. The top 10 countries by market size for which IPD produces its indices: Australia, Canada, France, Germany, Italy, Japan, Netherlands, Spain, United Kingdom and United States are included in the international opportunity set in this analysis. These markets are categorized as developed markets and represent 70.36% of the global institutional-grade real estate, coinciding with the top 13 countries by size of institutional-grade real estate investments in 2010, as estimated by Prudential Real Estate Investors (refer to Table 2.1 in Chapter II for information on market size and ranking). Brazil, China and Russia are the three markets in the top rank that are excluded from this analysis due to lack of availability of comparable direct real estate data and the “emerging” classification of the markets that makes direct real estate in those countries a different style of investment. Returns data points for all countries but Italy, Japan and the Netherlands start from 2000, while those for the three countries start from 2004, 2004 and 2001 respectively. To keep this analysis manageable and data consistent across markets, the all-property total returns are used.

The domestic opportunity set for U.S. real estate assumed in this study includes 6 major U.S. metropolitan markets: Boston, Chicago, Los Angeles, New York, San Francisco and Washington DC as classified by Core Based Statistical Areas (CBSAs). These markets collectively represent 55.3% of the total U.S. commercial property market. NCREIF NPI Indices are used to represent these domestic U.S. markets. The European opportunity set in this study includes the top 5 markets of the European Union (Eurozone): France, Germany, Italy, Netherlands and Spain, and are represented by the IPD Multinational Index for each respective country.

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7 As international diversification opportunities will be compared against the U.S. domestic opportunities as represented by the NCREIF NPI indices, for consistency in the data points observed, an-equal weighted portfolio of 6 U.S. domestic markets used in this study, as represented by the NCREIF NPI indices, are used to represent the U.S. real estate market in the international opportunity set.

8 NCREIF
Although the majority of direct real estate return indices used in this study are produced by a single source (IPD), the data is subject to market specific biases of varying nature and extent that may affect the comparability of the return performances across countries. Notable biases include the differential effects of appraisal smoothing across different countries, as well as different underlying real estate market norms and practices regarding trading, pricing, and valuation of real property. This renders cross-national comparison of direct private real estate market returns a somewhat “apples-vs-oranges” comparison. Nevertheless, the returns reported in the IPD indices do represent well and consistently the valuations that are reported by investment managers to their clients, and this thesis will not attempt to correct or control for differences in the nature and meaning of private real estate return metrics across countries.

Major local stock capitalization-weighted composite index for each respective country within the international opportunity set is used to represent the stock markets (refer to Appendix C for a list of country stock composite indices used in this study). DataStream 10-year Government Bond Indices are used to represent the international bond markets.

Historical spot exchange rates from the U.S. Federal Reserves and the European Central Bank are used to calculate currency returns and volatility, as well as convert real estate returns in local currency to U.S. dollar and euro for each of the respective domestic investors.

1.2 Methodology

This study first examines in Part I the historical characteristics of the international real estate, stocks and bonds markets in 2000 to 2009. Part II examines ex-ante international diversification effects for the three asset classes using only local currency-based returns, compared to domestic diversification. This case can be viewed as a rather “ideal” or “pure” diversification effect of international assets as if investors could fully hedge against currency risk. In Part III, the impact of currency movements is then taken into account so as to realistically consider the effect on a given investor holding either U.S. dollar or euro denominated portfolios.

This section involves a general discussion on ex-post international diversification opportunities in real estate, stocks and bonds observable from the past decade. The mean returns, variances and correlation metrics are computed from the index data sets. Overviews of market characteristics and performances of the three asset classes on a single-asset level are compared, and the relationships between asset markets and impacts of the surge in cross-border investing in the 2000s and global financial crisis that occurred during the later part of the decade examined.

Part II: Ex-Ante Diversification Opportunities: 2010 and Beyond

This section compares ex-ante diversification opportunities in international and domestic real estate, stocks and bonds asset classes for a future holding period commencing in 2010. For this purpose, expected returns (\( E[r_i] \)) are used instead of realized returns from the 2000 to 2009 sample period observed in the previous section. While the expected returns are ex-ante models, the second moments i.e. variances and covariances are based on the 10-year history, in effect taking the past decade as representing typical risk and co-movement characteristics. This is an interesting perspective as the past decade contained such a dramatic up and down cycle, and therefore arguably represents a “worst case” for risk and diversification within the investment markets in that extreme volatility during the dramatic cycle is coupled with decrease in returns and increased in cross-correlations across markets typically experienced in a downturn. In other words, to the extent we find diversification benefits using the second moments of the 2000 to 2009 decade, we could expect the benefits during the normal times will likely be at least that great. The following describes the methods used to estimate the expected returns for each asset class.

Expected returns for the real estate markets are derived from 2010 first quarter risk free rates and risk premiums for each of the international markets, as estimated by Real Capital Analytics (RCA). The RCA figures are cap rates for the various international markets. Reasonable growth rates are assumed and added to the cap rates to arrive at expected total returns for each market. From Geltner and Miller (2007):
\[ r_i = \hat{y}_i + \hat{g}_i \]  \hspace{1cm} (1)

where \( r_i \) is the total return of each market, \( \hat{y}_i \) is the cap rate and \( \hat{g}_i \) is the expected growth in capital value. The expected returns derived from this method are then compared with the ranges of expected returns for each of the markets obtained through the previously-noted interviews with industry practitioners to ensure that the assumptions fall within the range of forward looking return expectations that investors currently perceived to be reasonable.

Equilibrium expected returns for the stock markets are estimated through the use of the Capital Asset Pricing Model (CAPM) that compares the beta of stock markets against the world stock portfolio using the following formula as suggested by Bodie, Cane and Markus (2008).

\[ E[r_i] = r_f + \beta_i[E(r_m) - r_f] \]  \hspace{1cm} (2)

where \( E[r_i] \) is the expected return for a country stock market, \( E(r_m) - r_f \) is the estimated market risk premium for the world stocks portfolio and \( \beta_i \) is the beta of the individual market measured against the world stocks portfolio. 10-year government bond yield from each respective country is used as expected-return for the bond market.

Historical returns data of 2000 to 2009 are used to estimate the second moment and volatility of each market, and cross-correlations between markets as previously noted.

Classical Modern Portfolio Theory (Markowitz mean-variance optimization - MPT) is used to quantify the international diversification benefits by applying MPT to construct the efficient investment frontier within each single asset class portfolio, separately for real estate, stocks, and bonds. Optimal portfolio weights that minimize portfolio variance are calculated for each target return level to generate an efficient frontier for each of the portfolios under consideration. Portfolio variance can be written as:

\[ \sigma_p^2 = \sum_j \sum_i w_j w_i \text{Cov}(r_j, r_i) \]  \hspace{1cm} (3)
and $\text{Cov}(r_i, r_j) = \sigma_i \sigma_j C_{ij} \quad (4)$

where $\sigma^2_p$ is the portfolio variance, $w_i$ is the portfolio weight of assets $i$. $\text{Cov}(r_i, r_j)$ is the covariance between returns of assets $i$ and $j$, $\sigma_i$ is the volatility of asset $i$, and $C_{ij}$ is the correlation coefficient between the two assets’ periodic returns. To ensure the comparability of the analysis for the 3 asset classes, we assume that no short selling or derivatives are used since these are not generally possible in the real estate asset class, and also are often restricted in conservative institutional core portfolios. Results of this analysis are presented in the form of efficient frontiers for 3 asset classes and international real estate portfolio allocation weight area graphs.

The study then focuses on comparing diversification benefits of international direct real estate with those achievable through domestic U.S. or European opportunities. That is, within the real estate asset class only, we compare diversification across countries versus diversification within the respective domestic opportunity sets. International diversification benefits are presented on 2 levels; first, an unconstrained fully optimized portfolio with no cap on allocation weights, and second, a constrained partially optimized portfolio that reflects typical conditions set by real estate portfolio managers to control allocation weight of the domestic markets and exposure to any single foreign market.

**Part III: Currency Risks Effects on Diversification Benefits**

To demonstrate the impact of currency risk to the overall portfolio, this thesis further studies risks and returns when the international investments returns are converted to the domestic investor’s denominated currency. Currency hedging techniques and associated costs vary by market, time period and investor and manager preferences, therefore are not included in the quantitative study.

To study the effect of currency risk, mean returns, variance and covariance for each market are recalculated to reflect currency fluctuations using the methodologies suggested by Eun and Resnick (1986). Returns are converted to U.S. dollar and euro at spot exchange rates. The spot exchange rates are also used to calculate currency returns to determine each respective foreign currency’s second moment and volatility. Domestic rate of return from investment in a foreign market when the currency is not hedged can be written as:
\[ R_S = (1 + R_i) (1 + e_l) - 1 \]  \hspace{1cm} \text{(5a)}

\[ \hat{R}_S = \hat{R}_i + e_i + \hat{R}e_i \]  \hspace{1cm} \text{(5b)}

The expected return and variance in domestic currency are as follows:

\[ E(R_{iS}) = E((1 + R_i) (1 + e_l) - 1) \]  \hspace{1cm} \text{(6)}

\[ \text{var}(R_{iS}) = \text{var}(R_i) + \text{var}(e_l) + 2\text{cov}(R_i, e_l) \]  \hspace{1cm} \text{(7)}

where \( R_{iS} \) is the domestic currency return, \( R_i \) is the local return for the asset and \( e_l \) is the rate of appreciation of the local currency against the dollar. The variance in dollar portfolio returns, \( R_{pS} \), can be written as:

\[ \text{var}(R_{pS}) = \sum_i w_i^2 \text{var}(R_{iS}) + \sum_i \sum_{i \neq j} w_i w_j \text{cov}(R_{iS}, R_{jS}) \]  \hspace{1cm} \text{(8)}

where \( R_{pS} \) is the domestic currency return of the portfolio and \( w_i \) is the portfolio weight of asset \( i \).

Efficient frontiers for international real estate, when currency risks are taken into account, are generated separately for a U.S.-based and European-based investor. Results are compared against the international efficient frontiers in local currencies and that of the investor’s domestic opportunity set generated in Part II.

Results of the quantitative study are presented in Chapter IV: Quantifying Diversification Benefits to International Real Estate Investment Portfolios.
CHAPTER IV

QUANTIFYING DIVERSIFICATION BENEFITS TO INTERNATIONAL REAL ESTATE INVESTMENT PORTFOLIOS

In this chapter, we attempt to determine the benefits of international diversification, with an emphasis on direct real estate markets, through a series of quantitative analyses using the methodologies as elaborated in Chapter III. We first attempt to develop an understanding of the performance, relationships and interrelatedness of the international real estate, stocks and bond markets through an empirical study of the past decade: 2000 to 2009, with emphasis on the impact of the increased level of integration in the global capital markets that characterized this first decade of the new century, and on the great 2008 to 2009 global financial crisis. We then conduct a forward-looking analysis to determine the opportunities for real estate portfolio risk-return enhancement through international diversification that may be available to investors in the future after this global downturn. In this analysis, we take the points of view of U.S. and European investors. We combine the risk and correlation characteristics of the 2000 to 2009 period with plausible expected returns going forward. The idea is that, in some sense, the 2000s decade was arguably a worst case scenario for investment risk and diversification, therefore by taking it as representative, we will obtain a conservative picture of what international diversification and real estate diversification can do for the investor. Lastly, the impact of currency risks on the internationally diversified real estate portfolios is examined.

Real estate, stocks and bond markets of the ten largest developed economies\(^9\): Australia, Canada, France, Germany, Italy, Japan, Netherlands, United Kingdom and United States represent the international opportunity set in this study. Six U.S. major metropolitan markets: Boston, Chicago, Los Angeles, New York, San Francisco and Washington DC represent the U.S. domestic real estate opportunity set, while 5 Eurozone countries: France, Germany, Italy, Netherlands and Spain represent the European domestic real estate opportunity set.

\(^9\) As measured by country GDP in 2010

To begin, let us take a brief big picture view of diversification across the asset classes during the 2000s decade and before. Despite the increased integration of the financial and capital markets during the past decade, there was no significant increase in correlations between real estate, stocks and bonds asset classes in the United States in the 2000s from the level evident in the 1990s\textsuperscript{10}. This may seem surprising to many people in the real estate investment world, particularly as the conventional wisdom is that the 2008 to 2009 financial crisis caused a surge in covariance even across asset classes. In the bigger picture, it is true, as we see in Figure 4.1 that illustrate the relationship between domestic real estate and stocks returns for the U.S. markets, that in the 30-year history spanning 1980 to 2009, the U.S. real estate and stock markets experienced only one period of synchronized negative returns in 2008, but the U.S. stock market rebounded in 2009 while the real estate market continued to suffer from the lagged negative return. Figure 4.2 shows that for the international markets, the U.K. and to much lesser extent Spain, France, Australia and Japan experienced a similar pattern of synchronized year of negative real estate and stock returns in 2008 followed by a rebound of the stock markets in 2009, whereas half of the countries markets depicted in Figure 4.2 had no year during the last decade in which both stocks and real estate turned in synchronized negative total returns.

This broad-brush picture suggests that although diversification benefits even in a mixed-asset context may be undermined during a market downturn, diversification can still be quite useful, especially when applied both across asset classes and across countries, and even in an extremely severe market environment. The global financial crisis that occurred in 2008 was one of unprecedented magnitude that caused widespread impact across countries and industries, and a surge in level of systematic risk that affected all risky assets across the board. Such occurrence may be an exception rather than the norm. Furthermore, negative performances in the real estate markets was limited to 2008 and 2009 in a number of countries, while negative performances in the stock market have been much more common over the past decade. This indicates that international real estate should provide considerable diversification benefits to a mixed-asset portfolio in a globally integrated environment of the recent years.

\textsuperscript{10} From NCREIF, S&P 500 and 10-year US Government Bond annual and quarterly returns data.
Figure 4.1 Scatter Plot of Real Estate and Stocks Returns: U.S. Annual Data, 1980 – 2009
(Real Estate: Horizontal Axis, Stocks: Vertical Axis)

Figure 4.2 Scatter Plot of Real Estate and Stocks Returns: Int'l Annual Data, 2000 – 2009
(Real Estate: Horizontal Axis, Stocks: Vertical Axis)

Source: NCREIF, S&P 500

Source: IPD, NCREIF, Country Stock Composite Indices
Table 4.1  Annual Total Returns, Volatility and Correlations (in Local Currencies): International Real Estate, 2000 - 2009

<table>
<thead>
<tr>
<th></th>
<th>Australia</th>
<th>Canada</th>
<th>France</th>
<th>Germany</th>
<th>Italy</th>
<th>Japan</th>
<th>Netherlands</th>
<th>Spain</th>
<th>UK</th>
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<tr>
<td>Return</td>
<td>10.9%</td>
<td>10.7%</td>
<td>10.3%</td>
<td>3.1%</td>
<td>6.9%</td>
<td>5.9%</td>
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<tr>
<td>Std. Dev</td>
<td>7.1%</td>
<td>6.1%</td>
<td>7.5%</td>
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<tr>
<td>Return/Risk Ratio</td>
<td>1.53</td>
<td>1.76</td>
<td>1.38</td>
<td>1.78</td>
<td>1.83</td>
<td>0.82</td>
<td>1.89</td>
<td>0.88</td>
<td>0.57</td>
<td>0.70</td>
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Correlations of Annual Returns

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<td>1.00</td>
<td>0.64</td>
<td>0.98</td>
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<tr>
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<td>1.00</td>
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</table>

Source: IPD Multinational Total Return Indices

Table 4.2  Annual Total Returns, Volatility and Correlations (in Local Currencies): International Stocks, 2000 - 2009

<table>
<thead>
<tr>
<th></th>
<th>Australia</th>
<th>Canada</th>
<th>France</th>
<th>Germany</th>
<th>Italy</th>
<th>Japan</th>
<th>Netherlands</th>
<th>Spain</th>
<th>UK</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return</td>
<td>6.8%</td>
<td>5.4%</td>
<td>-1.1%</td>
<td>0.2%</td>
<td>-2.7%</td>
<td>-2.6%</td>
<td>-2.7%</td>
<td>3.6%</td>
<td>-0.8%</td>
<td>-0.6%</td>
</tr>
<tr>
<td>Std. Dev</td>
<td>20.6%</td>
<td>20.5%</td>
<td>23.8%</td>
<td>28.1%</td>
<td>23.9%</td>
<td>24.7%</td>
<td>27.1%</td>
<td>26.1%</td>
<td>18.5%</td>
<td>20.6%</td>
</tr>
<tr>
<td>Return/Risk Ratio</td>
<td>0.33</td>
<td>0.26</td>
<td>-0.05</td>
<td>0.01</td>
<td>-0.11</td>
<td>-0.11</td>
<td>-0.10</td>
<td>0.14</td>
<td>-0.04</td>
<td>-0.03</td>
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</table>

Correlations of Annual Returns

<table>
<thead>
<tr>
<th></th>
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<th>Canada</th>
<th>France</th>
<th>Germany</th>
<th>Italy</th>
<th>Japan</th>
<th>Netherlands</th>
<th>Spain</th>
<th>UK</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>1.00</td>
<td>0.89</td>
<td>0.88</td>
<td>0.79</td>
<td>0.89</td>
<td>0.72</td>
<td>0.92</td>
<td>0.87</td>
<td>0.88</td>
<td>0.87</td>
</tr>
<tr>
<td>Canada</td>
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<td>0.91</td>
<td>0.97</td>
<td>0.85</td>
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<td>0.89</td>
<td>0.96</td>
<td>0.96</td>
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</tr>
<tr>
<td>France</td>
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<td>0.97</td>
<td>0.86</td>
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<tr>
<td>Germany</td>
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<td>0.82</td>
<td>0.89</td>
<td>0.91</td>
<td>0.95</td>
<td>0.95</td>
<td>0.95</td>
<td>0.95</td>
</tr>
<tr>
<td>Italy</td>
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<td>0.93</td>
<td>0.88</td>
<td>0.94</td>
<td>0.91</td>
<td>0.94</td>
<td>0.91</td>
<td>0.91</td>
<td>0.91</td>
</tr>
<tr>
<td>Japan</td>
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<td>0.87</td>
<td>0.87</td>
<td>0.87</td>
<td>0.87</td>
</tr>
<tr>
<td>Netherlands</td>
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<td>1.00</td>
<td>0.95</td>
<td>0.96</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Spain</td>
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<td>0.88</td>
<td>0.94</td>
<td>0.91</td>
<td>0.94</td>
<td>0.91</td>
<td>0.94</td>
<td>0.94</td>
</tr>
<tr>
<td>UK</td>
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<td>1.00</td>
<td>0.95</td>
<td>0.96</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>USA</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
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</tr>
</tbody>
</table>

Source: Country Stock Composite Indices (Refer to Appendix C for list of stock composite indices used in this analysis)
### Table 4.3  Annual Total Returns, Volatility and Correlations (in Local Currencies): International Bonds, 2000 - 2009

<table>
<thead>
<tr>
<th></th>
<th>Australia</th>
<th>Canada</th>
<th>France</th>
<th>Germany</th>
<th>Italy</th>
<th>Japan</th>
<th>Netherlands</th>
<th>Spain</th>
<th>UK</th>
<th>USA</th>
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</thead>
<tbody>
<tr>
<td>Return</td>
<td>7.2%</td>
<td>7.2%</td>
<td>6.3%</td>
<td>6.2%</td>
<td>6.6%</td>
<td>2.6%</td>
<td>6.5%</td>
<td>6.3%</td>
<td>6.0%</td>
<td>6.5%</td>
</tr>
<tr>
<td>Std. Dev</td>
<td>10.0%</td>
<td>5.1%</td>
<td>4.9%</td>
<td>5.4%</td>
<td>3.8%</td>
<td>2.9%</td>
<td>4.5%</td>
<td>4.3%</td>
<td>5.5%</td>
<td>9.4%</td>
</tr>
<tr>
<td>Return/Risk Ratio</td>
<td>0.72</td>
<td>1.40</td>
<td>1.29</td>
<td>1.13</td>
<td>1.72</td>
<td>0.90</td>
<td>1.46</td>
<td>1.48</td>
<td>1.10</td>
<td>0.68</td>
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</table>

#### Correlations of Annual Returns

<table>
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<tr>
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<th>Canada</th>
<th>France</th>
<th>Germany</th>
<th>Italy</th>
<th>Japan</th>
<th>Netherlands</th>
<th>Spain</th>
<th>UK</th>
<th>USA</th>
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</thead>
<tbody>
<tr>
<td>Australia</td>
<td>1.00</td>
<td>0.47</td>
<td>0.51</td>
<td>0.59</td>
<td>0.22</td>
<td>0.48</td>
<td>0.45</td>
<td>0.38</td>
<td>0.78</td>
<td>0.72</td>
</tr>
<tr>
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<td>0.85</td>
<td>0.91</td>
<td>0.59</td>
<td>0.15</td>
<td>0.81</td>
<td>0.81</td>
<td>0.72</td>
<td>0.87</td>
<td>0.84</td>
</tr>
<tr>
<td>France</td>
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<td>0.98</td>
<td>0.90</td>
<td>0.19</td>
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<td>0.99</td>
<td>0.96</td>
<td>0.75</td>
<td>0.65</td>
</tr>
<tr>
<td>Germany</td>
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<td>0.96</td>
<td>0.97</td>
<td>0.93</td>
<td>0.96</td>
<td>0.97</td>
<td>0.41</td>
<td>0.33</td>
</tr>
<tr>
<td>Italy</td>
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<td>0.10</td>
<td>0.18</td>
<td>0.12</td>
<td>0.42</td>
<td>0.18</td>
<td>1.00</td>
<td>0.97</td>
<td>0.69</td>
<td>0.59</td>
</tr>
<tr>
<td>Japan</td>
<td>1.00</td>
<td>0.57</td>
<td>0.57</td>
<td>0.49</td>
<td>0.92</td>
<td>1.00</td>
<td>1.00</td>
<td>0.57</td>
<td>0.49</td>
<td></td>
</tr>
<tr>
<td>Netherlands</td>
<td>1.00</td>
<td>0.57</td>
<td>0.57</td>
<td>0.49</td>
<td>0.92</td>
<td>1.00</td>
<td>1.00</td>
<td>0.57</td>
<td>0.49</td>
<td></td>
</tr>
<tr>
<td>Spain</td>
<td>1.00</td>
<td>0.57</td>
<td>0.57</td>
<td>0.49</td>
<td>0.92</td>
<td>1.00</td>
<td>1.00</td>
<td>0.57</td>
<td>0.49</td>
<td></td>
</tr>
<tr>
<td>UK</td>
<td>1.00</td>
<td>0.57</td>
<td>0.57</td>
<td>0.49</td>
<td>0.92</td>
<td>1.00</td>
<td>1.00</td>
<td>0.57</td>
<td>0.49</td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>1.00</td>
<td>0.57</td>
<td>0.57</td>
<td>0.49</td>
<td>0.92</td>
<td>1.00</td>
<td>1.00</td>
<td>0.57</td>
<td>0.49</td>
<td></td>
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</tbody>
</table>

Source: Datastream 10-year Government Bond Indices

### Table 4.4  Annual Total Returns, Volatility and Correlations: US Real Estate, 2000 - 2009

<table>
<thead>
<tr>
<th></th>
<th>Boston</th>
<th>Chicago</th>
<th>Los Angeles</th>
<th>New York</th>
<th>San Francisco</th>
<th>Washington DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Returns</td>
<td>7.9%</td>
<td>6.6%</td>
<td>10.0%</td>
<td>10.3%</td>
<td>7.4%</td>
<td>11.0%</td>
</tr>
<tr>
<td>St. Dev</td>
<td>11.4%</td>
<td>9.7%</td>
<td>13.1%</td>
<td>16.0%</td>
<td>15.8%</td>
<td>11.4%</td>
</tr>
<tr>
<td>Return/Risk Ratio</td>
<td>0.69</td>
<td>0.68</td>
<td>0.77</td>
<td>0.64</td>
<td>0.47</td>
<td>0.97</td>
</tr>
</tbody>
</table>

#### Correlations of Annual Returns

<table>
<thead>
<tr>
<th></th>
<th>Boston</th>
<th>Chicago</th>
<th>Los Angeles</th>
<th>New York</th>
<th>San Francisco</th>
<th>Washington DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boston</td>
<td>1.00</td>
<td>0.84</td>
<td>0.88</td>
<td>0.70</td>
<td>0.60</td>
<td>0.79</td>
</tr>
<tr>
<td>Chicago</td>
<td>1.00</td>
<td>0.81</td>
<td>0.61</td>
<td>0.61</td>
<td>0.55</td>
<td>0.77</td>
</tr>
<tr>
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<td>0.52</td>
<td>0.52</td>
<td>0.50</td>
<td>0.51</td>
</tr>
<tr>
<td>New York</td>
<td>1.00</td>
<td>0.50</td>
<td>0.56</td>
<td>0.56</td>
<td>0.50</td>
<td>0.56</td>
</tr>
<tr>
<td>San Francisco</td>
<td>1.00</td>
<td>0.50</td>
<td>0.56</td>
<td>0.56</td>
<td>0.50</td>
<td>0.56</td>
</tr>
<tr>
<td>Washington DC</td>
<td>1.00</td>
<td>0.50</td>
<td>0.56</td>
<td>0.56</td>
<td>0.50</td>
<td>0.56</td>
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</tbody>
</table>

Source: NCREIF NPI Total Return Indices

### Table 4.5  Peak to Trough Loss in Asset Value: Late 2000s*

<table>
<thead>
<tr>
<th></th>
<th>Real Estate</th>
<th>Stocks</th>
<th>Bonds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>-2.4%</td>
<td>-41.3%</td>
<td>-7.8%</td>
</tr>
<tr>
<td>Canada</td>
<td>-0.3%</td>
<td>-35.0%</td>
<td>-3.0%</td>
</tr>
<tr>
<td>France</td>
<td>-2.3%</td>
<td>-42.7%</td>
<td>n/a</td>
</tr>
<tr>
<td>Germany</td>
<td>n/a</td>
<td>-42.4%</td>
<td>n/a</td>
</tr>
<tr>
<td>Italy</td>
<td>n/a</td>
<td>-51.7%</td>
<td>n/a</td>
</tr>
<tr>
<td>Japan</td>
<td>-6.2%</td>
<td>-48.0%</td>
<td>n/a</td>
</tr>
<tr>
<td>Netherlands</td>
<td>-0.2%</td>
<td>-52.3%</td>
<td>n/a</td>
</tr>
<tr>
<td>Spain</td>
<td>-12.7%</td>
<td>-39.4%</td>
<td>n/a</td>
</tr>
<tr>
<td>UK</td>
<td>-22.1%</td>
<td>-31.3%</td>
<td>-2.0%</td>
</tr>
<tr>
<td>USA</td>
<td>-24.1%</td>
<td>-38.5%</td>
<td>-10.3%</td>
</tr>
</tbody>
</table>

Average        | -7.0%       | -42.3% | -2.3% |

Source: IPD, NCREIF, Country Stock Composite Indices, Datastream
Note: * As a percentage of peak value based on annual returns, n/a = no peak - trough cycle
Tables 4.1 to 4.4 summarize the data that will be used in the quantitative analysis in this chapter: the mean returns, volatility and country correlations in real estate, stocks and bonds markets for the period between 2000 and 2009. In this table, all statistics are based on local currency returns, and therefore purely reflects the assets’ returns without the effects of exchange rates.

Generally speaking, direct real estate is substantially less risky than common stocks for all countries and slightly more risky than bonds in most countries, as measured by volatility. Table 4.5 presents what may be a more intuitive measure of asset class relative riskiness: the amplitude of the peak-to-trough drop in asset class cumulative investment value during the latter half of the decade. Table 4.5 thus dramatically encapsulates the impact of the great financial crisis in the latter years of the decade, in terms of the relative “hit” each asset class took in each country. The magnitude of the decline was greatest in the stock markets in every country, ranging from 31.3% to 42.7% across the board. The real estate markets suffered milder losses in value, declining by 7.0% on average. Italy and Germany did not experience a peak-trough cycle at all in real estate during the time period under study. The bond markets experienced little to no decline in value (in cumulative total returns) in most markets, with an average loss of 2.3%. Only in the U.S. and U.K., and to a lesser extent Spain, did the magnitude of the real estate peak-trough drop even approach that in the stock market.

The international real estate markets returns and volatility during the 2000 to 2009 period varied substantially from market to market. The average direct real estate returns varied from 3.1% p.a. for Germany to 10.9% for Australia. International stock markets during the period were generally characterized by high volatility and low mean returns, with performances ranging from -2.7% in Italy to 6.8% in Australia. The bond markets returns and volatility were both moderate. The 10-year government bond return is lowest in Japan at 2.6% and highest in Australia at 7.2%.

Annual correlations between real estate markets have been generally high during the sample period, with those between some pairs of country markets higher than those of their respective stock markets. In contrast to the findings from a few past studies, this sample data set does not indicate a conclusive relationship between country correlations within and across regions in real
Surprisingly, German real estate was the only market that demonstrated consistent negative correlation with all other markets except the Netherlands, as well as notably low return volatility. The average correlation for the non-Eurozone countries is 0.80 whereas that for the Eurozone countries is 0.50 when Germany is included, and 0.86 when Germany is excluded. This stark difference is due to the fact that Germany is negatively correlated with most other markets as noted earlier, thus the inclusion of Germany helped to bring down the average correlations for the otherwise moderately to highly correlated Eurozone markets. The U.K. real estate market presented moderate correlations with most other real estate markets in the opportunity set, averaging at 0.45, albeit the return volatility for the market is among the highest at 12.5%. Relative to the U.K. real estate, U.S. real estate presented a higher average correlation to the other markets at 0.75, while return volatility for the market stands roughly at the same level as that of the U.K. Negative to low correlations between some markets indicate that investors should be able to find substantial diversification opportunities in international real estate and bonds, while the consistently high correlations in the stock markets suggests that diversification opportunities in international stocks are scarce.

Of course, individual pairwise correlations, particularly over relatively short time spans, can be misleading. Sometimes a visual picture tells a more vivid story. The time-series graph of total returns for international direct real estate in Figure 4.3 reveals that most markets under this study followed a similar cyclical pattern in returns, with a slight downward movement in during the early part of the 2000s and a subsequent surge that began in 2004 and peaked in 2007, followed by a sharp decline towards the end of the decade. Correlations within the real estate asset class during the 2nd half of the 2000s increased by 25.7% on average compared to the first half. These findings indicate that real estate performances in developed markets during the recent years were highly influenced by global economic factors and were less localized than previously believed.

The sharp fall and correction in U.K. real estate returns explain the high volatility and relatively moderate level of correlation between the U.K. and the other international markets within our opportunity set, as evident in Figure 4.3. Similarly, extreme peak to trough swing contributed to the high volatility in the U.S. real estate market during the past decade. Italy experienced a somewhat flat growth in during the global up cycle from mid 2000s to 2007, and a
mild decline during the down market in 2008 to 2009. Germany appears to be the only market that did not follow the same cyclicality as the other markets. Germany held strong at a low return level and low volatility, and was also negatively correlated with all other international markets. This phenomenon perhaps reflects a combination of the strength in the underlying supply and demand in the space market in Germany, as well as possibly idiosyncrasies in property appraisal practices standards, or even the actual functioning of the property market in the country.

Figure 4.4 illustrates how a naïve Japanese, Spanish, U.K. or U.S. investor would have achieved superior risk reduction benefits by holding an equal-weighted portfolio of international real estate assets of the 10 developed countries, compared to holding a domestic real estate portfolio. U.S. and U.K. investors would reduced their portfolio risk by half from diversifying into international market with the equal-weighted portfolio. The value-weighted portfolio is less effective in risk reduction, due to the fact that U.S. and U.K. real estate account for 43.3% of the total portfolio, while those markets did not provide attractive risk-return efficiencies during the past decade. Canada, Australia and most of the Eurozone real estate markets demonstrated rather high risk-return efficiencies relative to the rest of the countries within the opportunity set. Figures 4.5 and 4.6 show a similar analysis for international stocks and bonds respectively.

Given the high degree of integration in the global asset markets, the risk-return relationship of each country should presumably fall on a positive trend line. As seen in the scatter plot in Figure 4.4 to 4.6, the real estate and bond markets in 2000 to 2009 both showed somewhat positive relationships between risk and return, while the stock markets did not show a clear positive relationship as expected. Given the high degree of integration in the global securities markets, assuming rational expectations, the risk-return relationship of each country should in principle fall on a positive trend line, over the long run. However, this was not the case for the stock markets in the particular stretch of history depicted here, reflecting the particular ex-post realization of risk and return that occurred in the equities markets during the 2000s.
Figure 4.3 Annual Total Returns: International Real Estate, 2000 – 2009

Source: IPD

Figure 4.4 International Real Estate Risk-Return Comparison, 2000 – 2009

Source: IPD Multinational Indices, Author
Figure 4.5 International Stocks Risk-Return Comparison, 2000 – 2009

Source: Country Stock Composite Indices, Author

Figure 4.6 International Bonds Risk-Return Comparison, 2000 – 2009

Source: Datastream 10-year Government Bond Indices, Author
4.2 Part II: Ex-Ante Diversification Opportunities: 2010 and Beyond

This section takes a forward look at diversification opportunities in international investments and attempts to project the benefits that U.S. and European investors may be able to achieve from diversifying into international asset markets in the near future, as compared to holding purely domestic asset portfolios. As noted, we do this by applying risk statistics i.e. volatility and correlations from the ex-post history of the 2000s decade combined with ex-ante return expectations that are plausible and typical among investors as of 2010. The domestic real estate opportunity set for U.S. investors assumed in this study includes Boston, Chicago, Los Angeles, New York, San Francisco and Washington DC, while that for European investors include France, Germany, Italy, Netherlands and Spain.

As noted, to examine future opportunities, realized returns from the period of 2000 – 2009 presented in the previous section are replaced with expected returns for real estate, stocks and bonds country markets. Historical standard deviations and correlations from the sample period are used as estimates for market volatilities. Appendix D shows the expected returns used in this analysis, and describes the methods and assumptions in estimating the expected returns for the three asset classes. All market returns used in this section are expressed in local currencies. This scenario thus can be considered a somewhat ideal case in which investors are able to perfectly hedge currency risks at no cost.

Real Estate, Stocks and Bonds

First, we compare separately the benefits to U.S. and European investors from international diversification within each asset class: real estate, stocks and bonds. Figure 4.7 shows, for a U.S. investor, the risk-return point of each asset class represented by a domestic-only index, versus a mean-variance efficient frontier of internationally diversified portfolios within each asset class. Figure 4.8 presents similar possibilities for a European investor.\(^\text{11}\)

\(^\text{11}\) For the domestic-only risk/return points, widely used indices are employed to represent the asset classes. In the case of the real estate domestic-only portfolio, an equal-weighted composite across domestic markets within the respective opportunity set (CBSAs in the U.S., countries in the Eurozone) is employed as the domestic-only index.
Figure 4.7 Effects of International Diversification for U.S. Investor (in Local Currencies)

Source: IPD, NCREIF, Country Stock Composite Indices, Financial Times, Datastream, Author

Figure 4.8 Effects of International Diversification for European Investor (in Local Currencies)

Source: IPD, NCREIF, Country Stock Composite Indices, Financial Times, Datastream, Author
From this perspective of domestic U.S. investors investing separately in the three asset classes, international diversification in the real estate asset class appears to provide more substantial risk-reduction benefits than does international diversification within either stocks or bonds. Volatility in the mean-variance optimized international real estate portfolio is 9.6% lower than that for U.S. equal-weighted domestic real estate portfolio at the same return level. Risk reduction benefits from the international stocks and bonds portfolios to U.S. investors are less at 2.6% and 6.6% respectively. For domestic European investors, potential risk reduction benefits from holding a mean-variance optimized international portfolio relative to holding equal-weight portfolio of domestic assets is highest in stocks, moderate in real estate and least in bonds. Reduction in volatility offered by the mean-variance optimized international real estate, stocks and bonds portfolios (relative to their domestic-only index counterparts) are 4.3%, 4.9% and 1.2% respectively.

The risk-return efficiency of the optimized international real estate portfolio also appears to be significantly better than that of the optimized international stocks portfolio.

**International VS Domestic Real Estate**

Next, we consider, within the real estate asset class alone, how domestic diversification across domestic geographies compares to international diversification, in improving the risk-return performance of the real estate portfolio. Figure 4.9 Illustrates the efficient frontier for international real estate relative to those based on U.S. and European domestic-only real estate. It appears that the U.S. investor is likely to benefit more from holding a diversified portfolio of international assets. Investments in international real estate provide significant portfolio risk-return improvement to a U.S. investor but only marginal improvement to a European investor relative to diversification within their respective domestic markets. This sharp contrast is largely due to the fact that several Eurozone markets during the 2000s displayed relatively high risk-return efficiencies and low correlations among themselves (mainly between Germany and other Eurozone markets), effectively providing most of the potential risk reduction benefits already within this opportunity set of developed countries. Thus, expanding the opportunity set to include markets outside the region does not help to substantially improve the portfolio risk return efficiency for European investors. By contrast, the 6 major metropolitan markets within the U.S.
domestic opportunity set are both highly volatile and nearly perfectly correlated, while providing only moderate returns. From a U.S. investor’s perspective, better diversification opportunities in real estate can be found outside the country.

Figure 4.10 shows the country allocation weights that form the international real estate efficient frontier portfolio in Figure 4.9. Germany holds a majority of the portfolio weight on the lower end of the return range. While Germany provides substantial diversification benefits from being negatively correlated with other country returns, its moderate expected returns limit its ability of the market in providing attractive portfolio risk-return on the higher end of the return range. Canada and Australia occupy most of the portfolio on the higher return range due to the fact that the countries offer high expected returns and moderate volatility. Despite being among the most prominent markets for cross-border and domestic real estate investments, U.S. real estate did not appear in the optimized international real estate portfolio, while U.K. real estate only appeared in fairly negligible weights. This is primarily due to fact that those two markets experienced a spike in volatility over the period, driven by the global financial crisis that began in late 2007. Of the 10 developed markets studied, the U.S. and U.K. underwent the sharpest correction in value from their peaks, declining 24% and 22% respectively in 2008, while the other markets in the sample set experienced between 13% decrease in value in Spain to slight increase value in Germany and Italy. This substantial change in value is reflected in the high volatility of the returns from the two markets during the past decade relative to those of the other markets in the opportunity set. The high second moment, coupled with high correlation with most other markets rendered the U.S. and U.K. real estate unattractive as risk-return enhancers for the international portfolio in the present analysis. To explore the possibility of including U.S. and U.K. real estate, we further conduct an analysis to test the conditions that would result in the U.S. and U.K. real estate being included in the portfolio in substantial weights. Results can be found in Appendix E.

It is apparent that the country allocation weights for this fully optimized international real estate efficient frontier portfolio depicted in Figure 4.10, at any given return level, are rather unbalanced, suggesting large allocations to a few markets while leaving out most of the markets within the opportunity set. In the next section, we examine how in practice investors may set upper limits on exposure to any single foreign market to help control the balance in allocation.
Figure 4.9 Effects of International Real Estate Diversification for U.S. and European Investors (in Local Currencies)

Source: IPD, NCREIF, Author

Figure 4.10 Optimized International Real Estate Portfolio Weights

Source: IPD, NCREIF, Author
Controlling for Home Bias and Country Caps

Investors in practice may overweight exposure to home-country markets and underweight, or in some cases ignore, exposure to foreign markets regardless of the markets’ potential risk-return enhancement benefits to the investors’ portfolios. This behavior is known as home bias. Key justifications for home biases include the fact that investors consumption is eventually tied to goods and services produced in the home country, thus domestic investments provide a natural hedge on consumer prices to domestic investors. Investors may also be inclined to assign higher weights to domestic markets in which they potentially have the advantage in developing deeper market knowledge and stronger deal flows. Furthermore, investors may assign country caps to limit their exposure to any single foreign market as part of their risk management mandates. This practice helps to control the balance in allocation weights of their international real estate portfolios.

In this section, we further examine how U.S. and European investors’ respective home bias and country caps mandates may affect risk-return enhancement potential of international real estate diversification. For U.S. investors, we assign a minimum weight for domestic investments at 50%, and a maximum limit for exposure to any single foreign market at 20% of the total portfolio. We reconstruct an efficient frontier for international real estate investments with U.S. home bias and country caps and compare against those for the fully optimized international real estate exposure within our international opportunity set with no home bias or country caps and for the domestic opportunity set, as illustrated in Figure 4.11. We find that fixing a minimum domestic market weight and maximum exposure to any single foreign market substantially reduces the risk reduction potential of international real estate for the U.S. investors’ portfolio, relative to when no minimum or maximum limits are assigned. Risk reduction benefits, as measured by difference between the standard deviation of the optimized international real estate portfolio and that of the optimized U.S. domestic portfolio at any given return level, decreased by approximately 2/3 when home bias and country caps conditions as described are assigned to the international portfolio. However, as the U.S. domestic-only opportunity set falls far short in providing attractive risk-return enhancement to the investor’s portfolio relative to the

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international 10-country opportunity set, U.S. investors should still benefit considerably from international diversification even with home bias and country caps conditions.

Figure 4.12 shows that the U.S. investors’ partially optimized international portfolio with home bias and country caps at any given return level includes more balanced allocation weights, relative to those of the fully optimized international real estate efficient frontier shown in Figure 4.10. The fully optimized portfolio with no home bias or country caps in any case will comprise of vast majority holdings in 1-2 foreign market (Germany, Canada or Australia), minimal to no exposure to other markets, and no exposure to U.S. home market. Whereas the partially optimized portfolio will include 50% exposure to U.S. domestic markets and several other markets in smaller weights.

We conduct a similar analysis on the effects of home bias and country caps on international diversification potential to European investors. We assign minimum weight for total Eurozone exposure at 50%, and a 20% cap on each of the 10 country markets within the international opportunity set. As with the U.S. investors’ case, we construct efficient frontier for international real estate that reflects European investors’ home bias and country caps and compare against those for the fully optimized international real estate exposure and the optimized domestic exposure. Results are shown in Figure 4.13. European home bias and country caps also limits the risk reduction potential that international real estate offers to investors. Risk reduction benefit i.e. decrease in portfolio standard deviation from international diversification relative to domestic diversification is reduced by approximately half when European home bias and country caps are assigned. Such home bias and country caps also limit the portfolio opportunities on the lower end of the risk-return spectrum due to the cap on German real estate, but offer more opportunities on the high end of the risk-return spectrum with the inclusion of markets such as Australia and Canada that provide higher expected returns than those offered by Eurozone markets. As illustrated in Figure 4.14, the optimized European portfolio with home bias and country caps on the lower end of the risk-return spectrum include maximum holdings of 3 Eurozone countries: Italy, Netherlands and Germany. France is introduced to the portfolio on the higher end of the risk-return spectrum while Spain, which exhibits the poorest risk-return efficiency among the European domestic real estate opportunity set and high correlations with other Eurozone country markets, is excluded from the portfolio at all return levels.
Figure 4.11 Effect of International Real Estate Diversification with U.S. Home Bias and Country Caps

![Graph showing the effect of international real estate diversification with U.S. home bias and country caps.](image)

Source: IPD, NCREIF, Author

Figure 4.12 Optimized International Real Estate Portfolio Weights with U.S. Home Bias and Country Caps

![Graph showing optimized international real estate portfolio weights with U.S. home bias and country caps.](image)

Source: IPD, NCREIF, Author
Figure 4.13 Effect of International Real Estate Diversification with European Home Bias and Country Caps

Figure 4.14 Optimized International Real Estate Portfolio Weights with European Home Bias and Country Caps
4.3 Part III: Effect of Currency Risk on Diversification Benefits

In this section, we expand our analysis from the previous section by further examining how currency risks may affect the risk-return enhancement potential that international real estate diversification can offer to U.S. and European investors. We begin with describing conceptually how currency risks affect the performances of foreign investments. First, exchange rates determine the actual realized returns that domestic investors achieve on their foreign investments when returns are converted to the investors’ domestic currency. Second, the second moment of return on a foreign investment calculated in domestic currency is a combination of the variance in foreign asset’s return in local currency, the variance in the rate of appreciation of the local currency against the domestic currency, and the covariance between the asset return and currency return.\(^1\) Given this, it is apparent that currency risks can greatly affect the total variance and thus the volatility of the foreign investments.

To examine extent to which currency risks affect the international real estate markets within our opportunity set in the sample period of 2000 to 2009, we present the decomposition of total variance for the 10 international real estate markets when returns are calculated in domestic currencies i.e. U.S. dollar and euro, and the risk and returns for each of the markets in domestic currencies in Tables 4.6 and 4.7 respectively. The decomposition of total variance shown in Table 4.6 highlights that, from the perspectives of both U.S. and European investors, currency variance substantially increases the total variance for most of their respective foreign markets from the pure real estate return variance in local currencies. For U.S. investors, Japan is the only market within this opportunity set in which the total variance is lower than the market’s return variance in Japanese yen. This is due to the fact that the covariance between Japanese real estate returns and the rate of appreciation of the local currency against the U.S. dollar was negative during the sample period of 2000 to 2009. For European investors, the total return variances are substantially higher than the return variances in local currencies in all cases. These increases in second moments are directly reflected in the increase in return volatility in domestic currency of the foreign real estate markets, as shown in Table 4.7.

\(^1\) \(\text{var}(R_i) = \text{var}(R_i) + \text{var}(e_i) + 2\text{cov}(R_i,e_i)\); where \(R_i\) is the domestic currency return, \(R_i\) is the local return for the asset and \(e_i\) is the rate of appreciation of the local currency against the dollar.
From Table 4.7, we note that foreign real estate returns in U.S. dollar are higher than those in local currencies in all cases, whereas foreign real estate returns in euro in are higher than those in local currencies in some cases. This is due to the fact that during the sample period, the U.S. dollar depreciated by 3% to 34% against all other currencies in the sample set while the Euro depreciated by 16.2% to 16.0% against the Australian dollar and Canadian dollar Japanese yen and appreciated by 7.1%, 24.9% and 22.2% against the Japanese yen, British pound and U.S. dollar respectively. Both the U.S. and European investors with unhedged positions in foreign investments would have made additional currency gains in the cases in which their respective domestic currencies depreciated against the foreign assets’ local currencies.

### Table 4.6  Decomposition of Total Variance (in Domestic Currency): Real Estate, 2000 - 2009

<table>
<thead>
<tr>
<th></th>
<th>US Dollar</th>
<th></th>
<th></th>
<th>US Dollar</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Return Variance</td>
<td>Currency Variance</td>
<td>Covariance (R,e)</td>
<td>Total Variance*</td>
<td>Return Variance</td>
<td>Currency Variance</td>
</tr>
<tr>
<td>Australia</td>
<td>0.0051</td>
<td>0.0105</td>
<td>0.0023</td>
<td>0.0201</td>
<td>0.0051</td>
<td>0.0156</td>
</tr>
<tr>
<td>Canada</td>
<td>0.0037</td>
<td>0.0036</td>
<td>0.0020</td>
<td>0.0114</td>
<td>0.0037</td>
<td>0.0210</td>
</tr>
<tr>
<td>France</td>
<td>0.0056</td>
<td>0.0086</td>
<td>-0.0005</td>
<td>0.0133</td>
<td>0.0056</td>
<td>n/a</td>
</tr>
<tr>
<td>Germany</td>
<td>0.0003</td>
<td>0.0086</td>
<td>-0.0004</td>
<td>0.0081</td>
<td>0.0003</td>
<td>n/a</td>
</tr>
<tr>
<td>Italy</td>
<td>0.0014</td>
<td>0.0086</td>
<td>-0.0016</td>
<td>0.0133</td>
<td>0.0014</td>
<td>n/a</td>
</tr>
<tr>
<td>Japan</td>
<td>0.0029</td>
<td>0.0063</td>
<td>-0.0033</td>
<td>0.0027</td>
<td>0.0029</td>
<td>0.0214</td>
</tr>
<tr>
<td>Netherlands</td>
<td>0.0022</td>
<td>0.0086</td>
<td>-0.0011</td>
<td>0.0085</td>
<td>0.0022</td>
<td>n/a</td>
</tr>
<tr>
<td>Spain</td>
<td>0.0078</td>
<td>0.0086</td>
<td>0.0011</td>
<td>0.0187</td>
<td>0.0078</td>
<td>n/a</td>
</tr>
<tr>
<td>UK</td>
<td>0.0156</td>
<td>0.0076</td>
<td>0.0035</td>
<td>0.0301</td>
<td>0.0156</td>
<td>0.0104</td>
</tr>
<tr>
<td>USA</td>
<td>0.0159</td>
<td>n/a</td>
<td>n/a</td>
<td>0.0159</td>
<td>0.0159</td>
<td>0.0203</td>
</tr>
</tbody>
</table>

Source: IPD, NCREIF, US Federal Reserve, European Central Bank, Author
Note: * Total Variance = var(R) + var(e) + 2covar(R,e); where R = Real estate return and e = Currency return

### Table 4.7  Annual Returns and Volatility (in Domestic Currency): Real Estate, 2000 - 2009

<table>
<thead>
<tr>
<th></th>
<th>Local Currency</th>
<th>US Dollar</th>
<th>Euro</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Return</td>
<td>Std. Dev</td>
<td>Return</td>
</tr>
<tr>
<td>Australia</td>
<td>10.86</td>
<td>7.11</td>
<td>14.90</td>
</tr>
<tr>
<td>Canada</td>
<td>10.73</td>
<td>6.10</td>
<td>14.07</td>
</tr>
<tr>
<td>France</td>
<td>10.32</td>
<td>7.48</td>
<td>13.70</td>
</tr>
<tr>
<td>Germany</td>
<td>3.12</td>
<td>1.75</td>
<td>6.28</td>
</tr>
<tr>
<td>Italy</td>
<td>6.89</td>
<td>3.77</td>
<td>13.43</td>
</tr>
<tr>
<td>Japan</td>
<td>7.95</td>
<td>5.38</td>
<td>11.22</td>
</tr>
<tr>
<td>Netherlands</td>
<td>8.83</td>
<td>4.69</td>
<td>12.09</td>
</tr>
<tr>
<td>Spain</td>
<td>7.77</td>
<td>8.85</td>
<td>13.19</td>
</tr>
<tr>
<td>UK</td>
<td>7.13</td>
<td>12.47</td>
<td>7.50</td>
</tr>
<tr>
<td>USA</td>
<td>8.87</td>
<td>12.60</td>
<td>8.87</td>
</tr>
</tbody>
</table>

Source: IPD, NCREIF, US Federal Reserve, European Central Bank, Author
As exchange rate movements theoretically follow a mean-reverting pattern in the long run, currency returns are assumed to be zero in an ex-ante projection. Given this, currency risks may increase the total volatility of the foreign investments when returns are calculated in the investors’ domestic currencies, without providing any upside to expected returns.

To examine how diversification opportunities provided by the foreign investments are affected by currency risks, we reconstruct efficient frontiers for fully optimized international real estate (in the investors’ domestic currencies) separately for the U.S. and European investors, using the real estate markets expected returns used in part II and volatility as determined in Table 4.7. Results are compare results with the efficient frontier for the fully optimized international real estate portfolio in local currency and those for the investors’ respective domestic portfolio determined in Part II, as presented in Figures 4.15 and 4.16. Even when additional exchange rate risks are taken into account, U.S. investors can still expect to achieve approximately 2-6% reduction in portfolio risk from international relative to domestic diversification when returns are in U.S. dollars, while a European investor whose benefits from international diversification in local currency was marginal will achieve negligible diversification benefits when returns are in euro and currency risks are unhedged. However, European investors can still benefit from return enhancement to the portfolio by investing in international markets that provide opportunities on the higher risk-return spectrum beyond that offered within the European opportunity set.

It is important to note that Figures 4.15 and 4.16 depict the presumably “worst case” scenario in which investors are fully exposed to currency risk. Currency hedging should reduce the additional volatility that is caused by currency variance and covariance between asset and currency returns, resulting in improvements in the international real estate portfolio’s risk-return efficiency in domestic currency relative to when no hedging is in place. However, ongoing hedging costs will somewhat deteriorate the total returns realized by the domestic investor. Degree of exposure to currency risk, hedging costs and appropriate hedging technique vary substantially by investor, market and time period. For this reason, currency management and its implication on portfolio risk and return are not quantitatively examined in this thesis.
Figure 4.15 Effect of International Real Estate Diversification for U.S. Investor (in U.S. Dollar)

Figure 4.16 Effect of International Real Estate Diversification for European Investor (in Euro)
CHAPTER V
CONCLUSION AND CLOSING NOTES

5.1 Conclusion

In this thesis, we find that while international direct real estate may not be immune to a global market downturn, the asset class should still offer attractive diversification opportunities to a mixed-asset portfolio. Within the real estate asset class, diversification opportunities can be found in international real estate markets. The existence of low correlations between international real estate markets and the stark difference in risk-return efficiency for each market are evidence that investors can potentially find attractive diversification benefits from international real estate opportunities. However, the degree to which an investor can benefit from these opportunities relative to domestic-only diversification would largely depend on the risk-return efficiency and degree of co-movement of investors’ domestic markets.

Through our study of annual historical data for international real estate, stocks and bonds for 10 developed countries spanning the period of 2000 to 2009, we find that even with the increased integration of the global markets and the occurrence of the 2008 to 2009 global financial crisis, 2008 was the only year during the past decade in which the real estate and stock markets in each country presented a synchronized negative return on a calendar year basis, and such synchronization was experienced by only half of the countries within our opportunity set. The mild peak to trough drop in international real estate values relative to that in international stocks during the latter half of the decade also suggests that real estate can still provide reasonable protection in a bear market.

In contrast to common notion that performance of real estate markets within the same region are more highly correlated than that of markets in different regions, this study shows that correlations between European markets vary substantially, with the most notable being Germany which negatively correlated with all other markets both within and outside the region. The existence of negative to low return correlation between markets, particularly during the period of synchronized global economic surge and downturn in which high correlation is expected,
underscores the benefits of international real estate diversification. However, whether the appraisal value of the properties from which the data points for direct real estate indices are derived reflect the liquid value at which properties are transacted or are merely figures that appear favorable to the investors and managers performance reports begs the question for further research.

U.S. real estate investors may substantially reduce their portfolio risk through diversification into international markets due to poor risk-return efficiency and moderate to high correlation between domestic opportunities. By contrast, European investors may find international diversification opportunities to be relatively lackluster as markets with considerable risk-return efficiency and moderate to low correlations and can be found within the region. The investor’s home bias and country caps help to control the balance in country exposure of the investor’s portfolios but undermine the investor’s ability to take full advantage of global diversification opportunities. Whereas, foreign investments currency risks may substantially increase the total risk of the international investments while providing no upside to expected returns, thereby ultimately reducing the benefits of international diversification.

We note that, given that the total returns data from all property types is used in this study, the mean-variance optimized portfolio weights represent the point of view of an “average” investor. In reality, investors are often confident in their ability to time the market, select the right property type and location in which to invest, and source mispriced assets that would outperform the market. This common belief, together with the fact that cross-border investors are drawn to larger, more liquid markets with good transparency and market depth supports the view that country markets such as the U.S. and U.K., which demonstrate the poorest risk-return performances among the 10 developed country markets covered in this study, should continue to be highly sought after targets for foreign capital.

5.2 Closing Notes

It is important to highlight that the portfolio optimization methodology used in this study serves to illustrate how investors may benefit from real estate portfolio risk-return enhancement through international diversification opportunities, as suggested by the empirical and ex-ante
studies on the sample countries as presented earlier. The inherent limitations of this methodology undermine its effectiveness as a tool for actual direct real estate portfolio allocation decisions. The lack of reliable long-horizon data limits the possibility of conducting meaningful quantitative analysis on asset allocation for most markets. Also, history of a market may not reflect its future potential, particularly with emerging markets that are evolving by nature. Furthermore, direct real estate investments require a blend of top down strategic allocation decision and bottom up capabilities in ground level assessment of opportunities, execution of deal flows and on-going asset management. This suggests that quantitative methodologies for portfolio allocation analyzes may only serve as a starting point in which to understand the potential benefits of international diversification rather than a comprehensive tool to develop conclusive allocation decisions.

In this closing section, we shall attempt to complete our study on international real estate diversification by expanding on the analyzes of issues presented in the previous chapters throughout this thesis to provide additional market views to address both the theoretical and practical perspectives on the topic of international real estate diversification. Information contained in this section is based in part on a series of interviews conducted with leading industry practitioners. We first discuss why investors increasingly seek cross-border real estate investment opportunities and examine how investors assess and select the countries and markets in which to invest. We then present a case on how diversification categories for international real estate investments should be determined in practice. Lastly, we examine the institutional real estate investors and investment managers’ views on currency risk management for real estate investment funds and portfolios.

**International Real Estate: Diversification and Yield Enhancement**

Real estate investors seek opportunities to invest in international markets for two main reasons. The first reason, which we have examined throughout this thesis, is that international real estate investments may provide attractive diversification benefits to the investors’ portfolios. We have

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15 The views and conclusions herein are those of the author and should not be attributed to any one or combination of the interviewees.
demonstrated in the previous chapters how international real estate can offer diversification benefits by improving the risk-return efficiency of the investment portfolios, particularly when movements in the domestic markets are highly correlated, and when the risk-return efficiency for the opportunities within the investor’s home country are lackluster relative to those for the international markets. In practice, another key reason that drives investors to seek cross-border real estate opportunities is to achieve higher yields that may be available outside their home market. Investors look to international real estate markets as a source for yield enhancement for their portfolios. Yield compression in domestic markets have increasingly led investors in developed countries to seek opportunities to achieve higher returns by investing in the more risky emerging markets and non-core assets. Allocating parts of their real estate portfolios to investments that fall on the higher end of the risk-return spectrum allows investors to maintain the average returns on their overall real estate portfolio at a desired level. In addition, broadening the investment avenue through investing in foreign markets and building a strong foothold in several international markets enable the investors to shift their allocation strategies to investing in various markets and property sectors to take advantage of superior market opportunities as they arise.\(^\text{16}\)

**Diversification Categories: Beyond Geographic Borders**

We quantitatively analyze in this thesis the effects of international real estate diversification on a country market level. For the purpose of determining whether international markets provide attractive risk-return enhancement to the real estate portfolio, markets within the opportunity set under the analysis are classified by geographical borders and constituents. We also did not make any distinction between different property types within each country market. Such classification of opportunities in real estate represents a rather simplified view of category-based diversification.

As demand for real estate i.e. the space market is directly linked to the geographic region’s economic base and demography, real estate portfolio diversification should ultimately be

considered on a macro perspective with emphasis on diversification of markets based on economic activity and demographic trends. Merely segmenting by geographic borders or product type does not provide investors with a complete picture of the market drivers of the real estate product. Investors should also look to the underlying economic factors that characterize each particular location as a guide in appropriately classifying markets by different economic bases.

Prudential Real Estate Advisors classified the top 6 U.S. CBSAs studied in this thesis by economic geography as shown in Table 5.1. According to Prudential, the principles for this geographic segmentation of the markets within the United States include its size, economic structure and geographical location.

<table>
<thead>
<tr>
<th>CBSAs</th>
<th>Classification</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boston</td>
<td>Tech Centers</td>
<td>Centers of advanced and emerging technology, and higher education</td>
</tr>
<tr>
<td>San Francisco</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chicago</td>
<td>Heartland Market</td>
<td>Midwest markets with high concentration in manufacturing and distribution</td>
</tr>
<tr>
<td>Los Angeles</td>
<td>Southern California</td>
<td>Diverse west coast economy with high growth and broad economic diversity including financial services, trade, distribution, technology and Traditional industry</td>
</tr>
<tr>
<td>New York</td>
<td>New York Corridor</td>
<td>A mature market highly influenced by the financial sector and strong transportation and commerce links along the Northeast Corridor</td>
</tr>
<tr>
<td>Washington DC</td>
<td>Capital Metro</td>
<td>The nation’s center for government and military-oriented economy</td>
</tr>
</tbody>
</table>

Source: Prudential Real Estate Investors, 2004

Applying the same framework to the international markets, it is clear that the underlying performance drivers for the assets are not only country specific but also location specific. Furthermore, with increasing level of global economic and capital market integration, the economic links between markets extend far beyond country borders. Cities in different continents built around the financial industry can be more highly correlated than are the technology and commodity based economies within the same country. Therefore, simplifying the analysis by categorizing markets by geographic borders may result in misleading conclusions about diversification. Investors should seek to further understand the driving forces behind the
demand and supply base for specific locations, and the interdependence and economic relationships between markets, in order to make well-informed strategic allocation decisions.

In practice, as bases for diversification, investors also look to micro level categories such as lease maturity and duration, tenant types and degree of supply constraints as well as tactical categories pertaining to investment allocation such as vintage year that has proven to be critical to the performance of the real estate investments funds over the past market cycle.

**Currency Risk Management**

There are two ways in which exchange rate risks can be naturally hedged; holding a portfolio of investments in multiple local currencies or taking on leverage in the asset’s local currency. On the portfolio level, when an investor holds investments in several currencies, imperfect correlations between exchange rate returns reduce the overall portfolio’s currency risk; the same way diversification reduces the assets idiosyncratic risks. On the asset level, local currency leverage will cancel out any currency risk on the levered portion of the investment. The remaining exposure to currency risk can be managed through purchasing of currency hedging instruments available in the market.

The extent to which currency risk is managed varies by investor, investment manager and currency. Size of the investors overall portfolio of international investments is one of the key factors that determine the demand for currency hedging. Smaller investors that are exposed to a small number of cross-border investments may require investment managers or currency managers to hedge currency risks while larger investors can benefit from the natural hedge provided through diversification of local currencies holdings. Investment managers also have varying views with regards to currency risk management. Some prefer to hedge currency risk to the extent possible, as currency movement is an additional risk factor that is beyond the scope of real estate investment and management. Others prefer that the currency risks remain unhedged unless their investors require otherwise, as hedging costs will undermine the bottom line performance reported to investors at the fund level. This is of particular concern in the positive years, in which investment managers would be enthusiastic about reporting higher performance figures.
The degree to which currency exposure is hedged can range from maximum hedging in which a projected exit value and expected cash flow stream generated from the investment over an assumed holding period is completely hedged, to merely hedging the capital value to lock in any unrealized currency gains as they arise. However, due to uncertainty of future cash flows and capital value of the assets, perfect hedging is unlikely.

The viability of active currency management also varies from currency to currency. Hedging is generally feasible in major currencies with significant capital market depth. On the other hand, costs of hedging local currencies of smaller developing countries with shallow capital markets, especially ones with high volatility, can be prohibitive. In some markets hedging instruments may be unavailable. For this reason, currency risks and trends may impact investors and managers decision to invest in certain markets, particularly those of “emerging” classification that historically have demonstrated high currency fluctuation.
APPENDIX
APPENDIX A

List of Interviewees

Michael Acton   AEW
Russell Devlin  AEW
Cervantes Lee   CBRE Investors
Varun Pathria   Colony Capital
Paige Mueller   GIC
Jacques Gordon  Lasalle Investment Management
Komson Attavivan Lasalle Investment Management
Simon Treacy    MGPA Asia
Youguo Liang    Prudential Real Estate Investors
Asieh Mansour  RREEF
**APPENDIX B**

Jones Lang Lasalle Real Estate Transparency Index and Sub-Indices
(for Countries within the International Opportunity Set)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>U.S.</td>
<td>6,414</td>
<td>6</td>
<td>1.25</td>
<td>1.07</td>
<td>1.17</td>
<td>1.36</td>
<td>1.50</td>
</tr>
<tr>
<td>2</td>
<td>Japan</td>
<td>2,285</td>
<td>26</td>
<td>2.3</td>
<td>1.71</td>
<td>2nd Tier</td>
<td>2nd Tier</td>
<td>2nd Tier</td>
</tr>
<tr>
<td>3</td>
<td>Germany</td>
<td>1,483</td>
<td>10</td>
<td>1.38</td>
<td>1.57</td>
<td>1.00</td>
<td>1.33</td>
<td>1.36</td>
</tr>
<tr>
<td>4</td>
<td>U.K.</td>
<td>1,239</td>
<td>3</td>
<td>1.24</td>
<td>1.00</td>
<td>1.60</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>5</td>
<td>France</td>
<td>1,211</td>
<td>8</td>
<td>1.28</td>
<td>1.14</td>
<td>1.20</td>
<td>n/a</td>
<td>1.18</td>
</tr>
<tr>
<td>7</td>
<td>Italy</td>
<td>963</td>
<td>21</td>
<td>1.89</td>
<td>1.57</td>
<td>2.00</td>
<td>1.67</td>
<td>2nd Tier</td>
</tr>
<tr>
<td>8</td>
<td>Spain</td>
<td>650</td>
<td>14</td>
<td>1.58</td>
<td>1.43</td>
<td>1.60</td>
<td>n/a</td>
<td>2nd Tier</td>
</tr>
<tr>
<td>9</td>
<td>Canada</td>
<td>605</td>
<td>2</td>
<td>1.23</td>
<td>1.14</td>
<td>1.40</td>
<td>1.00</td>
<td>1.36</td>
</tr>
<tr>
<td>11</td>
<td>Australia</td>
<td>448</td>
<td>1</td>
<td>1.22</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.36</td>
</tr>
<tr>
<td>13</td>
<td>Netherlands</td>
<td>360</td>
<td>9</td>
<td>1.38</td>
<td>1.43</td>
<td>1.80</td>
<td>1.00</td>
<td>1.36</td>
</tr>
</tbody>
</table>

Source: Jones Lang Lasalle, 2010
APPENDIX C
List of Country Stock Composite Indices

<table>
<thead>
<tr>
<th>Country</th>
<th>Index Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>S&amp;P/ASX 200</td>
</tr>
<tr>
<td>Canada</td>
<td>S&amp;P/TSX Composite</td>
</tr>
<tr>
<td>France</td>
<td>CAC 40 Index</td>
</tr>
<tr>
<td>Germany</td>
<td>DAX</td>
</tr>
<tr>
<td>Italy</td>
<td>FTSE MIB Index</td>
</tr>
<tr>
<td>Japan</td>
<td>TOPIX</td>
</tr>
<tr>
<td>Netherlands</td>
<td>AEX</td>
</tr>
<tr>
<td>Spain</td>
<td>IBEX 35</td>
</tr>
<tr>
<td>UK</td>
<td>FTSE 100</td>
</tr>
<tr>
<td>USA</td>
<td>S&amp;P 500</td>
</tr>
</tbody>
</table>
APPENDIX D  
Expected Returns Estimation

Real Estate:

Reasonable growth rates are assumed and added to the cap rates to arrive at expected total returns for each market. From Geltner and Miller (2007):

\[ r_i = \hat{y}_i + \hat{g}_i \]  \hspace{1cm} (1)

where \( r \) is the total return of each market, \( \hat{y}_i \) is the cap rate and \( \hat{g}_i \) is the expected growth in capital value. The expected returns derived from this method are then compared with the ranges of expected returns for each of the markets obtained through the previously-noted interviews with industry practitioners to ensure that the assumptions fall within the range of forward looking return expectations that investors currently perceived to be reasonable. The expected returns for the international real estate markets within our opportunity set are determined as follows.

<table>
<thead>
<tr>
<th>Country</th>
<th>( y^* )</th>
<th>( g )</th>
<th>( E(r) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>8.3%</td>
<td>2.0%</td>
<td>10.3%</td>
</tr>
<tr>
<td>Canada</td>
<td>8.0%</td>
<td>2.0%</td>
<td>10.0%</td>
</tr>
<tr>
<td>France</td>
<td>7.5%</td>
<td>1.0%</td>
<td>8.5%</td>
</tr>
<tr>
<td>Germany</td>
<td>6.7%</td>
<td>0.0%</td>
<td>6.7%</td>
</tr>
<tr>
<td>Italy</td>
<td>6.6%</td>
<td>1.0%</td>
<td>7.6%</td>
</tr>
<tr>
<td>Japan</td>
<td>5.5%</td>
<td>0.0%</td>
<td>5.5%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>7.5%</td>
<td>1.0%</td>
<td>8.5%</td>
</tr>
<tr>
<td>Spain</td>
<td>6.6%</td>
<td>1.0%</td>
<td>7.6%</td>
</tr>
<tr>
<td>U.K.</td>
<td>6.7%</td>
<td>0.0%</td>
<td>6.7%</td>
</tr>
<tr>
<td>U.S.</td>
<td>8.4%</td>
<td>0.0%</td>
<td>8.4%</td>
</tr>
</tbody>
</table>

Source: Real Capital Analytics, Author  
Note: * As of Q1/2010

Stocks:

Equilibrium expected returns for the stock markets are estimated through the use of the Capital Asset Pricing Model (CAPM) that compares the beta of stock markets against the world stock portfolio using the following formula as suggested by Bodie, Cane and Markus (2008).
\[ E[r_i] = r_f + \beta_i[E(r_m) - r_f] \]  

(2)

where \( E[r_i] \) is the expected return for a country stock market, \( [E(r_m) - r_f] \) is the estimated market risk premium for the world stocks portfolio and \( \beta \) is the beta of the individual market measured against the world stocks portfolio. From this formula, we obtain the expected returns (as of June 2010) for the country stock markets within our opportunity set as follows:

<table>
<thead>
<tr>
<th>Country</th>
<th>rf</th>
<th>Beta*</th>
<th>E(r )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>4.11%</td>
<td>0.77</td>
<td>10.3%</td>
</tr>
<tr>
<td>Canada</td>
<td>2.09%</td>
<td>0.80</td>
<td>8.5%</td>
</tr>
<tr>
<td>France</td>
<td>2.06%</td>
<td>0.87</td>
<td>9.0%</td>
</tr>
<tr>
<td>Germany</td>
<td>1.58%</td>
<td>0.93</td>
<td>9.0%</td>
</tr>
<tr>
<td>Italy</td>
<td>3.10%</td>
<td>0.96</td>
<td>10.8%</td>
</tr>
<tr>
<td>Japan</td>
<td>0.09%</td>
<td>0.97</td>
<td>7.8%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>1.81%</td>
<td>0.95</td>
<td>9.4%</td>
</tr>
<tr>
<td>Spain</td>
<td>3.70%</td>
<td>0.88</td>
<td>10.7%</td>
</tr>
<tr>
<td>U.K.</td>
<td>2.35%</td>
<td>0.73</td>
<td>8.2%</td>
</tr>
<tr>
<td>U.S.</td>
<td>1.96%</td>
<td>0.87</td>
<td>8.9%</td>
</tr>
</tbody>
</table>

Source: Country Stock Composite Indices, FT, Author

Notes: * Country Stock Market Index Against World Stock Market Index

Data as of June 30, 2010

Assumptions:
1) World Stock Market Risk Premium = 8%
2) Risk-free Rate = 10-year Govt Bond Yield - 100bps

Bonds:

10-Year Government Bond Yield from each respective country are used as expected-returns for the bond markets.

<table>
<thead>
<tr>
<th>Country</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>5.11%</td>
</tr>
<tr>
<td>Canada</td>
<td>3.09%</td>
</tr>
<tr>
<td>France</td>
<td>3.06%</td>
</tr>
<tr>
<td>Germany</td>
<td>2.58%</td>
</tr>
<tr>
<td>Italy</td>
<td>4.10%</td>
</tr>
<tr>
<td>Japan</td>
<td>1.09%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>2.81%</td>
</tr>
<tr>
<td>Spain</td>
<td>4.70%</td>
</tr>
<tr>
<td>U.K.</td>
<td>3.35%</td>
</tr>
<tr>
<td>U.S.</td>
<td>2.96%</td>
</tr>
</tbody>
</table>

Source: Financial Times

Note: Data as of June 30, 2010
APPENDIX E

International Real Estate
Optimized Portfolio Weights Adjustments

The surge in volatility in the U.S. and U.K. real estate in 2008 to 2009 relative to that in other countries may arguably be a one-time event with little likelihood of reoccurrence in the near term. An upward trend that would potentially make up for the loss in value might even be expected from both markets in the foreseeable future. To demonstrate a scenario in which U.S. and U.K. real estate may be included in the optimized portfolio, we have conducted a sensitivity analysis to test pairs of expected returns and risk assumptions for the two markets that would result in the U.S. and U.K. markets entering the portfolio in substantial weights. When the volatility is adjusted downward to a mid range level of 7.5%, and the growth rate assumed at 3% \(^1\) while returns and standard deviations for the other markets are held the same as before, the optimal portfolio will include reasonable weights of U.S. and U.K. real estate as shown in the portfolio weight graph on the next page.

The inclusion of the U.S. assets in substantial weight, as well as the U.K. ones albeit to a lesser extent, is largely due to our assumption that the U.S. market will be able to provide strong returns to the portfolio on the high risk-return range. The assumed growth rate of 3% for both markets increases the expected returns to 11.4% and 9.7% for the U.S. and U.K. real estate respectively. These expected returns are well above the 7-8% range as projected by industry practitioners. Optimistic investors may argue that this moderate future growth expectation for the two markets may not be overreaching, as the capital growth to make up for the recent substantial loss in value can be expected in the future. However, as the prospects in the underlying space market for the two countries do remain questionable as of July 2010, so a more conservative growth assumption may be preferred by some analysts.

\(^1\) As described in the methodology section in Chapter III, expected returns for real estate incorporates yield (as represented by cap rates) and growth components \((r = y + g)\). Thus, adjusting the growth assumption for the two markets essentially increases the expected returns for those markets by the additional growth assumed.
Optimized International Real Estate Portfolio Weights with U.S. and U.K. Return and Volatility Adjustment

Source: IPD, NCREIF, Author
REFERENCES


