

Does International Diversification Work Better for Real Estate than for Stocks and Bonds?

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International diversification is now an established fact for stock and bond portfolios. For real estate shares, however, this acceptance has so far not been the case. This study is an investigation of the effectiveness of international real estate diversification relative to international diversification of stock and bond portfolios. Tests of international correlation matrixes of real estate returns, common stock returns, and bond returns indicate significantly lower correlations between national real estate returns than between common stock or bond returns. The implication is that international diversification reduces the risk of a real estate portfolio more than that of common stock and bond portfolios.

International diversification reduces the risk of investment portfolios because asset returns in different countries are not perfectly correlated. Many studies have investigated the extent of this risk reduction for stocks and bonds. The benefits of international diversification for real estate have been documented less extensively. Still, several attempts have been made to examine the risk-reduction possibilities of international diversification of real estate portfolios and even to use portfolio models to determine the optimal international allocation of real estate investments.

Sweeney calculated the correlations between office rent indexes in major cities across the world.¹ Because many of these correlations are negative, she concluded that the diversification potential of international real estate investments is substantial. Using a Markowitz portfolio model, Sweeney also determined the composition of efficiently diversified international real estate portfolios. As inputs for the model, she used the realized covariance matrix based on the rent indexes. The compositions of the resulting efficient portfolios are somewhat counterintuitive because New York and Frankfurt have no place in these portfolios and Tokyo, Hong Kong, Madrid, and Brussels have only small representation.

Giliberto and Giliberto and Testa used the returns of property shares to demonstrate the risk-reduction possibilities of international real estate diversification

and to calculate efficient portfolios.² Again, the potential for risk reduction was found to be substantial and the composition of the efficient portfolios counterintuitive. Gordon based his calculations of efficient frontiers on appraisal-based real estate returns.³ He looked at investments only in the United Kingdom and the United States and also concluded that investing internationally reduces portfolio risk.

Although none of the studies mentioned compare the diversification benefits of international real estate investments with those of international stock or bond investments, such a comparison would provide additional insight into the case for international real estate diversification. Intuitively, one would expect real estate returns to show lower international correlations than common stock returns because of the local nature of real estate markets. Moreover, because investing internationally in real estate is less common than investing in stocks and bonds, real estate markets could be less integrated than stock and bond markets. Therefore, international real estate investments should have a larger potential for risk reduction than international common stock investments.

In this study, we compared the international correlation structure of property share returns and common stock and bond returns. We found the international correlations of property share returns to be lower than those of common stock and of bond returns. We also found that the effectiveness of international real estate diversification is substantial.

DATA

The data used in the study were time series of property share, common stock, and bond index returns

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For property shares, none of the available international data bases make a clear difference between property investors and property developers. Especially in the Far East, property companies are involved in development activities. This involvement is reflected in most available indexes, so using these indexes would entail comparing different constructs for different countries.

The Limburg Institute of Financial Economics (LIFE) has constructed new property share indexes—The LIFE Global Real Estate Securities Indices—that avoid this problem. Included are all publicly listed companies with market capitalization exceeding US\$50 million and with more than 75 percent of their revenues coming from *equity* real estate investment portfolios. Development and construction companies are therefore excluded. The returns on these indexes reflect the returns on an underlying portfolio of real estate. Indexes are available for all countries having publicly listed property investment companies of sufficient size.⁴ The indexes can be aggregated and disaggregated into separate indexes for different continents and economic areas; property types; and for some countries, also for regions within those countries. The indexes are based on the monthly total rates of return—including both dividend and capital values—of the selected property shares.

To keep this study manageable, we looked only at the total country indexes of some of the more important markets: France, the Netherlands, the United Kingdom, Sweden, Hong Kong, Japan, Singapore, Canada, and the United States. The study period was from January 1985 to August 1994.

We compared the LIFE real estate securities indexes with Morgan Stanley Capital International's common stock indexes and with Salomon Brothers' bond performance indexes. Unfortunately, no bond data were available for Hong Kong and Singapore.

All returns are expressed in local currencies and therefore reflect the position of an investor who is fully hedged against currency risk. The use of local currencies has the advantage of isolating the pure asset returns from the exchange rate returns.

Sample statistics of the property share, common stock, and bond indexes are given in Table 1. Average indirect real estate returns vary from -1.29 percent a month for Canada to 2.40 percent for Hong Kong. Stock performance ranges between 0.48 percent for Canada and 1.85 percent for Hong Kong. Bond returns are lowest in Japan and the Netherlands: 0.57 and 0.59 percent a month, respectively; in the other countries, bond returns are about 0.90 percent a month.

Real estate securities are a little more risky than common stocks for most countries, especially for Sweden and Singapore. Only in France and the Netherlands are standard deviations smaller for indirect real estate investments than for common stocks. For

Table 1. Property Share, Common Stock, and Bond Indexes in Local Currency, Monthly Logarithmic Returns and Standard Deviations, January 1985–August 1994

Country	LIFE Global Real Estate Securities		Morgan Stanley Indexes		Salomon Brothers Bond Indexes	
	μ	σ	μ	σ	μ	σ
France	0.69	3.93	1.02	6.35	0.88	1.80
Netherlands	0.18	3.16	0.74	4.77	0.59	1.27
Sweden	0.28	13.00	1.30	7.40	0.92	1.38
United Kingdom	0.79	6.72	0.89	5.58	0.91	2.49
Hong Kong	2.40	8.96	1.85	8.83	NA	NA
Japan	0.98	8.70	0.52	6.58	0.57	1.89
Singapore	1.60	12.08	1.11	7.82	NA	NA
Canada	-1.29	8.33	0.48	4.25	0.94	2.48
United States	0.97	4.84	0.89	4.51	0.92	2.40

NA = Not available.

Sources: Property share indexes—the Limburg Institute of Financial Economics (LIFE) global real estate securities data base. Common stock indexes—Morgan Stanley Capital International, except for the Singapore index, which is the Straits Times Index. Bond indexes—Salomon Brothers Bond Performance Indexes, except for the Swedish index, which is from Datastream/EFFAS (European Federation of Financial Analysts). Bond indexes for Hong Kong and Singapore are not available to us.

all countries, the volatility of the bond returns is substantially lower than the volatility of the common stock and property share returns. The bond standard deviations vary from 2.49 percent for the United Kingdom to 1.27 percent for the Netherlands.

The correlations between country indexes for the three asset classes are given in Tables 2 through 4. The tables indicate that the diversification potential of international property share investments has been substantial in our sample period. The correlations between the property share indexes in the various countries are, on average, lower than those between the common stock and between the bond indexes. Each property share correlation is lower than its corresponding stock correlation, and with only one exception, this is also the case for property share and bond correlations. The real estate securities' correlations range from 0.07 to 0.53, the stock correlations vary between 0.24 and 0.79, and the bond correlations are between 0.19 and 0.76. These findings suggest that international property share investments reduce portfolio risk better than international common stock and international bond investments. In other words, international diversification is most effective for real estate securities portfolios. Before drawing any hard conclusions, however, we tested the equality of the correlation matrixes.

THE EQUALITY OF PROPERTY SHARE AND STOCK AND BOND CORRELATIONS

We tested the null hypothesis that the international

Table 2. Correlations between Property Share Indexes, Monthly Logarithmic Returns in Local Currencies, January 1985–August 1994

Country	France	Netherlands	Sweden	United Kingdom	Hong Kong	Japan	Singapore	Canada
Netherlands	0.35							
Sweden	0.22	0.30						
United Kingdom	0.30	0.28	0.23					
Hong Kong	0.24	0.16	0.12	0.40				
Japan	0.34	0.26	0.19	0.28	0.07			
Singapore	0.29	0.31	0.12	0.53	0.37	0.22		
Canada	0.34	0.41	0.24	0.29	0.19	0.33	0.28	
United States	0.44	0.33	0.19	0.47	0.29	0.32	0.53	0.42

Source: LIFE real estate securities indexes.

Table 3. Correlations between Common Stock Indexes, Monthly Logarithmic Returns in Local Currencies, January 1985–August 1994

Country	France	Netherlands	Sweden	United Kingdom	Hong Kong	Japan	Singapore	Canada
Netherlands	0.63							
Sweden	0.50	0.60						
United Kingdom	0.61	0.76	0.55					
Hong Kong	0.44	0.57	0.44	0.61				
Japan	0.40	0.36	0.43	0.33	0.24			
Singapore	0.39	0.62	0.52	0.65	0.66	0.36		
Canada	0.56	0.73	0.47	0.70	0.62	0.38	0.58	
United States	0.60	0.70	0.48	0.76	0.53	0.35	0.62	0.79

Source: Morgan Stanley stock indexes.

Table 4. Correlations between Bond Indexes, Monthly Logarithmic Returns in Local Currency, January 1985–August 1994

Country	France	Netherlands	Sweden	United Kingdom	Hong Kong	Japan	Singapore	Canada
Netherlands	0.75							
Sweden	0.46	0.39						
United Kingdom	0.56	0.56	0.31					
Hong Kong	NA	NA	NA	NA				
Japan	0.41	0.49	0.23	0.46	NA			
Singapore	NA	NA	NA	NA	NA	NA	NA	
Canada	0.50	0.49	0.28	0.49	NA	0.42	NA	
United States	0.53	0.48	0.19	0.42	NA	0.43	NA	0.76

NA = Not available.

Source: Salomon Brothers bond indexes.

correlation matrix of property share returns equals the matrixes of common stock and of bond returns against the alternative that the correlations of property share returns are lower than those of common stock and bond returns. We used a test proposed by Jennrich, which is described in the appendix.⁵ The higher the Jennrich statistic the greater the likelihood that the correlation matrixes are not equal. Table 5 provides the results. The Jennrich statistic is 65.12 for the comparison of property share correlations with common stock correlations. The *p*-value is zero for 36 degrees of freedom, which implies a zero chance that the difference between the correlation matrixes is

coincidental. Comparing property share and bond correlations, we also found a significant difference. The Jennrich statistic is 49.27, which gives a *p*-value of zero.

Because the null hypothesis is rejected, we may conclude that international property share returns are correlated less strongly than international common stock and bond returns. International correlation matrixes of asset returns are not stable over time, however.⁶ A key question is whether the stability of property share correlations differs from the stability of common stock correlations.

In real estate markets, return-influencing events tend to be of a local nature, which causes nonsimul-

taneous developments in different real estate markets. Examples are easy to find. In some parts of Texas, real estate prices and rents went through a crisis in the late 1980s, although the Texas real estate market as a whole was flourishing. The Japanese market is still in the doldrums, while European markets, such as the Netherlands and the United Kingdom, are already recovering.

National real estate markets are influenced by national economic factors that do not influence non-domestic real estate markets. If these national economic factors are nonsynchronous with economic factors in other countries, which is probably the case, then unstable international correlation structures of property share returns would be likely. In contrast, stock and bond markets are less influenced by local factors and are more influenced by global factors than are real estate markets. The correlations of international common stock and bond returns are therefore likely to be more stable than the correlations of international property share returns. Thus, we cannot assume a priori that the correlations we found for the full sample period will be valid for subperiods.

To test for the robustness of our results, we divided the time series into two equal subperiods of 58 months each. For each subsample, we tested whether the correlations of the property share index returns equal the correlations of the common stock and the bond returns. The results, which are reported in Table 5, only partially confirm our findings for the full sample. For the subsamples, we found *p*-values to be higher than for the full period; thus, the correlation differences are less significant than for the full sample. This result can partly be explained by the fact that the Jennrich test's power decreases as the number of observations decreases.

We also found that *p*-values were higher for the second than for the first subperiod. When we compared property share correlations with common

stock correlations between November 1989 and August 1994, we did not find a significant difference. This result could indicate that property share correlations are increasing, which could be attributable to growing capital streams related to international real estate. This effect would decrease the usefulness of international diversification. Eichholtz and Lie reported some relevant findings in this regard.⁷ They showed that international property share correlations are increasing between countries within the same continent but are decreasing between countries on different continents. This finding led the authors to conclude that the international real estate markets are in a process of regionalization. Most of the pairwise correlations in our matrixes are between countries from different continents, which could explain the higher *p*-values in the second subsample.

THE EFFECTIVENESS OF INTERNATIONAL PROPERTY SHARE DIVERSIFICATION

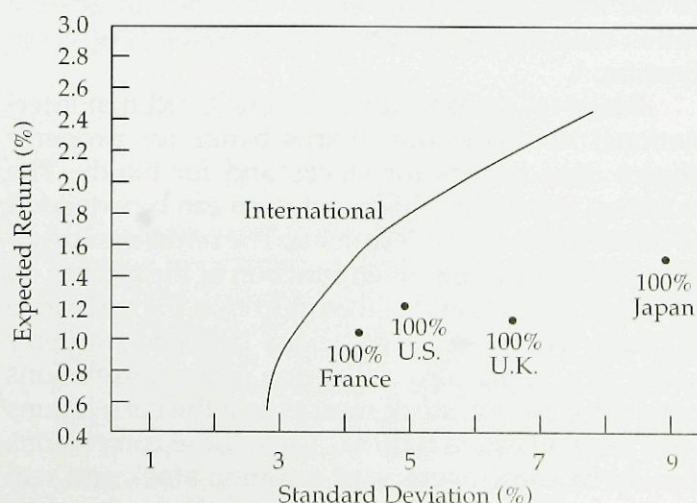
To illustrate the risk-reduction potential of international property share investments, we constructed an efficient frontier of international property share investments. This frontier is presented in Figure 1. For comparison purposes, Figure 1 also shows the domestic property share market portfolios for the United States, the United Kingdom, France, and Japan. For all four countries, the gains of international property share diversification were substantial during the sample period. With constant expected returns, standard deviations for international property shares were more than 1 percent lower than those for the United States and France, more than 3 percent lower than for the United Kingdom, and more than 5 percent lower than for Japan.

Table 5. Tests of Equality of Correlation Matrixes

Sample	Jennrich χ^2	<i>p</i> -Value
<i>Full samples</i>		
Property shares versus common stock		
January 1985–August 1994	65.12	0.00
Property shares versus bonds		
January 1985–August 1994	49.27	0.00
<i>Subsamples</i>		
Property shares versus common stock		
January 1985–October 1989	49.60	0.06
November 1989–May 1994	41.88	0.23
Property shares versus bonds		
January 1985–October 1989	51.16	0.00
November 1989–May 1994	34.73	0.03

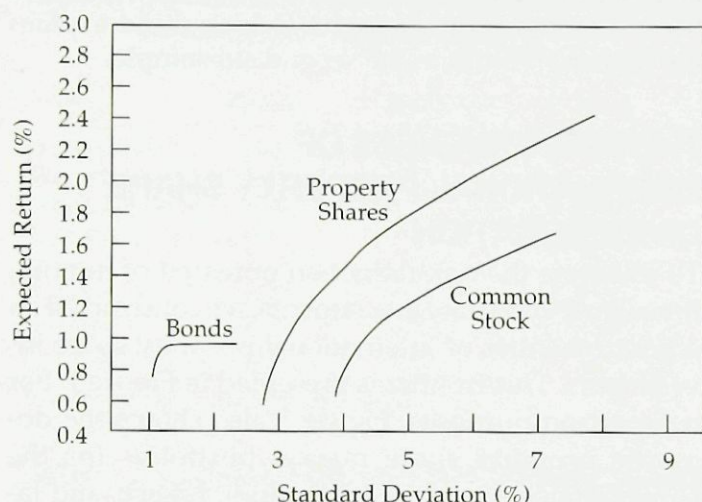
Sources: Property shares—LIFE real estate securities indexes. Common stocks—Morgan Stanley stock indexes. Bonds—Salomon Brothers bond indexes.

Figure 1. Efficient Frontiers, International and National Property Share Portfolios



To illustrate the effectiveness of international property share diversification relative to international common stock and bond diversification, we also constructed international efficient frontiers for stocks and bonds. The frontiers for the three asset classes are compared in Figure 2. Apparently, international real estate diversification can be very effective, despite the fact that the standard deviations of the national property share indexes are, on average, somewhat higher than common stocks' standard de-

Figure 2. Comparison of International Efficient Frontiers: Property Shares, Common Stocks, and Bonds



viations. The minimum variance property share portfolio has a more than 1 percent smaller monthly standard deviation than the common stock minimum variance portfolio (3 percent versus 4 percent a month). Thus, investments in property shares are relatively risky for portfolios limited to only one country, but internationally diversified property share portfolios are quite safe. Only an international bond portfolio presents lower risk, mainly because of the low standard deviation of bonds in general rather than the effectiveness of international diversification.

Based on these results, we concluded that international diversification works better for property shares than it does for stocks and for bonds. The question is whether this conclusion can be extended to direct real estate investments. The returns on property shares are a combined function of the returns on the stock markets and of the returns on the real estate markets. Therefore, correlations between property share returns are also a function of the correlations between common stock returns and the correlations between real estate returns. Thus, these correlations should be some average of common stock and real estate returns. Because property shares are less strongly correlated than common stock returns, the

international correlations of direct real estate returns must be even lower than those of property share returns. Therefore, even though we cannot observe direct real estate returns, we can probably extend our conclusions to direct real estate.

PRACTICAL RELEVANCE

First of all, our results have consequences for allocation within real estate portfolios. International diversification is an established fact for stock and bond investors but not for real estate investors (except for the Dutch and the British). Our results suggest that this lack of international diversification in real estate portfolios is not justified. A possible explanation of our findings might be barriers to real-estate-related capital movements between the countries in our sample. In that case, the results would not have any practical consequences because they would be impossible to act upon.

To what extent do real estate investment barriers exist? Of the countries in our sample, Belgium, France, Italy, Sweden, the United Kingdom, Australia, Japan, Canada, and the United States are members of the Organization for Economic Cooperation and Development (OECD). As such, they adhere to the OECD's Code of Liberalization of Capital Movements (March 1992). Subject to this Code, international real estate transactions, both by residents in other member countries and by nonresidents in the country concerned, are completely free of restrictions. Hong Kong and Singapore are not members of the OECD but nevertheless have no restrictions whatsoever concerning cross-border real estate investments. Thus, none of the countries in our sample have legal barriers to international real estate investments.

Other barriers do exist, however. Foreign investors usually have less information on direct real estate markets than local players do. The (few) successful international real estate investors always work with local people who have local knowledge. Establishing such a network takes time and money, however. These high information costs could be an explanation for the rarity of international real estate portfolios.

Still, even this need for local knowledge does not give a full explanation for our results, which are based on indirect real estate investments: investments through publicly listed property funds. Shares of these funds are easy to buy, and information about them is available at low cost. Keep in mind, however, that until recently, the combined market capitalization of all the real estate investment funds in the world was very small, so small that property shares were not treated as a serious investment vehicle by institutional investors, let alone as a way to construct an international real estate portfolio. In the mid-

1980s, the combined market capitalization of all property investment funds was about US\$13 billion; now, it is US\$120 billion. We expect further worldwide growth of publicly listed property funds, both in number and in size. This growth implies that indirect real estate investment has become a serious possibility for building up an international real estate portfolio.

With increasing real estate securitization, international real estate investing gets easier, which could increase real-estate-related international capital streams and growing integration of real estate markets. Greater integration, however, would lower the risk-reduction potential of international property investments. The available evidence indicates that real estate markets are becoming more integrated within continents and less integrated among continents. This difference implies that investors seeking risk reduction through international property investments should spread their portfolios intercontinentally.

CONCLUSIONS

We investigated the diversification potential of international real estate investments relative to those of international common stock and bond investments. To that end, we examined whether international correlations of property share returns differ from international correlations of common stock and bond returns. Our results indicate that property share returns are less strongly internationally correlated than common stock and bond returns. This implies that international diversification can reduce the risk of indirect real estate portfolios even more than it can reduce the risk of common stock and bond portfolios. Moreover, indirect real estate returns are determined by the stock markets and the real estate markets, which could also hold for their correlations. This duality implies that the international correlations among indirect real estate returns are somewhere between those of direct real estate returns and common stock returns. In turn, the correlations between

direct real estate returns should be even lower than those between indirect real estate returns. Therefore, our conclusion may also hold for direct real estate investments.⁸

APPENDIX: THE JENNRICH TEST

To test the equality of two correlation matrixes, one could simply calculate the average and standard deviation of the correlation coefficients for each matrix and perform a *t*-test to see whether the difference between the averages is significant. Such a test, however, would take into account only the values and the number of the pairwise correlations and disregard the length of the time series on which these correlations are based.

Suppose we have two correlation matrixes based on time series of ten daily observations and two matrixes based on series of 10,000 daily observations. The second pair of correlation matrixes would be estimated more reliably than the first pair. This reliability is information that should be used when studying correlation coefficients. Therefore, a good test for the equality of correlation matrixes should take into account the number of observations on which the correlations are based, which is what the Jennrich χ^2 test statistic does. The statistic is

$$\chi^2 = \frac{1}{2} \text{tr}(Z^2) - \text{diag}(Z)S^{-1}\text{diag}(Z),$$

where $Z = c^{1/2}R^{-1}(R_1 - R_2)$, in which $R = (n_1R_1 + n_2R_2)/(n_1 + n_2)$, $c = n_1n_2/(n_1 + n_2)$, R_1 and R_2 are the correlation matrixes to be compared, and n_1 and n_2 are the number of observations on which the matrixes are based. In the original equation, $S = (\delta_{ij} + r_{ij}r^{ij})$, in which δ_{ij} is the Kronecker delta, the r_{ij} are the elements of R , and the r^{ij} are the elements of R^{-1} , the inverse of R . The ij are the "coordinates" of the correlations in the matrix R . The Jennrich test statistic has $p(p-1)/2$ degrees of freedom, p being the dimension of the correlation matrix.

NOTES

1. F.M. Sweeney, "Investment Strategy, A Property Market Without Frontiers," *Estates Gazette* (September 1989):21-30.
2. See S.M. Giliberto, "Global Real Estate Securities: Index Performance and Diversified Portfolios," Salomon Brothers Real Estate Research (February 23, 1990); and S.M. Giliberto and B. Testa, "Global Property Share Performance by Geographic Region," Salomon Brothers Real Estate Research (August 21, 1990).
3. J.N. Gordon, "The Diversification Potential of International Property Investments," *Real Estate Finance Journal*, vol. 7, no. 2 (Fall 1992):42-48.
4. LIFE provides return indexes of property companies for the following 30 countries: in Europe—Austria, Belgium, Denmark, France, Germany, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom; in North America—Canada and the United States; in the Far East—Australia, Hong Kong, Indonesia, Japan, Malaysia, New Zealand, the Philippines, Singapore, Sri Lanka, and Thailand; and in the rest of the world—Argentina, Israel, Mexico, and South Africa. Indexes of publicly listed property development companies are being constructed.
5. R.I. Jennrich, "An Asymptotic χ^2 Test for the Equality of Two

- Correlation Matrices," *Journal of the American Statistical Association*, vol. 65, no. 4 (1970):904-12.
6. See E.C. Kaplanis, "Stability and Forecasting of the Comovement Measures of International Stock Market Returns," *Journal of International Money and Finance*, vol. 7, no. 3 (1988):63-75; and P.M.A. Eichholtz, "The Stability of the Covariances of International Property Share Returns," *Journal of Real Estate Research* (forthcoming).
7. P.M.A. Eichholtz and R.T. Lie, "Globalization of Real Estate Markets?" working paper, City University Business School, London (March 1995).
8. The author would like to thank David Geltner, Jacques Gordon, Kees Koedijk, Ronald Mahieu, Steven Maijoor, and Christian Wolff for their helpful comments. All errors are the responsibility of the author. The financial support of the Real Estate Research Institute is much appreciated.

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