NEW YORK UNIVERSITY
STERN SCHOOL OF BUSINESS
FINANCE DEPARTMENT

Working Paper Series, 1996

The Predictability of International Real Estate Markets, Exchange Rate Risks and Diversification Consequences

Liu, Crocker and Jianping Mei

FIN-96-33

The Predictability of International Real Estate Markets, Exchange Rate Risks, and Diversification Consequences

Crocker H. Liu and Jianping Mei

Leonard N. Stern School of Business
New York University

Current Draft: December 4, 1996

Associate Professors of Finance, Stern School of Business. Any comments can be sent to the authors at: 44 West 4th Street, Suite 9-190, New York, NY 10012-1126 Phone (212) 998-0353 and (212) 998-0354 respectively. Alternatively, readers can address their comments to us at cliu@stern.nyu.edu or jmei@stern.nyu.edu respectively.

The Predictability of International Real Estate Markets, Exchange Rate Risks, and Diversification Consequences

Current Draft: December 4, 1996

Abstract

We investigate whether international real estate related securities offer any incremental diversification benefits over foreign stocks using mean-variance analysis together with a multifactor latent variable model. The study finds that diversification benefits are primarily driven by unanticipated returns which in turn are partly driven by changes in exchange rate risk. Although exchange rate risk accounts for a larger portion of the return fluctuation in real estate related securities relative to common stocks, international real estate securities are found to provide some incremental diversification benefits over common stocks even if currency risks are hedged.

Key Words: Predictability, Diversification, International Property Trusts

Introduction

Recent evidence suggests that returns for U.S. real estate securities and stocks are not only predictable but also that these returns tend to move in tandem to some extent[1]. While some controversy exists on whether these findings are also applicable on an international basis for stock returns, little (if any) research exists on either the predictability or co-movement of international real estate related securities[2]. The purpose of the current study is to investigate the degree to which returns on international stocks and real estate related securities are predictable and exhibit systematic co-movement. We then assess the role of this co-movement on international portfolio diversification. If returns are fairly predictable, and this predictability is the result of the integration of returns on stock and real estate related securities among markets where integration is evidenced by common factors which are responsible for the systematic co-movement of returns, then the construction of efficient portfolios will be affected.

A related issue here is whether it pays to use international real estate related securities if a portfolio already includes international stocks of each country and if all of the markets for stocks and real estate securities are integrated. The extent to which own country real estate related securities offer incremental benefits over and above that of stocks in each country has not been studied to our knowledge. Some diversification studies involving international real estate have

---

[1]See for example Campbell [1987], Campbell and Hamao [1992], Chen, Roll, and Ross [1986], Fama and French [1988, 1989], Fama and Schwert [1977], and Keim and Stambaugh [1986]. These papers find that the dividend yield on the stock market, the January effect, the return on Treasury bills and the long-term yield spread are useful in predicting excess stock returns among other variables. Liu and Mei (1992, 1993) also find these factors in addition to the cap rate can help predict excess real estate returns. Liu and Mei further find that excess returns on real estate are more predictable than stocks.

[2]Both Stehle [1977] as well as Errunza and Losq [1985] cannot reject the proposition that a common factor(s) affects returns on international stocks. Jorion and Schwartz [1986] in contrast, find that different factors may impact on different stock markets as a result of statutory investment barriers. Recently, Campbell and Hamao [1991] find that common factors influence returns on U.S. and Japanese stocks and also that these returns are predictable.

used returns on direct real estate investment which have different characteristics from that of real estate related securities. Alternatively, other studies have used an international real estate index which provides few insights on portfolio construction from a micro-perspective e.g., mixed asset, inter-country portfolio construction. Of the few papers on international real estate diversification, Ziobrowski and Curcio [1991] find that U.S. real estate did not offer U.K and Japanese investors any significant incremental diversification advantages over own country real estate due to higher riskiness of U.S. real estate when returns are denominated in foreign currency. In contrast to this, Asabere, et al [1991] conclude that international real estate should improve portfolio efficiency for U.S. investors given a weak positive correlation with U.S. REIT returns. Asabere, et al further find that international real estate equity securities have a higher risk and return relative to U.S. REITs. A partial reason for the conflicting results is that the former study employs direct real estate investment whereas the latter study uses the Morgan-Stanley index of international real estate securities. In addition to this, different methodologies are also used. In exploring this issue, we also consider the impact of exchange rate risk since prior studies have shown that currency risk is a dominant factor. Consideration is also given to whether our results are robust to hedged versus unhedged returns. However, we do not include settlement costs and other transaction costs in our analysis of hedging currency risk although we do discuss the consequences of these costs on portfolio risk and return[3].

[3]Most studies on international stocks and real estate either ignore exchange rate fluctuations or alternatively adjust returns for currency on a periodic basis. Moreover, Worzala (1995) observes in her survey of institutional investors with respect to international investments that "... few of these international investors indicate hedging as one of their basic strategies." As such, our study is guilty of the same sins of omission.

There are several distinguishing features of our study. First, we use monthly returns on real estate related securities for six countries. Returns on foreign property trusts are utilized for a more direct comparison with portfolio diversification studies involving U.S. real estate investment trusts (REITs) except where no trusts exist. In these cases, property companies are employed to get some sense of incremental diversification benefits. Second, we find that only one factor is necessary in accounting for the time-variation of expected returns across different countries. This implies that international real estate securities are integrated with international stocks because one factor can account for the movement of the expected returns of all assets. This result holds regardless of whether exchange risk is hedged. However, we find that the unexpected portion of returns is quite large and accounts for most of the diversification benefits. We also find evidence that changes in currency risk account in part for movements in unanticipated returns. This phenomenon is more pronounced for real estate related securities relative to stocks for most countries. Moreover, there is some evidence that real estate securities of some countries (but not others) do add incremental diversification benefits, even if stocks of that country are already included in an international portfolio.

The remainder of the paper is organized as follows. Section 2 describes the data set while the analytical framework that we use is contained in section 3. The existence of predictable excess real estate returns is documented in Section 4 together with the extent to which international real estate markets are integrated. Section 5 concludes the study.

The Data

Monthly returns on property trusts, and/or property-related securities, as well as capital market indices are obtained for Australia, France, Japan, South Africa, United Kingdom, and the United States. The Australian Stock Exchange provided us with a market capitalization weighted index of listed property trusts. The Interactive Data Corporation (IDC), which is also the source of the CRSP data, furnished us with returns on individual property trusts in France from which a property trust return series inclusive of dividends is constructed.[4] For Japan, returns on property companies are taken from the Nikkei Telecom News Retrieval system which reports Japanese value-weighted stock price indices by industry for the first section of the Tokyo Stock Exchange. B.O.E. Properties (Transvaal) Limited provided us with the value-weighted South Africa property unit trust index inclusive of dividends for the Johannesburg Stock Exchange. The Financial Times value weighted property index which consists of property-related companies including a few developers, is used for the United Kingdom (U.K.). For U.S. real estate, we use the value weighted monthly index of equity real estate investment trusts (EREITs) inclusive of dividends from the National Association of Real Estate Investment Trusts (NAREIT).[5]

Information on stock market returns, short term government yields, long term government yields, consumer price indices, and exchange rates are obtained from Ibbotson and Associates IDEAS

---

[4]We were unable to obtain the total number of shares outstanding for each property trust and therefore could not construct a value weighted index. The return data are adjusted for stock splits in an identical manner to that in the CRSP database. The stocks included in our index include Cofimeg, Cogifi, Foncina, GFII, Sefimeg, Simco, Socim which are SIIs in addition to Codetel, Immoffice, Locindus, Unibail which are all Sicomis.

[5]An adjustment was made to the NAREIT index since the dividend yield in the NAREIT index is calculated using current price (t) rather than the price at the beginning of the period (t-1). The index consists of all tax-qualified REITs listed on the New York Stock Exchange, the American Stock Exchange, and the NASDAQ. Prior to 1987, REITs were included in the index for the January following their listing. After 1987, REITs were added to the index in the month that their shares were issued. The beginning of the month is used in calculating the value-weighted total return with only REITs listed for the entire period included in the index for that month.

database for each of the six countries.[6] The Morgan Stanley Capital International Indices cum dividend is used as the proxy for capital market returns[7]. All monthly return data for each country start in February 1980 and end in March 1991.

All of the return series are converted into U.S. returns to facilitate cross-country comparisons. As such, the perspective of the U.S. investor is assumed in this study. The formula used to translate returns on foreign assets into dollar terms is as follows:

$$\tilde{R}_{i\$} = (1+\tilde{R}_i)(1+\tilde{R}_{ei})-1 \qquad (1)$$

where the tilde "~" represents a random variable, $\tilde{R}_{i\$}$ is the dollar rate of return on an unhedged investment in the ith foreign market, $\tilde{R}_i$ is the rate of return stated in local currency, and $\tilde{R}_{ei}$ is the rate of appreciation of the local currency relative to the dollar. We use the framework of Eun and Resnick (1988) to compute returns using a hedged strategy using a foreign exchange forward contract, and alternatively, an unhedged strategy with respect to currency risk. This, in turn, allows us to determine the benefits from international diversification.[8] If currency risk isn't

[6]Ibbotson and Associates repackage data from several sources. For government yields and consumer price indices, the data is either from the International Monetary Fund's publication *International Financial Statistics* or the publications of the Organization of Economic Cooperation and Development (OECD) including *Main Economic Indicators* and *Financial Statistics: Part I.* Exchange rates until 1987 are from OECD, *Main Economic Indicators: Historical Statistics* and after this date, *The Wall Street Journal* is used. Short term government yields are derived from government instruments with less than 3 months to maturity or from an official discount rate. Long term government yields in contrast assume that a single bond with a maturity of between 7.5 to 20 years for a country is bought at par at the beginning of each period and then is sold at the end of the period, e.g., a month at the then-prevailing market yield. The rate of inflation is calculated as the change in the consumer price index from the beginning to the end of the month for each country. For Australia however, the Producer Price Index taken from the I.M.F. *International Financial Statistics* is used as the proxy for inflation since the CPI is unavailable either from Ibbotson or from the IMF book.

[7]We used the Financial Times (FT) stock index for South Africa since no Morgan Stanley Capital International Index exists for this country.

[8]Eun and Resnick (1988) show that exchange rate fluctuations add to foreign investment risk by way of its own variance and also through its "positive" correlations with returns in the local stock market. In fact, the authors find that a sizable portion of dollar stock volatility arises from exchange rate risk in developed countries. Hauser, Marcus, and Yaari (1994) however, find that this phenomenon does not necessarily hold for stocks in emerging markets.

hedged, then the expected rate of return, the actual rate of return, the variance of that return, and the covariance of returns in terms of dollars are as follows:

Expected Return: $E(\tilde{R}_{i\$}) = (1+E(\tilde{R}_i))(1+E(\tilde{R}_{ei}))-1$ (2)

Actual Return[9]: $\tilde{R}_{i\$} = (1+\tilde{R}_i)(1+\tilde{R}_{ei})-1 \approx \tilde{R}_i+\tilde{R}_{ei}$ (3)

Variance of Returns: $var(\tilde{R}_{i\$}) \approx var(\tilde{R}_i)+var(\tilde{R}_{ei})+2cov(\tilde{R}_i,\tilde{R}_{ei})$ (4)

Covariance: $cov(\tilde{R}_{i\$},\tilde{R}_{j\$}) \approx cov(\tilde{R}_i,\tilde{R}_j)+cov(\tilde{R}_{ei},\tilde{R}_{ej})+cov(\tilde{R}_i,\tilde{R}_{ej})+cov(\tilde{R}_j,\tilde{R}_{ei})$ (5)

where "≈"denotes an approximation and E is the expectations operator. If a U.S. investor decides to hedge currency risk through a forward contract, Eun and Resnick (1988) show that the expected rate of return, the actual rate of return, the variance of that return, and the covariance of returns in terms of dollars are as follows:

Expected Return: $E(\tilde{R}^H_{i\$}) = (1+E(\tilde{R}_i))(1+f_i)-1$ (6)

Actual Return: $\tilde{R}^H_{i\$} = (1+E(\tilde{R}_i))(1+f_i)+(\tilde{R}_i-E(\tilde{R}_i)(1+\tilde{R}_{ei})-1 \approx \tilde{R}_i+f_i$ (7)

Variance of Returns: $var(\tilde{R}^H_{i\$}) \approx var(\tilde{R}_i)$ (8)

Covariance: $cov(\tilde{R}^H_{i\$},\tilde{R}^H_{j\$}) \approx cov(\tilde{R}_i,\tilde{R}_j)$ (9)

where superscript H denotes the rate of return under the hedged strategy, f_i is the relative forward exchange premium or discount, and subscript j refers to an asset j which is different from asset i. To calculate the relative foreign exchange premium/discount we assume that interest rate parity holds[10] so that

---

[9]The actual return on an international investment in dollar terms actually consists of 3 components: the return on the asset (R_i), the return on the currency (R_{ei}), and the interaction between the return on the investment and the return on the currency (R_iR_{ei}). Since the interaction term is small, we omit it in all subsequent calculations.

[10]Frenkel and Levich (1977) among other others provide evidence supporting this assumption.

$$\frac{1+r_\$}{1+r_i} = 1+f_i \tag{10}$$

where $r_\$$ represents the U.S. risk-free rate, and r_i is the risk-free interest rate in the ith foreign country.

A comparison of Equations (4) and (8) reveals that if the covariance between return on the asset and return arising from currency fluctuations is positive, e.g., $cov(\tilde{R}_i, \tilde{R}_{ei})>0$, then the variance of the unhedged returns exceeds that of the hedged returns. Consequently, hedging currency risk is a superior strategy in this situation[11]. If $cov(\tilde{R}_i, \tilde{R}_{ei})<0$ however, the hedged currency strategy is not necessarily superior to that of an unhedged strategy. Moreover, strategy to hedge currency risk is dependent on the extent to which currency risk contributes to the overall volatility. To further explore the contribution of currency risk to overall volatility of returns stated in dollar terms, the variance of returns in Equation (4) is decomposed into two components: (a) the portion of the variance associated with own country variance (V_1), and (b) the portion of the variance due to exchange rate risk (V_2) as follows:

$$1 = V_1 + V_2 = \left[\frac{var(\tilde{R}_i)}{var(\tilde{R}_{i\$})}\right] + \left[\frac{var(\tilde{R}_{ei}) + 2cov(\tilde{R}_i, \tilde{R}_{ei})}{var(\tilde{R}_{i\$})}\right] \tag{11}$$

Characteristics of Foreign Property Trusts

Our study uses property trusts (except for Japan and the U.K. where property companies are employed) to the extent possible to increase the comparability of investing in real estate securities similar to that of U.S. property trusts. Foreign property trusts share many features with

---

[11]This presumes that no settlement costs or transactions costs exist.

U.S. REITs. For one, shares of a property trust are traded on a stock exchange. Another similarity to REITs is that foreign property trusts are taxed only at the investor level. To qualify for tax exemption at the firm level, property trusts are required to distribute a certain percentage of net earnings, are subject to certain asset restrictions, and are typically prohibited from engaging in certain real estate related activities. Most property trusts tend to have portfolios consisting of offices, retail, and/or industrial properties. Some differences do exist, however, in that some foreign property trusts are limited in the amount of leverage that they can use to purchase property. The leverage is typically much lower than that for U.S. REITs. Besides this, while the U.S. has at least seven times more property trusts relative to other countries, the aggregate market capitalization of foreign property trusts (in US dollars) is less than two times that of U.S. REITs. Table 1 provides detailed information on property trusts in various countries.

Put Table 1 Here

While we tried to look for property trusts in all countries for which data was available over our study period, we were forced to use property companies in the case of Japan and the U.K.. For Japan, we were unable to find any property trusts. Although property unit trusts do exist in the U.K., the characteristics of these trusts are more similar to that of U.S. commingled real estate funds (CREFs) than REITs. For example, only pension funds can invest in the authorized property unit trusts with prices for these trusts quoted on a weekly basis based on the appraised value of trust properties. Admittedly, the use of property companies, in lieu of property trusts for Japan and the U.K., does create a comparability problem. In particular, property companies, in contrast to property trusts, take a more active role in real estate development since there are no prohibitions on certain real estate activities like those that exist for property trusts. As such, property companies tend to exhibit greater price volatility relative to property trusts in general. Besides this, property companies pay taxes at the firm level. However, they do not have any distribution requirements as is the case with property trusts. While we recognize this as a potential problem, it is not unrealistic to assume that if an investor wishes to participate in real estate-related securities, that investor will invest in property companies to get some exposure in a particular market if no property trusts are available. More importantly, we wish to include as many countries as possible in examining whether there are any incremental diversification advantages to investing in publicly traded real estate-related interests (preferably property trusts) over that of foreign stocks.

The Analytical Framework

To investigate whether international stock markets and markets for real estate related securities are integrated, we use both ordinary least square (OLS) regressions as well as the asset pricing framework described in Liu and Mei (1992a). First, OLS regressions of asset returns are performed for each country against own country state variables.[12] The state variables used are a dummy variable for the January effect, the lagged short term rate, the lagged spread in that country, and lagged market returns. We use lagged market returns to proxy for the dividend yield of an equally weighted portfolio because the latter is not available for many countries. This set of regressions gives an indication of the level of predictability of returns based on the own country information set. Next, excess asset returns are regressed (OLS) against common state

[12] Our study is conducted from a U.S. investor's perspective. As a U.S. investor, we can only obtain either the currency adjusted return (unhedged) or the hedged return. Thus, the study focuses on currency adjusted returns (unhedged) and the hedged returns.

variables where "common" is defined in terms of U.S. variables. The rationale for using U.S. variables is that we study international markets from a U.S. investor's perspective.[13] The common, economic state variables that we use are a January dummy, the T-bill, the spread between the long term and short term rate, and the dividend yield of an equally weighted portfolio. These regressions offer a partial test of international market integration. If a common set of U.S. variables can explain or predict the time-varying risk premiums for all assets across countries, then we have a strong indication of international market integration.

The forecasting variables chosen reflect those widely used in previous stock return and real estate securities studies (see Campbell (1987), Fama and French (1989), Keim and Stambaugh (1986), Ferson and Harvey (1989), Liu and Mei (1991), Mei and Saunders (1995) among others). These studies have consistently shown that these variables are capable of explaining the time variation of expected returns over different sample periods and their use also conforms to asset pricing theories. These variables are also expected to act as important variables in our study. The January dummy captures the persistence in the positive rate of return during January. This effect has been found to be present for U.S. stocks during the 1970s[14]. We include the January dummy to see if this seasonal effect is present in other security markets as well. The treasury bill rate proxies for the level of interest rates. A high relative bill rate is consistent with a sudden increase in the short-term interest rates in the economy and increased inflationary expectations, which

[13] There are two other reasons for using only the U.S. variables. First, the latent variable model could treat "omitted variables" as random errors. As such, the model is still well-specified even if variables of some other country(ies) are left out. Thus, our test still holds with only U.S. variables. Second, we needed to be careful with degree of freedom restrictions. If we include variables from all countries, we will get spuriously very high R-squares but meaningless results.

[14] Recent studies however have noted that the January effect has been nonexistent in the late 1980s. Malkiel (1990) makes reference to this fact.

could adversely impact the pay-off on real estate assets---especially those assets with relatively fixed nominal rental incomes---see Miles, Webb and Guilkey (1991). Thus, in periods when interest rates are higher (or lower) than "normal" we might expect a change in the interest-rate risk premium to be impounded in real estate security returns. The spread between the yield on long-term government bonds and the treasury bill rate proxies for the slope of the yield curve. A widening of the spread reflects investors' expectations of increased long-term inflation risk and thus may impact the present value of real estate assets, which are sensitive to long-term inflation. The dividend yield on equally-weighted stock portfolios seeks to capture changing expectations regarding expected future returns in the security markets. An increase in the risk (or perception) of security investment will increase the required rate of return on stocks and thus lower the market value of stocks. This, in turn, will result in an increase in the dividend yield. On the other hand, an unexpected increase in the future cash flows (dividends) to stocks will result in a higher dividend yield. A higher dividend yield makes stocks look more attractive to investors in terms of higher expected future returns.

One question which arises given our alternative information sets is the extent to which these forecasting variables, denominated in own country currency, are correlated. Table 2 reveals that the state variables for a country exhibit only a modest correlation with the same state variables for another country in general. In fact, only eight of the correlation coefficients equal or exceed .5 between state variables of different countries. All of these eight correlations are statistically significant. Consequently, the majority of the correlations are low even though most are statistically significant due to the number of time periods used in this study. While low correlations might suggest that segmentation exists since these variables might be expected to fluctuate together in an integrated market, Adler and Dumas (1983) point out that this rationale is misguided given that national random factors such as politics are reflected in these state variables. Thus, small correlations among national stock market indices, for example, are generally consistent with perfect capital market integration.

Put Table 2 Here

In addition to OLS regressions, we also use Hansen's Generalized Method of Moments (GMM) in conjunction with the asset pricing framework set forth in Liu and Mei (1992a) as a more rigorous test of international market integration. This is because the asset pricing test not only imposes the restriction that the expected returns of all assets must be explained by a common set of state variables, but their movement must also satisfy some linear pricing restrictions outlined in the Appendix. It also has the advantage of being robust to heteroskedasticity in excess returns. More specifically, we fit asset expected returns using a latent variable model. If the international markets are integrated, then as Campbell and Hamao (1992) point out, the time-variation of risk premiums across different countries should satisfy the linear pricing restrictions determined by some systematic factors. We use a chi-squared test to examine the linear pricing restrictions imposed by the latent variable model. We initially divided our sample into two markets, real estate related securities and stocks, due to the limited number of time series observations. Next, a chi-square test is conducted on each of the two separate samples to determine if the securitized property market is integrated, and alternatively, the stock market is integrated. If we find that each respective market is integrated, we next construct an equally weighted, international market index for real estate and for stock, respectively, to see whether the international real estate market is integrated with the international stock market. The rationale for "collapsing" the 7 countries into an international category is to circumvent the ranking (dimensionality) problem which arises from the limited number of time periods. Appendix A contains a more detailed discussion of the latent variable model and the associated test of linear pricing restrictions.

After we examine whether international real estate markets are integrated, we next explore the issue of what is the optimal holdings of international assets from the perspective of a U.S. investor. To do this, we calculate the mean-variance efficient portfolios for real estate, stocks, and the combination real estate and stocks, respectively, assuming that no short sales are allowed.[15]

Empirical Results

Table 3 shows the average dollar return and the accompanying standard deviation for stocks and real estate-related securities in each country. Return and risk are reported on an unhedged and hedged currency basis together with the decomposition of volatility on unhedged returns. In terms of returns, Japanese stocks and property companies have the highest average monthly returns over the sample period regardless of whether currency risk is hedged. South African

---

[15]Mathematically,

$$\begin{aligned} &\min\ x'\Sigma x \\ &\text{s.t. } x'\iota = 1 \\ &\quad x'\mu = R_p \\ &\quad x \_ 0 \end{aligned}$$

where x is the vector of weights, Σ is the variance-covariance matrix of returns, ι is the unity vector, and μ is the vector of mean returns.

stocks and property trusts, in contrast, exhibit the lowest relative returns from both a hedged and unhedged perspective. South African stocks and property trusts also display the highest relative volatility in terms of unhedged returns. When currency risk is hedged, however, Australian stocks and Japanese property companies have the highest inter-country risk. Not surprisingly, US stocks and property trusts have the lowest standard deviation[16]. Interestingly, no linear risk-return tradeoff appears to exist regardless of whether currency risk is hedged. More specifically, both stocks and real estate related securities with relatively higher average returns do not necessarily have correspondingly higher standard deviations.

When the volatility of unhedged returns is partitioned, we find that the exchange rate risk of the countries in our sample accounts for a sizable portion of the dollar return volatility for both stocks and real estate related securities. This evidence is consistent with prior studies on international stock diversification in developed markets. Consequently, hedging currency risk may be a desirable investment strategy[17]. The impact of currency risk on stocks and property related securities differs depending on the country in question. For South Africa, exchange rate risk accounts for most of the variation in both returns on stocks and property trusts with the impact relatively larger for stocks. This situation also holds for Japan. In all other countries, however, currency risk accounts for a larger portion of the fluctuations in returns on property trusts/companies compared to stock returns in that country.

Put Table 3 Here

---

[16]These returns are not adjusted for currency fluctuations

[17]The degree to which hedging currency risk is desirable depends in part on the magnitude of settlement and other transaction costs which we do not recognize in this paper. See Worzala (1995) for further details on how transaction costs can increase the variability of the portfolio.

Table 4 presents the inter-country correlations and accompanying T-statistics from an unhedged return perspective. Table 5 presents the same information when currency fluctuations are hedged. The correlations in both tables are relatively low across countries between different asset types indicating that gains are possible from international diversification in general. More specifically, the degree of co-movement in the international property trust markets is low with an average inter-country correlation coefficient of .26 (.19) if returns are unhedged (if currency risk is hedged). Similarly, the average inter-country correlation coefficient between international stocks is .34 and .36 for unhedged and hedged returns respectively. While both sets of intra-asset correlations are low, returns tend to move more closely in international stock markets relative to the international property trust markets. This suggests larger diversification benefits are possible for a property trust portfolio relative to a stock portfolio if portfolio diversification is on an intra-asset basis. The degree of co-movement between stocks in one country, and real estate-related securities in a different country is also low in general. In particular, the average inter-country correlation is .29 for unhedged returns and .26 for hedged returns. However, the intra-country correlations between stocks and property trusts/companies in both tables are moderate to high ranging from .62 to .80 if returns are unhedged and from .47 to .73 if currency risk is hedged[18]. This suggests that while some incremental benefits do exist from adding international real estate securities to a portfolio of international stocks, the extent of the gain might be modest.

[18]Intra-country correlations between stocks and property trusts/companies are higher if returns are unhedged than if currency risk is hedged since both own-country returns are adjusted by the same currency factor each month in the former case. We thank an anonymous reviewer for this point.

Some differences also exist when the unhedged and hedged correlation structures are compared. For one, the intra-country correlations between stocks and property trusts/companies appear to be relatively lower when currency risk is hedged. This indicates that potentially larger gains from diversifying with international real estate securities exists if a US investor hedges currency risk through a forward transaction. Secondly, the unhedged correlations do differ from the hedged correlations although no clear pattern is evident as to the direction of the difference.

Put Table 4 and Table 5 Here

To determine the role that hedging exchange rate risk has on expected returns and in turn, the impact that fluctuations in expected returns have on the movement of actual returns, we perform a series of regressions. The results for the first set of OLS regressions, which explores the question of how predictable returns are for each country using own country state variables as the relevant information set, are reported in Table 6. These own country variables are in local currency since the intuition is to proxy for each country's economic condition. The results for the second set of OLS regressions, reported in Table 7, examines the related question of how predictable returns are for each country. Table 7, in contrast to Table 6, uses a set of common U.S. state variables in lieu of own country economic variables as the appropriate information set. The U.S. variables are in U.S. currency since as stated earlier 1) this provides evidence of whether U.S. variables are more important relative to own country economic variables in predicting returns, 2) this gives an indication of whether international markets are integrated, and 3) we study international markets from a U.S. investor's perspective.

Put Table 6 and Table 7 Here

Table 6 shows that own country state variables do account for a portion of the variation in expected rates of return in some countries but not in other countries. Own country variables for Japan and South Africa play a significant role in predicting returns on real estate securities in both countries regardless of whether exchange rate risk is hedged. This is also the case, to a weaker extent, for unhedged U.S. property returns. For expected returns on Japanese property companies, hedging exchange rate risk reduces the role of own country variables. The converse is true for expected returns on South Africa property trusts. Own country variables for South Africa are also important in accounting for the variation in South African stock returns regardless of whether exchange rate risk is hedged. For Japan, in contrast, own country variables are not influential with respect to stock returns on either an unhedged or hedged basis. Own country variables are also related to movements in unhedged U.K. stock returns although to a more limited extent relative to South Africa. While the preceding evidence indicates that own country economic variables as well as exchange rate risk do influence expected returns, this evidence is relatively weak as reflected in the relatively low F-statistics and adjusted R-squares. In general, only minor differences exist between using an unhedged or hedged strategy with respect to capturing *expected* rates of return. Consistent with Liu and Mei (1992), short-term rates and the spreads are negatively related to expected asset returns in general.

Table 7 reveals a similar story to Table 6. While some differences are present with respect to which U.S. common variables are useful in predicting returns due to currency hedging, this difference is not significant. Stated differently, only minor differences exist between using an unhedged or hedged strategy, in general, with respect to capturing expected rates of return when U.S. economic variables are substituted for own country state variables. However, some conflicting evidence exists as to which information set is more useful in predicting returns . A comparison of Table 7 with Table 6 reveals that U.S. economic variables appear to be better predictors of individual country returns on both stocks and real estate securities. The F-statistics are significant and the adjusted R-squares are slightly higher when the set of U.S. economic variables is used relative to own country economic variables for more countries. However, own country economic variables have more explanatory power based on the adjusted R-squares for unhedged and hedged returns on Japanese property companies and also South Africa stocks. South Africa economic variables also account for more of the variation in hedged returns on South African property trusts relative to U.S. economic variables. In all other cases, however, U.S. economic variables are slightly better predictors of individual country returns on both stocks and real estate securities relative to own country variables. The adjusted R-squares in Table 7 also suggest that U.S. real estate securities are more predictable relative to other U.S. stocks. This is consistent with the findings of Liu and Mei (1992a). Returns on foreign stocks are relatively more predictable relative to the returns on foreign real estate securities in general. Another interesting observation is that the "January effect" is insignificant in all countries and for all assets except for South African stocks.

A plausible explanation as to why U.S. economic variables better predict returns relative to own country economic variables is that the former information set includes equally weighted dividend yields. The latter information set, in comparison, uses lagged market returns as a proxy for equally weighted dividend yields since this information was unavailable in most countries. The equally weighted dividend yield does slightly better than the lag of market return in predicting asset returns because the dividend yield consists of two components - the lag of price and dividends. The lag of market returns in contrast, provides information about past performance but not about the value of stocks with respect to dividends.

To formerly address the issue of market integration, Hansen's GMM methodology is used in conjunction with the asset pricing framework described in Liu and Mei (1992a) to test whether a one factor model is effective in accounting for movements in the expected rate of return (the null hypothesis) and to also test whether the linear pricing relationship of an integrated world market holds. The alternative hypothesis is that a one-factor can not capture the time-variation of risk premiums across different countries. The GMM results, reported in Table 8, show no evidence to reject the null hypothesis[19]. Consequently, one latent factor is capable of capturing the time-variation of expected returns across different countries regardless of whether returns are hedged or unhedged. This implies that international real estate securities are integrated with international stocks. Given the findings of Table 6, Table 7, and Table 8, we can see that the predicted part of the returns are extremely small and the expected returns have a tendency to move together. This is because a one factor model is capable of explaining the movement of all expected returns. However, the unanticipated part of the returns are fairly large. Consequently, the benefits of

[19]The chi-square on the linear pricing restrictions imposed by the latent variable model in Table 8 is not significant at either the 5% or 10% level. Although the GMM test offers a more rigorous test of international market integration by imposing the restriction that the expected returns of all assets must satisfy some linear pricing restrictions, it may lack statistical power in *small* samples due to the fact it puts much less restrictions on the data. For example, it does not require that the residual returns follow i.i.d. normal distributions. As a result, it may be more robust but on the other hand, it also sacrifices the efficiency associated with the OLS tests under i.i.d. normal distributions.

diversification come primarily from the unexpected portion of returns. These results, read in conjunction with Table 3, imply that movements in unanticipated returns are due in part to changes in currency risk.

Put Table 8 Here

Given our finding that international real estate securities are integrated with international stocks regardless of whether returns are hedged, we now explore the question of whether it pays to use international real estate related securities if a portfolio already includes international stocks of each country. In other words, do own country real estate related securities offer incremental risk/return advantages to a portfolio over and above that of stocks in each country?

Figure 1 reports the mean-variance frontiers calculated from three sets of assets: 1) all six property trusts, 2) all six stocks, and 3) both the property trusts and the stocks assuming that returns are unhedged (Figure 1a) and alternatively assuming that currency risk is hedged (Figure 1b). Regardless of whether currency risk is hedged, the combination of international stock and real estate securities provides less risk at all levels of return relative to either an all real estate portfolio or a portfolio consisting only of stocks. However, the incremental reduction in risk is small at very low and very high levels of portfolio return. At low levels of return, the risk of an efficient, mixed asset portfolio is similar to an efficient portfolio consisting solely of international, real estate related securities. At high levels of return, the risk on an efficient, mixed asset portfolio is similar (albeit lower than) to an efficient portfolio comprised only of international stocks. Table 9, which complements Figure 1, also reveals that investing in an international portfolio of stocks and real estate securities reduces the risk of a portfolio consisting solely of U.S. stocks and U.S. property trusts at all levels of return. In particular, portfolio risk is reduced between 15%-27% (31%-40%) on monthly returns of 1.1%-1.3% respectively, when foreign currency is not hedged (is hedged). Table 9 further shows that incremental reduction in risk is small at low levels of portfolio return because international real estate securities represent between 86%-88% of the efficient portfolio when the portfolio return equals 1.1% per month. Conversely, the incremental reduction in risk is also small at high levels of portfolio return since international stocks account for 71%-74% of the efficient portfolio when the portfolio return equals 1.6% per month. Although the aggregate inter-asset weights for real estate and stocks are similar for the efficient portfolio at low and high levels of returns regardless of whether returns are hedged, there are differences in intra-asset allocations. These differences depend on whether currency risk is hedged. U.S. real estate securities dominate efficient portfolios with low returns (and risk) when returns are unhedged. When returns are hedged, however, non-U.S. real estate related securities comprise the majority of the efficient portfolio at low levels of portfolio risk and return. At the highest levels of portfolio risk and return, the weight for U.S. stocks is almost equal to (but a little less than) the weight on international stocks when returns are unhedged. However, only international stocks are included in the efficient portfolio when currency risk is hedged. In fact, only international stocks and international real estate comprise the efficient portfolio if an investor hedges foreign exchange risk and desires at least a 1.6% portfolio return per month.

Put Figure 1 and Table 9 Here

Consequently, the investment implications are that if an investor is very risk averse and desires a yearly portfolio return of 12% then the investor should hold a portfolio that has 86%-88% weight in real estate related securities and a 12-14% weight in stocks to achieve the lowest risk. The intra-asset composition of this portfolio will depend on whether that investor wishes to hedge currency risk. If currency risk is hedged then the investor should invest primarily in international real estate securities. On the other hand, if the return is unhedged then U.S. REITs should comprise the majority of the investor's portfolio. If the investor desires higher returns, say 19% per year, then he or she should invest primarily in stocks (71%-74%) with not more than 26%-29% in real estate securities. Furthermore, this portfolio should consist of only international assets if currency risk is hedged. Conversely, a 34% exposure in U.S. stocks in addition to international assets is warranted if portfolio returns are unhedged. Regardless of whether currency risk is hedged however, the inclusion of international stocks and real estate securities in a portfolio does reduce the incremental risk for any given level of return relative to a portfolio consisting solely of U.S. stocks and U.S. property trusts.

While it is unlikely that any investor would hold at least 25% (90%) in real estate securities to obtain a 19% (12%) annual return, what this finding suggests is that real estate securities do provide diversification benefits. Furthermore, some real estate exposure is warranted even if the investor desires a high level of return. Another implication is that international real estate securities provide more diversification benefits relative to U.S. REITs, the higher the portfolio return if currency risk is hedged. Even if currency risk is not hedged, an investor still derives an advantage to having some exposure in foreign real estate securities.

Although it might appear from a comparison of Figure 1a to Figure 1b that an investor benefits from hedging currency risk[20] e.g., portfolio risk is reduced, this finding ignores settlement costs and other transaction costs of the hedge. Worzala (1995) argues that if settlement costs are explicitly recognized in the hedging process, then not only will the portfolio return decrease but also the portfolio risk will increase. Thus, settlement costs might completely offset any advantage to hedging currency risk.

A finer delineation of the composition of the optimal mixed asset portfolio into the stocks and real estate securities of various countries reveals that when currency risk is not hedged, U.S. REITs comprise 60% of the efficient portfolio while French property trusts represent an additional 23% when the portfolio return desired is equal to 1.1% a month (13.2% per year) as shown in Figure 2a. Japanese property companies and Australian property trusts round out the real estate portion of this portfolio with weights of 4.4% and 1.4% respectively. Consequently, real estate securities comprise approximately 89% of the efficient portfolio when risk and return are relatively low and currency risk is unhedged. The remaining 11% of the portfolio consists of stocks of the U.S. (5%), South Africa (4%), and Japan (2%). Figure 2b shows that when currency risk is hedged and the return on the efficient portfolio remains at 1.1% a month, the majority of the portfolio is still weighted towards real estate securities. However, French property trusts now constitute the largest portion of the optimal portfolio with a weight of 33.6% followed by U.S. and Australian property trusts with weights of 30% and 17% respectively[21].

[20]This is not surprising given that the variance of unhedged returns will exceed that of hedged returns when a positive covariance exists between the return on the asset and currency returns.

[21]Detailed tables on which Figure 2a and Figure 2b are based are available from the authors.

Japanese property companies round out the list of real estate related securities, representing about 5% of the efficient portfolio. The only stocks included in this portfolio are those from South Africa (12%) and Japan (1.5%). Thus, the real estate securities and stocks that comprise the efficient portfolio at a return of 1.1% are similar on average, albeit the weights differ, regardless of whether currency risk is hedged.

Put Figure 2a and Figure 2b Here

As the return on the efficient portfolio increases to 1.5% per month (18% per year), the weights associated with property trusts/ companies of various countries decrease when currency risk is not hedged. The only exception to this are French property trusts whose portfolio weight remains relatively constant at 24%-26%. Moreover, only the real estate securities of three countries, France (26%), U.S. (12%), and Japan (2.6%), remain in the efficient portfolio when the return is at 18% per year. In contrast, the weights associated with U.S. and Japanese stocks continue to increase as the risk and return on the efficient portfolio increase. In fact, U.S. and Japanese stocks dominate the portfolio (with weights of 31% and 28% respectively) when returns reach 18% per year. At no time do South African property trusts, UK property companies, Australian stocks, French stocks, and U.K. stocks enter into the efficient portfolio over this region of portfolio return.

A slightly different perspective obtains when currency risk is hedged. Both the allocation to French property trusts and Japan property companies increase, in general, until returns reach 1.5% per month (18% per year). South African property trusts also begin to enter into the mixed asset portfolio. In contrast, the weight given to U.S. REITs and Australian property trusts decrease as portfolio returns increase while U.K. property companies do not enter the optimal portfolio at any level of risk and return. In terms of international stocks, Japanese stocks are the dominant asset (with a weight of 59%) in the optimal portfolio as returns exceed 1.5%. An inverse relationship appears to exist, in general, between the weights for real estate related securities and stocks of a given country. For example, exposure to U.S. stocks increase while the weight on U.S. REITs decrease as the risk/return on an efficient portfolio increases. Further, French stocks start to enter into the efficient portfolio only after French property trusts exit from the portfolio. The only exception to this inverse tendency is with respect to Japanese assets. Australian stocks never enter into the efficient portfolio.

At the highest level of monthly portfolio return shown, 1.6% (19.2% per year), Japanese stocks represent 37% of the portfolio while U.S. stocks closely follow with a weight of 34% when currency risk is unhedged. French property trusts comprise another 25% of this portfolio while Japanese property companies (1%) and U.K . stocks (2%) have a minor contribution. When currency risk is hedged, Japanese stocks comprise 59% of the portfolio followed by French property trusts and U.K stocks with a 25% and 10% weight respectively. Japanese property companies and French stocks make up the remaining assets in this portfolio.

In summary, real estate related securities from at least one country are included in the optimal mixed asset portfolio except at extremely high levels of return when currency risk is hedged. When currency risk is not hedged, in contrast, real estate securities of South Africa and the U.K are not included in any efficient portfolio. In terms of real estate related securities included in the optimal portfolio, U.S. property trusts and French property trusts have the largest weights regardless of whether currency risk is hedged. The incremental risk/return influence of U.S. property trusts decreases while that of French property trusts increases at higher levels of portfolio risk and return. However, not all of the property securities of each country are included in an efficient portfolio. Does the fact that U.K. and Japanese property companies have different characteristics e.g., development opportunities, relative to the rest of the real estate securities in our sample impact on the optimal portfolio? Interestingly, our results show that Japanese and U.K. property companies have a minor influence, if any, on the composition of the efficient portfolio regardless of whether currency risk is hedged. More specifically, Japanese property companies comprise 2.6% (4.4%-5%) of the optimal portfolio when portfolio returns are high (low). At no time do U.K. property companies, in contrast , enter into the efficient portfolio. These results are invariant to whether currency risks are hedged.

Conclusions

We study the extent to which returns on stocks and real estate related securities are predictable in six countries in an attempt to discover which portion of the return is responsible for international diversification benefits. Both a hedged strategy for exchange rate risk and an alternative unhedged strategy are considered in this process. A group of own country economic variables and a set of U.S. economic variables are alternatively used as the relevant information set to predict hedged and unhedged returns. We find that the predicted portion of the returns on both stocks and real estate securities are small and tend to move in tandem. This common co-movement of expected returns arises because these capital markets are integrated and a one-factor model is sufficient in capturing the time-variation of risk premiums across different countries. Further, regardless of which information set is used, the expected portion of returns for portfolios consisting of both unhedged and hedged returns are quite small. This suggests that diversification benefits arise primarily from the unexpected portion of returns. We further provide evidence that changes in currency risk account in part for movements in unanticipated returns. The most distinguishing result of our study is our finding that investing in international real estate related securities provides additional (incremental) diversification benefits over and above that associated with international stocks. These benefits are relatively more pronounced at lower risk-return levels of the optimal portfolio and are present regardless of whether currency risks are hedged. Thus, a U.S. investor should consider including international real estate securities in his or her portfolio.

It is worth noting that the above results are based on historical returns from the sample period of 1980-1991. The optimal portfolio weights derived in this paper, therefore, may not be applicable to future asset allocations if the underlying economic conditions have changed. However, our study has at least demonstrated the benefits of international diversification and the role of real estate securities. Furthermore, the approaches developed in the paper are certainly useful for portfolio managers in solving their asset allocation problems.

We wish to thank John Campbell for letting us use his latent variable model algorithm and Wayne Ferson for providing data on business condition factors. We also wish to thank Robert Boetticher, John Douglas, Sanjiv Gupta, Martin Hoesli, and Niki Vontas for various return data *on international property trusts. Finally, we are grateful to Will Goetzmann, Steve Grenadier, Kerry Vandell, and two anonymous reviewers whose comments substantially improved the contents of our paper.*

Appendix

Detailed Description of the Latent Variable Model

Basically, the asset pricing framework used in this study is identical to that of Liu and Mei (1992) and assumes that the following K-factor model generates asset returns:

$$\tilde{r}_{i,t+1} = E_t[\tilde{r}_{i,t+1}] + \sum_{k=1}^{K} \beta_{ik} \tilde{f}_{k,t+1} + \tilde{\varepsilon}_{i,t+1} \quad \text{(A.1)}$$

Here $\tilde{r}_{i,t+1}$ is the return on asset i in excess of the riskfree rate held from time t to time t+1, $E_t[\tilde{r}_{i,t+1}]$ is the conditional expected excess return on asset i which is allowed to vary through time[22], $\tilde{f}_{k,t+1}$ are the factor realizations, β_{ik} are the time-invariant factor loadings, and the idiosyncratic error is $\tilde{e}_{i,t+1}$. If certain restrictions are imposed on this return generating model then we can rewrite equation (A.1) as[23]:

$$E_t[\tilde{r}_{i,t+1}] = \sum_{k=1}^{K} \beta_{ik} \sum_{n=1}^{L} \theta_{kn} X_{nt} = \sum_{n=1}^{L} \alpha_{in} X_{nt} \quad \text{(A.2)}$$

The combination of equations (A.1) and (A.2) represent a multi-factor "latent-variable" model.[24] The model implies that expected excess returns are time-varying and can be predicted by the forecasting variables (X_{nt}) in the information set. The forecasting variables that we use are the

---

[22]Evidence on time-varying risk premiums is reported in Campbell (1987), Fama and French (1989), Ferson, Kandel and Stambaugh (1987), among others.

[23] These restrictions are that 1) the conditional expected rate of return is a linear function of the factor risk premiums, with the coefficients equal to the betas of each asset or mathematically:

$$E_t[\tilde{r}_{i,t+1}] = \sum_{k=1}^{K} \beta_{ik} \lambda_{ik}$$

where λ_{kt} is the "market price of risk" for the k'th factor at time t. There are a number of intertemporal asset pricing models which can generate this type of linear pricing relationship, under either a no arbitrage opportunity condition or through a general equilibrium framework (see for example, Ross (1976), Campbell (1990), Connor and Korajczyk (1989)), and 2) the conditional expectations are a linear function of L forecasting variables X_{nt}, n=1,...L (where X_{1t} is a constant) which represent the information set at time t so that we can write λ_{kt} as

$$\lambda_{kt} = \sum_{n=1}^{L} \Theta_{kn} X_{nt}$$

[24]For more details on this model, see Gibbons and Ferson (1985), Campbell (1987), and Ferson and Harvey (1990).

common, economic state variables discussed earlier.[25] The model puts some restrictions on the coefficients of equation (A.2), namely

$$\alpha_{ij} = \sum_{k=1}^{K} \beta_{ik}\theta_{kj} \tag{A.3}$$

Here, β_{ik} and θ_{kj} are free parameters. To test the restriction in equation (A.3), we first renormalized the model by setting the factor loadings of the first K assets as follows: $\beta_{ij}=1$ (if $j=i$) and $\beta_{ij}=0$ (if $j\neq i$) for $1\leq i \leq K$. If the linear pricing relationship holds, that implies that the data should not be able to reject the null hypothesis of (A.3) H_0: $\alpha = \Theta B$ in the following regression (A.4),

$$\begin{aligned} R_1 &= X\Theta + \mu_1 \\ R_2 &= X\alpha + \mu_2 \end{aligned} \tag{A.4}$$

where B is a matrix of β_{ij} elements and $R = (R_1,R_2)$ is the excess returns matrix. Here R_1 is a TxK matrix of excess returns of the first K assets and R_2 is a Tx(N-K) matrix of excess returns on the rest of the assets. The regression system in equation (A.4) is used to see to what extent the forecasting variables, X, predict excess returns of all assets and to test the linear pricing restriction of (A.3). If the linear pricing restriction is not rejected by the data, then we can say that there is evidence of market integration, since the variations in asset expected returns can be explained by the variation of some systematic factors, $f_{k,t+1}$.

---

[25]Campbell (1987), Campbell and Hamao (1992), Fama and French (1988, 1989), Ferson (1989), Ferson and Harvey (1989), Keim and Stambaugh (1986), and Liu and Mei (1992, 1993) have used these variables among others. Fama and French (1989) also uses the spread between yields of a low grade long-term corporate bond and a long-term treasury bond to capture the default risk in the financial market. But they find the variable to be capturing the same information as the dividend yield. Thus, we only include dividend yield in the study.

The regression system of equation (A.4) given the restriction in equation (A.3) is estimated and tested using Hansen's Generalized Method of Moments (GMM). A chi-square test is performed to see if the data rejects the restricted regression system (A.4).

References

Adler, Michael and Bernard Dumas. 1983. International Portfolio Choice and Corporation Finance: A Synthesis, *Journal of Finance* 38: 925-984.

Asabere, Paul, Robert Kleiman, and Carl McGowan Jr.. 1991. The Risk-Return Attributes of International Real Estate Equities, *Journal of Real Estate Research* 6: 143-152.

Campbell, John Y.. 1987. Stock Returns and the Term Structure, *Journal of Financial Economics* 18: 373-399.

Campbell, John Y.. 1990. Intertemporal Asset Pricing Without Consumption, Working Paper, Princeton University.

Campbell, John Y. and Yasushi Hamao. 1992. Predictable Stock Returns in the United States and Japan: A Study of Long-Term Capital Market Integration, *Journal of Finance* 47: 43-70.

Chan, K.C., Patric Hendershott, and Anthony Sanders. 1990. Risk and Return on Real Estate: Evidence from Equity REITs, *AREUEA Journal* 18: 431-452.

Chen, Nai-fu, Richard Roll and Stephen Ross. 1986. Economic Forces and the Stock Market, *Journal of Business* 59: 386-403.

Colwell, Peter and Hun Y. Park. 1990. Seasonality and Size Effects: The Case of Real-Estate-Related Investment, *Journal of Real Estate Finance and Economics* 3: 251-260.

Connor, Gregory and Robert A. Korajczyk. 1988. Risk and Return in an Equilibrium APT: Application of a New Test Methodology, *Journal of Financial Economics*, 21, 255-289.

Eun, C., and B. Resnick. 1988. Exchange Rate and Uncertainty, Forward Contracts, and International Portfolio Selection, *Journal of Finance* 43: 197-215.

Errunza, Vihang and Etienne Losq. 1985. International Asset Pricing under Mild Segmentation: Theory and Test, *Journal of Finance* 40: 105-124.

Fama, E. and K. French. 1988. Dividend Yields and Expected Stock Returns,*Journal of Financial Economics*, 22, 3-25.

Fama, E. and K. French. 1989. Business Conditions and Expected Return on Stocks and Bonds, *Journal of Financial Economics* 25, 23-49.

Fama, E. and G. William Schwert. 1977. Asset Returns and Inflation, *Journal of Financial Economics* 5, 115-146.

Ferson, W.. 1989. Changes in Expected Security Returns, Risk, and Level of Interest Rates, *Journal of Finance* 44, 1191-1217.

Ferson, W.. 1990. Are the Latent Variables in Time-Varying Expected Returns Compensation for Consumption Risk ?, *Journal of Finance* 45: 397-430.

Ferson, W. and C. Harvey. 1990. The Variation of Economic Risk Premiums, *Journal of Political Economy*, Forthcoming.

Ferson, Wayne, Shmuel Kandel and Robert Stambaugh. 1987. Test of Asset Pricing with Time-Varying Expected Risk Premiums and Market Betas, *Journal of Finance* 42: 201-219.

Frenkel, Jacob and Richard Levich. 1977. Transactions Cost and Interest Arbitrage: Tranquil versus Turbulent Periods, Journal of Political Economy 85, 1209-26.

Gibbons, Michael R. and Wayne Ferson. 1985. Testing Asset Pricing Models with Changing Expectations and an Unobservable Market Portfolio, *Journal of Financial Economics* 14: 217-236.

Giliberto, S. Michael. 1990. Equity Real Estate Investment Trust and Real Estate Returns, *Journal of Real Estate Research* 5: 259-263.

Harvey, Campbell R.. 1989. Time-Varying Conditional Covariances in Tests of Asset Pricing Models, *Journal of Financial Economics* 24: 289-317.

Jorion, Phillippe and Eduardo Schwartz. 1986. Integration versus Segmentation in the Canadian Stock Market, *Journal of Finance* 41:603-616.

Keim, Donald B.. 1983. Size Related Anomalies and Stock Return Seasonality: Empirical Evidence, *Journal of Financial Economics* 12: 13-32.

Keim, D. and R. Stambaugh. 1986. Predicting Returns in the Stock and Bond Markets, *Journal of Financial Economics* 17: 357-390.

Liu, Crocker H. and Jianping Mei. 1992. The Predictability of Returns on Equity REITs and Their Co-movement with Other Assets, *Journal of Real Estate Finance and Economics* 5: 401-418.

Liu, Crocker H. and Jianping Mei. 1992. An Analysis of Real Estate Risk Using the Present Value Model" forthcoming *Journal of Real Estate Finance and Economics.*

Malkiel, Burton. 1990. A Random Walk Down Wall Street, W.W. Norton, 5th Edition, New York.

Mei, Jianping and Crocker H. Liu. 1994. The Predictability of Real Estate Returns and Market Timing, *Journal of Real Estate Finance and Economics* 8, 115-135.

Mei, Jianping and A.Saunders. 1995. Have U.S. Financial Institutions' Real Estate Investments Exhibited 'Trend-Chasing' Behavior?, *Review of Economics and Statistics*, forthcoming

Miles, Mike, Brian Webb, and David Guilkey. 1991. On the Nature of Systematic Risk in Commercial Real Estate, Graduate School of Business, Indiana University, Working Paper, #467.

Roll, Richard and Stephen A. Ross. 1980. An Empirical Investigation of the Arbitrage Pricing Theory, *Journal of Finance* 35: 1073-1103.

Ross, Stephen. 1976. The Arbitrage Theory of Capital Asset Pricing, *Journal of Economic Theory* 13: 341-360.

Stehle, Richard. 1977. An Empirical Test of the Alternative Hypotheses of National and International Pricing of Risky Assets, *Journal of Finance* 32: 493-502.

White, Halbert. 1980. A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity, *Econometrica* 48: 817-838.

Worzala, Elaine. 1995. Currency Risk and International Property Investments, *Journal of Property Valuation and Investment* 13: 23-38.

Ziobrowski, Alan and Richard Curcio. 1991. Diversification Benefits of U.S. Real Estate to Foreign Investors, *Journal of Real Estate Research* 6: 119-142.

Table 1 ■ Characteristics of International Property Trusts

	Australia	France	South Africa	U.S.
Number of Ppty Trusts In the Index (1990)	14	11	16	119
Market Capitalization Local Currency (1990) U.S. Currency (1990)	 A$6.904 billion $5.352 billion	 Francs 26 billion[1] $5.108 billion	 R 3.400 billion $.999 billion	 $8.737 billion $8.737 billion
Minimum Percent of Assets in Direct Property	20% (most trusts invest 80-85%)	No information	No information	75%
Taxation at Firm Level	No	No	No	No
Distribution Requirement	No Information	85% of Net Earnings	No Information	95% of Taxable Income
Borrowing Restrictions	20% of gross assets (trusts on average use 7.5% of assets)	No information	No borrowing is allowed (0%)	Depends on REIT declaration/charter
Other Characteristics	Single largest group of net funds invested in property from 1985-1989 (29%) Larger trusts own CBD offices & retail. Smaller trusts own suburban offices, retail and industrial	Sicomis represented 65% of all commercial real estate financings in 1990. Sicomis engage in leasing of commercial and industrial properties and are prohibited from residential rental activites. SIIs in contrast, invest primarily in residential properties.	Pension funds can invest up to 30% of their funds in property trusts. The portfolio orientation is on industrial, office, and/or retail properties.	Not more than 30% of gross income can be from sale of properties held for less than 4 years.

[1]Approximate market cap at year end 1991. The market cap is approximated using L. Ducrozant, March 1992, "Real Estate/Property Securities in the Stock Markets of the World", *Institut De L'Epargne Immobiliere Et Fonciere*.

Table 2 ■ Correlation of Economic State Variables (All Variables are in Own Country Currency)

	AUS ST	AUS SP	AUS M	FR ST	FR SP	FR M	JP ST	JP SP	JP M	SAF ST	SAF SP	SAF M
AUS ST	1											
AUS SP	-.6*	1										
AUS M	-.1	.0	1									
FR ST	.2	.0	-.2	1								
FR SP	-.2	.4	.1	-.3	1							
FR M	.3	-.1	.0	.0	-.1	1						
JP ST	.1	.0	-.1	.6*	.1	.1	1					
JP SP	-.2	.3	-.1	.0	.0	-.2	-.5*	1				
JP M	.1	.0	.3	-.1	.0	.1	.0	-.1	1			
SAF ST	.2	-.2	-.1	.2	-.2	.1	.1	.0	.0	1		
SAF SP	.2	-.2	.1	-.2	.3	.0	.1	-.3	.1	-.4	1	
SAF M	.1	-.2	.3	.0	-.1	.1	.1	-.2	.2	.5*	.1	1
UK ST	.3	-.3	-.1	.5*	-.2	.1	.5*	-.4	-.1	.2	.1	.1
UK SP	-.3	.7*	.0	.1	.4	-.1	.0	.5*	.0	-.2	.0	-.2
UK M	-.1	-.1	.5*	-.2	.0	.0	.0	-.1	.4	.1	.0	.3
US ST	-.1	.2	-.2	.3	-.2	-.1	.2	.1	-.2	-.1	-.2	-.2
US SP	-.4	.5*	-.1	.3	.1	-.1	.1	.3	-.1	.0	-.4	-.2
US M	.1	-.1	.1	-.1	.0	.5*	.0	-.2	-.1	-.1	.0	.2
US DY	-.1	.2	-.1	.3	-.1	-.1	.3	-.2	-.2	-.1	-.2	-.1

	UK ST	UK SP	UK M	US ST	US SP	US M	US DY
AUS ST							
AUS SP							
AUS M							
FR ST							
FR SP							
FR M							
JP ST							
JP SP							
JP M							
SAF ST							
SAF SP							
SAF M							
UK ST	1						
UK SP	-.5*	1					
UK M	-.1	-.1	1				
US ST	.0	.3	-.1	1			
US SP	-.2	.6*	-.1	.7*	1		
US M	.0	-.1	.0	-.1	-.2	1	
US DY	.1	.2	.0	.7*	.7*	.1	1

AUS = Australia, FR = France, JP = Japan, SAF = South Africa, UK = United Kingdom, US = United States, ST = short term rate, SP = spread of the long term rate over the short term rate, M = lag of market return, and DY = equally weighted dividend yield. All correlation coefficients with an asterisk(*) are statistically significant at the 5% level. The statistic used in calculating whether a correlation is significant is $S = \frac{c}{\sqrt{|c|(1-|c|)}} * \sqrt{T}$ where c is the correlation coefficient, |c| is the absolute value of the correlation coefficient, and T is th number of time periods. A correlation is significant, given our number of time periods, if $|S| \geq 2$.

Table 3 ■ Decomposition of the Volatility of the Monthly Rate of Return (February 1980 - March 1991)

Country	Unhedged Returns $E(R_{i\$})$	Unhedged Returns $\sigma(R_{i\$})$	Fraction (%) of Volatility Due to: V_1	Fraction (%) of Volatility Due to: V_2	Hedged Returns $E(\tilde{R}^H_{i\$})$	Hedged Returns $\sigma(\tilde{R}^H_{i\$})$
I. Stocks						
Australia	.0119	.0837	67.1	32.9	.0099	.0693
France	.0153	.0714	76.5	23.5	.0154	.0626
Japan	.0197	.0671	54.7	45.3	.0172	.0497
South Africa	-.0006	.0922	38.0	62.0	.0067	.0564
United Kingdom	.0162	.0656	71.7	28.3	.0152	.0551
U.S.	.0137	.0470	100.0	0.0	.0137	.0470
Average	.0127	.0712	68.0	32.0	.0130	.0567
II. Real Estate Related Securities						
Australia	.0110	.0548	54.4	45.6	.0090	.0411
France	.0135	.0520	54.3	45.7	.0136	.0382
Japan	.0181	.0831	60.1	39.9	.0156	.0642
South Africa	.0058	.0911	45.5	54.5	.0131	.0611
United Kingdom	.0123	.0742	68.5	31.5	.0113	.0612
U.S.	.0098	.0342	100.0	0.0	.0098	.0342
Average	.0118	.0649	63.8	36.2	.0121	.0500

Note: $V_1 = var(\tilde{R}_i)/var(\tilde{R}_{i\$})$ = volatility due to own country risk

$V_2 = (var(\tilde{R}_{ei}) + 2cov(\tilde{R}_i, \tilde{R}_{ei}))/var(\tilde{R}_{i\$})$ = volatility due to currency risk

Table 4 ■ Unhedged Correlations [$Corr(\tilde{R}_{i\$}, \tilde{R}_{j\$})$] (February 1980 - March 1991)

	AUS RE	AUS Stk	FR RE	FR Stk	JP RE	JP Stk	SAF RE	SAF Stk	UK RE	UK Stk	US RE	US Stk
AUS RE	1.00											
AUS Stk	0.80	1.00										
FR RE	0.51	0.53	1.00									
FR Stk	0.54	0.55	0.64	1.00								
JP RE	0.20	0.22	0.24	0.29	1.00							
JP Stk	0.24	0.29	0.22	0.31	0.70	1.00						
SAF RE	0.23	0.29	0.21	0.21	0.14	0.26	1.00					
SAF Stk	0.16	0.20	0.04	0.14	0.21	0.28	0.79	1.00				
UK RE	0.50	0.51	0.32	0.36	0.30	0.37	0.13	0.09	1.00			
UK Stk	0.45	0.55	0.33	0.47	0.32	0.41	0.23	0.16	0.82	1.00		
US RE	0.30	0.38	0.13	0.35	0.11	0.24	0.15	0.12	0.38	0.52	1.00	
US Stk	0.30	0.44	0.19	0.47	0.09	0.25	0.15	0.10	0.38	0.55	0.62	1.00

T-Statistics

	AUS RE	AUS Stk	FR RE	FR Stk	JP RE	JP Stk	SAF RE	SAF Stk	UK RE	UK Stk	US RE	US Stk
AUS RE	----											
AUS Stk	14.8[a]	----										
FR RE	6.6[a]	6.9[a]	----									
FR Stk	7.1[a]	7.2[a]	9.2[a]	----								
JP RE	2.3[a]	2.5[a]	2.7[a]	3.4[a]	----							
JP Stk	2.8[a]	3.3[a]	2.5[a]	3.6[a]	11.0[a]	----						
SAF RE	2.6[a]	3.4[a]	2.4[a]	2.3[a]	1.7[b]	3.0[a]	----					
SAF Stk	1.8[a]	2.2[a]	0.4	1.6[b]	2.4[a]	3.3[a]	14.2[a]	----				
UK RE	6.4[a]	6.6[a]	3.7[a]	4.3[a]	3.5[a]	4.5[a]	1.5	1.0	----			
UK Stk	5.5[a]	7.2[a]	3.9[a]	5.9[a]	3.7[a]	4.9[a]	2.6[a]	1.8[a]	15.7[a]	----		
US RE	3.5[a]	4.6[a]	1.4	4.1[a]	1.2	2.8[a]	1.7[a]	1.3	4.6[a]	6.8[a]	----	
US Stk	3.5[a]	5.4[a]	2.2[a]	6.0[a]	1.0	2.8[a]	1.7[a]	1.1	4.5[a]	7.4[a]	8.8[a]	----

AUS = Australia, FR = France, JP = Japan, SAF = South Africa, UK = United Kingdom, US = United States, Stk = stock and RE = real estate. Significance levels are calculated by treating $(N-2)^{1/2}\rho/(1-\rho^2)^{1/2}$ as coming from a t-distribution with N-2 degrees of freedom, where N is the appropriate sample size (134 in this study) and ρ is the Pearson correlation coefficient. All T-statistics which are significant at the 5% (10%) level are indicated with a superscript of a (b). Subscript i and j associated with R refers to the return (R) on asset i and asset j respectively where i≠j.

Table 5 ■ Hedged Correlations [$Corr(\tilde{R}^H_{i\$}, \tilde{R}^H_{j\$})$] (February 1980 - March 1991)

	AUS RE	AUS Stk	FR RE	FR Stk	JP RE	JP Stk	SAF RE	SAF Stk	UK RE	UK Stk	US RE	US Stk
AUS RE	1.00											
AUS Stk	0.65	1.00										
FR RE	0.09	0.19	1.00									
FR Stk	0.32	0.35	0.48	1.00								
JP RE	0.11	0.13	0.09	0.25	1.00							
JP Stk	0.27	0.27	0.11	0.32	0.47	1.00						
JSE RE	0.23	0.34	0.16	0.16	0.01	0.16	1.00					
JSE Stk	0.22	0.26	-0.07	0.15	0.16	0.24	0.49	1.00				
UK RE	0.51	0.46	0.07	0.27	0.08	0.27	0.18	0.14	1.00			
UK Stk	0.46	0.52	0.14	0.45	0.14	0.39	0.33	0.25	0.73	1.00		
US RE	0.38	0.46	0.15	0.38	0.17	0.37	0.23	0.20	0.46	0.62	1.00	
US Stk	0.33	0.49	0.18	0.49	0.13	0.35	0.30	0.24	0.47	0.67	0.62	1.00

T-Statistics

	AUS RE	AUS Stk	FR RE	FR Stk	JP RE	JP Stk	SAF RE	SAF Stk	UK RE	UK Stk	US RE	US Stk
AUS RE	----											
AUS Stk	9.5[a]	-----										
FR RE	1.0	2.2[a]	----									
FR Stk	3.7[a]	4.1[a]	6.0[a]	----								
JP RE	1.2	1.4	1.0	2.8[a]	----							
JP Stk	3.1[a]	3.2[a]	1.2	3.7[a]	6.0[a]	----						
JSE RE	2.7[a]	4.0[a]	1.8[a]	1.8[a]	0.2	1.8[a]	----					
JSE Stk	2.5[a]	3.0[a]	-0.8	1.7[a]	1.8[a]	2.8[a]	6.2[a]	----				
UK RE	6.5[a]	5.7[a]	0.8	3.1[a]	0.9	3.1[a]	2.0[a]	1.6[b]	----			
UK Stk	5.8[a]	6.7[a]	1.6[b]	5.5[a]	1.6[b]	4.7[a]	3.9[a]	2.9[a]	11.8[a]	----		
US RE	4.5[a]	5.7[a]	1.6[b]	4.5[a]	1.9[a]	4.4[a]	2.6[a]	2.3[a]	5.8[a]	8.7[a]	----	
US Stk	3.8[a]	6.3[a]	2.1[a]	6.3[a]	1.4	4.1[a]	3.5[a]	2.7[a]	5.9[a]	10.1[a]	8.8[a]	----

AUS = Australia, FR = France, JP = Japan, SAF = South Africa, UK = United Kingdom, US = United States, Stk = stock, and RE = real estate. Significance levels are calculated by treating $(N-2)^{1/2}\rho/(1-\rho^2)^{1/2}$ as coming from a t-distribution with N-2 degrees of freedom, where N is the appropriate sample size (134 in this study) and ρ is the Pearson correlation coefficient. All T-statistics which are significant at the 5% (10%) level are indicated with a superscript of a (b). Subscript i and j associated with R refers to the return (R) on asset i and asset j respectively where i≠j.

Table 6 ■ Regression of Asset Returns Against Own Country State Variables

Property (Unhedged)

	Constant	T-Stat	January	T-Stat	ST rate	T-Stat	Spread	T-Stat	Mkt_{t-1}	T-Stat	F-Stat	$AdjR^2$
Australia	0.00	0.1	0.02	1.1	0.06	0.3	-0.03	-0.1	0.01	0.2	0.4	-0.02
France	0.03	2.1 [a]	-0.02	-0.9	-0.01	-1.1	-0.45	-0.9	0.09	1.4	1.1	0.00
Japan	0.03	2.2 [a]	-0.06	-2.1 [a]	-0.26	-1.3	-1.17	-1.6 [b]	0.54	4.2 [a]	6.6 [a]	0.15
S. Africa	0.06	2.3 [a]	0.02	0.7	-0.37	-2.2 [a]	-0.47	-1.8 [b]	0.32	2.4 [a]	1.8 [b]	0.03
UK	0.01	0.4	0.00	0.0	0.05	0.3	-0.43	-1.0	-0.19	-1.6	1.0	0.00
US	-0.01	-0.4	0.02	1.4	-3.75	-2.1 [a]	0.42	1.8 [b]	0.10	1.5	2.2 [b]	0.04

Stocks (Unhedged)

	Constant	T-Stat	January	T-Stat	ST rate	T-Stat	Spread	T-Stat	Mkt_{t-1}	T-Stat	F-Stat	$AdjR^2$
Australia	0.030	0.8	0.00	0.0	-0.13	-0.5	-0.378	-0.9	0.02	0.1	0.2	-0.03
France	0.023	1.2	0.01	0.6	-0.05	-0.3	-0.520	-0.8	0.05	0.5	0.3	-0.02
Japan	0.021	1.5	-0.01	-0.2	-0.01	-0.1	-0.524	-0.8	0.11	0.9	0.6	-0.01
S. Africa	0.046	1.9 [a]	0.05	1.7 [b]	-0.39	-2.4 [a]	-0.301	-1.2	0.48	3.7 [a]	4.5 [a]	0.10
UK	-0.005	-0.3	0.02	1.0	0.19	1.2	-0.456	-1.3	-0.20	-1.9 [a]	2.0 [b]	0.03
US	0.025	1.0	0.01	0.8	-0.17	-0.7	-0.008	-0.0	0.01	0.1	0.4	-0.02

Property (Hedged)

	Constant	T-Stat	January	T-Stat	ST rate	T-Stat	Spread	T-Stat	Mkt_{t-1}	T-Stat	F-Stat	$AdjR^2$
Australia	0.035	0.8	0.02	0.5	-0.09	-0.3	-0.34	-0.6	0.02	0.3	0.2	-0.03
France	0.048	1.8 [b]	-0.01	-0.2	-0.11	-0.5	-0.97	-1.1	0.09	1.3	0.8	-0.01
Japan	0.031	1.5	-0.04	-1.1	-0.02	-0.1	-1.04	-1.0	0.31	3.2 [a]	3.8 [a]	0.08
S. Africa	0.053	1.9 [a]	0.03	0.8	-0.31	-1.7 [b]	-0.44	-1.3	0.32	3.3 [a]	3.1 [a]	0.06
UK	0.017	0.6	0.04	0.9	0.12	0.5	-0.41	-0.6	-0.17	-1.8 [b]	1.1	0.00
US	0.018	0.5	0.03	1.2	-5.41	-1.4	0.41	0.8	0.06	0.8	1.0	0.00

Stocks (Hedged)

	Constant	T-Stat	January	T-Stat	ST rate	T-Stat	Spread	T-Stat	Mkt_{t-1}	T-Stat	F-Stat	$AdjR^2$
Australia	0.063	1.1	-0.00	-0.0	-0.28	-0.6	-0.68	-0.9	0.03	0.3	0.2	-0.03
France	0.042	1.1	0.02	0.6	-0.04	-0.1	-1.04	-0.8	0.07	0.7	0.4	-0.02
Japan	0.029	1.3	0.01	0.2	0.08	0.3	-0.58	-0.5	0.08	0.8	0.5	-0.02
S. Africa	0.037	1.3	0.06	1.4	-0.28	-1.4	-0.22	-0.6	0.41	3.9 [a]	4.9 [a]	0.11
UK	0.005	0.2	0.06	1.5	0.25	1.0	-0.44	-0.7	-0.17	1.8 [b]	1.7	0.02
US	0.051	1.0	0.03	0.8	-3.33	-0.7	-0.02	-0.0	0.01	0.1	0.4	-0.02

Degrees of freedom for the F-Statistic are F(4,120). [a] Significant at 5% level [b]Significant at 10% level

Table 7 ■ Regression of Asset Returns Against Common U.S. State Variables

Property (Unhedged)

	Constant	T-Stat	January	T-Stat	Tbill	T-Stat	Spread	T-Stat	DivYld	T-Stat	F-Stat	$AdjR^2$
Australia	0.05	1.9[b]	0.02	1.0	-0.00	-1.1	-0.00	-1.3	-0.01	-0.5	1.2	0.01
France	0.05	2.0[a]	-0.02	-1.3	-0.00	-1.6	-0.00	-1.0	0.00	0.1	1.2	0.01
Japan	0.10	2.5[a]	-0.04	-1.5	-0.00	-0.8	-0.00	-0.6	-0.02	-1.2	2.0[b]	0.03
S. Africa	0.06	1.5	0.02	0.6	-0.01	-2.2[a]	-0.01	-2.2[a]	0.02	0.9	1.9[b]	0.03
UK	0.06	1.8	-0.01	-0.4	-0.01	-2.2[a]	-0.00	-0.4	0.01	0.6	1.9[b]	0.03
US	-0.00	-0.3	0.01	1.0	-0.01	-2.7[a]	0.00	1.3	0.02	2.6[a]	4.5[a]	0.10

Stocks (Unhedged)

Australia	0.09	2.3[a]	-0.01	-0.3	-0.01	-2.3[a]	-0.01	-1.3	0.01	0.2	2.0[b]	0.03
France	0.06	1.7[b]	0.01	0.4	-0.00	-1.0	-0.00	-0.9	-0.01	-0.3	0.7	0.00
Japan	0.08	2.6[a]	-0.00	-0.1	-0.00	-0.9	-0.00	-1.0	-0.02	-1.1	1.4	0.01
S. Africa	0.09	2.3[a]	0.05	1.5	-0.01	-2.2[a]	-0.01	-2.0[a]	0.00	0.0	3.0[a]	0.06
UK	0.05	1.7[b]	0.01	0.5	-0.01	-3.0[a]	-0.00	-0.9	0.02	1.6[b]	2.7[a]	0.05
US	0.02	0.7	0.01	0.4	-0.01	-3.0[a]	-0.00	-0.3	0.03	2.4[a]	2.8[a]	0.06

Property (Hedged)

	Constant	T-Stat	January	T-Stat	Tbill	T-Stat	Spread	T-Stat	DivYld	T-Stat	F-Stat	$AdjR^2$
Australia	0.12	2.2[a]	0.01	0.2	-0.01	-1.7[b]	-0.01	-1.1	0.00	0.0	1.3	0.01
France	0.08	1.8[b]	-0.01	-0.4	-0.01	-1.1	-0.00	-0.6	-0.00	-0.1	0.6	0.00
Japan	0.15	2.8[a]	-0.03	-0.7	-0.01	-0.8	-0.01	-0.8	-0.03	-1.3	1.6	0.02
S. Africa	0.12	2.1[a]	0.03	0.7	-0.02	-2.4[a]	-0.01	-2.0[a]	0.02	0.7	2.1[b]	0.04
UK	0.08	1.4	0.02	0.5	-0.01	-2.3[a]	-0.00	-0.5	0.03	1.2	1.8	0.03
US	0.01	0.4	0.02	0.7	-0.01	-3.0[a]	0.00	0.4	0.05	2.8[a]	3.7[a]	0.08

Stocks (Hedged)

Australia	0.16	2.2[a]	-0.02	-0.4	-0.02	-2.2[a]	-0.01	-1.0	0.01	0.3	1.8	0.02
France	0.09	1.4	0.02	0.4	-0.01	-0.7	-0.00	-0.5	-0.01	-0.2	0.4	0.00
Japan	0.13	2.5[a]	0.01	0.3	-0.00	-0.7	-0.01	-1.0	-0.03	-1.1	1.2	0.01
S. Africa	015	2.4[a]	0.06	1.3	-0.02	-2.2[a]	-0.01	-1.7[b]	0.00	0.0	2.7[a]	0.05
UK	0.07	1.2	0.04	1.0	-0.02	-2.6[a]	-0.00	-0.7	0.05	1.8[b]	2.4[a]	0.04
US	0.03	0.7	0.01	0.4	-0.01	-2.8[a]	-0.00	-0.3	0.05	2.4[a]	2.5[a]	0.05

Degrees of freedom for the F-Statistic are F(4,120). [a] Significant at 5% level [b]Significant at 10% level

Table 8 ■ Estimation of the Latent Variable Model with the Rank Restriction of Equation Imposed

	Unhedged Returns				Hedged Returns			
	Property Trust		Stocks		Property Trust		Stocks	
	β_i	S. D.	β_i	S. D.	β_i	S. D.	β_i	S. D.
Australia	.08	.23	1.43	.41	.90	.23	1.17	.29
France	.59	.30	.87	.35	.63	.23	0.78	.25
Japan	.55	.37	.14	.27	.26	.19	0.36	.18
South Africa	-.58	-1.00	1.94	.64	.74	.35	1.15	.37
UK	1.20	0.36	1.45	.31	1.18	.20	1.23	.21
US	1.00	------	1.00	-------	1.00	------	1.00	------
χ^2 of restriction (5):	22.5		20.5		20.2		21.5	
Significance level:	P=.31		P=.43		P=.45		P=.37	
Degrees of Freedom	20		20		20		20	

	EW Stocks and Property Trusts		EW Stocks and Property Trusts	
	β_i	S. D.	β_i	S. D.
Stocks	1.00	-----	1.00	-----
Property	.74	.11	.90	.07
χ^2 of restriction (5):	4.47		5.36	
Significance level:	P=.35		P=.25	
Degrees of Freedom	4		4	

The null hypothesis (H_0) is whether a one factor model explains the movement in the expected rate of returns. The alternative hypothesis (H_A) is if more than one factor is needed to account for variations in the expected rate of return. The Significance level is the level required to reject the null hypothesis e.g., a P=.31 means that H_0 is rejected if a 31% significance level is used. The k-factor model that is assumed to generate asset returns is

$$\tilde{r}_{i,t+1} = E_t[\tilde{r}_{i,t+1}] + \sum_{k=1}^{K} \beta_{ik}\tilde{f}_{k,t+1} + \tilde{\varepsilon}_{i,t+1}$$

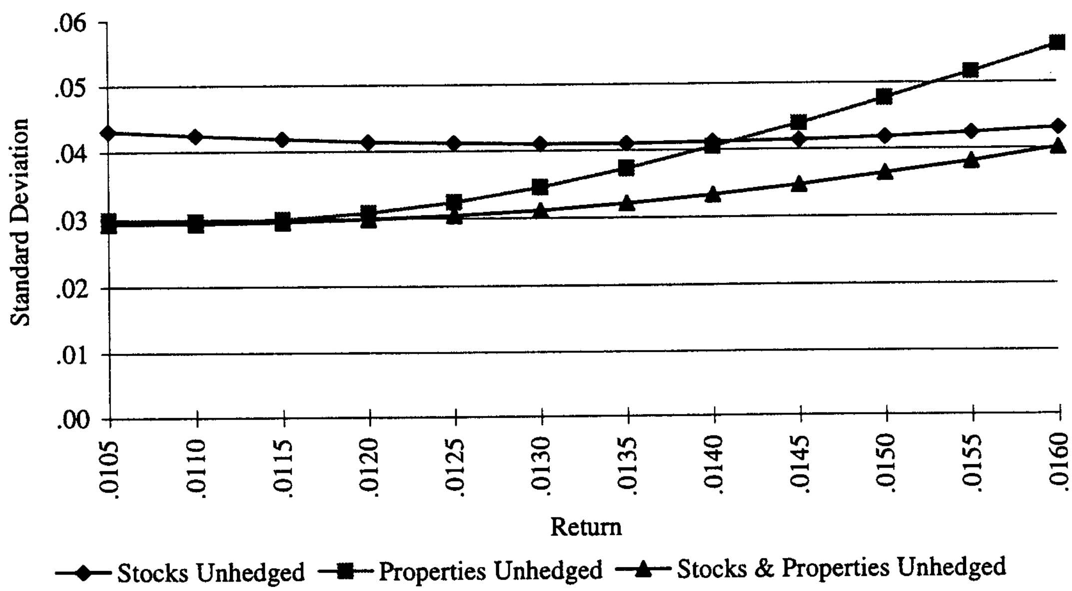
Here $\tilde{r}_{i,t+1}$ is the return on asset i in excess of the riskfree rate held from time t to time t+1, $E_t[\tilde{r}_{i,t+1}]$ is the conditional expected excess return on asset i which is allowed to vary through time, $\tilde{f}_{k,t+1}$ are the factor realizations, β_{ik} are the time-invariant factor loadings, and the idiosyncratic error is $\tilde{e}_{i,t+1}$. If certain restrictions are imposed on this return generating model then we can rewrite the preceding equation as

$$E_t[\tilde{r}_{i,t+1}] = \sum_{k=1}^{K} \beta_{ik} \sum_{n=1}^{L} \theta_{kn} X_{nt} = \sum_{n=1}^{L} \alpha_{in} X_{nt}$$

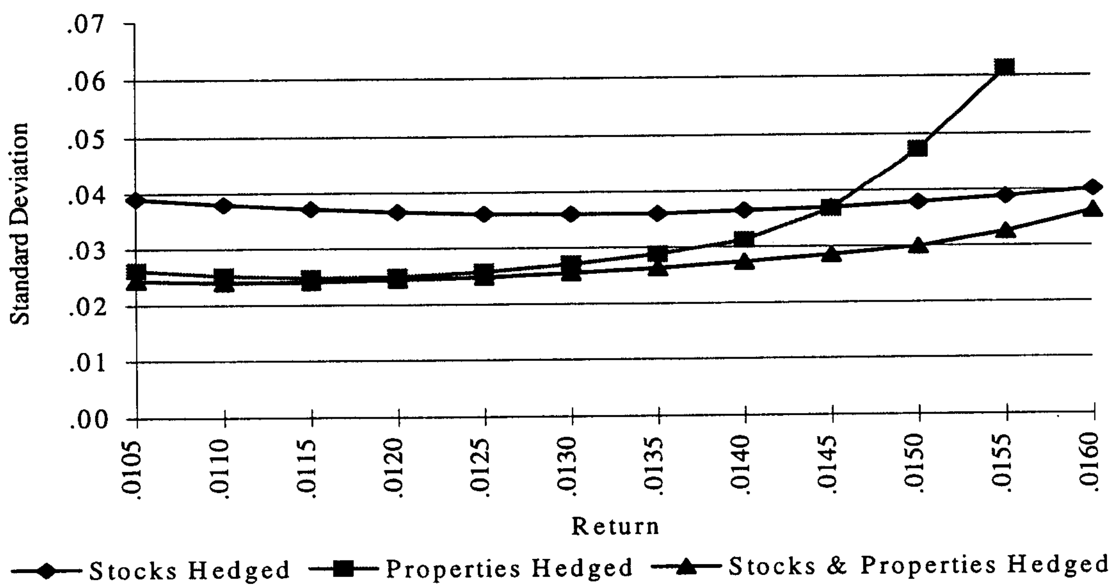
The combination of these two equations represent a multi-factor "latent-variable" model.

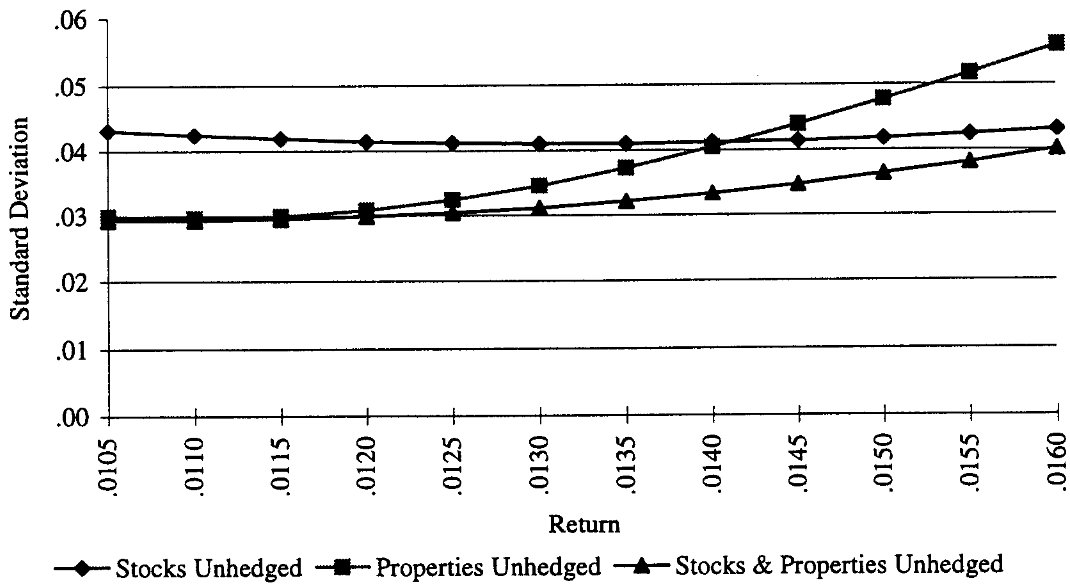
Figure 1 ■ Efficient Mixed Asset Frontiers

a. Efficient Frontier Assuming Currency Risk is Not Hedged

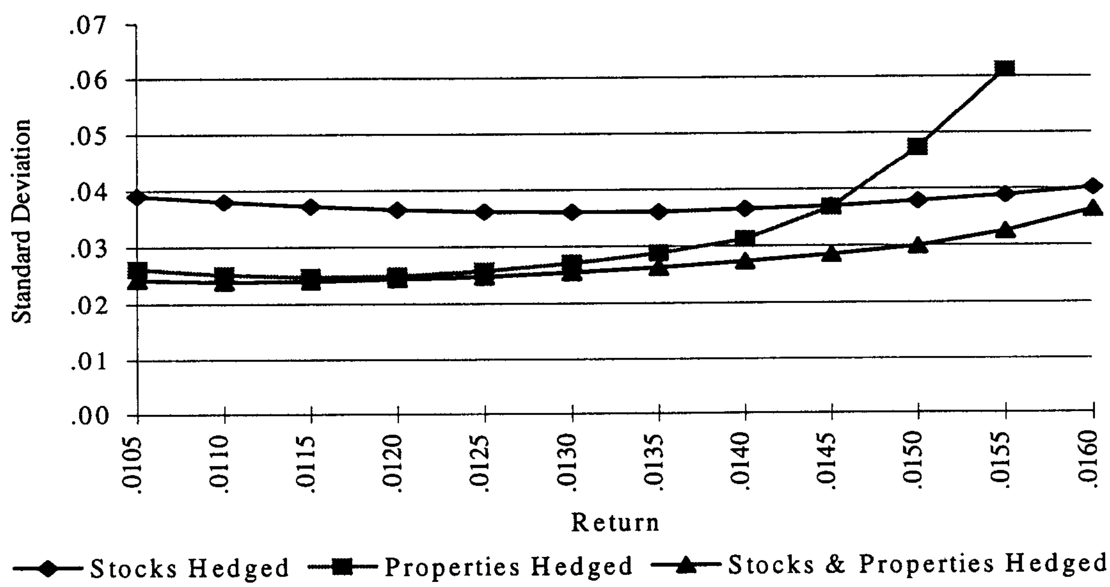


b. Efficient Frontier Assuming Currency Risk is Hedged





.06
.05
.04
.03
.02
.01
.00
Standard Deviation
.0105
.0110
.0115
.0120
.0125
.0130
.0135
.0140
.0145
.0150
.0155
.0160
Return
Stocks Unhedged
Properties Unhedged
Stocks & Properties Unhedged



.07
.06
.05
.04
.03
.02
.01
.00
Standard Deviation
.0105
.0110
.0115
.0120
.0125
.0130
.0135
.0140
.0145
.0150
.0155
.0160
Return
Stocks Hedged
Properties Hedged
Stocks & Properties Hedged

Table 9 ■ Returns, Standard Deviations, and Portfolio Allocations (February 1980 - March 1991)

Common Stocks and Property Stocks (U.S. Only)*

Return	.0110	.0120	.0130
Standard Deviation	.0346	.0376	.0426
Allocations			
U.S. Real Estate	.69	.44	.18
U.S. Stocks	.31	.56	.82

Common Stocks and Property Stocks Unhedged

Return	.0110	.0120	.0130	.0140	.0150	.0160
Standard Deviation	.0293	.0299	.0311	.0333	.0364	.0401
Allocations						
U.S. Real Estate	.60	.54	.42	.27	.12	.00
Intl Real Estate	.29	.29	.29	.29	.29	.26
U.S. Stocks	.05	.09	.16	.23	.31	.34
Intl Stocks	.07	.08	.14	.21	.28	.39
Aggregate Weights						
Real Estate	.88	.82	.71	.56	.41	.26
Stocks	.12	.18	.29	.44	.59	.74

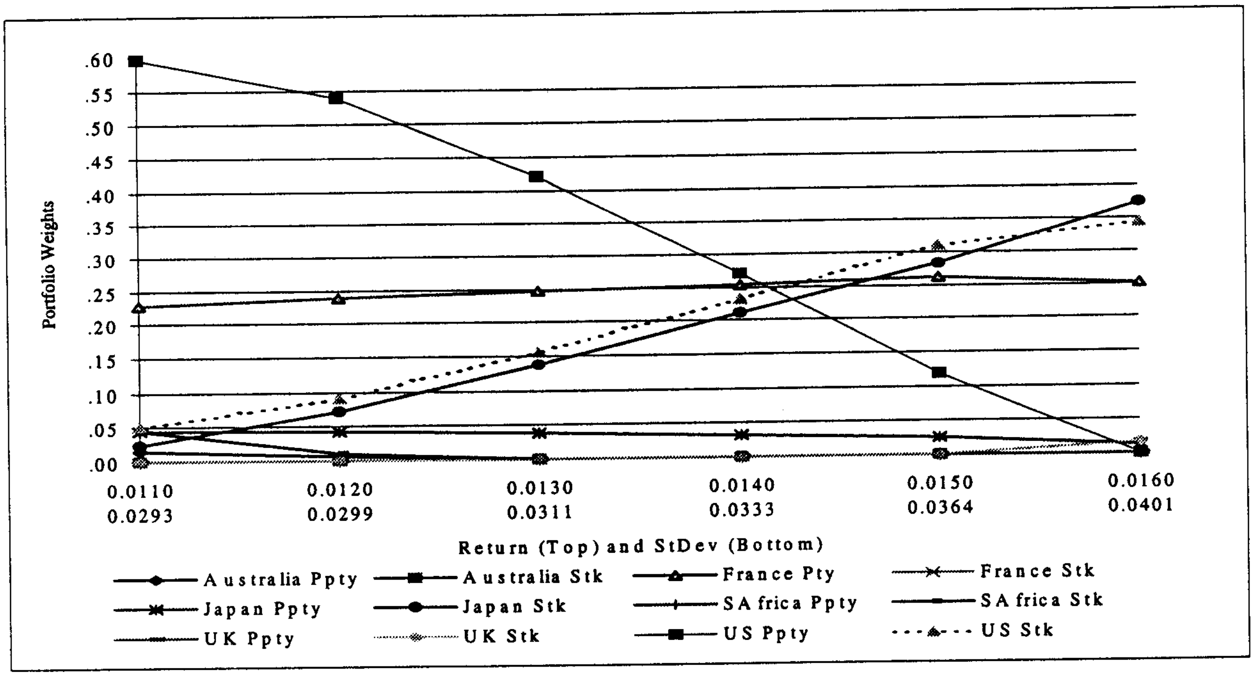
Common Stocks and Property Stocks Hedged

Return	.0110	.0120	.0130	.0140	.0150	.0160
Standard Deviation	.0240	.0244	.0255	.0273	.0299	.0363
Allocations						
U.S. Real Estate	.30	.24	.17	.07	.00	.00
Intl Real Estate	.56	.59	.61	.61	.54	.29
U.S. Stocks	.00	.00	.05	.09	.06	.00
Intl Stocks	.14	.16	.17	.23	.40	.71
Aggregate Weights						
Real Estate	.86	.83	.78	.68	.54	.29
Stocks	.14	.17	.22	.32	.46	.71

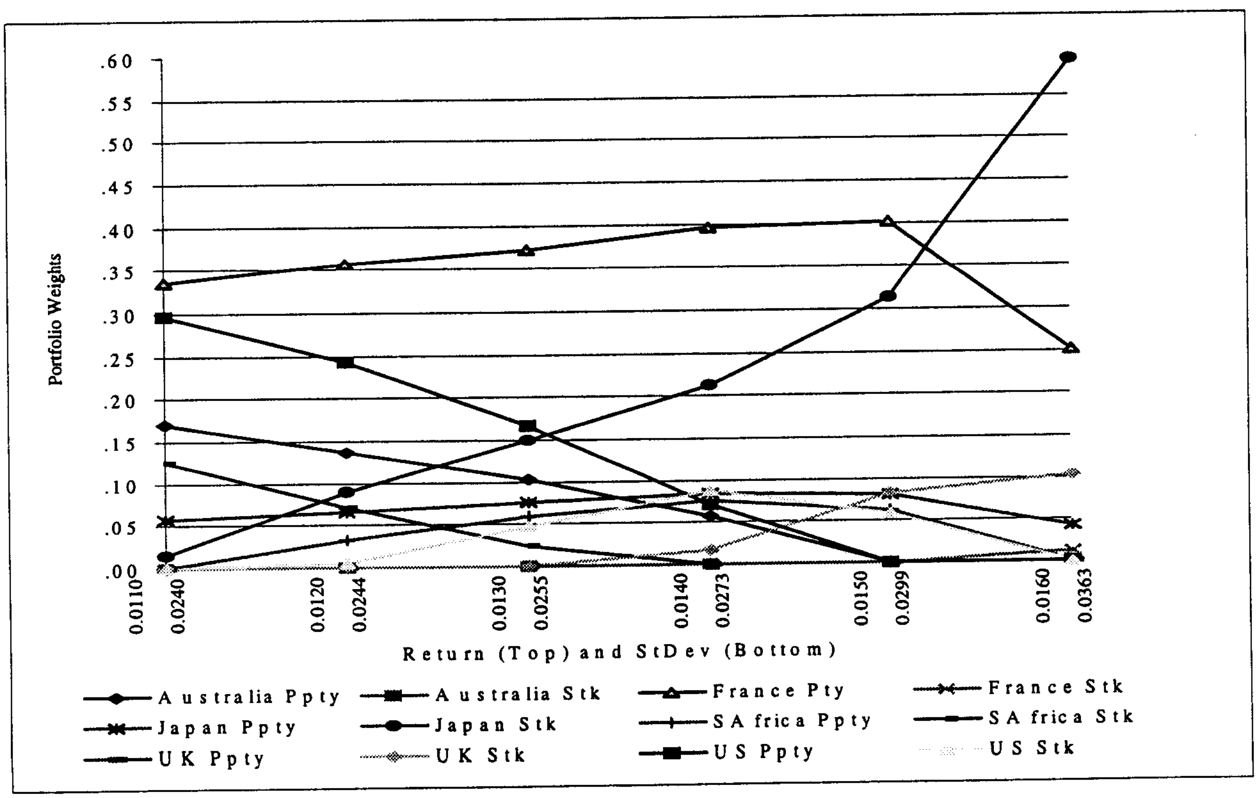
Note(*): The return on the efficient portfolio consisting of stocks and property trusts of the U.S. does not equal or exceed 1.4% since the return on U.S. stocks is 1.37% while the return on U.S. property trusts is .98%.

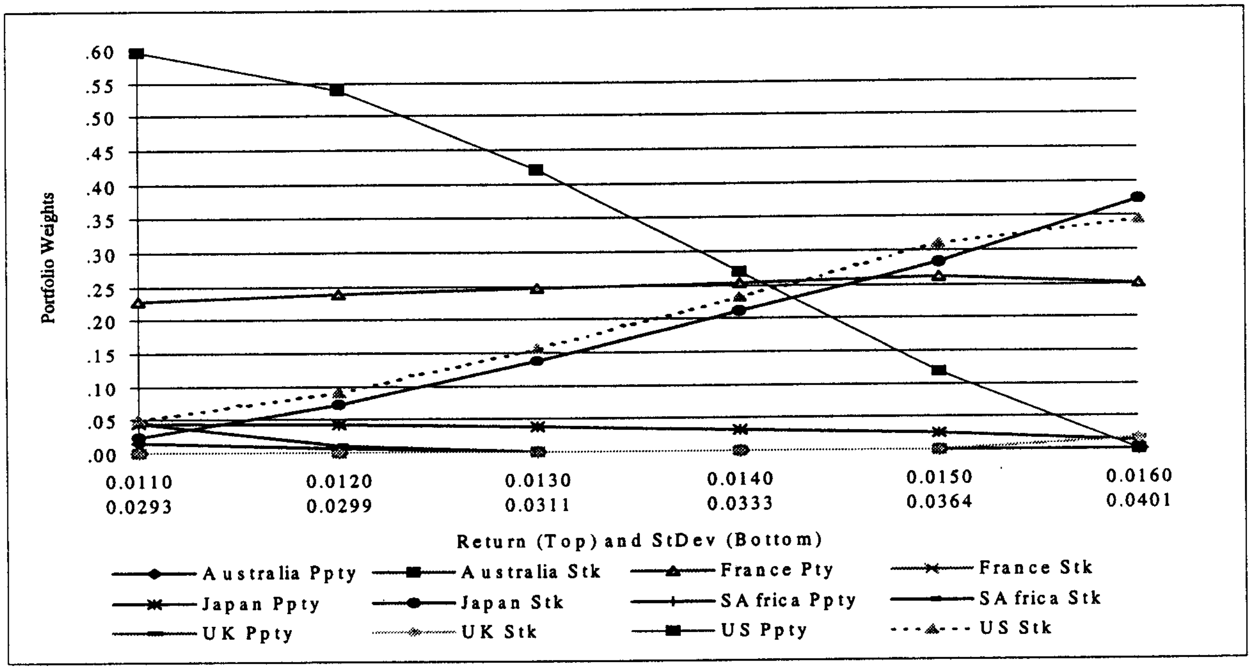
Figure 2 ■ Optimal Portfolio of Stocks and Real Estate

a. Optimal Portfolio of Stocks and Real Estate Assuming Currency Risk is Not Hedged

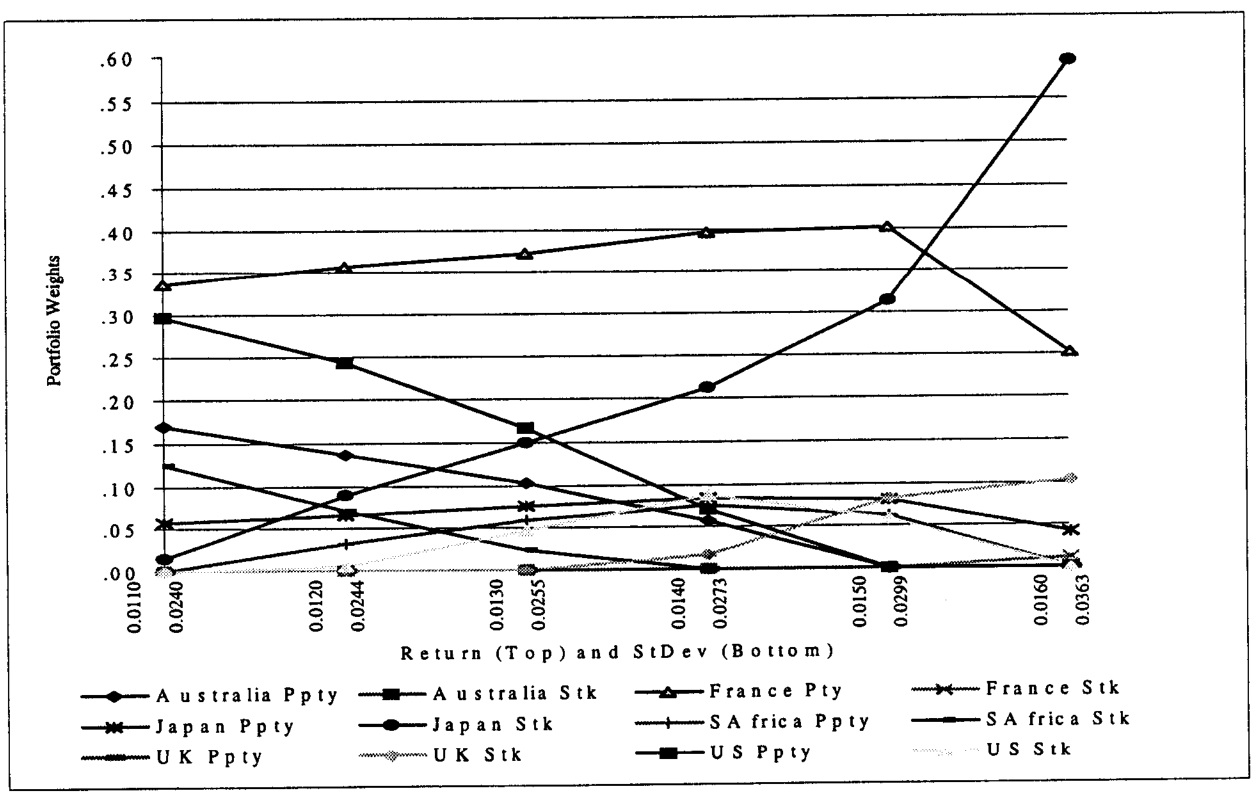


b. Optimal Portfolio of Stocks and Real Estate Assuming Currency Risk is Hedged





Portfolio Weights
.60
.55
.50
.45
.40
.35
.30
.25
.20
.15
.10
.05
.00
0.0110 0.0293
0.0120 0.0299
0.0130 0.0311
0.0140 0.0333
0.0150 0.0364
0.0160 0.0401
Return (Top) and StDev (Bottom)
Australia Ppty
Australia Stk
France Pty
France Stk
Japan Ppty
Japan Stk
SAfrica Ppty
SAfrica Stk
UK Ppty
UK Stk
US Ppty
US Stk



Portfolio Weights
.60
.55
.50
.45
.40
.35
.30
.25
.20
.15
.10
.05
.00
0.0110 0.0240
0.0120 0.0244
0.0130 0.0255
0.0140 0.0273
0.0150 0.0299
0.0160 0.0363
Return (Top) and StDev (Bottom)
Australia Ppty
Australia Stk
France Pty
France Stk
Japan Ppty
Japan Stk
SAfrica Ppty
SAfrica Stk
UK Ppty
UK Stk
US Ppty
US Stk