Benefits of Global Diversification on a Real Estate Portfolio

That free lunch.

Adam Hastings and Hans Nordby

Capital flows are increasingly global across all asset classes, including the real estate world. Even the least sophisticated investor generally understands the benefit of a global investment strategy in a stock or bond portfolio. Consequently, institutional investors should also apply a global view on asset allocation to real estate investment.

Because global real estate portfolios include assets influenced by different national economies, with very different drivers, growth rates, and risk, the correlation of total returns between assets in these markets can be very low. Low or negative correlations provide the ultimate recipe for the free lunch of modern portfolio theory returns that are the weighted average of assets in the portfolio but less volatile than the individual assets. The movement of foreign exchange rates must be considered, however, as unfavorable currency movements can severely hamper performance. Real estate generally represents a long-term investment, but property income and ultimately the final selling price will be received in the local currency and must at some point be repatriated to U.S. dollars.

We examine the benefits of global diversification in a real estate portfolio and the effect of currency movements on those returns, using historical return data for 18 international office markets.

In the United States, pension funds represent a sizable portion of the private equity universe. Pension funds that held more than 20% of total assets in real estate in 2005 allocated approximately 7.6% of total assets to real estate. Broadening the perspective to a larger sample of pension funds, including those that have more recently begun to make real estate investments, approximately 6.5% of assets

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were allocated to real estate in 2006, about 130 basis points lower than their target.[1]

Within these real estate assets, a small but growing portion has been allocated to international real estate. As current international allocations are at only about 3.3%, it is expected that the percentage of international real estate in all real estate held by pension funds should continue to rise. Indeed, of the capital flows projected for 2007, 11.0% has been slated for international investment.[2]

Broadening our perspective to the entire private equity universe, expectations for capital flows to international real estate are the same, as it becomes more difficult to find attractive domestic investments in a period of unprecedented pricing, record-low cap rates, and a slowing U.S. economy.

Previous research on the topic has examined both the portfolio benefits of holding international assets and the potential currency implications of investing internationally. No research, however, has been able to quantify the benefits of international diversification as measured by total portfolio returns.

Worzala and Newall [1997] survey European and Asian institutional investors, focusing primarily on their investment decision-making framework. At the time of the survey, 45% of European institutional investors and 30% of Asian institutional investors actively sought international investments. Over the past ten years, both European and Asian markets have continued to mature, and those percentages are likely significantly higher today. Recent research supports this idea, estimating that European and Asian investors spent $5 billion and $16 billion on real estate, respectively, outside their domestic regions in 2006. This represents about three-fourths of total U.S. international capital flows to real estate over the same period (see Chin, Topintzi, and Hobbs [2007]).

Johnson et al. [2006] study the effects of currency movements on a simulated London-based property hedged with a series of different currency swaps using a Monte Carlo simulation model. The volatility in the pound-dollar exchange rate is the driver of the model, with property fundamentals held constant. The authors look at unhedged returns, returns after swapping the rental income and initial purchase price, and returns after swapping the rental income and expected selling price. Although both hedging scenarios reduce the probability of negative returns, the average return to the investor is also lower, as upside potential is lost because the exchange rate is set in the swap contract.

We look at the effect of currency movements across a number of different markets, and find the optimal way to invest in those markets to take advantage of those currency movements. We start with a study on total returns, volatility, and the behavior of a diverse portfolio of office property assets in the U.S., Canada, Europe, and Asia. While hedging considerations are important, we do not investigate their impact on returns directly, and we consider only the perspective of a U.S. investor.

DATA AND MARKET SELECTION

We use Property & Portfolio Research, Inc.'s (PPR) metro-level return data as estimated by the derived market return (DMR) model[3]. PPR tracks the performance of 100 office markets in the United States, 21 in Europe, and 6 in Asia. The DMR model measures year-over-year total returns, constituting value appreciation and income return, for an average commercial property in a particular market.

The returns used in this analysis are historical returns only. PPR's time series of returns for the Asian markets in this analysis vary in length, depending on availability of macro- and microeconomic data. We truncate the return series to equal the length of the shortest series, so that all time series in the analysis are the same length. The returns considered in the analysis are between 1991Q1 and 2005Q4.

The number of markets covered is unequal by continent, so we limit the U.S. and European markets included in the analysis. For the U.S. we rank the 54 markets tracked by PPR by a number of variables intended to measure their liquidity, stability over business cycles, and economic drivers of performance. We consider higher-ranked markets more core, and choose the top five U.S. office markets for this analysis: the New York, Chicago, Atlanta, Los Angeles, and Washington/Northern Virginia/Maryland metropolitan statistical areas.

Exhibit 1 shows the historical performance of each market.

For the European markets, we select six of the largest markets tracked by PPR as measured by market capitalization. To provide a diverse group of markets representing six different national economies, we select one market per country when several cities in the same country are ranked as one of the six largest markets. The European office markets for this analysis are Amsterdam, London, Paris, Stockholm, Frankfurt, and Madrid. All returns are measured in local currencies.

Exhibit 2 shows the historical returns of these markets.

We use all six Asian markets tracked by PPR in this analysis: Beijing, Hong Kong, Singapore, Sydney, Tokyo, and Shanghai. Although Sydney is technically part of the

EXHIBIT 1

Total Returns of U.S. Office Markets

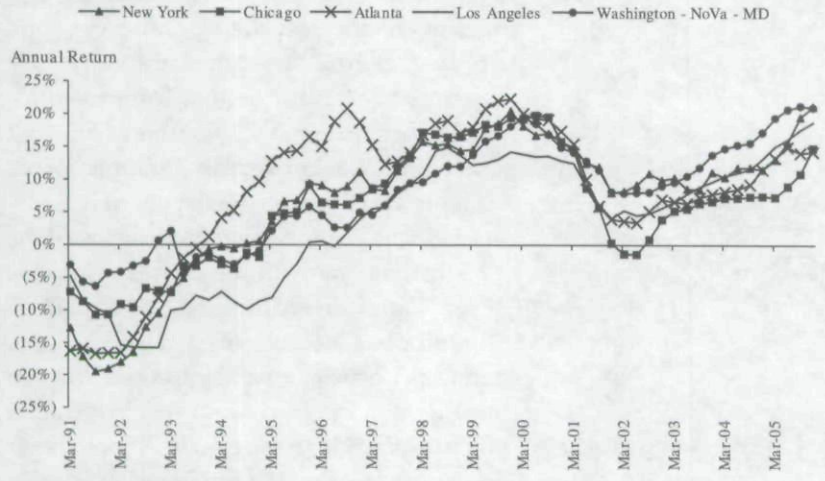
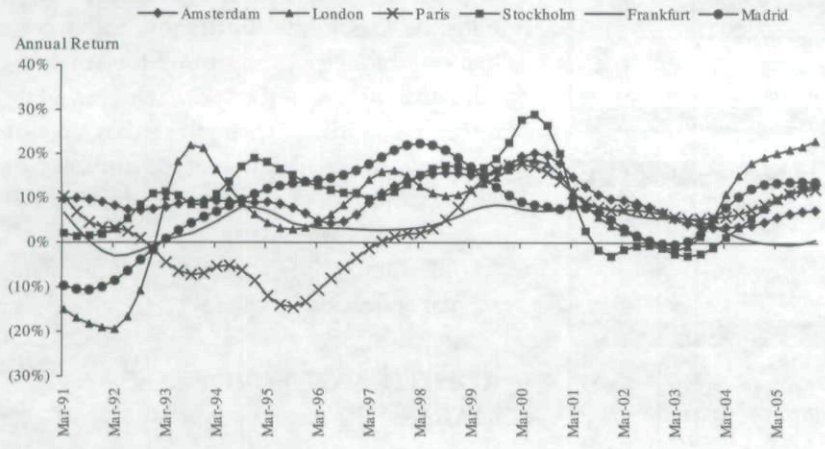


EXHIBIT 2

Total Returns of European Office Markets



Australian continent, for the purposes of our analysis we consider it part of Asia. Again, all returns are measured in local currencies.

Exhibit 3 shows the historical returns of these markets.

PPR also tracks the performance of six Canadian markets. We select one Canadian market, Toronto, to include in this analysis so that there are an equal number of markets representing each continent.

Throughout the analysis, we measure risk-adjusted returns as the ratio of average annual returns, without subtracting the risk-free rate, to the standard deviation of returns, effectively giving us a modified Sharpe ratio.

U.S. MARKETS

As Exhibit 4 indicates, of the U.S. office markets included in this analysis, Atlanta had the highest average annual returns between 1991 and 2005 but was also the riskiest market. For the same period, Los Angeles had very slightly lower risk and very poor returns, resulting in the lowest risk-adjusted returns. The Washington-NoVa-MD office market performed second-best in terms of overall returns but had superior risk-adjusted returns over the period, due to its relatively low volatility of total returns.

To create a portfolio that outperforms any one of these markets individually, one must first consider the correlation of these markets' cycles. Low or negative correlations imply strong diversification benefits, as it is those correlation measures that become the major piece of the volatility calculation as more assets are added to the portfolio.

Exhibit 5 shows the correlations of total returns over 1991-2005 of the U.S. markets in this analysis. We can see that the markets are not perfectly correlated; the lowest correlation is between Atlanta and Los Angeles, at 0.68. In general, however, these markets are highly correlated, with most correlation coefficients above 0.80. All of these office markets are impacted by U.S. national economic trends, a single currency, and a central bank working on the same interest rates. While risk can be reduced somewhat by mixing and matching office investments among these metros, the influence of the same macroeconomic drivers allows for relatively few risk reduction benefits.

Exhibit 6 maps out the efficient frontier that can be created from these five markets and compares the frontier to the individual markets performance, the NCREIF Office Market Index, and the PPR Office Market Index (a market capitalization-weighted average of the 54 office markets tracked by PPR). We can create a portfolio that has risk-adjusted returns even/better than the Washington-NoVA-MD metro alone, but the outperformance is limited by both the superior performance of that market (notice that it sits nearly on the frontier) and the relatively high correlation between each of these U.S. markets.

EXHIBIT 3

Total Returns of Asian Office Markets

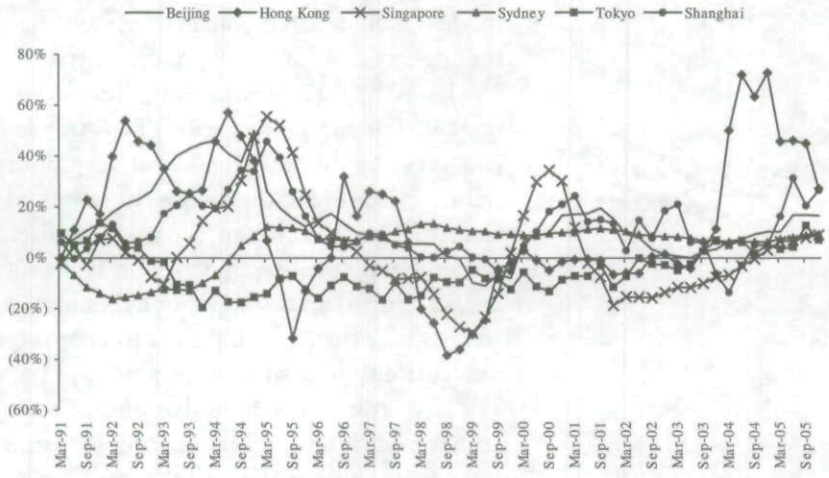


EXHIBIT 4

Summary of Global Office Market Returns

	Local Currency			U.S. Dollars		
	1991 Q1 - 2005 Q4			1991 Q1 - 2005 Q4		
	Average Return	Standard Deviation	Risk-Adjusted Return	Average Return	Standard Deviation	Risk-Adjusted Return
Canada						
Toronto	5.87%	10.00%	0.59	5.84%	12.12%	0.48
United States						
New York	6.70%	10.78%	0.62	6.70%	10.78%	0.62
Chicago	5.61%	8.86%	0.63	5.61%	8.86%	0.63
Atlanta	8.29%	10.93%	0.76	8.29%	10.93%	0.76
Los Angeles	3.50%	10.06%	0.35	3.50%	10.06%	0.35
Washington - NoVa - MD	7.76%	7.94%	0.98	7.76%	7.94%	0.98
Europe						
Amsterdam	9.76%	4.42%	2.21	12.14%	10.95%	1.11
London	7.69%	11.15%	0.69	8.02%	12.50%	0.64
Paris	3.41%	8.47%	0.40	5.80%	13.96%	0.42
Stockholm	9.87%	8.05%	1.23	8.74%	12.27%	0.71
Frankfurt	4.00%	3.19%	1.26	6.41%	11.86%	0.54
Madrid	8.21%	8.66%	0.95	7.22%	14.48%	0.50
Asia						
Beijing	13.83%	13.81%	1.00	9.65%	11.11%	0.87
Hong Kong	14.01%	27.38%	0.51	14.04%	27.46%	0.51
Singapore	3.30%	18.87%	0.17	4.51%	21.95%	0.21
Sydney	4.51%	8.96%	0.50	4.97%	14.28%	0.35
Tokyo	-5.00%	8.61%	(0.58)	-2.65%	14.28%	(0.19)
Shanghai	11.77%	11.87%	0.99	8.07%	12.58%	0.64

The composition of each efficient portfolio along the frontier can be observed in Exhibit 7.

NORTH AMERICAN MARKETS

With Canada right next door to the U.S., it makes sense to begin examining the historical benefits of international investing there. Because of low historical average annual returns (5.87%, higher than only Los Angeles among the U.S. metros considered here), however, and volatility of 10%, about the same as the U.S. average, allocations to the Toronto office market feature only at very low ends of the risk spectrum. We know from Exhibit 5 that Toronto's total returns are in general less correlated with the U.S. markets than any of the U.S. markets are with themselves. This suggests more diversification benefit from Toronto, but, because of its relatively weak return performance, we see Toronto show up in efficient portfolios only at very low ends of the risk spectrum. Allocation to Toronto never exceeds 10% of total portfolio value.

Exhibit 8 shows the efficient frontier including Toronto (North American frontier) with the frontier created from the U.S. markets alone. This frontier essentially overlaps with the U.S.-only frontier, except at very low ends of the risk spectrum. Efficient portfolios that include Toronto can achieve slightly lower-risk profiles than those that do not include Toronto. Because of the similarity of the two frontiers, we will refer henceforth only to the North American frontier.

Exhibit 9 shows the extent of the incremental allocations to Toronto.

ADDITION OF EUROPEAN MARKETS

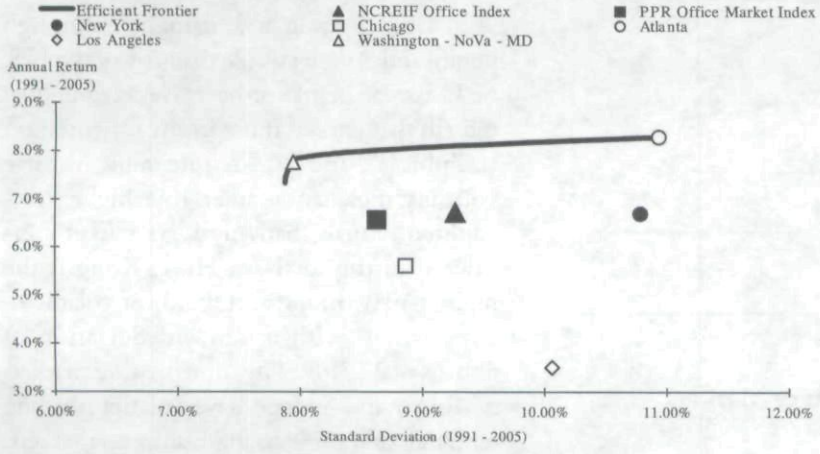
The six European office markets in this analysis represent six different national economies, each affected by different demand and supply cycles. Thus, the European markets have not only low correlations with the U.S. markets but also low correlations with one another (Exhibit 5).

In general, the European markets show higher risk-adjusted returns than the North American markets we include. Demand for office space tends to be more stable, since it is tougher to hire and fire people in (more socialistic) Europe. Also, supply is more stable, as it is harder to build in most European cities. Finally, cap rates are much less volatile in the European markets, so large value gains or losses are less common. Obviously, markets differ.

EXHIBIT 5
Correlations of Global Office Market Returns

	Toronto	New York	Chicago	Atlanta	Los Angeles	Washington - NoVa - MD	Amsterdam	London	Paris	Stockholm	Frankfurt	Madrid	Beijing	Hong Kong	Singapore	Sydney	Tokyo	Shanghai
Toronto	1.00																	
New York	0.68	1.00																
Chicago	0.76	0.91	1.00															
Atlanta	0.51	0.91	0.88	1.00														
Los Angeles	0.81	0.87	0.85	0.68	1.00													
Washington - NoVa - MD	0.69	0.88	0.82	0.70	0.91	1.00												
Amsterdam	0.46	0.31	0.52	0.35	0.26	0.27	1.00											
London	0.23	0.73	0.63	0.75	0.50	0.61	0.29	1.00										
Paris	0.59	0.31	0.39	0.02	0.64	0.55	0.32	(0.04)	1.00									
Stockholm	0.17	0.38	0.57	0.59	0.19	0.26	0.64	0.51	(0.04)	1.00								
Frankfurt	0.31	0.34	0.35	0.27	0.34	0.15	0.33	(0.02)	0.37	0.15	1.00							
Madrid	0.45	0.74	0.72	0.88	0.50	0.52	0.28	0.78	(0.22)	0.55	(0.01)	1.00						
Beijing	(0.74)	(0.42)	(0.53)	(0.27)	(0.64)	(0.52)	(0.18)	0.13	(0.60)	0.09	(0.23)	(0.10)	1.00					
Hong Kong	(0.53)	(0.34)	(0.44)	(0.33)	(0.31)	(0.16)	(0.50)	0.10	(0.13)	(0.17)	(0.53)	(0.18)	0.49	1.00				
Singapore	(0.39)	(0.11)	(0.07)	0.04	(0.23)	(0.20)	(0.06)	(0.03)	(0.25)	0.41	0.21	(0.07)	0.47	0.17	1.00			
Sydney	0.70	0.82	0.76	0.73	0.78	0.65	0.18	0.34	0.29	0.21	0.61	0.56	(0.51)	(0.49)	0.07	1.00		
Tokyo	(0.01)	(0.33)	(0.33)	(0.55)	0.04	0.05	(0.42)	(0.49)	0.44	(0.51)	(0.32)	(0.58)	(0.27)	0.30	(0.16)	(0.26)	1.00	
Shanghai	(0.40)	(0.07)	(0.19)	0.03	(0.31)	(0.18)	(0.05)	0.16	(0.43)	0.20	0.04	0.04	0.65	0.12	0.61	(0.03)	(0.27)	1.00

EXHIBIT 6
U.S. Office Market Efficient Frontier



In terms of total returns, Amsterdam outperforms all other markets, with average annual returns of 9.76%. Amsterdam also posts the highest risk-adjusted returns due to its low volatility (second only to Frankfurt). Paris, however, posts the lowest average annual return of the European markets, averaging only 3.41% annually. In general, standard deviations of returns for the European markets are lower than in the U.S. markets and, coupled with similar performance, the European markets have higher risk-adjusted returns.

With the addition of the European markets, we are beginning to see correlations that are quite low, or negative, and performance that varies across markets and regions. This suggests that adding Europe to our office portfolio should dramatically reduce risk. Indeed, including the European markets allows us to create a portfolio that outperforms, in terms of risk-adjusted returns, one that does not include Europe at every risk level. This can be seen in Exhibit 8 by the outward shift of the North American + Europe Frontier relative to the North American Frontier. Not surprisingly, because of their relatively higher risk-adjusted returns, efficient portfolios along the blue frontier hold mostly European markets, with the exception of about 5% allocation to Washington-NoVA-MD along most points of the frontier.

The composition of efficient portfolios including European markets is graphed in Exhibit 10.

At low ends of the risk spectrum, we see a heavy allocation to Frankfurt, which has the lowest historical standard deviation of total returns of all markets in the analysis thus far. As we move up the risk spectrum, we see more and more allocation to Amsterdam, driven by its superior risk-adjusted returns. At the high end of the

EXHIBIT 7

Optimal Allocations to U.S. Office Markets

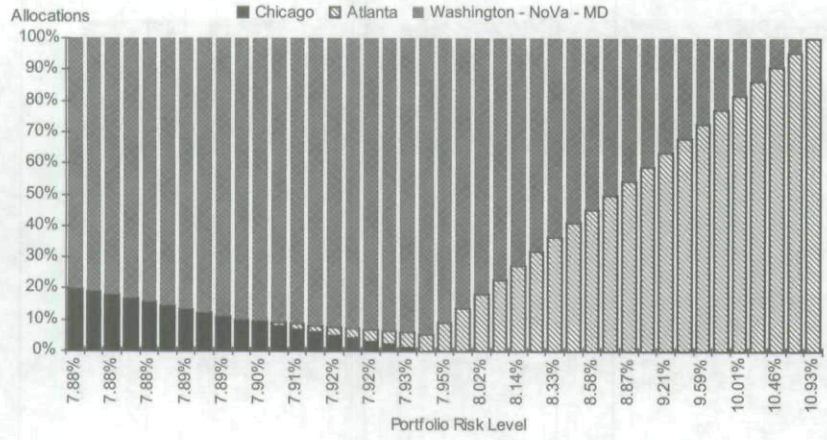


EXHIBIT 8

Efficient Frontiers After Inclusion of Global Office Markets

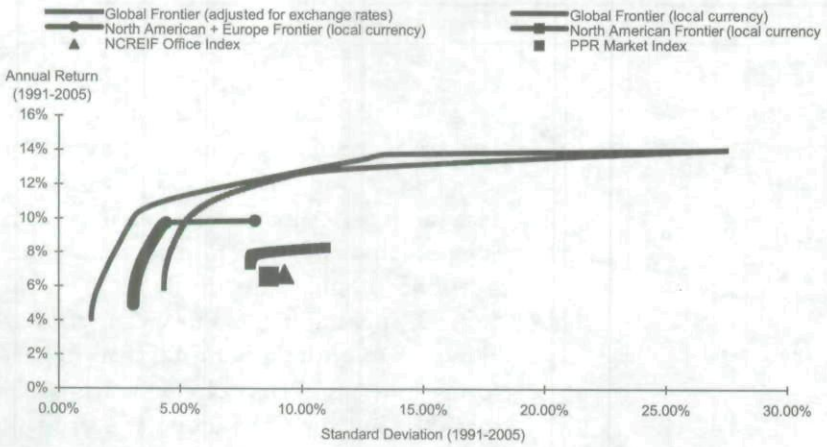
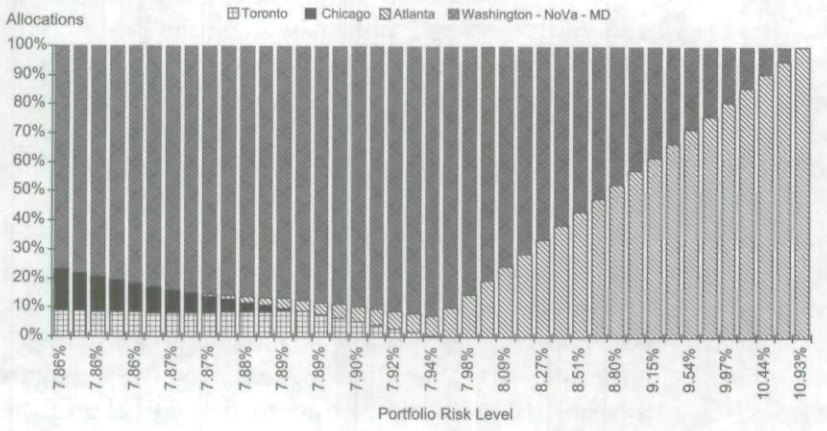


EXHIBIT 9

Optimal Allocations to U.S. and Canadian Office Markets



frontier, we see complete allocation to Stockholm, as that market just barely beats Amsterdam in terms of total returns. Madrid, Washington-NoVA-MD, and Paris serve as risk reducers because of their low correlations with Frankfurt and Amsterdam.

ADDITION OF ASIAN MARKETS

Many multinational corporations already have well-established roots in Asia, and American capital for private equity real estate continues to flow into the region. Solid economic growth, combined with the trend toward a more service-based economy in countries like China, bodes well for institutional investment-quality real estate demand growth. While the economic outlook for the region is solid, the historical performance of many of these cities is mixed. The financial crisis of the late 1990s did affect performance in many markets, but solid performance both before and after the crisis must also be considered.

Both Beijing and Shanghai, although significantly more volatile than any of the U.S. or European markets, have averaged annual returns that exceed those in any other region (Exhibit 4). Indeed, despite high historic volatility, these two markets have higher risk-adjusted returns than any U.S. market considered in this analysis. Hong Kong is the highest-networking and the most volatile of any market, with a standard deviation of returns of 27.38%. The more mature markets of Tokyo and Sydney have volatility in line with that of most U.S. and European markets. Tokyo, however, has suffered negative returns over much of the period, due to the deflating of the land price bubble that peaked in the early 1990s.

Interestingly, the Asian markets, except Sydney, are generally negatively correlated with all North American markets (Exhibit 5). Similarly, the Asian markets generally have low or negative correlations with the European markets. Given such low correlations, North American or European investors would have dramatically improved their

EXHIBIT 10

Optimal Allocations to U.S., Canadian, and European Office Markets

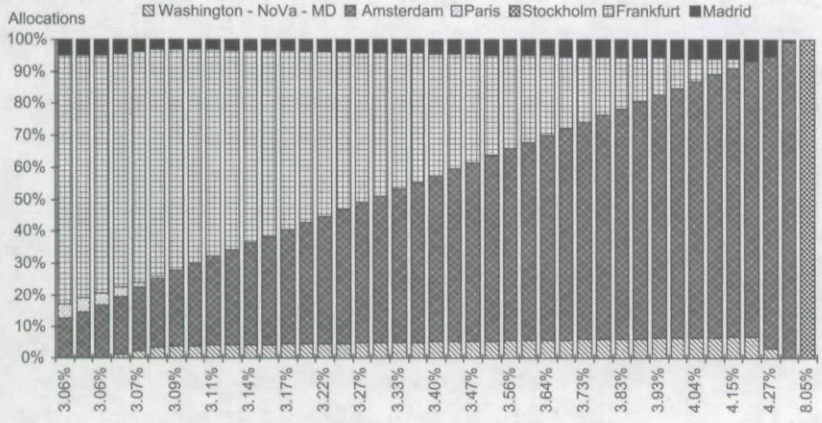
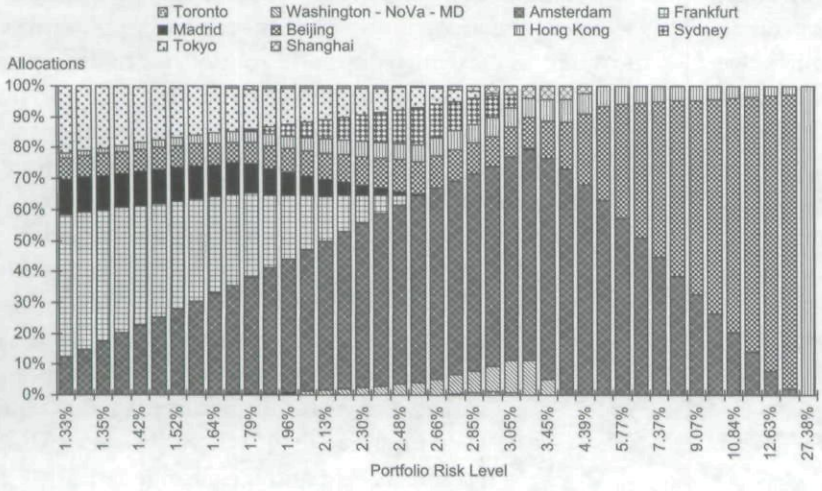


EXHIBIT 11

Optimal Allocations to Global Office Markets



real estate portfolio performance, in both absolute and risk-adjusted terms, by investing in Asia.

The efficient frontier that can be constructed by adding the Asian markets in Exhibit 8 [Global Frontier (local currency)] again is shifted outward. There is also a greater range of potential portfolio characteristics, as can be seen by the longer length of the frontier. An optimal portfolio using a global investment strategy would have outperformed one that does not include Asia by 18%. Even more dramatic, an optimal global portfolio would outperform one that does not hold either Europe or Asia by 171%.

Exhibit 11 shows the composition of the global efficient frontier. Note that the efficient frontier, at some level of risk, suggests investment in every geographic region considered. At low ends of the risk spectrum, we see allocations in primarily European markets, like Amsterdam, Frankfurt, and Madrid. As we move up the risk spectrum, allocations are increased to Beijing and Amsterdam. We see allocations to Washington-NoVA-MD and Toronto show up at moderate levels of risk, primarily because of their benefits as risk reducers, since they have low correlations with the higher allocated markets.

CURRENCY CONSIDERATIONS

The analysis thus far has considered efficient allocations based on market returns measured only in a local currency. A U.S. investor, however, must eventually repatriate both the income and, ultimately the selling value of a property to U.S. dollars. To analyze the effect of exchange rate movements on market returns, we calculate the return to a U.S. investor so that the return in any particular period is multiplied by the change in the exchange rate over that period:

$$\text{Return}_{USD} = [(1+ \text{Return}_{LOCAL})\times (1 + \Delta \text{ Spot Rate [USD/Local]})] - 1$$

where return_{USD} is the market return measured in U.S. dollars, return_{LOCAL} is the market returns measured in the local currency, and Δspot rate[USD/local] is the periodic change in the spot exchange rate between the local currency and U.S. dollars. This methodology assumes that all income and capital gains or losses are repatriated every period.

The methodology for calculating variance of returns to a domestic investor is slightly more complicated. Thomas and Lee [2006] discuss the need to understand the correlation between movements in the exchange rate and real estate returns. Both the volatility of market returns in local currency and the volatility of the exchange rate contribute to the volatility of the returns to a U.S. investor. If market returns and exchange rates tend to move in opposite directions, total volatility of unhedged

returns could be dampened, or even be lower than the volatility of returns in the local currency.

Thus, we approach the volatility measure in a way that is similar to a portfolio of two risky assets under modern portfolio theory;

$$\text{Var}(\text{Returns}_{USD}) = \text{Var}(\text{Returns}_{LOCAL}) + \text{Var}(\text{Returns}_{FX}) + \text{Covar}(\text{Returns}_{LOCAL}, \text{Returns}_{FX})$$

where var(returns$_{USD}$) is the variance in total returns measured in USD, var (returns$_{LOCAL}$) is the variance of returns measured in the local currency, var (returns$_{FX}$) is the variance of the local currency to the U.S. dollar, and covar (returns$_{LOCAL}$, returns$_{FX}$) is the covariance between total returns in the local currency and the exchange rate.

We then recalculate each return series and its corresponding volatility measure to determine the effect of currency movements on local market returns. Exhibit 12 highlights the effects of currency movements on London office markets returns for a U.S. investor. The London-West End DMR line illustrates total returns for investors in the London-West End office market in local currency, the British pound. Volatility of returns in this market is the highest for any of the European markets in this analysis. The green line shows the exchange rate measured in pounds per U.S. dollar.

It is not difficult to see that the exchange rate and local market returns tend to move in the same direction. This positive correlation serves to magnify total return volatility to the U.S. investor.

As Exhibit 4 has shown, in all European markets except Paris risk-adjusted returns are markedly lower once we factor in the effect of exchange rates. In all cases, total returns are actually higher than they are in the local currency, which is attributable to a depreciating dollar. In terms of volatility, the added effect of exchange rates makes U.S. dollar-denominated returns more volatile than local currency-denominated returns. While Amsterdam still boasts the highest risk-adjusted returns, the margin over the U.S. markets is not nearly as great.

London is the only European market in this analysis that is not part of the euros zone; pounds sterling remain the local currency. While returns are 33 basis points higher when measured in U.S. dollars because of a slight appreciation trend over the period, the increase in volatility is even greater and depresses risk-adjusted returns.

For the Asian markets, results are mixed. Both China and Hong Kong peg their currency to the U.S. dollar. Since China began pegging the yuan to the U.S. dollar in 1994 (and this analysis uses returns back to 1991), returns measured in local currency and U.S. dollars are different. When the peg was initiated, there was an immediate devaluation of the yuan, which would have hurt returns to the U.S. investor. Thus, risk-adjusted returns for both Beijing and Shanghai are lower when measured in U.S. dollars.

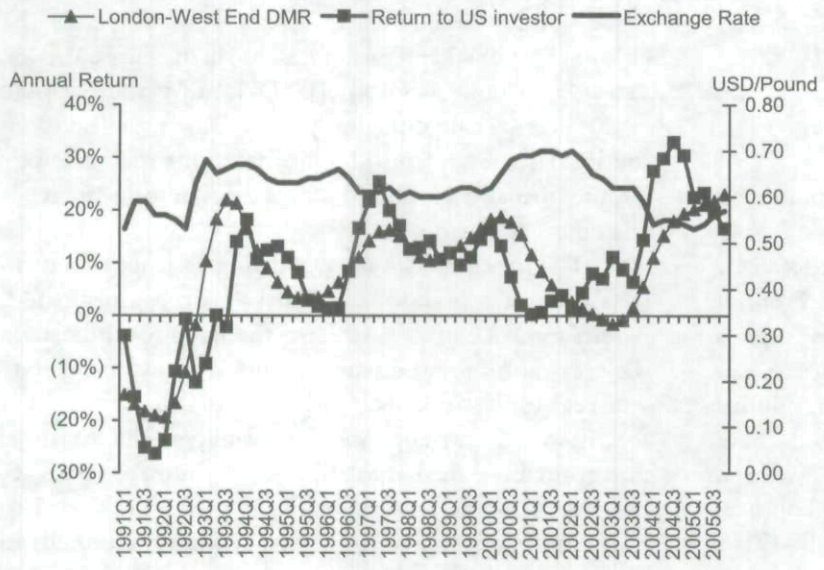
The office market performance of Hong Kong, whose currency was pegged to the dollar before 1991, is virtually the same when denominated in the local currency and U.S. dollars. Similarly, the performance of the Singapore market returns is not dramatically different when measured in U.S. dollars because of the relative stability of the exchange rate.

The Tokyo office market actually looks slightly better measured in U.S. dollars, although average returns are still negative. The exchange rate between the yen and the dollar is relatively volatile, and returns on the yen and returns on Japanese private equity are positively correlated. The result is to nearly double the volatility of total returns to a U.S. investor. The yen tended to appreciate over the period.

Of the Asian markets studied here, Sydney has the greatest increase in volatility from the perspective of a U.S. investor. The mid-1990s saw a general depreciation in the Australian dollar relative to the U.S. dollar;

EXHIBIT 12

London Office Returns to a U.S. Investor



over 2001–2005, however, the trend was reversed, and the Australian dollar appreciated markedly against the U.S. dollar, driven by Australia's close economic ties to a rising commodity market. This volatility in the exchange rate magnifies the volatility of returns to a U.S. investor.

We saw in Exhibit 5 the effect of exchange rate volatility on the global efficient frontier. Exchange rate volatility hinders the performance of an unhedged portfolio, as can be seen in the inward shift of the global efficient frontier when we account for exchange rates. An investor cannot, along any point of the frontier, form an efficient portfolio that performs as well as one that lies along a global frontier not adjusted for exchange rates.

At moderate and high levels of risk, however, the difference in achievable total returns is quite small. At the 6.5% standard deviation level, returns on an efficient portfolio adjusted for exchange rates are only about 5.0% lower than an efficient portfolio in local currency. The difference is minimized at approximately 10% standard deviation, but admittedly, typical U.S. investors would seek risk levels lower than that. Only at low levels of risk is the performance difference significant.

When we do not account for exchange rates, efficient portfolios with standard deviations of returns as low as 1.33% could be formed. With the added volatility of exchange rates, however, it is not possible to form efficient portfolios with a standard deviation of returns of less than 3.9%. An investor's global optimal portfolio (measured in U.S. dollars) would have outperformed a U.S.-only portfolio by almost 92%.

Exhibit 13 shows the composition of the global efficient frontier adjusted for the effect of exchange rates. Madrid, Shanghai, and Washington-NoV-MD have now completely dropped out of our efficient allocations. We see allocations to two new markets, Atlanta and London-West End. Again, results show allocations to every geographic region of the world at some point along the efficient frontier. In fact, even more allocation is given to both the U.S. and Canada.

Except at high levels of risk, there is greater diversification within efficient portfolios. While the composition of efficient portfolios has changed with the inclusion of exchange rate effects, the implications of a global strategy remain the same.

SUMMARY AND FUTURE RESEARCH

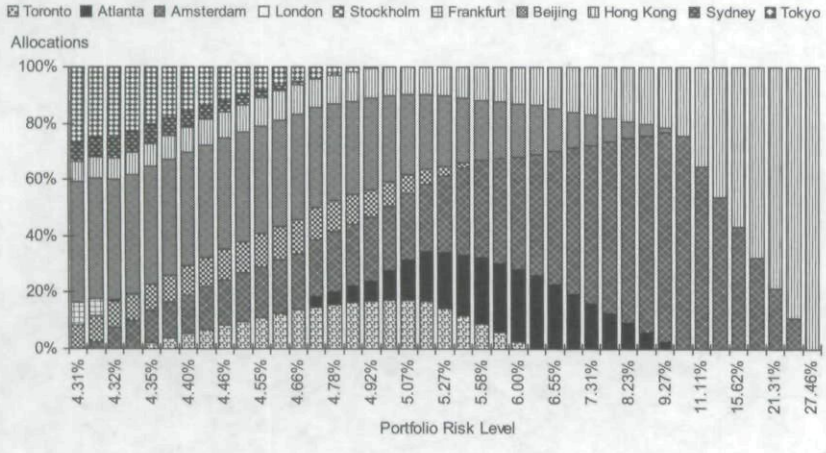
Global investment in office properties, in terms of both reduced volatility and increased returns, both with and without currency exchange rate factors, is considered in this research, which makes a compelling case for global, instead of U.S.-only, investment in the office sector. When only U.S. office investments are considered, an investor has limited performance options. As we add markets from Europe and Asia, the range of return and risk options becomes greater, as seen by the outward shifts of the efficient frontiers.

Over the period surveyed, investors achieved superior risk-adjusted returns by selectively taking advantage of markets whose performance is impacted by macro- and microeconomic factors different from those in the U.S. The optimal global portfolio, denominated in local currencies, would have outperformed a U.S.-only portfolio by 171% over the period examined. While this outperformance is overstated if the effect of exchange rate movements is considered, even accounting for the volatility of exchange rates and returns that are lower at every risk level, a real estate investor is still significantly better off than if invested solely in the U.S. A global portfolio that maximized risk-adjusted returns would still outperform a U.S.-only portfolio by 92%.

We have not examined the effect of any hedging strategies in this analysis. Furthermore, we assume that returns, generated by both property income and value appreciation, are repatriated every quarter. While both assumptions could be argued as

EXHIBIT 13

Optimal Allocations to Global Office Markets Measured in U.S. Dollars



oversimplifying, they set a reasonable framework for global asset allocation strategies.

Further research would likely consider the use of hedging strategies and currency repatriation timing strategies on efficient portfolios of global real estate. For example, if the assumption of quarterly repatriation were eliminated, one could better understand the effect of those hedging strategies on performance.

Finally, this analysis could be expanded to include other property types, as diversifying among property types rather than just geographically can also prove to benefit portfolio performance.

ENDNOTES

[1]Pension Real Estate Association 2006 Investor Survey.

[2]"Annual Plan Sponsor Survey: Tax -Exempt Real Estate Investment 2007."

[3]The derived market return (DMR) is PPR's calculation of the total nominal return on unlevered property investments, including both income and capital value components of return. The DMR reflects national capital market and macroeconomic effects, as well as local property market fundamentals, including occupancy rates, rents, and net operating income (NOI) trends and expectations. The DMR assumes market average vacancy rates, rents, and marked-to-market capital values. Effectively, it represents the return on the average asset in the market, or on a representative portfolio of assets in the market. The DMR for each quarter represents the total return for the year ending in that quarter.

REFERENCES

"Annual Plan Sponsor Survey: Tax-Exempt Real Estate Investment 2007." Kinsley Associates, 2007.

Chin, Henry, E. Topintzi, and P. Hobbs. "Global Real Estate Investment Performance 2006 and 2007." RREEF, 2007.

Johnson, R., C. Lizieri, L. Soenen, and E. Worzala. "Simulating Currency Risk on Private Investments in Real Estate." *Journal of Real Estate Portfolio Management*, May/August 2006, pp. 91-101.

Thomas, M., and S. Lee. "The Impact of Exchange Rates on International Real Estate Portfolio Allocation." *Journal of Real Estate Portfolio Management*. September/December 2006, pp. 277-293.

"2006 Plan Sponsor Research Report." Pension Real Estate Association.

Worzala, E., and G. Newall. "International Real Estate: A Review of Strategic Investment Issues." *Journal of Real Estate Portfolio Management*, 1997.