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Foreign Real Estate Security Investments for Japanese Investors

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Foreign real estate investment funds have recently been added to the practical investment opportunity sets of ordinary Japanese investors. This paper analyzes the additional diversification benefits of U.S. REITs and Australian listed property trusts (LPTs) for Japanese investors who already hold Japanese, U.S., and Australian financial assets while considering different risk definitions in a mean-lower partial moment (MLPM) framework. The study uses data from August 1994 to July 2004. The impacts of currency adjustment and risk definition on the diversification benefits are examined. Our results suggest that the additional diversification benefits of U.S. REITs and Australian LPTs can be obtained only in very limited cases by Japanese investors.

Keywords

foreign real estate security investments; Japanese investors; mean-lower partial moment

Introduction

Japanese investors have recently seen important changes in the real estate security investment environment. Following the advent of Japanese real estate investment trusts (J-REITs) in 2001, mutual funds that invest in foreign REITs became available to Japanese investors in 2003 through the revision of investment rules by Japan's Investment Trusts Association. Currently, Japanese citizens may invest in mutual funds comprised of J-REITs only, U.S. REITs only, and Australian listed property trusts (LPTs) only as well as global property funds which hold real estate securities from around the world. These REIT funds provide the Japanese with practical investment vehicles that allow them to conveniently add foreign real estate securities to their financial portfolios. At the end of June 2004, the total asset value of 34 REIT funds was 360 billion Yen ($3.3 billion), with J-REITs, U.S. REITs, and Australian LPTs dominating the market, accounting for 18%, 60%, and 16%, respectively.

During the past decade, an increasing number of studies on foreign real estate security investment have been published. Worzala and Sirmans (2003) have summarized two approaches that the literature has taken to the topic: a mixed-asset portfolio approach and a real estate security-only portfolio approach. Although real-estate security-only portfolio studies typically show that foreign real estate securities provide diversification benefits, it is irrational to assume that investors will arbitrarily limit themselves to a single class of assets (e.g. real estate securities). Since investors can also diversify internationally with foreign financial assets such as stocks, bonds, and money market investments as well as foreign real estate securities, we should examine whether foreign real estate security investments provide diversification benefits in addition to those obtainable from these other more traditional financial assets using the mixed-asset portfolio approach.

In a foreign direct real estate investment context, studies by Ziobrowski et al. (1991, 1993, 1995, 1997, and 1999) show the importance of the mixed-asset portfolio approach and the currency adjustment. Ziobrowski and Curcio (1991) examine potential benefits from adding foreign real estate investments from the British and Japanese investor's perspective using the mixed-asset portfolio approach. They first find no additional diversification benefits of U.S. real estate investments for the British and Japanese investors, when returns of each investment are converted to the investor's domestic currency, because volatile exchange rate fluctuations induce a level of risk in U.S. real estate investments that offset any potential diversification benefits. Ziobrowski and Boyd (1991), Ziobrowski and Ziobrowski (1993, 1995), Ziobrowski et al. (1997), and Cheng et al. (1999) examine several techniques to reduce that risk including such hedging strategies as leverage, currency options, forward contracts, and currency swaps. Their findings suggest that nothing produces acceptable additional diversification benefits from foreign real estate in terms of higher mean-variance portfolio efficiency.

Mull and Soenen (1997) investigate the addition of U.S. REITs to the domestic stock and bond portfolios of the G-7 countries from 1985 to 1994. U.S. REIT returns are adjusted for currency fluctuations from each investor's country and are not hedged. They find no additional diversification benefits from U.S. REITs during the 1985-1990 period, but did find some benefits during the 1990-1994 period. For Japanese investors in particular, U.S. REITs provide no diversification benefits for the entire period and both sub-periods.

Liu and Mei (1998) construct efficient frontiers using historical returns for the period of 1980-1991 from the perspective of the U.S. investor. They include stocks and real estate securities of six countries in the investment opportunity set. Foreign bonds and money market investments are not included in the opportunity set. Currency risk of all assets are analyzed both on a hedged and unhedged basis. They find that foreign real estate securities offer U.S. investors no diversification gains when currency risk is left unhedged, while they offer some diversification gains when hedged for currency risk. They construct static efficient frontiers only once using data from the whole period making them more vulnerable to estimation error in optimization than the month-by-month efficient frontier construction used in our study.

Maurer and Reiner (2002) is the only study that uses the mean lower partial moments (MLPM) framework to examine the diversification benefits of real estate securities. They examine the additional diversification benefits of foreign real estate securities for U.S. and German investors who already hold foreign stocks and bonds in five countries, using the returns for 1985 to 2001. They conclude that the diversification potential of foreign real estate securities is large when currency risk is hedged and small when currency risk is left unhedged for both German and U.S. investors. However, Maurer and Reiner (2002) combine domestic and foreign real estate securities and treat them as a single asset class. Thus, this study does not show whether the diversification benefits of international real estate securities come from domestic real estate securities or foreign real estate securities. In addition, this study employs only one risk definition in the MLPM framework with a single target rate of return.

Generally speaking, evidence of significant diversification benefits is rare when currency risk is not hedged, while some gains are found when currency risk is hedged.

In this study, we examine the diversification benefits of foreign real estate securities to provide implications and guidance for actual investors. Specifically, we examine the additional diversification benefits of U.S. REITs and Australian LPTs for Japanese investors who already hold Japanese, U.S., and Australian financial assets. Ideally, J-REITs would be included in this study. However, since J-REITs started in 2001 and the index data of J-REITs only became available in 2003, there is insufficient index data for an empirical study at this time. Although we do not include J-REITs, this approach is conservative. If U.S. REITs and Australian LPTs cannot enter the optimal portfolios without J-REITs in the opportunity set, most certainly they cannot enter the optimal portfolios with J-REITs being available. We measure these additional diversification benefits using degree of risk reduction, weights on U.S. REITs and Australian LPTs, and out-of-sample performance of optimal portfolios. We also examine the degree to which diversification gains are influenced by currency adjustment and the risk definition.

We find that the additional diversification benefits of U.S. REITs and Australian LPTs can be obtained by Japanese investors only in very limited cases. Consistent with earlier studies, when Japanese investors do not hedge the currency risk, we find no diversification gains from U.S. and Australian real estate securities beyond the benefits derived from other traditional U.S. and Australian financial assets (stocks, bonds or money market instruments). In general, currency risk hedging does not significantly improve the diversification gains associated with U.S. REITs and Australian LPTs because the costs of hedging (forward exchange premium) are so high. When currency risk is hedged, only investors with a long-term investment horizon enjoy diversification gains from U.S. and Australian real estate securities. Also, only investors who can accept a low rate of return receive some diversification benefits.

Data Description and Methodology

We use the monthly data from August 1994 to July 2004. The returns of Japanese stocks and short-term interest rates come from Datastream. Japanese bond return data are from Nomura Securities, Financial and Economic Research Center. The returns of U.S. stocks, bonds and short-term interest rates come from Datastream. U.S. REIT return data is from the National Association of Real Estate Investment Trusts (NAREIT). Only equity REITs are used because the NAREIT equity REIT index is the typical benchmark of REIT mutual funds in Japan. Australian financial asset and LPT return data are also provided by Datastream. Foreign exchange rates (spot rates) come from the Bank of Japan and the Reserve Bank of Australia.

All financial assets are proxied by widely used market indices as follows: TOPIX for Japanese stocks; NOMURA-BPI (Bond Performance Index) for Japanese bonds; S&P 500 composite index for U.S. stocks; Solomon Brothers Government and Corporate Bond index for U.S. bonds; NAREIT performance index for U.S. REITs; S&P/ASX 300 index for Australian stocks; UBS bond index for Australian bonds; and S&P/ASX 300 Property Trusts index for Australian LPTs. All returns are calculated as total returns, which include income and price appreciation. For short-term financial products, we use the 3-month CD rates for the U.S. and Japan and the 90-day Bank Accepted Bills rate for Australia. The Japanese overnight call money rate is used as a risk-free rate when calculating the risk-adjusted returns. When estimating the currency risk hedging costs, we use the 3-month treasury bill rates for the U.S., the 3-month bond repurchase agreement rates (Gensaki) for Japan, and the 90-day Bank accepted bills rate for Australia.

Currency risk is treated on both a hedged and unhedged (Yen-denominated) basis. Assuming that Japanese investors hedge currency risk through a forward contract, hedged returns are calculated as follows:

$$R_{i\mathrm{H}} = R_i + f_i \tag{1}$$

where $R_{i\mathrm{H}}$ is the return under the hedged strategy in the i-th foreign market; R_i is the return stated in local currency; and f_i is the relative forward exchange premium or discount.

Assuming the interest rate parity, the relative foreign exchange premium/discount (hedging cost) is calculated as follows:

$$f_i = (1 + r_{\mathrm{Y}}) \big/ (1 + r_i) - 1 \tag{2}$$

where r_{Y} is the short-term interest rate in Japan and r_i is the short-term interest rate in the i-th foreign market.

Yen-denominated returns are calculated as follows:

$$R_{i\mathrm{Y}} = (1 + R_i)(1 + R_{ei}) - 1 \tag{3}$$

where $R_{i\mathrm{Y}}$ is the Yen-denominated return on an unhedged investment in the i-th foreign market; R_i is the return stated in local currency; and R_{ei} is the rate of appreciation of the local currency relative to the Yen.

Most studies of portfolio diversification using foreign real estate securities have employed the traditional mean-variance approach introduced by

Markowitz (1959) when constructing efficient frontiers. The mean-variance framework requires either quadratic utility functions or symmetric return distributions. Neither assumption is necessarily correct in empirical situations. A quadratic utility function implies decreasing marginal utility of wealth and increasing absolute and relative risk-aversion, both of which are criticized as unrealistic. In addition, real estate and real estate security returns, like most asset returns, are not symmetrically distributed, as they are often described by a negatively skewed distribution (Young and Graff , 1995).

Markowitz (1959) considers various alternative risk measures in order to take account of asymmetricity of return distribution and concludes that the most theoretically robust measure is semi-variance. Semi-variance, a very simple downside risk measure, is the expected value of the squared negative deviations about a specified target rate of return. According to Markowitz (1959), "Variance is superior with respect to cost, convenience, and familiarity."

Bawa (1975) generalizes the semi-variance measure of risk to reflect a less restrictive class of decreasing absolute risk-averse (DARA) utility function. The generalized concept of downside risk is the lower partial moments (LPM). The LPM refers to the realizations below some target rate of return specified by the investor over a specific holding period. Computationally, the k-th order LPM to the target rate of return, $r_{G,}$ with a random variable, R, can be defined as follows (Hibiki, 2000):

$$\mathrm{LPM}_k(R;\ r_G) \equiv \frac{1}{T}\sum_{t=1}^{T}\left|r_t - r_G\right|_-^k \qquad (4)$$

The parameter $k \geq 0$ determines the weights attached to negative deviations from the target, i.e., it can be viewed as a measure of risk aversion where risk aversion increases with *k*.

Although the LPM is one of several downside risk measures, we use the LPM in this study because it is important to examine the diversification benefits of real estate securities by defining investors' situations as specifically as possible. Some investors think of the dispersion below the target rate of return of 0% as their risk. Mutual fund managers could be this type of investor because they are always sensitive to what becomes of their customers' money. Obviously, their risk definition is a reflection of customers' risk definition. Therefore, most individual investors have this kind of risk definition, the risk of actually losing money. Others may think of the dispersion below the certain target rate of return such as 3% or 5% as their risk. Pension fund and insurance company managers could be this type of investor because they typically have a predetermined policy rate of return for their investment. The LPM can capture all of these different risk definitions. Therefore, we examine efficient frontiers constructed using the LPM (i.e., under the MLPM framework) with several different target returns to examine the diversification benefits for each of Japanese investors with different risk definitions.

In order to examine the additional diversification benefits of U.S. REITs and Australian LPTs in specific situations, we define eight investors' situations: the two currency adjustment methods i.e., hedging (H) and no hedging (UH) of currency risk, each with four investors' risk preferences, where MLPM (*k*, *r*%) represents the mean-lower partial moments of *k*-th order lower partial moments with the target rate of return of *r*%. The four investors' risk preferences are mean-variance (MV), MLPM (2, 0%), MLPM (2, 0.2%), and MLPM (2, –0.2%). Thus MLPM (2, 0%) employs the second order lower partial moments with the target rate of return of 0%.

As to risk definition, we employ the second-order lower partial moments in addition to the traditional standard deviation for the purpose of comparison with traditional standard deviation. The target rate of return of 0% is chosen for the risk definition of typical mutual fund managers. The target rate of return of 0.2% per month is chosen on the basis of the historical anticipated rate of return on insurance premium investments in Japan. Japanese life insurance companies decide their insurance premium reflecting the anticipated rate of return on insurance premium investment. Therefore, life insurance fund mangers have to consider the anticipated rate of return their minimum target rate of return. The target rate of return of –0.2% per month is also chosen. Large institutional investors often have pre-determined investment benchmark such as TOPIX (Japanese stock index). Because their minimum task is to beat their benchmark, they can occasionally have a negative target rate of return when a benchmark performance is negative.

This study adopts the mixed-asset portfolio approach used in the studies headed by Ziobrowski. Three opportunity sets are examined for each of the eight investors' situations defined above. The first opportunity set is limited to Japanese financial assets. Foreign financial assets are then added to the opportunity set (U.S. and Australian stocks, bonds, and money market investments). This second group of assets allows us to examine the benefits achievable by diversification with foreign traditional financial assets alone. Finally, we add U.S. REITs and Australian LPTs to the opportunity set. Here we can examine the additional benefits of U.S. REITs and Australian LPTs.

The optimization problem for the mean-variance framework (MV) is (Hibiki, 2000):

$$\begin{aligned}
&\text{Minimize} && \frac{1}{T}\sum_{t=1}^{T} y_t^2 \\
&\text{Subject to} && \sum_{j=1}^{n} r_{jt} x_j - y_t = \overline{r_p} && (t = 1,\ldots,T) \\
& && \overline{r_p} \geq r_E, && && (5) \\
& && \sum_{j=1}^{n} x_j = 1, \quad x_j \geq 0 \quad (j = 1,\ldots,n) \\
& && x \in X
\end{aligned}$$

where y_t is the variable introduced for optimization; r_{jt} is the return of j-asset at time t; x_j is the weight of j-asset ; $\overline{r_p}$ is the portfolio return; and r_E is the required rate of return.

The optimization problem for the mean-lower partial moments (MLPM) by Bawa and Linderberg (1977) can be represented as:[1]

$$\begin{aligned}
&\text{Minimize} && \frac{1}{T}\sum_{t=1}^{T} d_t^2 \\
&\text{Subject to} && \sum_{j=1}^{n} r_{jt} x_j + d_t \geq r_G && (t = 1,\ldots,T) \\
& && d_t \geq 0, && (t = 1,\ldots,T) \quad (6) \\
& && \overline{r_p} \geq r_{\mathrm{E}}, \\
& && \sum_{j=1}^{n} x_j = 1, x_j \geq 0, \quad (j = 1,\ldots,n) \\
& && x \in X
\end{aligned}$$

where d_t is the variable introduced for optimization; r_{jt} is the return of j-asset at time t; x_j is the weight of j-asset; $\overline{r_p}$ is the portfolio return; r_E is the required rate of return; and r_{G} is the specified target rate of return.

We employ a month-by-month efficient frontier construction to reduce potential estimation error associated with optimizations. For the first month estimation, we use the monthly returns of the first five years, from August

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[1] The optimization problem of the MLPM is an LP if k=1, a QP if k=2, and a nonlinear program if $k\geq3$. For computational reasons and the comparison with the standard variance measure, this paper deals only with MLPM with k=2 using QP.

1994 to July 1999, to estimate the distributions. Assuming these past return realizations to be good proxies for the true distributions, we construct the efficient frontiers for three opportunity sets for each of eight investors' situations. We store the information of constructed efficient frontiers such as achieved standard deviations, achieved lower partial moments, and optimal weights of assets on several points on the efficient frontiers defined by the required rates of return in optimizations.[2] We then extend the estimation period by one month, recalculate the distributions, and reconstruct the efficient frontiers.[3] In order to examine the out-of-sample (ex ante) performances of optimal portfolios, we calculate and store the monthly and annual returns on several portfolios on efficient frontiers over the next month and by compounding the next twelve monthly returns, respectively. Through the month-by-month efficient frontier constructions, we can obtain 60 time-series sets of information of constructed efficient frontiers. Then, we take averages of these time-series sets of information. This way we can reduce potential estimation error in obtained information.

The out-of-sample performance is measured by risk-adjusted returns similar to the Sharpe Ratio and the Sortino ratio (SR) for the MV portfolios and MLPM portfolios, respectively. The Sortino ratio, suggested by Sortino and Price (1994) (See also Plantinga et al., 2001), is defined as:

$$\mathrm{SR} = (\overline{R}_P - r_{\mathrm{G}}) \Big/ \sqrt{\mathrm{LPM}^2_{r_{\mathrm{G}}}} \tag{7}$$

where $\overline{R}_P$ is the average rate of return of a portfolio; r_{G} is the specified target rate of return; and $\mathrm{LPM}^2_{r_{\mathrm{G}}}$ is 2^{nd} order LPM to the target rate of return of r_{G}.

When computing the Sharpe ratio like risk-adjusted performance, we use the Japanese overnight call money rate as the proxy for the "risk-free" rate for Japanese investors. We compute the risk-adjusted monthly and annual out-of-sample performances by dividing each month's excess return by the standard deviation or the square root of the lower partial moments achieved by each month's optimal portfolio. Using the time-series risk-adjusted out-of-sample performances, we conduct the paired-samples *t*-tests[4] to examine

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[2] By assuming either unlimited borrowing and lending at a risk-free rate or unlimited short-selling, we could assume the two fund separation theorem holds in the traditional mean-variance framework. However, in the MLPM framework, there are still some arguments on whether the two fund separation theorem holds or not for arbitrary target rates of return. Thus, we do not use the tangent portfolio's properties in this study.

[3] For the estimation of return distribution, we use August 1994 to July 1999 period in the first round, August 1994 to August 1999 in the second round and so on, until August 1994 to June 2004 in the 60th round. A similar procedure is utilized in Agarwal and Naik (2000).

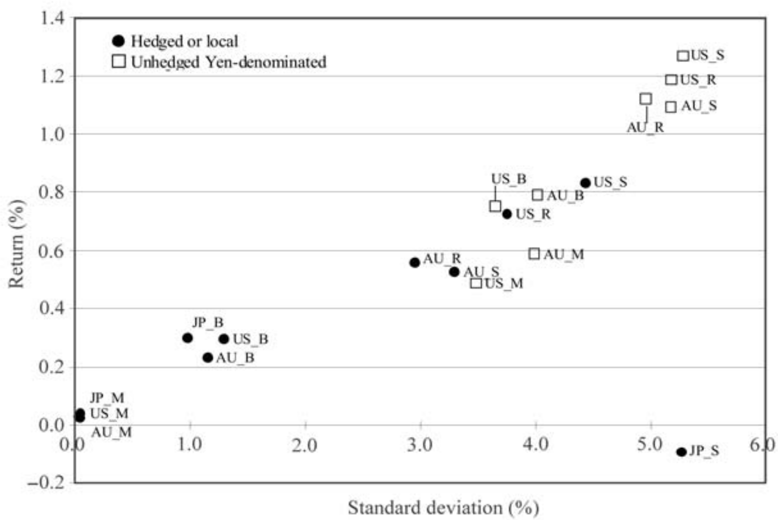
[4] Since it is possible that the performance series are not normally distributed, the Wilcoxon

the differences in the out-of-sample performances of the optimal portfolios.

Results

Table 1 gives an overview of descriptive statistics of the monthly index returns for the period from August 1994 to July 2004. Figure 1 shows risk-return relationships of assets for this period. When returns are hedged for currency risk, the risk, as measured by the standard deviation of returns, is the highest for common stocks in each country. The standard deviation and the mean return of U.S. REITs are between those of U.S. stocks and bonds. The mean return of Australian LPTs is the highest among Australian assets, while the standard deviation of Australian LPTs is between those of stocks and bonds. When returns are received in Yen without the benefit of a currency hedge, the standard deviations of all non-Japanese assets increase dramatically due to currency fluctuations and all foreign assets become very similar in terms of risk and return (see Figure 1).

Figure 1: Risk-return relationships (August 1994-July 2004, monthly returns)



JP_*: Japanese, US_*: U.S., AU_*: Australian, *_S: Stock, *_B: Bond, *_M: Money market, *_R: REITs or LPTs

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signed rank test, a nonparametric analog to the parametric paired-samples *t* test, was also conducted and the consistent test results were confirmed.

Skewness is also important when we use LPM measures because LPM measures focus on the portion of the distribution that lies below some target rate of return. Thus investors' risk becomes larger when the distribution is negatively skewed and it becomes smaller when the distribution is positively skewed even when standard deviations of these distributions are the same. When returns are hedged for currency risk, the skewness values show that the monthly returns of U.S. stocks, bonds, and REITs are negatively skewed although only U.S. REITs exhibit negative skewness that is significantly different from zero. Money market investments in all countries exhibit significant positive skewness. When returns are converted to Yen, all U.S. and Australian assets show negative skewness, although only U.S. bond and U.S. money market investments are significantly skewed.

Table 1: Descriptive statistics (August 1994-July 2004, monthly)

A: Hedged or local returns

		Mean (%)	Standard deviation (%)	Sharpe ratio	Min (%)	Max (%)	Skewness
JAPAN	Stock	–0.09	5.26	–0.02	–11.18	17.93	0.29
	Bond	0.30	0.98	0.28	-4.09	3.56	–0.35
	Money	0.04	0.05	0.22	0.00	0.19	2.03*
U.S.	Stock	0.83	4.43	0.18	–11.01	13.56	–0.30
	Bond	0.30	1.29	0.21	–4.14	4.27	–0.30
	Money	0.03	0.04	–0.01	–0.03	0.15	1.65*
	REITs	0.73	3.75	0.19	–14.66	10.01	–0.46*
Australia	Stock	0.53	3.29	0.15	–8.66	8.25	–0.12
	Bond	0.23	1.15	0.18	–2.96	3.77	0.01
	Money	0.03	0.04	–0.13	0.00	0.17	2.65*
	LTPs	0.56	2.95	0.18	–7.32	9.33	0.00

B: Unhedged Yen-denominated returns

		Mean (%)	Standard deviation (%)	Sharpe ratio	Min (%)	Max (%)	Skewness
U.S.	Stock	1.27	5.28	0.23	–12.04	13.53	–0.20
	Bond	0.75	3.65	0.20	–15.98	12.48	–0.61*
	Money	0.49	3.48	0.13	–14.11	11.01	–0.52*
	REITs	1.19	5.17	0.22	–16.05	12.99	–0.21
Australia	Stock	1.09	5.17	0.21	–14.46	14.45	–0.17
	Bond	0.79	4.01	0.19	–9.21	14.27	–0.14
	Money	0.59	3.99	0.14	–10.24	13.30	–0.26
	LTPs	1.12	4.95	0.22	–13.53	13.28	–0.14

*Skewness is significantly different from 0 at 5% confidence level

Table 2 shows the correlation matrices. When U.S. and Australian assets are hedged, we see relatively high correlations among the returns of the same asset classes across countries (e.g., Japanese stocks show high positive correlation with both U.S. and Australian stocks). U.S. REITs and Australian LPTs have low positive or even negative correlations with all Japanese financial assets. However, it should be remembered that Japanese REITs are not included in this study because of limited availability and may ultimately prove to exhibit the same degree of positive correlation with U.S. REITS and Australian LPTs. Correlations of U.S. REITs with U.S. stocks, bonds, and money market instruments are low, while correlations of Australian LPTs with Australian stocks and bonds are higher.

Table 2: Correlation matrices (August 1994-July 2004, monthly returns)

A: Hedged (local returns)

	JP_S	JP_B	JP_M	US_S	US_B	US_M	US_R	AU_S	AU_B	AU_M	AU_R	USD/ JPY	AUD/ JPY
JP_S	1												
JP_B	–0.298	1											
JP_M	–0.045	0.293	1										
US_S	0.413	–0.038	0.162	1									
US_B	–0.097	0.065	–0.062	0.075	1								
US_M	–0.155	0.157	0.440	0.047	0.139	1							
US_R	0.030	0.052	0.141	0.175	0.111	–0.117	1						
AU_S	0.431	–0.173	0.078	0.662	0.034	0.107	0.252	1					
AU_B	–0.101	0.223	0.112	0.009	0.563	0.173	0.155	0.146	1				
AU_M	–0.137	0.271	0.885	0.121	0.022	0.413	–0.111	0.007	0.214	1			
AU_R	0.057	0.022	–0.058	0.219	0.330	0.011	0.277	0.420	0.363	–0.043	1		
USD/JPY	–0.043	0.009	0.084	–0.054	–0.057	0.128	0.038	–0.106	–0.088	0.095	–0.067	1	
AUD/JPY	0.199	0.025	-0.054	0.157	–0.051	–0.194	0.220	0.042	–0.158	-0.066	0.029	0.616	1

B: Unhedged (Yen-denominated returns)

	JP_S	JP_B	JP_M	US_S	US_B	US_M	US_R	AU_S	AU_B	AU_M	AU_R	USD/ JPY	AUD/ JPY
JP_S	1												
JP_B	–0.298	1											
JP_M	–0.045	0.293	1										
US_S	0.343	–0.029	0.150	1									
US_B	–0.101	0.053	0.093	0.532	1								
US_M	–0.050	0.020	0.110	0.542	0.901	1							
US_R	0.029	0.056	–0.003	0.509	0.600	0.641	1						
AU_S	0.387	–0.053	0.023	0.702	0.389	0.415	0.532	1					
AU_B	0.159	0.127	0.017	0.538	0.596	0.583	0.585	0.761	1				
AU_M	0.198	0.027	–0.041	0.550	0.528	0.606	0.559	0.754	0.941	1			
AU_R	0.176	0.030	–0.059	0.519	0.482	0.457	0.554	0.795	0.809	0.762	1		
USD/JPY	–0.043	0.009	0.084	0.543	0.899	0.998	0.652	0.423	0.591	0.617	0.467	1	
AUD/JPY	0.199	0.025	–0.054	0.550	0.527	0.605	0.558	0.754	0.939	0.999	0.761	0.616	1

JP_S: Japanese Stock, JP_B: Japanese Bond, JP_M: Japanese Money Market, US_S: U.S. Stock, US_B: U.S. Bond, US_M: U.S. Money Market, US_R: U.S. REITs, AU_S: Australian Stock, AU_B: Australian Bond, AU_M: Australian Money Market, AU_R: Australian LPTs, USD/JPY: U.S. dollar/Japanese Yen exchange rate, AUS/JPY: Australian dollar/Japanese Yen exchange rate

Without hedging for currency risk when returns are converted to Yen, the positive correlation among all U.S. assets and among all Australian assets are very high. This is not surprising because the huge currency fluctuations make the returns of all assets from the same country move together. Furthermore, all U.S. assets exhibit high positive correlation with all Australian assets. Due to the very high correlation between U.S. dollar/Yen exchange rate and Australian dollar/Yen exchange rate (0.616), correlations across countries are also very high.

The information of optimal portfolios with the required rates of return of 0.2%, 0.4%, 0.6%, 0.8%, and 1.0% per month is provided in Tables 3 to 6 (A and B), each of which corresponds to one of the eight investors' situations. On a hedged basis, the information of optimal portfolios with the required rate of return of 1.0% is not available because 1.0% cannot be achieved by any combination of assets on a hedged basis. In each case, Table A shows the risks achieved by optimal portfolios, the percent changes in risks between opportunity sets, optimal weights on U.S. REITs and Australian LPTs, and the summary of the out-of-sample performances on a hedged basis. Table B shows the same information on an unhedged basis. Also, to obtain a sense of the degree of risk reduction, efficient frontiers obtained in the mean-variance framework are shown in Figure 2(A, B).[5]

Risk reduction

In general, moderate risk reductions are obtained by adding foreign financial assets to the Japanese domestic assets (i.e., from opportunity set A to B) both on a hedged and unhedged basis. Currency risk hedge strategy does not improve the degree of risk reduction because costs of hedging are high (0.3% per month against U.S. dollar and 0.4% per month against Australian dollar) due to very low short-term interest rates in Japan.

When U.S. REITs and Australian LPTs are added to the opportunity set (i.e., from opportunity set B to C), the risk reductions are generally very small. Although they are slightly larger on a hedged basis than on an unhedged basis, a 10% improvement in risk reduction is rare even when we hedge. When we do not hedge, the risk reductions do not exceed 2.5%.

Risk definition has little impact on the amount of risk reduction. Investors with the risk definition defined as MLPM (2, –0.2%) enjoy the largest risk reduction when adding U.S. REITs and Australian LPTs, followed by small gains for MLPM (2, 0%) investors, MLPM (2, 0.2%) investors, and MV

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[5] Figures of efficient frontiers obtained in the mean-lower partial moments framework are available from the authors upon request.

investors. In other words, only investors who can accept a low rate of return benefit from U.S. REITs and Australian LPTs. Without hedging, we see no risk reduction from foreign real estate securities.

Table 3: Information on efficient frontier – MV

A: MV – Hedged (local) basis

Required rates of return	0.20%	0.40%	0.60%	0.80%
Opportunity set A: Japanese financial assets only				
Standard deviation	0.466%	1.077%		
Opportunity set B: Opportunity set A + Foreign financial assets				
Standard deviation	0.380%	0.785%	1.747%	2.906%
% change in risk = (A–B)/A	18.537%	27.116%		
Opportunity set C: Opportunity set B + US REITs and AU LPTs				
Standard deviation	0.339%	0.771%	1.641%	2.766%
% change in risk = (B–C)/B	10.723%	1.755%	6.102%	4.816%
Weights on US REITs	0.953%	2.304%	9.805%	8.453%
Weights on AU LPTs	0.081%	0.746%	4.330%	0.803%
Mean difference in out-of-sample performance (B–A)				
Monthly	0.021	0.013		
Annual	0.071 *	0.052 *		
Mean difference in out-of-sample performance (C –B)				
Monthly	0.031	0.032	0.050	0.026
Annual	0.031 *	0.018 *	0.032 *	0.002

B: MV – Unhedged (Yen-denominated) basis

Required rates of return	0.20%	0.40%	0.60%	0.80%	1.00%
Opportunity set A: Japanese financial assets only					
Standard Deviation	0.466%	1.077%			
Opportunity set B: Opportunity set A + Foreign financial assets					
Standard deviation	0.319%	0.741%	1.221%	1.874%	2.622%
% change in risk = (A–B)/A	31.559%	31.222%			
Opportunity set C: Opportunity set B + US REITs and AU LPTs					
Standard deviation	0.319%	0.740%	1.209%	1.838%	2.564%
% change in risk = (B–C)/B	0.127%	0.076%	0.992%	1.883%	2.228%
Weights on US REITs	0.235%	0.472%	1.917%	4.808%	7.723%
Weights on AU LPTs	0.048%	0.070%	1.091%	1.930%	2.749%
Mean difference in out-of-sample performance (B – A)					
Monthly	–0.011	–0.026			
Annual	–0.028	–0.048			
Mean difference in out-of-sample performance (C – B)					
Monthly	–0.003	–0.003	0.012	0.016	0.023
Annual	–0.001	0.000	0.009 *	0.013 *	0.016 *

* shows that mean difference is significantly different from 0 at the 5% level (one-tailed). Out-of-sample performance is calculated by dividing each month's excess return by the standard deviation achieved by each month's optimal portfolio. On a hedged basis, the required rate of return of 1.00% cannot be achieved.

Table 4: Information on efficient frontier – MLPM (2, 0%)

A: MLPM (2, 0%) – Hedged (local) basis

Required rates of return	**0.20%**	**0.40%**	**0.60%**	**0.80%**
Opportunity set A: Japanese financial assets only				
Square root of LPM (2, 0%)	0.253%	0.583%		
Opportunity set B: Opportunity set A + Foreign financial assets				
Square root of LPM (2, 0%)	0.116%	0.304%	0.939%	1.721%
% change in risk = (A–B)/A	54.282%	47.805%		
Opportunity set C: Opportunity set B + US REITs and AU LPTs				
Square root of LPM (2, 0%)	0.113%	0.296%	0.874%	1.647%
% change in risk = (B–C)/B	2.067%	2.879%	6.904%	4.316%
Weights on US REITs	0.957%	2.321%	9.219%	8.385%
Weights on AU LPTs	0.000%	0.157%	3.856%	0.169%
Mean difference in out-of-sample performance (B –A)				
Monthly	0.413	0.298		
Annual	0.328*	0.229 *		
Mean difference in out-of-sample performance (C – B)				
Monthly	0.095	0.090	0.073	0.013
Annual	0.102 *	0.077 *	0.033 *	0.002 *

B: MLPM (2, 0%) – Unhedged (Yen-denominated) basis

Required rates of return	**0.20%**	**0.40%**	**0.60%**	**0.80%**	**1.00%**
Opportunity set A: Japanese financial assets only					
Square root of LPM (2, 0%)	0.253%	0.583%			
Opportunity set B: Opportunity set A + Foreign financial assets					
Square root of LPM (2, 0%)	0.142%	0.353%	0.595%	0.955%	1.381%
% change in risk = (A–B)/A	43.906%	39.479%			
Opportunity set C: Opportunity set B + US REITs and AU LPTs					
Square root of LPM (2, 0%)	0.142%	0.353%	0.587%	0.930%	1.347%
% change in risk = (B–C)/B	0.117%	0.101%	1.478%	2.556%	2.490%
Weights on US REITs	0.130%	0.278%	1.723%	4.348%	6.845%
Weights on AU LPTs	0.000%	0.000%	0.308%	1.328%	2.457%
Mean difference in out-of-sample performance (B–A)					
Monthly	0.023	–0.022			
Annual	0.018	–0.035			
Mean difference in out-of-sample performance (C–B)					
Monthly	0.005	0.005	0.011	0.029	0.026
Annual	0.000	0.000	0.004 *	0.018 *	0.017 *

* shows that mean difference is significantly different from 0 at the 5% level (one-tailed). Out-of-sample performance is calculated by dividing each month's excess return by the square root of the lower partial moments achieved by each month's optimal portfolio. On a hedged basis, the required rate of return of 1.00% cannot be achieved.

Table 5: Information on efficient frontier – MLPM (2, 0.2%)

A: MLPM (2, 0.2%) – Hedged (local) basis

Required rates of return	0.20%	0.40%	0.60%	0.80%
Opportunity set A: Japanese financial assets only				
Square root of LPM (2, 0.2%)	0.336%	0.662%		
Opportunity set B: Opportunity set A + Foreign financial assets				
Square root of LPM (2, 0.2%)	0.218%	0.403%	1.037%	1.819%
% change in risk = (A−B)/A	35.218%	39.181%		
Opportunity set C: Opportunity set B + US REITs and AU LPTs				
Square root of LPM (2, 0.2%)	0.215%	0.392%	0.972%	1.746%
% change in risk = (B−C)/B	1.302%	2.587%	6.276%	4.022%
Weights on US REITs	1.047%	2.509%	10.352%	8.419%
Weights on AU LPTs	0.000%	0.333%	3.731%	0.173%
Mean difference in out-of-sample performance (B–A)				
Monthly	0.707	0.285		
Annual	0.791 *	0.364 *		
Mean difference in out-of-sample performance (C –B)				
Monthly	0.041	0.069	0.027	0.011
Annual	0.048 *	0.057 *	0.037 *	0.001 *

B: MLPM (2, 0.2%) – Unhedged (Yen-denominated) basis

Required rates of return	0.20%	0.40%	0.60%	0.80%	1.00%
Opportunity set A: Japanese financial assets only					
Square root of LPM (2, 0.2%)	0.336%	0.662%			
Opportunity set B: Opportunity set A + Foreign Financial Assets					
Square root of LPM (2, 0.2%)	0.234%	0.440%	0.683%	1.044%	1.473%
% change in risk = (A–B)/A	30.354%	33.610%			
Opportunity set C: Opportunity set B + US REITs and AU LPTs					
Square root of LPM (2, 0.2%)	0.234%	0.439%	0.677%	1.021%	1.439%
% change in risk = (B−C)/B	0.105%	0.095%	0.875%	2.207%	2.348%
Weights on US REITs	0.178%	0.326%	1.714%	4.320%	6.819%
Weights on AU LPTs	0.000%	0.000%	0.419%	1.448%	2.573%
Mean difference in out-of-sample performance (B – A)					
Monthly	–0.304	–0.211			
Annual	–0.336	–0.247			
Mean difference in out-of-sample performance (C – B)					
Monthly	0.002	0.004	0.008	0.018	0.024
Annual	0.000	0.000	0.004 *	0.010 *	0.016

* shows that mean difference is significantly different from 0 at the 5% level (one-tailed). Out-of-sample performance is calculated by dividing each month's excess return by the square root of the lower partial moments achieved by each month's optimal portfolio. On a hedged basis, the required rate of return of 1.00% cannot be achieved.

Table 6: Information on efficient frontier – MLPM (2, –0.2%)

A: MLPM (2, -0.2%) – Hedged (local) basis

Required rates of return	**0.20%**	**0.40%**	**0.60%**	**0.80%**
Opportunity set A: Japanese financial assets only				
Square root of LPM (2, –0.2%)	0.198%	0.517%		
Opportunity set B: Opportunity set A + Foreign financial assets				
Square root of LPM (2, –0.2%)	0.051%	0.222%	0.848%	1.628%
% change in risk = (A–B)/A	74.360%	57.069%		
Opportunity set C: Opportunity set B + US REITs and AU LPTs				
Square root of LPM (2, –0.2%)	0.050%	0.216%	0.785%	1.557%
% change in risk = (*B*–*C*)/*B*	2.011%	2.939%	7.355%	4.338%
Weights on US REITs	0.667%	1.915%	8.935%	8.347%
Weights on AU LPTs	0.000%	0.038%	3.772%	0.167%
Mean difference in out-of-sample performance (B–A)				
Monthly	6.562 *	1.401 *		
Annual	7.169 *	1.365 *		
Mean difference in out-of-sample performance (C–B)				
Monthly	0.141	0.111	0.083	0.015
Annual	0.162 *	0.098 *	0.036 *	0.002 *

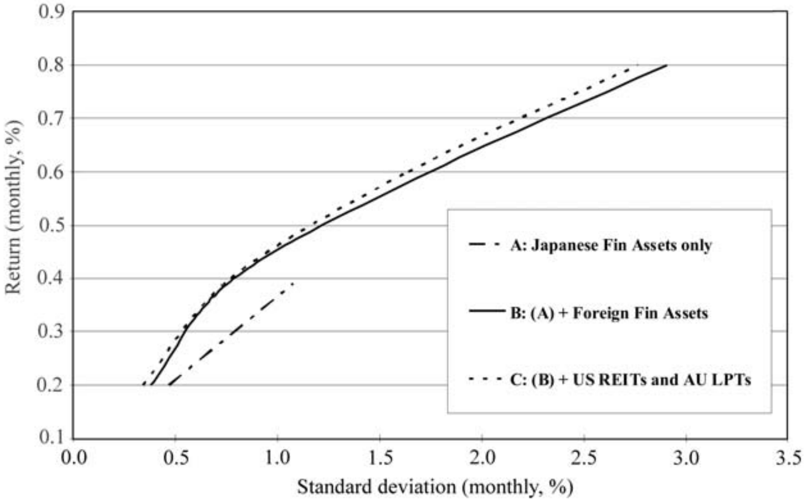
B: MLPM (2, -0.2%) – Unhedged (Yen-denominated) basis

Required rates of return	**0.20%**	**0.40%**	**0.60%**	**0.80%**	**1.00%**
Opportunity set A: Japanese Financial Assets only					
Square root of LPM (2, –0.2%)	0.198%	0.517%			
Opportunity set B: Opportunity set A + Foreign Financial Assets					
Square root of LPM (2, –0.2%)	0.081%	0.281%	0.518%	0.872%	1.291%
% change in risk = (A–B)/A	59.161%	45.718%			
Opportunity set C: Opportunity set B + US REITs and AU LPTs					
Square root of LPM (2, –0.2%)	0.081%	0.281%	0.512%	0.852%	1.260%
% change in risk = (*B*–*C*)/*B*	0.163%	0.082%	1.073%	2.239%	2.374%
Weights on US REITs	0.126%	0.205%	1.740%	4.322%	6.843%
Weights on AU LPTs	0.000%	0.000%	0.246%	1.277%	2.355%
Mean difference in out-of-sample performance (B – A)					
Monthly	2.247 *	0.382			
Annual	2.541 *	0.420 *			
Mean difference in out-of-sample performance (C – B)					
Monthly	0.008	0.001	0.015	0.023	0.022
Annual	–0.001	0.000	0.004	0.013 *	0.013 *

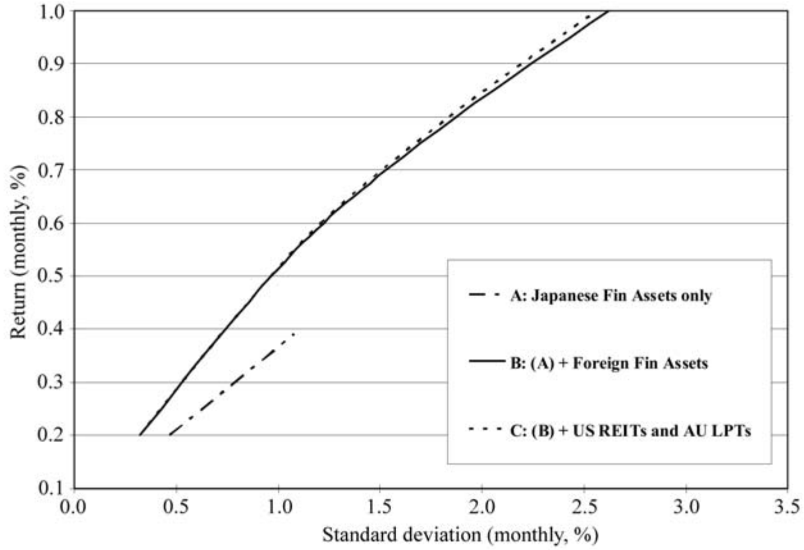
* shows that mean difference is significantly different from 0 at the 5% level (one-tailed). Out-of-sample performance is calculated by dividing each month's excess return by the square root of the lower partial moments achieved by each month's optimal portfolio. On a hedged basis, the required rate of return of 1.00% cannot be achieved.

Figure 2: Efficient frontier: MV

A: Hedged (local)



B: Unhedged (Yen-denominated)



Weights on U.S. REITs and Australian LPTs

Generally speaking, significant weights are allocated to U.S. REITs when the required rates of return are 0.6% and 0.8% per month on a hedged basis, while only small weights are allocated to Australian LPTs because of the extremely high hedging costs for Japanese investors against Australian dollar. On a hedged basis, when the required rate of return is 0.2%, Japanese money market investments dominate the allocation. When it is 0.4%, Japanese bond and money market investments and U.S. bond dominate the allocation. When it is 0.6%, Japanese bond and U.S. stock and REITs dominate the allocation. When it is 0.8%, U.S. stock allocation is the largest followed by Japanese bond and U.S. REITs.[6]

On an unhedged basis, significant weights are never allocated to U.S. REITs and Australian LPTs. When the required rate of return is 0.2% and 0.4%, Japanese money market and bond investments dominate the allocation. When it is over 0.6%, Japanese bond and U.S. stock allocations become significant.

Although the general trend of weights on U.S. REITs and Australian LPTs does not differ depending on the risk definition, there is a small difference between the risk definition defined as MV and those defined as MLPM. Investors with MV risk would allocate slightly more to Australian LPTs and less to U.S. REITs than would investors with MLPM risk. Among MLPM risk definitions, there is no significant difference in weights on U.S. REITs and Australian LPTs.

Risk-adjusted out-of-sample performance

The addition of hedged foreign financial assets to the Japanese domestic assets (i.e., from opportunity set A to B) significantly improves the out-of-sample performances when the investment horizon is one year regardless of the risk definition. When the investment horizon is one month, significant improvements can only be obtained with investors whose risk definition is MLPM (2, –0.2%). Without hedging, only investors with the risk definition of MLPM (2, –0.2%) enjoy significant performance improvements (see Table 6B) from foreign financial assets regardless of the investment horizon.

When U.S. REITs and Australian LPTs are added to the opportunity set (i.e., from opportunity set B to C), the monthly out-of-sample performances never improve significantly whether foreign real estate securities are hedged or not hedged. However, the annual out-of-sample performance significantly

[6] Tables showing detail asset allocations are available from the authors upon request.

improves in most cases when foreign real estate securities are hedged, Without hedging, annual out-of-sample performance improves significantly only when the required rates of return are 0.6% or higher.

Risk definition has the similar impact on the out-of-sample performance results. Hedging foreign assets, the investors with the risk definition, MLPM (2, –0.2%), see the greatest improvements in performance by adding U.S. REITs and Australian LPTs, followed by MLPM (2, 0%) investors, MLMP (2, 0.2%) investors, and MV investors. In the absence of hedging, these improvements disappear.

Summary and Conclusions

This paper analyzes the additional diversification benefits of U.S. REITs and Australian LPTs using the information from efficient frontiers for Japanese investors who already hold Japanese, U.S. and Australian financial assets. The study analyzes the monthly data from August 1994 to July 2004. Both hedged and unhedged analyses are conducted. We measure the additional diversification benefits using degree of risk reduction, weights on U.S. REITs and Australian LPTs, and out-of-sample performance of optimal portfolios. We also examine the degree to which diversification gains are influenced by currency adjustment and the risk definition.

Overall, we find that the additional diversification benefits of U.S. REITs and Australian LPTs can be obtained only in some very limited cases. On an unhedged basis, we find no diversification benefits of U.S. REITs and Australian LPTs. Even on a hedged basis, the additional diversification benefits of U.S. REITs and Australian LPTs are very limited because of the high costs of hedging against U.S. dollar and Australian dollar.

In terms of the out-of-sample performance, only investors with a long (e.g., one-year) investment horizon can obtain significant performance improvements. When the investment horizon is only one month, there are no performance improvements. Generally, only Japanese investors, who can accept a low rate of return, receive diversification benefits from U.S. REITs and Australian LPTs.

Overall the results of this study are highly consistent with other studies that have indicated the limited value of foreign real estate investments in the context of rational portfolio construction. The results raise questions about the wisdom of Japanese enthusiasm for foreign real estate securities. Although the Japanese culture places a high value on real estate assets, heavy investment in foreign real estate securities may be seriously misplaced.

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References

Agarwal, Vikas, and Narayan Y. Naik (2000). Does Gain-Loss Analysis Outperform Mean-Variance Analysis? Evidence from Portfolios of Hedge Funds and Passive Strategies, Working Paper.

Bawa, V. S. (1975). Optimal rules for ordering uncertain prospects, *Journal of Financial Economics*, **2**, 95-121.

Bawa, V. S., and E. B. Linderberg (1977). Capital market equilibrium in a mean-lower partial moment framework, *Journal of Financial Economics*, **5**, 189-200.

Cheng, P., A. J. Ziobrowski, Caines R., and B. J. Ziobrowski (1999). Uncertainty and foreign real estate, *Journal of Real Estate Research*, **18**, 463-480.

Hibiki, Norio (2000). *Financial Engineering and Optimization*. Asakura-Shoten, Tokyo.

Liu, C., and J. Mei (1998). The predictability of international real estate markets, exchange risks and diversification consequences, *Real Estate Economics*, **26**, 3-40.

Markowitz, H.M. (1959). *Portfolio Selection: Efficient Diversification of Investments*. Wiley, New York.

Maurer, R., and F. Reiner (2002). International asset allocation with real estate securities in a shortfall risk framework: the view point of German and US investors, *The Journal of Real Estate Portfolio Management*, **8**, 55-61.

Mull, S., and L. Soenen (1997) U.S. REITs as an asset class in international investment portfolio, *Financial Analysts Journal*, **53**, 55-61.

Plantinga, Auke, Robert van der Meer, and Frank Sortino (2001). The impact of downside risk on risk-adjusted performance of mutual funds in the Euronext markets, Working paper, http://ssrn.com/abstract=277352.

Sortino, F.A., and L. N. Price (1994). Performance measurement in a downside risk framework, *Journal of Investing*, **3**, 59-64.

Worzala, Elaine, and C. F. Sirmans (2003). Investing in international real estate stocks: A Review of the literature, *Urban Studies*, **40**, 1115-1149.

Young, Michael S., and Richard A. Graff (1995). Real estate is not normal: A fresh look at real estate return distributions, *Journal of Real Estate Finance and Economics*, **10**, 225-259.

Ziobrowski, A. J., and J. B. Boyd (1991). Leverage and foreign investment in US real estate, *Journal of Real Estate Research*, **7**, 33-58.

Ziobrowski, A. J., and R. J. Curcio (1991). Diversification benefits of US real estate to foreign investors, *Journal of Real Estate Research*, **6**, 119-142.

Ziobrowski, A. J., and B. J. Ziobrowski (1993). Hedging foreign investments in US real estate with currency swaps, *Journal of Real Estate Research*, **8**, 27-54.

Ziobrowski, A. J., and B. J. Ziobrowski (1995). Hedging foreign investments in US real estate with forward contracts, *Journal of Property Valuation and Investment*, **13**, 22-43.

Ziobrowski, A. J., B. J. Ziobrowski, and S. Rosenberg (1997). Currency swaps and international real estate investment, *Real Estate Economics*, 25, 223-251.

Ziobrowski, A. J., Caines, R. W., and Ziobrowski, B. J. (1999). Mixed-asset portfolio composition with long-term holding periods and uncertainty, *Journal of Real Estate Portfolio Management*, 2, 139-144.