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Risk and return characteristics of property indices in emerging markets

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Abstract

Little is known about the performance and possible diversification benefits from real estate investments in emerging capital markets. During the period examined, property indices experienced relatively high total risk and low returns, but only a few of these indices underperformed on a risk-adjusted basis. Real estate investments offered diversification opportunities to equity market investors in emerging markets as well as to real estate and equity market investors in developed markets. Policy-makers should recognize that there is a tradeoff between potential benefits from keeping capital in their domestic markets versus reductions in diversification benefits available to domestic investors.

JEL classification: G11; G15

Keywords: Real estate; International; Diversification; Emerging markets

1. Introduction

The market capitalization of securities in emerging capital markets has grown rapidly over the past 20 years.[1] This growth and the potential for future growth have attracted the

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[1] Barry et al. (1997) document that the market capitalization of equity for emerging markets tracked by the International Finance Corporation (IFC) grew from US$167 billion in 1985 to US$603.5 billion in 1990. The market capitalization of all emerging markets (including some not previously tracked by the IFC) grew to more than US$3 trillion by the end of 1999. The market capitalization of developed markets experienced a little over a three- and three-quarters-fold increase over the same time interval. The market capitalization of emerging markets as a percentage of world market capitalization increased during the past decade (Emerging Stock Markets Factbook, 2000, p. 17).

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attention of many global researchers and investors. The historical record of performance in these markets has given rise to the characterization that, overall, emerging equity markets are volatile in isolation but offer diversification opportunities for global investors.[2] Comparatively little is known, however, regarding the performance of real estate investments in emerging markets or whether such investments offer meaningful diversification opportunities for global investors.

Indeed, the literature is relatively silent regarding the performance and diversification opportunities offered by real estate investments in emerging markets. This paper helps fill this gap by reporting on risk, return and performance characteristics of real estate indices in a large number of emerging markets. We provide comparable measures for both real estate and non-real estate investments in emerging markets and a large number of developed markets. The examination and comparison of the risk and return characteristics in multiple developed and emerging markets helps shed additional light on potential diversification opportunities available to global investors.

Several studies have documented the historical performance of real estate investments and examined the extent to which these investments provide diversification benefits, primarily among US investments.[3] Diversification opportunities available from international real estate investments in developed markets have also been documented (see, for example, Ling and Naranjo, 2002).[4]

Barry et al. (1996) examined real estate in emerging markets as an asset class. Based on data from 1989 to 1995 for a composite index, they report that real estate in emerging markets provided diversification opportunities for common stock portfolios and for real estate portfolios in developed markets.[5] Due to limitations in their data, they did not examine real estate diversification opportunities for investors within any individual emerging market or how any individual emerging market's real estate investments may provide diversification opportunities to global investors.

Ling and Naranjo (2002) find international diversification benefits from commercial real estate securities across several developed markets. Although their data included a few emerging markets, they did not focus on how these markets performed relative to

[2] Diversification opportunities from equity investments in emerging markets have been well documented. For example, Harvey (1995), Bekaert and Urias (1996), Errunza (1983) and Barry et al. (1997, 1998).

[3] Seiler et al. (1999) review literature related to real estate diversification within mixed-asset portfolios and diversification within real estate portfolios. Viezer (2000) provides an additional review of this literature.

[4] Ling and Naranjo (2002) find international diversification benefits across several developed markets. Eichholtz et al. (1998) report continental factors and point to international real estate diversification opportunities. Liu and Mei (1998) find that international real estate securities provide some incremental diversification benefits over common stocks even if currency risks are hedged. Stevenson (2000) points to concerns over the reliability of the mean return and correlation coefficients obtained using hedged indices. Gordon et al. (1998) examine diversification benefits from international real estate securities for an investor in US stocks, bonds and real estate. Mueller and Anderson (2002) and Liang and Gordon (2003) provide characteristics of real estate assets in a variety of global markets. Quan and Titman (1999) examine real estate prices versus equity market values and find relatively low contemporaneous correlations between equity market values and real estate prices, but they find higher correlations across time and on a pooled basis.

[5] The passage of time and data availability allows us to employ a longer time series for this study as well as report on individual emerging markets.

developed markets. Bond et al. (2003) examine risk and return characteristics of publicly traded real estate indices in 14 developed markets and find evidence of a strong global market factor in the returns of those markets.

This paper adds to the literature by examining real estate diversification opportunities for 15 individual emerging markets. We also examine diversification opportunities available from those individual emerging markets for global investors, and we compare the performance and diversification opportunities from real estate investments in emerging markets with those in 21 developed markets.

Despite relatively high total risk and low returns, we find that few real estate indices significantly underperformed on a risk-adjusted basis. We also find that real estate investments in emerging markets offered diversification opportunities to investors in their own markets as well as for global investors.

The next section describes the data employed in this study. Section 3 discusses the use of local currencies versus a common currency when examining metrics across markets. Section 4 discusses the return performance for developed and emerging equity market and property indices. Section 5 provides risk-adjusted performance measures. Section 6 offers insights on the diversification potential from real estate in emerging markets. Section 7 provides concluding remarks.

2. Data

We employ data provided by the World Equity Index Group from Salomon Smith Barney.[6] The data consist of monthly returns for broad market indices (BMI) for 21 developed and 28 emerging markets and for property indices for 21 developed markets and 15 emerging markets. The data also include a composite world index and regional indices for developed markets, as well as a composite emerging market index and regional indices for emerging markets. These indices are float-capitalization weighted indices constructed to reflect returns that were realistically attainable by investors.[7] This methodology is similar to that used for the International Finance Corporation's (IFC) Investable Indices.[8]

Our data series include monthly returns from July 1989 through February 2001 (i.e., 140 months total). For indices in emerging markets, for a few cases where index data was not available from Salomon, we employed returns based on data provided by the IFC.[9]

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[6] We are grateful for the data support provided by Gerrit Parker, Craig Lazzara and George Patterson from Salomon Smith Barney.

[7] Float refers to the outstanding shares that are not held by individuals or institutions for the purpose of control or corporate relationships, or by the domestic government, and are not restricted from purchase by foreign investors. Float-capitalization is the market value of the outstanding float. For further details regarding these indices, see Introducing the Salomon Brothers World Equity Index (1994) available at http://www.ssbgei.com/data/pdf/introdoc.pdf.

[8] For details regarding IFC indices, see IFC Index Methodology (1993).

[9] Even after merging data from both sources, there were some months with unavailable data. This accounts for the instances where extending the reported number of months for an index from the starting date of that index does not lead to the appearance that the time series finishes at the end of February 2001.

The index returns based on IFC data were constructed using methodology as described by Barry et al. (1998). When we had data from both sources their returns were very similar, adding confidence to the continuity of the merged series employed in this study.

Table 1 provides summary statistics of the data used in this study.[10] It presents data for developed markets on the left and data for emerging markets on the right. Panel A of Table 1 shows the number of observations, arithmetic average, geometric mean, standard deviation, skewness and kurtosis for the broad market indices. Panel B in Table 1 shows the corresponding statistics for the property indices we examined.

Data were available to us for this study for 140 months for all developed market broad market indices and for 49 to 140 months for emerging market broad market indices. Data for property indices ranged from 32 to 140 months for developed markets and 13 to 140 months for emerging markets.

Skewness and kurtosis statistics reported in Table 1 indicate departures from normality for many of the examined return series. Table 1 reports p-values from Shapiro–Wilk normality tests confirming significant departures from normality. The returns for several BMI and property indices of individual emerging and developed emerging markets are not normally distributed, as indicated by the significant p-values reported. At the regional level, departures from normality appear to be more severe for broad market indices in emerging market regions than in developed markets. The normality test results are mixed for regional property indices in developed and emerging markets.

Table 1 also reports p-value results from tests for first order autocorrelation. The reported p-values indicate that there are few markets with significant first order autocorrelations. In addition, some regional return series experienced significant first order autocorrelation.

We discuss the reported performance characteristics that are shown in Table 1 in Section 4.

3. Common currency- versus local currency-based returns

We examined monthly returns for all indices employed in this study both in local currency and in US dollar terms. Liu and Mei (1998) report that exchange rate risk is an important factor affecting the benefits of diversification among international real estate and equity assets. They find that real estate can offer diversification benefits even after hedging currency risk.

Return metrics measured in local currency terms can differ greatly from their values measured in US dollar terms. While this observation is true for broad market indices in developed markets as well as emerging markets, the emerging markets are especially prone to extreme differences. Some extreme examples come from emerging markets such as Brazil, Turkey, Argentina and Venezuela. For example, the terminal value from

[10] Unfortunately, we do not have details regarding the companies making up the indices. Hence, we do not know to what extent the real estate indices reflect entities equivalent to Real Estate Investment Trusts (REITs) in the US, real estate developers or other participants that may have been classified as being in the real estate industry among publicly traded firms in each country.

investing a single unit of local currency in June 30, 1989 in the Brazilian equity market would have grown to about 20.9 million local currency units by February 2001. Turkey provides another extreme example wherein a single unit of local currency invested in the equity market would have grown to 1234.8 units in local terms over roughly the same period as the one we examined in the case of Brazil. In both of these extreme examples, however, the terminal wealth measured in US dollar terms was only about six times the initial invested amount.[11] These examples highlight the need to utilize a common currency when comparing across markets. It would be misleading to compare local returns for Brazil (of about 12.8% per month in Brazilian currency) with local returns from a developed market or from a more stable emerging market when making portfolio allocation decisions.

The variance of returns denominated in US dollars $V(R_{US})$ can be decomposed into three parts as

$$V(R_{US}) = V(R_{LC}) + V(R_{ER}) + 2\mathrm{COV}(R_{LC}, R_{ER}) \quad (1)$$

where $V(R_{LC})$ is the variance of returns denominated in local currency, $V(R_{ER})$ is the variance of exchange rate returns (i.e., local currency returns relative to the US dollar) and $\mathrm{COV}(R_{LC}, R_{ER})$ is the covariance between returns denominated in the local currency and exchange rate returns.[12] Hence, the percentage of variation derived from the local market is equal to the ratio of variances denominated in local and US currencies $[V(R_{LC})/V(R_{US})]$.

Given that real estate derives value in part from its spatial location, it is reasonable to expect that real estate returns would be affected more by local factors than would be the case for the broader equity markets as measured by the BMI. That is to say, intuitively one would expect that variations in real estate values might be a more "local" phenomenon than would be variations in the values of publicly traded, non-real-estate-related equity securities. However, test results examining Eq. (1) above for property indices versus BMI do not support this intuition.[13] We find no significant differences between the percentage of variance explained by the local currency component of return for BMI versus property indices when examining developed markets, emerging markets or the combination of all markets.[14]

[11] A US$1 investment would have grown to US$5.63 and US$5.81 in Brazil and Turkey, respectively. Hence, although the local currency values greatly diminished relative to the US dollar during the periods examined, investments underlying these indices did not experience the value losses associated with the local currencies.

[12] For more detailed discussions of the decomposition of variance, see Liu et al. (1997) and Stevenson (2000).

[13] We employed a standard two-sample t-test and a Wilcoxon–Mann–Whitney rank sum test to test if the percentage of the return variance attributed to local return factors were different for property indices versus the local percentages pertaining to BMI return variances. Iman and Conover (1989) report that the Wilcoxon–Mann–Whitney rank sum test procedure is valid for all sample sizes (including small sample sizes) and all distributions.

[14] The low or negative covariations between the local currency returns (relative to the US dollar) and real estate returns denominated in the local currency actually helped decrease the total variation of returns (measured in US dollars) in some markets.

Table 1
Reports the number of monthly observations available for each listed market (and region) within the June 1989 through February 2001 time period for each BMI (Panel A) and property (Panel B) index examined

Based on monthly returns in US dollars

Developed markets	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)*	(9)**	Emerging markets	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)*	(9)**
Panel A: BMI summary statistics																			
Australia	140	0.85	0.72	5.07	0.08	0.03	(0.17)	0.42	0.93	Argentina	140	2.61	1.02	18.34	0.12	1.74	11.86	0.91	0.00
Austria	140	0.57	0.32	7.12	0.02	0.17	1.91	0.41	0.01	Brazil	140	2.88	1.24	17.96	0.14	0.61	4.67	0.09	0.00
Belgium	140	1.03	0.93	4.48	0.14	(0.51)	0.94	0.53	0.03	Chile	140	1.62	1.34	7.52	0.16	0.08	0.70	0.00	0.06
Canada	140	0.70	0.57	5.13	0.06	(0.90)	2.78	0.63	0.00	China	98	(0.07)	(0.87)	12.88	(0.04)	0.67	1.23	0.54	0.03
Denmark	140	1.03	0.91	4.83	0.13	(0.20)	(0.23)	0.06	0.38	Colombia	121	1.56	1.04	10.54	0.11	1.04	2.04	0.00	0.00
Finland	140	1.73	1.31	9.17	0.14	(0.09)	0.78	0.02	0.35	Czech Republic	85	(0.90)	(1.41)	10.01	(0.13)	(0.01)	1.04	0.98	0.20
France	140	1.15	1.02	5.11	0.14	(0.22)	0.09	0.69	0.29	Egypt	49	0.63	0.23	9.30	0.02	0.78	2.18	0.51	0.06
Germany	140	1.10	0.94	5.63	0.12	(0.33)	1.25	0.13	0.06	Greece	140	1.94	1.25	12.46	0.12	1.65	4.94	0.28	0.00
Hong Kong	140	1.85	1.49	8.52	0.17	0.24	2.17	0.99	0.00	Hungary	98	1.40	0.64	12.61	0.08	0.96	5.68	0.90	0.00
Ireland	140	1.40	1.23	5.92	0.17	0.29	2.01	0.32	0.00	India	100	0.41	0.02	8.95	0.00	0.28	(0.44)	0.78	0.39
Italy	140	0.93	0.67	7.27	0.07	0.27	0.13	0.07	0.41	Indonesia	126	(0.45)	(1.44)	14.13	(0.06)	0.60	3.09	0.03	0.00
Japan	140	(0.01)	(0.28)	7.48	(0.06)	0.46	0.48	0.86	0.06	Israel	49	(0.05)	(0.14)	4.31	(0.11)	0.27	(0.33)	0.32	0.76
Netherlands	140	1.27	1.17	4.37	0.19	(0.50)	0.11	0.02	0.04	Jordan	140	0.83	0.71	5.04	0.08	0.60	1.65	0.38	0.00
New Zealand	140	0.46	0.24	6.75	0.01	0.43	1.33	0.90	0.09	Malaysia	140	0.80	0.13	11.83	0.03	0.84	4.12	1.00	0.00
Norway	140	0.75	0.54	6.47	0.05	(0.52)	1.67	0.37	0.01	Mexico	140	1.79	1.24	10.27	0.13	(0.73)	1.38	0.27	0.00
Singapore	140	0.85	0.46	8.98	0.05	0.46	2.40	0.81	0.00	Morocco	49	1.82	1.43	8.73	0.16	(0.85)	3.49	0.88	0.01
Spain	140	1.19	0.97	6.53	0.12	(0.12)	0.65	0.70	0.30	Pakistan	121	1.14	0.34	12.68	0.06	0.22	1.09	0.69	0.02
Sweden	140	1.28	1.02	7.19	0.12	(0.17)	0.55	0.88	0.51	Peru	98	1.00	0.59	9.11	0.07	0.29	2.05	0.57	0.03
Switzerland	140	1.33	1.20	5.01	0.18	(0.23)	1.13	0.63	0.06	Philippines	140	0.43	(0.22)	11.52	0.00	0.49	1.87	0.01	0.01
United Kingdom	140	1.09	0.98	4.65	0.14	0.22	0.32	0.39	0.42	Poland	98	3.38	2.04	17.61	0.17	1.76	8.40	0.30	0.00
United States	140	1.25	1.16	4.10	0.20	(0.62)	1.46	0.33	0.01	Portugal	140	1.14	0.91	6.91	0.10	0.72	1.78	0.47	0.00
										Russia	49	(0.82)	(1.70)	13.12	(0.09)	(0.10)	0.39	1.00	0.81
										South Africa	98	0.89	(0.04)	13.62	0.04	0.62	6.67	0.78	0.00
										South Korea	110	0.53	(0.34)	13.78	0.01	1.32	4.64	0.61	0.00
										Taiwan	122	0.58	0.05	10.70	0.02	1.38	3.73	0.96	0.00
										Thailand	140	0.28	(0.59)	13.32	(0.01)	0.47	1.54	0.36	0.00
										Turkey	139	2.62	1.27	17.42	0.13	1.32	3.81	0.21	0.00
										Venezuela	134	3.02	1.49	17.76	0.15	0.44	1.51	0.81	0.00
Regions																			
Asia Pacific	140	0.09	(0.14)	6.83	(0.05)	0.34	0.44	0.74	0.19	Asia Pacific Emerging	140	0.42	0.06	8.41	-	(0.50)	2.41	0.19	0.00
Europe	140	1.13	1.03	4.36	0.16	(0.34)	0.48	0.30	0.24	European Emerging	140	1.39	0.89	10.19	0.10	0.54	1.71	0.10	0.02
North America	140	1.21	1.13	4.08	0.19	(0.66)	1.59	0.37	0.01	Latin America	140	1.92	1.49	9.09	0.17	(0.76)	3.39	0.44	0.00
EPAC	140	0.60	0.48	4.92	0.04	(0.01)	0.56	0.17	0.80	Mid-East, Africa	140	0.95	0.71	6.93	0.08	(0.57)	3.91	0.40	0.00
World	140	0.89	0.81	4.10	0.12	(0.49)	1.09	0.27	0.04	Emerging markets	140	1.05	0.81	7.05	0.09	(0.01)	0.90	0.07	0.01

Panel B: Property indices summary statistics

Australia	140	0.85	0.75	4.39	0.10	0.11	0.26	0.09	0.88	Argentina	72	0.90	0.24	11.41	0.04	(0.15)	0.93	0.28	0.68
Austria	48	0.00	(0.13)	5.51	(0.08)	2.33	12.69	0.21	0.00	Brazil	17	2.44	1.94	10.64	0.19	0.85	(0.16)	0.54	0.12
Belgium	140	0.27	0.11	5.72	(0.03)	0.51	0.45	0.37	0.03	Chile	98	0.43	(0.37)	16.97	(0.02)	0.74	0.62	0.45	0.00
Canada	140	(0.99)	(1.25)	7.26	(0.19)	0.18	1.59	0.11	0.01	China	38	0.18	(0.92)	10.80	0.00	0.62	0.74	0.73	0.31
Denmark	128	0.59	0.28	7.98	0.02	0.51	3.93	0.76	0.00	Colombia									
Finland	32	(1.14)	(1.33)	6.16	(0.25)	0.27	0.46	0.86	0.31	Czech Republic									
France	140	0.73	0.63	4.43	0.07	0.34	0.27	0.29	0.25	Egypt	44	(3.68)	(4.06)	8.69	(0.47)	0.06	(0.46)	0.64	0.73
Germany	104	1.13	0.90	7.02	0.11	0.60	0.89	0.26	0.03	Greece									
Hong Kong	140	2.08	1.43	11.68	0.14	0.88	3.92	0.79	0.00	Hungary									
Ireland	92	(1.21)	(2.43)	14.83	(0.11)	0.32	10.50	0.86	0.00	India									
Italy	116	(1.12)	(1.75)	11.61	(0.13)	1.36	5.76	0.60	0.00	Indonesia	100	(1.85)	(4.11)	20.14	(0.11)	0.41	5.09	0.16	0.00
Japan	140	(0.10)	(0.58)	9.90	(0.05)	0.42	0.87	0.53	0.08	Israel	49	0.42	0.03	8.91	(0.00)	0.02	1.47	0.24	0.01
Netherlands	140	0.07	(0.00)	3.80	(0.09)	0.05	0.41	0.03	0.77	Jordan									
New Zealand	68	(2.50)	(3.46)	14.44	(0.20)	1.50	5.30	0.19	0.00	Malaysia	140	(0.04)	(1.07)	14.82	(0.03)	1.14	4.12	0.97	0.00
Norway	56	0.37	0.06	7.85	(0.01)	(0.36)	2.68	0.48	0.04	Mexico	38	(1.01)	2.38	16.37	(0.09)	0.24	1.78	0.40	0.06
Singapore	140	1.08	0.31	12.69	0.05	0.96	6.04	0.13	0.00	Morocco									
Spain	140	0.49	0.15	8.24	0.01	(0.16)	1.29	0.12	0.15	Pakistan									
Sweden	140	0.63	0.03	11.19	0.02	1.13	5.65	0.24	0.00	Peru									
Switzerland	140	0.98	0.85	5.25	0.11	0.37	0.55	0.32	0.33	Philippines	122	1.09	0.05	15.44	0.05	1.19	8.40	0.36	0.00
United Kingdom	140	0.68	0.50	5.95	0.04	(0.23)	(0.31)	0.71	0.38	Poland									
United States	140	0.73	0.66	3.79	0.08	0.06	0.80	0.06	0.04	Portugal	77	(0.37)	(0.50)	5.19	(0.15)	0.40	(0.54)	0.47	0.05
										Russia									
										South Africa									
										South Korea	13	(7.58)	(8.82)	16.04	(0.50)	0.52	(0.94)	0.15	0.18
										Taiwan	38	(3.56)	(4.42)	13.69	(0.29)	1.57	4.74	0.74	0.00
										Thailand	105	1.05	(3.61)	47.96	0.01	7.85	73.10	0.54	0.00
										Turkey	37	0.40	(1.86)	21.47	(0.00)	0.38	0.76	0.32	0.78
										Venezuela									
Regions																			
Asia Pacific	140	0.64	0.30	8.35	0.03	0.67	2.94	0.99	0.00	Asia Pacific	140	(0.94)	(1.15)	10.50	(0.13)	0.01	1.12	0.04	0.05
										Emerging									
Europe	140	0.51	0.42	4.43	0.02	(0.07)	0.06	0.52	0.48	European	77	0.89	(0.04)	13.99	0.03	1.02	4.89	0.10	0.00
										Emerging									
North America	140	0.58	0.50	3.80	0.04	(0.22)	1.28	0.02	0.03	Latin America	38	(0.64)	(1.40)	12.07	(0.09)	(0.31)	1.65	0.90	0.16
EPAC	140	0.49	0.31	6.10	0.01	0.29	0.94	1.00	0.10	Mid-East, Africa	49	(1.76)	(1.99)	6.75	(0.32)	(0.19)	0.99	0.08	0.35
World	140	0.51	0.39	5.04	0.02	0.18	0.79	1.00	0.24	Emerging markets	140	(0.70)	(1.17)	9.75	(0.11)	0.19	1.08	0.16	0.03

(1) Number of observations, (2) arithmetic average, (3) geometric mean, (4) standard deviation, (5) Sharpe ratio, (6) skewness, (7) kurtosis, (8) *P*-value from test for first order auto correlation, (9) *P*-value from Shapiro–Wilk normality test.

The arithmetic mean, geometric mean, standard deviation, Sharpe ratio, skewness and kurtosis for each return series is provided. In addition, *P*-values from tests for first order autocorrelation and from Shapiro–Wilk normality tests are reported.

Although the exchange rate movements (and co-movements) have a direct effect on variance measures denominated in US dollars as discussed above, the standard deviation estimates measured in local currency terms in our sample generally do not vary widely from their values measured in US dollar terms. However, the differences in local versus US dollar denominated returns can be extremely large in some cases, such as Brazil and Turkey, as we discussed above. Accordingly, to facilitate comparisons of risk-return ratios across markets, we focus on return and risk measures in a common currency (US dollar).

4. Basic performance characteristics

Fig. 1 illustrates the performance of composite world and emerging market BMI and property indices. We provide details regarding these performance measures in Table 1. Overall, the emerging market BMI performed similarly to the world BMI in terms of terminal value. The emerging market real estate index and the world real estate index experienced lower returns than their BMI counterparts. While investments in the three other indices shown produced different degrees of positive returns, investing in the

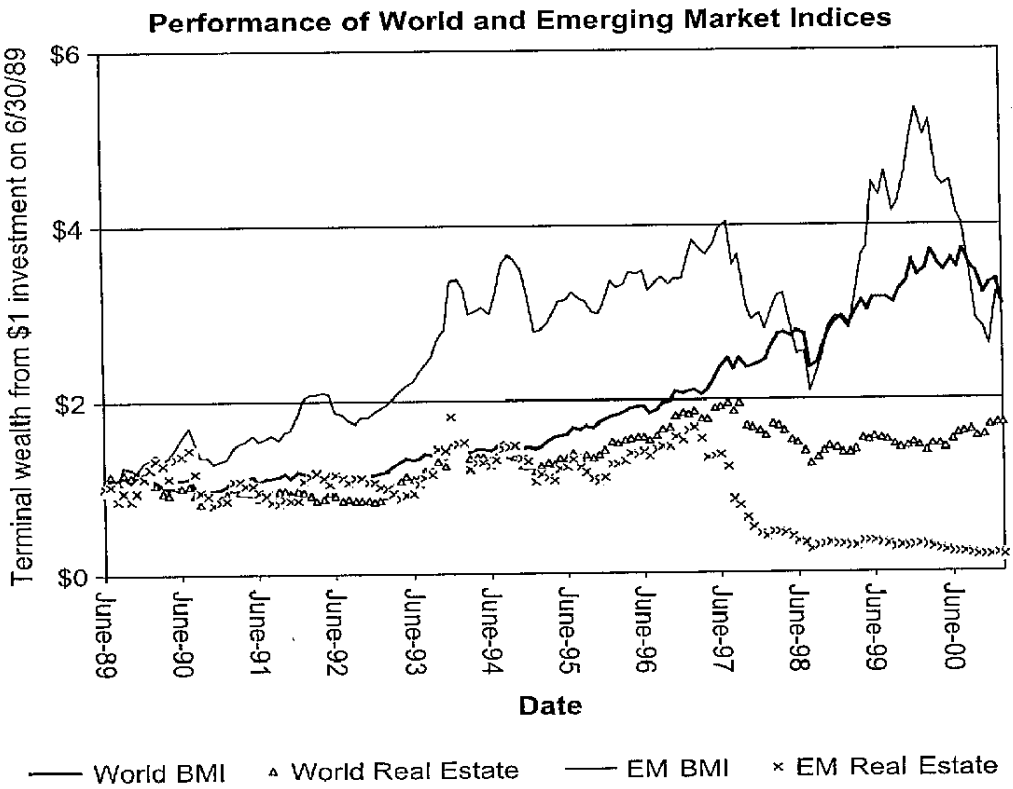

Fig. 1. Plots the results that would have been achieved from investing US$1 at the end of June 1989 through February 2001 in broad market (BMI) indices and property indices (real estate) in emerging market composite indices and overall developed market (world) indices.

emerging market real estate index would have resulted in a loss during the period we examined, as discussed below.

The monthly compound average rate of return for the composite index of developed world property was 0.387%, whereas the monthly compound average rate of return for the composite index of emerging market property was negative 1.17%. Therefore, investing one dollar in the composite index of developed world property on June 30, 1989 would have produced a terminal value of US$1.72 by the end of February 2001, a 72% total return. In contrast, investing the same amount in the composite index of emerging market property would have resulted in a terminal value equal to US$0.19, a loss of 81% of the initial value invested.[15]

Fig. 2 shows that all developed market BMI except Japan experienced positive returns during the period examined, but 8 out of 21 property indices for developed markets experienced negative returns.[16] Property indices in emerging markets performed poorly as well. Eleven out of 15 property indices experienced negative returns.[17] The median monthly geometric mean of property indices in emerging markets was negative 1.07%. The median monthly geometric mean of property indices in developed markets was 0.11%. Hence, overall at the composite level and the individual market level, real estate indices in both emerging and developed markets performed poorly relative to their BMI counterparts.

In contrast to the negative and low returns experienced by the real estate indices, the composite emerging market BMI achieved a positive total return comparable to the BMI for developed markets. A dollar invested in the composite emerging market BMI on June 30, 1989 would have produced a terminal value of wealth of US$3.08 by the end of February 2001. A dollar invested in a developed market world BMI would have resulted in a terminal value of US$3.09 over the same period.

Although the overall composite BMI in emerging and developed markets experienced similar returns, Fig. 2 illustrates large differences in the performance across BMI for emerging markets. Hence, examining individual emerging markets provides insights into the non-homogenous nature of returns in this asset class. The median monthly geometric mean of BMI in emerging markets was 0.468%. The median monthly geometric mean of BMI in developed markets was 0.942% per month. Hence, the previously mentioned positive performance for the composite BMI for emerging markets was due to the

[15] The results for composite indices covered the total time period under study. Indices for some individual markets did not cover this entire time period. If the time period is not the same for indices being compared, then the comparison may reflect differences in performance in time as opposed to differences in performance attributable to the indices. To see if differences in time periods affect the comparison of indices, we examined metrics over the same time periods within each market for BMI and property indices in developed and emerging markets. Results based on returns over the matching time periods are consistent with those reported throughout this text.

[16] The Netherlands experienced a slightly negative return that is not visible given the scale of the graph.

[17] Property indices for Israel and the Philippines experienced slightly positive returns of .02% and .04%, respectively, that are not visible because of the scale of the graph. The other emerging market property indices that are not visible on the graph are due to a lack of available data on real estate indices for those markets.

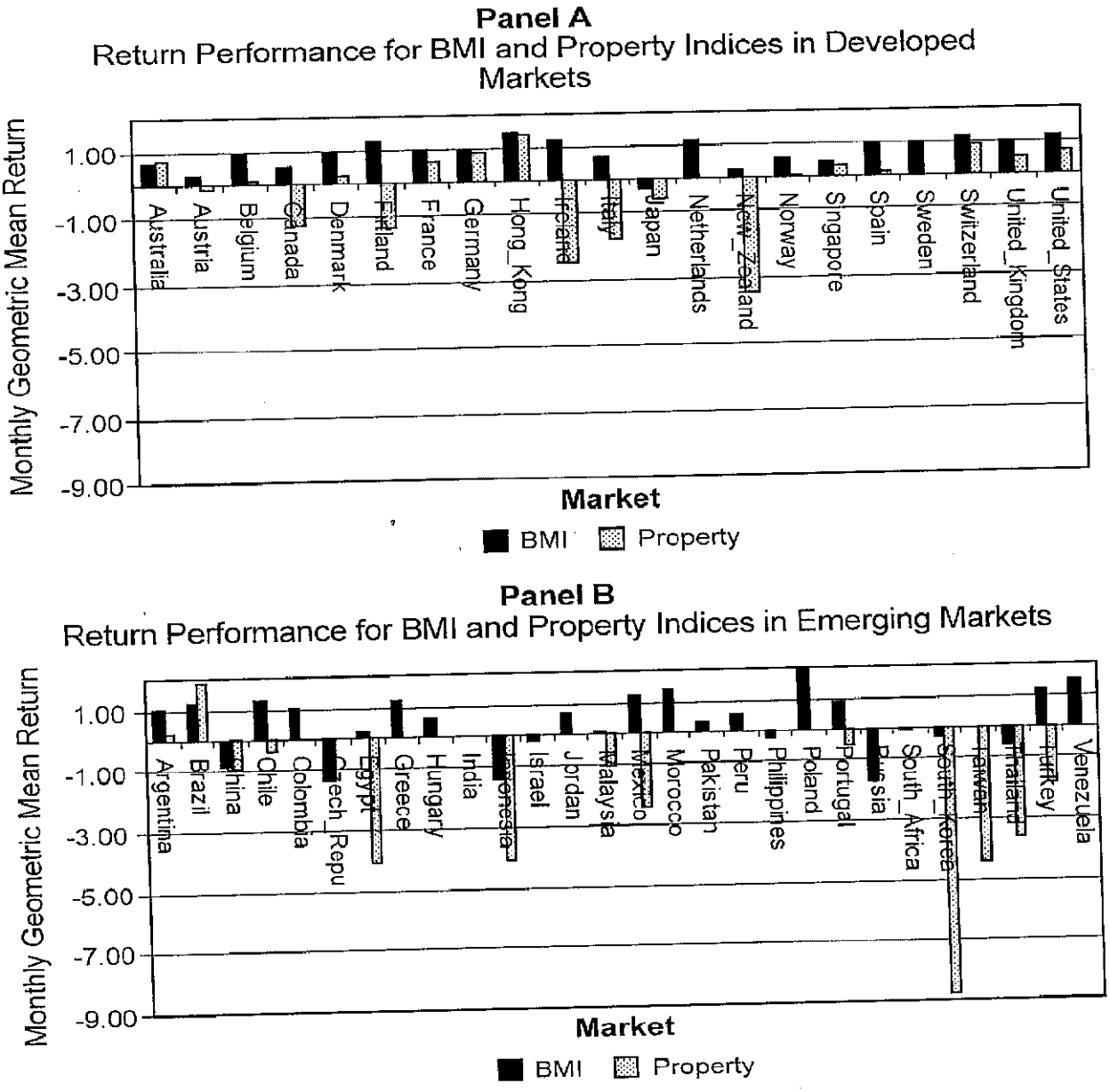

Fig. 2. Provides estimates of the geometric mean return experienced based on data available for each market within the June 1989 through February 2001 time period examined. Panel A illustrates the geometric mean returns for BMI and property indices in developed markets. Panel B illustrates the geometric mean returns for BMI and property indices in emerging markets.

extraordinary performance of some emerging markets despite the relatively low performance of others.

Fig. 1 indicates that despite the comparable terminal values, the emerging market BMI composite experienced much higher volatility than the developed world BMI composite. Accordingly, the total risk (as measured by standard deviation of monthly returns) was greater for the emerging market BMI composite (7.05%) than the developed world BMI (4.10%). The emerging market composite property index also experienced a higher

standard deviation of returns (9.75%) than did the developed world composite property index (5.04%).

The experiences of individual markets reflect those discussed for the composites. Fig. 3 illustrates that both BMI and property indices in individual emerging markets tended to

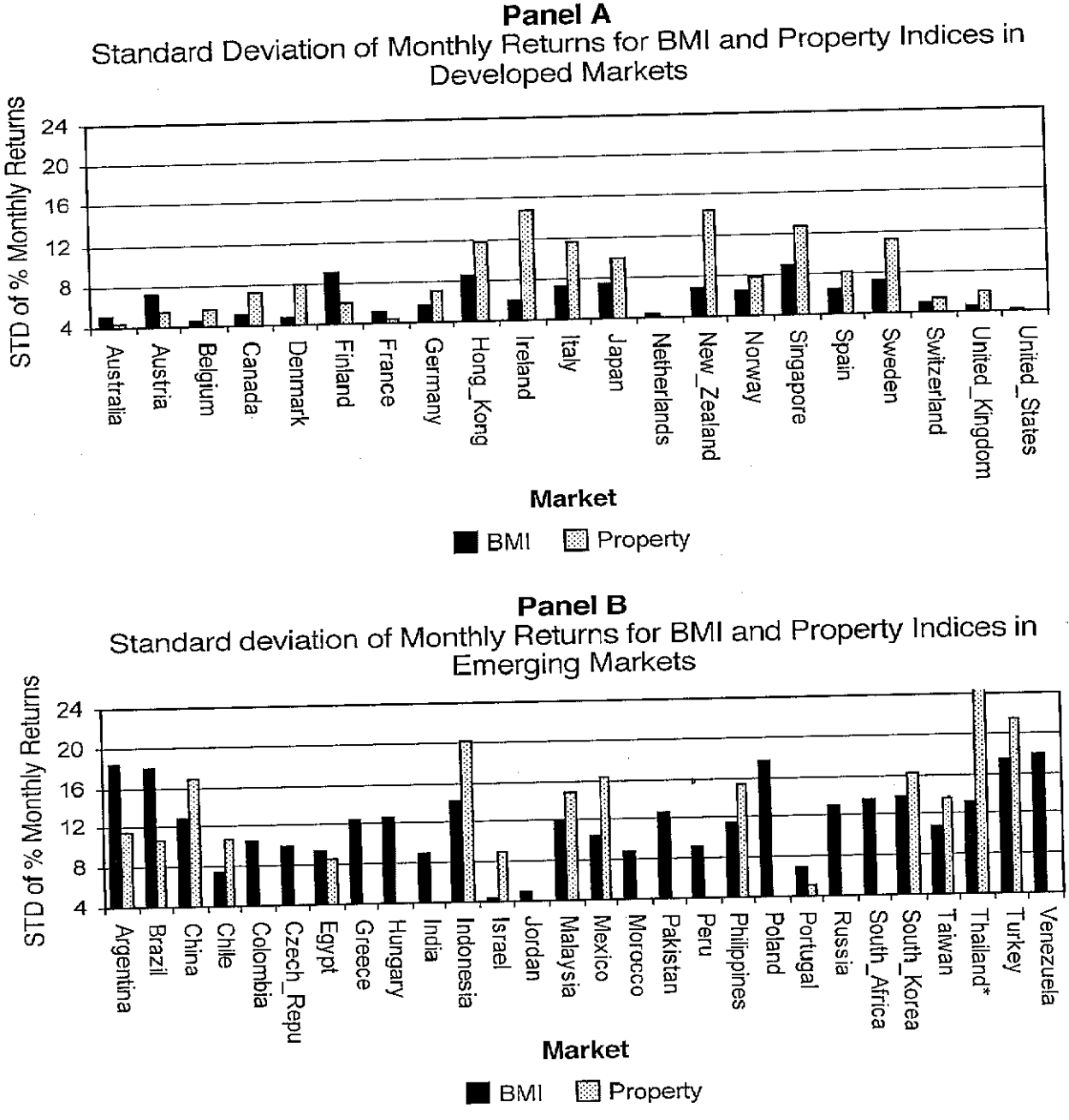

Fig. 3. Provides estimates of the standard deviation of returns based on data available for each market within the June 1989 through February 2001 time period examined. Panel A illustrates the standard deviations for BMI and property indices in developed markets. Panel B illustrates the standard deviations for BMI and property indices in emerging markets. *The Thailand real estate index experienced a 47.96% standard deviation that is off the scale on this graph.

have much higher standard deviations of returns than those in developed markets. This is consistent with previous research indicating that indices in emerging markets tend to be more volatile than those of developed markets.[18]

The median value of the standard deviation of returns across the emerging market property indices (14.82%) was higher than the median standard deviation of property indices across developed markets (7.26%).[19] A developed market experienced the lowest standard deviation (US = 3.79%), while an emerging market experienced the highest standard deviation of monthly returns (Thailand = 47.96%) among all individual market property indices.[20]

Generally speaking, portfolios that focus on a single industry and do not diversify across industries tend to have high standard deviations of returns. Real estate can be viewed as a single industry. Fig. 3 indicates that the property indices tended to have higher levels of variation than did their broad market counterparts. Of course, the BMI are generally diversified across the full range of public companies in a market, resulting in reduced standard deviations for the indices. The variation of the property index was greater than that of its BMI counterpart for 15 out of 21 developed markets. The median standard deviation for individual BMI in developed markets was 5.93%, whereas the median standard deviation for property indices in developed markets was 7.26%.[21]

Like the results reported for developed markets, the composite property index for emerging markets exhibits a higher variation of returns than its BMI counterpart. The standard deviation of monthly returns for the composite emerging market BMI was 7.05%, while the corresponding measure for the composite emerging property index was 9.75%. Fig. 3 shows that the variation of the property index was greater than that of the BMI index in 11 out of 15 emerging markets with available data.[22] The median of individual emerging market standard deviations for broad market indices is 12.14%, whereas the median standard deviation across the property indices for emerging markets that we study is 14.82%.

On the whole, the results indicate that property indices experienced higher levels of risk than did their BMI counterparts. However, it is unclear if the property indices were more volatile (relative to their BMI counterparts) in emerging versus developed markets. If the relative volatility of property versus broad market indices was very similar, the differences

[18] Higher variation may be expected for emerging markets due to their relatively higher level of market capitalization concentration, higher political risk, lower within-market diversification and relatively lower level of integration with the world economy.

[19] Consistent with the results for the composite BMI and property indices, the median standard deviation of individual emerging market BMI (12.14%) was higher than the median standard deviation of developed market BMI (5.92%). Like the experience reported for property indices, a developed market BMI experienced the lowest standard deviation (US = 4.1%), while an emerging market BMI experienced the highest (Argentina = 18.3%) individual standard deviation of monthly BMI returns.

[20] This is off the scale shown as indicated below the graph.

[21] Also as should be expected, the average of individual market standard deviations was higher than the standard deviation of composites made up of the same individual markets as the latter captures the existing covariance of returns between individual markets while the former does not.

[22] Property indices were not available for the countries with missing data in Fig. 3.

in standard deviation between property indices and BMI) should be about the same in developed markets as it is in emerging markets.

On average, the standard deviation of monthly returns experienced by the property indices was 1.9% higher than that achieved by the broad market index in the same developed market. In emerging markets, on average the standard deviation experienced by the property index was 3.9% higher than that experienced by the BMI index in the same market. These differences do not appear to be driven by outlier observations.[23] Although property indices in emerging markets experienced higher levels of variation (relative to their BMI counterpart) than did property indices in developed markets, we did not find the higher levels of relative variation to be statistically significantly different for emerging versus developed markets.[24]

5. Risk-adjusted performance

The return metrics discussed in the previous section do not adjust for risk. This section reports on the risk-adjusted performance of BMI and property indices in emerging and developed markets. Specifically, we report Sharpe ratios to measure relative performance controlling for total risk. In addition, we report Jensen's α's computed after controlling for world and local market risk. Although the latter risk estimates capture covariance risk that is fundamental to modern portfolio theory, these estimates are not necessarily more valid risk measures than the reported Sharpe ratios.[25] Which measures are valid depends on the purpose for which they are being used. For instance, an investor interested in investing only in real estate, could compare measures based on total risk (i.e., the Sharpe ratios) to ascertain whether the investor was earning a reasonable return for the total risk accepted in choosing to focus narrowly on a real-estate-only portfolio versus what a more diversified portfolio would have produced.

[23] The median difference in standard deviation experienced by the property index was 1.4% higher than that of the BMI in each developed market. The median difference in standard deviation experienced by the property index was 3.3% higher than that experienced by the BMI in each emerging market.

[24] A t-test indicates that these averages were not significantly different (p-value = 0.368), as does the result from a Wilcoxon–Mann–Whitney rank sum test (p-value = 0.261).

[25] Volatility estimates are the correct measures of risks for fully segmented markets. Contrary to the perception that global capital markets are becoming more integrated, Bekaert and Harvey (1995) provide mixed evidence regarding the time varying integration of emerging markets. Bekaert et al. (1997) show there is little relationship between risk as measured by the CAPM and expected returns in emerging markets. These authors argue that the CAPM framework is not appropriate for emerging markets if these markets are not integrated into the world capital markets. Also see Harvey (1995) and Bekaert and Harvey (1997). In addition, CAPM applications may not be appropriate for reasons that are also valid in integrated developed markets such as the use of a world portfolio index that is not mean-variance efficient, the need for a multi-factor model or the time-varying nature of risk and return. O'Hara (2003) explains that the notion that idiosyncratic risk is irrelevant for asset pricing in general is being called into question. Barry et al. (1996) discuss restrictions related to real estate investments in emerging markets. All else being equal, such restrictions should result in real estate in emerging markets being relatively less integrated with world capital markets, which would lead to a relatively less meaningful relationship between the covariation of a common world factor and the expected returns of real estate investments in emerging markets.

Table 1 reports Sharpe ratios for BMI and property indices in emerging markets and developed markets. Composite real estate indices underperformed their BMI counterparts for both emerging and developed markets. Panel A in Table 1 shows the Sharpe ratio for the composite BMI in developed markets was 11.5%, whereas Panel B in Table 1 shows the real estate composite for developed markets was 1.8%. The Sharpe ratio for the composite BMI in emerging markets was 8.95%, whereas the real estate composite for emerging markets was negative 11.5%. Hence, based on return performance standardized by total risk, the performance illustrated in Fig. 1 holds after adjusting for total risk.

Fig. 4 illustrates that the results reported for the composites generally hold at the individual market level. BMI outperformed their real estate index counterparts in 18 out of 21 developed markets. BMI outperformed their real estate index counterparts in 10 out of 15 emerging markets. Table 1 shows similar results for developed and emerging market regions except for the case of developed markets in the Asia Pacific region where the BMI underperformed the property index in that region on a total risk-adjusted basis.[26]

Under modern portfolio and asset pricing theory, risk measures tend to emphasize the covariation of asset returns with systematic risk factors. Following Ling and Naranjo (2002), we compute Jensen's α's from a two-factor model. First, for each country we estimate the following regression:

$$R_{it} - R_{\mathrm{ft}} = \alpha_{1i} + \beta_{i1\mathrm{w}}[R_{\mathrm{wt}} - R_{\mathrm{ft}}] + \lambda_{it}, \tag{2}$$

where R_{it} is the return for the BMI for country i, R_{ft} is the risk free rate and R_{wt} is the return on the world BMI. The value for $\beta_{i1\mathrm{w}}$ is the sensitivity of index i to the world factor and α_{1i} is the Jensen α in a one-factor model. The residuals (λ_{it}) represent the portion of each country's return that was not explained by the world BMI, and they are used in the following two-factor model:

$$R_{it} - R_{\mathrm{ft}} = \alpha_{2i} + \beta_{i2\mathrm{w}}[R_{\mathrm{wt}} - R_{\mathrm{ft}}] + \beta_{i\mathrm{L}}\lambda_{it} + \epsilon_{it}, \tag{3}$$

where R_{it} is the return for the property index for country i, $\beta_{i2\mathrm{w}}$ is the sensitivity of country i's property index to the world factor and $\beta_{i\mathrm{L}}$ is the sensitivity of country i's property index to the orthogonal factor. The latter may capture sensitivity to local phenomena not captured by the world factor, particularly for relatively segmented markets. Abnormal performance is represented by α_{2i} (i.e., Jensen's α's from the two-factor model).

Table 2 provides the results from estimating Eq. (2). The results for the one-factor model indicate that all developed market BMI are sensitive to the world market factor. Twenty-three out of the 28 BMI for emerging markets are also significantly related to the world factor.

The results for the one-factor model indicate that BMI did not experience abnormal performance on a risk-adjusted basis. Only one developed market BMI significantly underperformed the world index on a risk-adjusted basis (Japan, with a negative α of

[26] Contrasting this, but consistent with the overall findings, the BMI for the Asia Pacific Emerging Market region performed better on a total risk adjusted basis than the property index in that region.

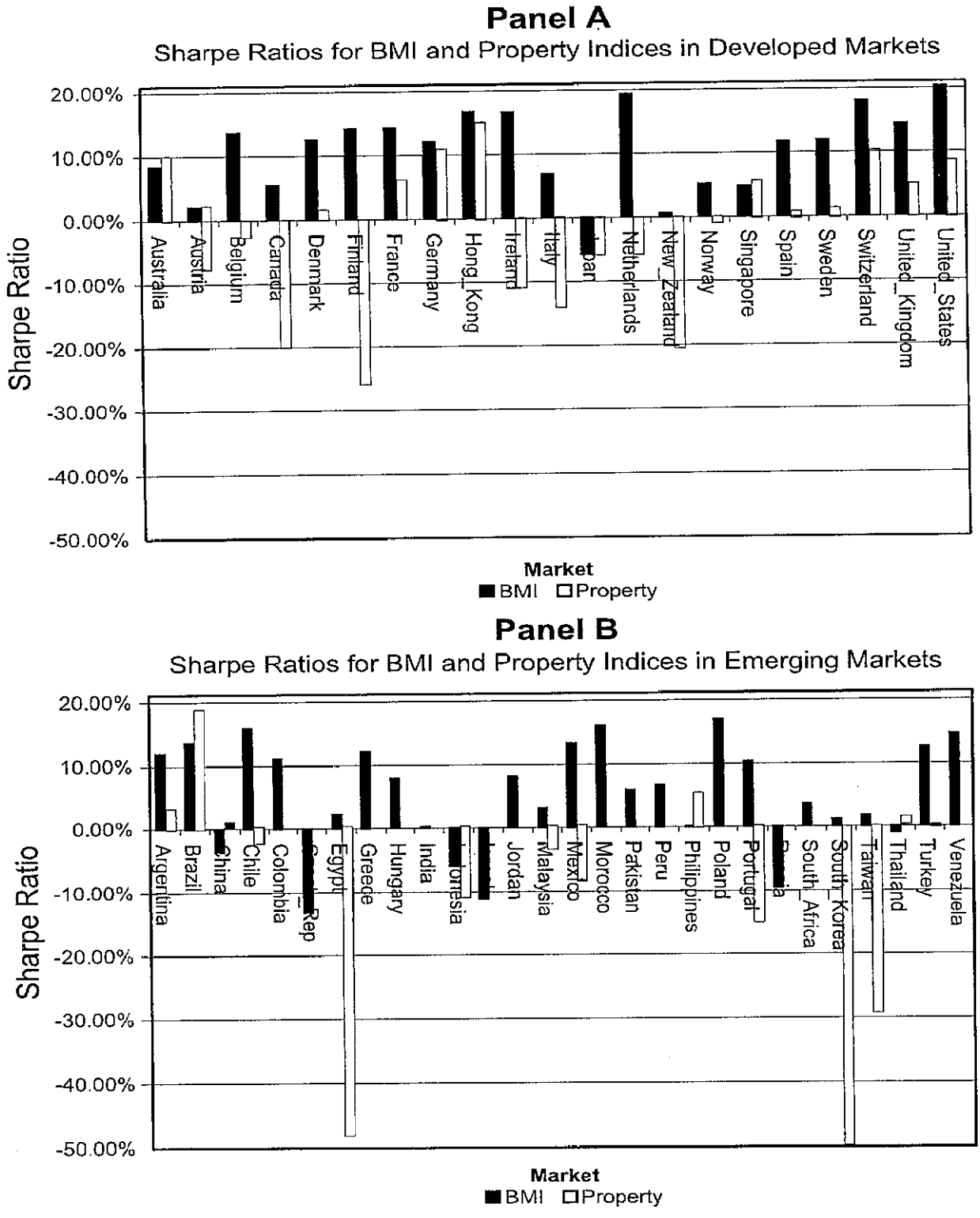

Fig. 4. Provides Sharpe ratio estimates based on data available for each market within the June 1989 through February 2001 time period examined. Panel A illustrates Sharpe ratios for BMI and property indices in developed markets. Panel B illustrates Sharpe ratios for BMI and property indices in emerging markets.

Table 2
Risk-adjusted performance estimates

Developed markets	α_{1i}	β_{i1w}	Emerging markets	α_{1i}	$\alpha_{1i}+\beta_{i1w}$
Results for one-factor model for BMI					
Australia	0.081	0.736***	Argentina	1.834	0.755**
Austria	−0.174	0.690***	Brazil	1.727	1.545***
Belgium	0.287	0.690***	Chile	0.974	0.470***
Canada	−0.147	0.911***	China	−1.026	0.821**
Denmark	0.279	0.693***	Colombia	0.965	0.340
Finland	0.716	1.256***	Czech Republic	−1.748*	0.811***
France	0.306	0.904***	Egypt	−0.195	0.850***
Germany	0.255	0.901***	Greece	1.222	0.633**
Hong Kong	0.866	1.189***	Hungary	−0.183	1.734***
Ireland	0.498	1.032***	India	−0.250	0.383
Italy	0.091	0.878***	Indonesia	−1.744	1.556***
Japan	−1.053**	1.320***	Israel	−0.569	0.195
Netherlands	0.472*	0.797***	Jordan	0.330	0.177*
New Zealand	−0.365	0.864***	Malaysia	−0.139	1.091***
Norway	−0.104	0.928***	Mexico	0.804	1.208***
Singapore	−0.218	1.379***	Morocco	0.895	1.056***
Spain	0.238	1.117***	Pakistan	0.557	0.319
Sweden	0.282	1.224***	Peru	0.092	0.754***
Switzerland	0.511	0.840***	Philippines	−0.543	1.169***
United Kingdom	0.252	0.885***	Poland	1.690	1.896***
United States	0.430**	0.845***	Portugal	0.325	0.830***
			Russia	−1.698	0.948**
			South Africa	−0.524	1.487***
			South Korea	−0.641	1.422***
			Taiwan	−0.416	0.968***
			Thailand	−0.788	1.369***
			Turkey	1.940	0.642*
			Venezuela	2.508	0.263
Regions					
Asia Pacific	−0.944**	1.299***	Asia Pacific Emerging	−0.550	1.174***
Europe	0.279	0.905***	European Emerging	0.550	0.882***
North America	0.393**	0.845***	Latin American	0.910	1.254***
EPAC	−0.335*	1.097***	Mid-East, Africa	0.148	0.814***
World			Emerging markets	0.181	0.954***

Reports results for one-factor models for broad market indices in emerging and developed markets. For each country (and for each region) listed, we estimate the following regression: $R_{it}-R_{ft}=\alpha_{1i}+\beta_{1iw}[R_{wt}-R_{ft}]+\lambda_{it}$, where R_{it} is the return for the BMI for country i, R_{ft} is the risk-free rate and R_{wt} is the return on the world BMI. The value for β_{i1w} is the sensitivity of index i to the world factor and α_{1i} is the Jensen α in a one-factor model. RSQ is the R^2 computed for each one-factor model.

* Indicates significant at the 10% level.

** Indicates significant at the 5% level.

*** Indicates significant at the 1% level.

1.05% per month). Two developed markets significantly outperformed the world index on a risk-adjusted basis (the US, with an α of 0.43% per month, and the Netherlands, with an α of 0.47% per month). Only one emerging market BMI significantly underperformed the

world index on a risk-adjusted basis (Czech Republic, with an α of negative 1.75% per month).

Table 3 provides the results from estimating Eq. (3). Overall, the results for the two-factor model indicate that both the global factor (β_{i2w}) and the orthogonal factor (β_{iL}) are each significantly related to the returns for real estate indices in emerging and developed markets.[27] All but two developed market property indices are significantly related to the global factor that we used. The property indices for Austria and Finland were the only two exceptions. Ten out of 15 property indices for emerging markets were also significantly related to the global factor. The orthogonal (local) component was significantly related to all but one property index for developed markets. Austria was the exception. The orthogonal component was significant for 11 out of 15 property indices in emerging markets.[28]

Consistent with the findings reported by Bond et al. (2003) for developed markets, our results indicate that global and local factors (that the orthogonal component captures) are important for the performance of real estate in both emerging and developed markets.

The results show a few cases where the orthogonal (local) component is significant and the world factor is not. That was the case for four emerging market property indices (Chile, China, Taiwan and Turkey). Finland was the only case for which this occurred among the property indices in developed markets. These cases are consistent with a lack of relative integration between the local real estate markets and the world capital markets.

Despite the relatively poor performance of real estate indices during the period we examined, the results indicate that only four developed and five emerging market property indices significantly underperformed the equity market on a risk-adjusted basis.[29]

6. Diversification potential from real estate investments in emerging markets

We report metrics that shed additional light on diversification opportunities available from real estate-related investments in different markets in Table 4. We provide correlation measures between the BMI and property index returns for each market with available data. We also show the allocation to real estate within each market that would minimize the variance of returns of a portfolio consisting of the property index and BMI from that market (i.e., we show the allocation to real estate in the minimum variance

[27] We find similar results for an expanded model. The expanded version includes first lags on the property and world BMI series, i.e., four variables are used in the expanded version. Table 3 provides the R^2 (RSQ_{4f}) based on an expanded version of the two-factor model. Table 3 also reports the R^2 for a one-factor model based on each property index against a world index (RSQ_w) and a one-factor model based on each property index against a local market index (RSQ_L).

[28] The relatively small amount of data available for property indices in some markets makes it difficult to test the stability of the two-factor model.

[29] The latter five caused the composite real estate index in emerging markets to also underperform on a risk-adjusted basis. To gain additional insights on how real estate indices performed on a risk adjusted basis, we estimated a one-factor model employing the local BMI indices as the single factor. The results from doing so were very similar to those reported for the two-factor model.

portfolio). In addition, we provide a calculation of the "cut-off" correlation in each market.[30] The cut-off correlation is the correlation above which real estate would have a weight of zero in the country's minimum variance combination of real estate property and equity market index.

To gain insights regarding diversification opportunities available for global property portfolios, in Table 5, we provide the same metrics based on correlations between each property index and the developed global property index. To examine diversification opportunities available for global equity portfolios, in Table 6, we provide the same metrics based on correlations between each property index and the global BMI (i.e., developed world BMI).

Consistent with previous research, real estate investments offered opportunities for diversification within most developed markets. The average correlation between BMI and property indices within each developed market shown in Table 6 was 0.540. For developed markets, the average weight allocated to property in the minimum variance portfolio was 29.1%. Five developed markets (Hong Kong, Japan, New Zealand, Singapore and Ireland) would not have included any property allocation within their minimum variance portfolios.[31]

The diversification opportunities available from real estate investments within emerging markets were similar to those reported for developed markets. The average correlation between BMI and property indices within each emerging market was 0.602. The average minimum variance portfolio weight allocated to property was 32.3% for emerging markets. Five emerging markets (Chile, Indonesia, Malaysia, the Philippines and Thailand) would not have included any allocation to their property index in a minimum variance portfolio. The results from both parametric (p-value = 0.48) and nonparametric (p-value = 0.48) tests revealed no significant difference between the correlations (between BMI and real estate indices) in emerging versus developed markets.[32]

International real estate investments can provide diversification opportunities beyond those available within individual markets. Table 5 reports the correlations between each individual market property index and the developed world global property index. The average correlation between developed market property indices and the global property index was 0.386. This is significantly less than the average correlation of 0.540 between property and BMI within each of these markets.[33] The average correlation between

[30] The allocations assume that investors form portfolios based only on means and variances. If some investors exhibit skewness-preference, the allocations reported could be sub-optimal for them.

[31] The cut-of correlation metrics indicate that if the correlation for Ireland had been slightly less (below 0.4, instead of its actual value of 0.422), property would have been included in the minimum variance portfolio.

[32] The correlations between BMI and real estate indices were relatively large for both developed and emerging Asian markets as discussed below. However, very similar results (for differences between emerging and developed markets) are obtained when examining developed versus emerging markets if Asian markets are removed from the developed and emerging market sets.

[33] We employed a standard two-sample t-test and a Wilcoxon–Mann–Whitney rank sum test to examine differences in sets of correlations. Both a parametric test (p-value = 0.04) and nonparametric test (p-value = 0.004) indicate a significant difference in these average correlations for developed markets.

emerging market property indices and the global property index (0.265) was also significantly less than the average correlation between property and BMI within these markets (0.602).[34] Hence, these results indicate diversification opportunities exist from investing in real estate outside local markets.

Although real estate investments in emerging markets offered relatively low correlations against global property indices, their high variances result in relatively small allocations that would be made to emerging market real estate in minimum variance combinations of emerging market and developed market real estate portfolios. On average, the minimum variance portfolio allocation to an emerging market property index investment in a global property portfolio would have been about 8%. That is consistent, however, with the relatively low values of properties in emerging markets as compared to those in developed markets.

It is not unusual for real estate investors to invest only in their home market. The evidence discussed above suggests that diversification opportunities are available to those investors willing (and able) to allocate part of their portfolio to real estate investments outside their home country. This is especially true for real estate investors within emerging markets.[35] However, restrictions exist that limit some of these investors from making international investments.[36] Frequently, government policies in emerging markets do not permit their citizens to invest in foreign securities. Some of these restrictions may be based on the notion that keeping capital inside a country's borders will prove beneficial for capital accumulation and growth within those countries. However, a result of the policies can also be to force citizens to bear unnecessarily high risk in their investment portfolios. Government officials should recognize that there is a tradeoff between any potential benefits and disadvantages, such as limiting the access of citizens to diversification benefits, arising from policies that limit available investment sets.

Table 5 reports some large differences in the correlations between regional real estate indices and the global real estate index for emerging and developed market regional property indices within the same continent. For example, the correlation between the developed market European real estate index and the world index was 0.68, whereas the correlation between the emerging market European real estate index and the world real estate index was 0.19. The correlation between the emerging and developed European property indices was 0.39. This suggests that there are diversification opportunities across real estate asset classes (combining developed market and emerging market real estate)

[34] Both a parametric test (p-value = 0.0001) and nonparametric test (p-value = 0.0001) indicate a significant difference in these average correlations for emerging markets.

[35] Property indices from emerging markets experienced a larger difference in correlations (between their correlation with their BMI and counterpart and the correlation with the world property index) than did developed markets. A parametric test (p-value = 0.006) and nonparametric test (p-value = 0.004) indicated the average difference in correlations for developed markets (0.154) was significantly less than that for emerging markets (0.337). Hence, investors within emerging markets appear to have greater benefits from allocating part of their real estate portfolios to property investments outside their markets than would real estate investors in developed markets.

[36] Moreover, there can be very substantial information, management and transactions costs for those investors who would invest in real estate abroad.

Table 3
Risk-adjusted performance estimates

Developed markets	α_{2i}	β_{i2w}	β_{iL}	RSQ_W	RSQ_L	RSQ_{2f}	RSQ_{4f}	Emerging markets	α_{2i}	β_{i2w}	β_{iL}	RSQ_W	RSQ_L	RSQ_{2f}	RSQ_{4f}
Results for two-factor model for property indices															
Australia	0.185	0.510***	0.711***	0.23	0.66	0.66	0.67	Argentina	0.712	1.077***	0.736***	0.32	0.55	0.57	0.71
Austria	−0.356	0.132	0.156	0.01	0.03	0.03	0.10	Brazil	1.894	1.469***	0.393	0.61	0.63	0.68	0.71
Belgium	−0.327	0.372***	0.707***	0.07	0.25	0.26	0.27	Chili	1.468	0.361	1.132***	0.16	0.60	0.61	0.68
Canada	−1.784***	0.799***	0.665***	0.20	0.30	0.31	0.32	China	−0.024	0.098	0.884***	0.00	0.41	0.42	0.43
Denmark	0.086	0.390**	0.749***	0.04	0.17	0.17	0.19	Columbia							
Finland	−1.301	−0.077	−0.253**	0.02	0.13	0.15	0.29	Czech Republic							
France	0.122	0.390***	0.515***	0.13	0.30	0.30	0.29	Egypt	−4.460***	0.237	0.251	0.01	0.06	0.06	0.13
Germany	0.559	0.431**	0.404**	0.05	0.10	0.10	0.14	Greece							
Hong Kong	0.967***	1.460***	1.343***	0.26	0.91	0.91	0.91	Hungary							
Ireland	−1.529	0.892***	1.099***	0.07	0.18	0.18	0.18	India							
Italy	−1.520	0.698***	0.875***	0.06	0.29	0.29	0.33	Indonesia	−2.381*	0.668*	1.165***	0.01	0.53	0.57	0.63
Japan	−1.159**	1.355***	1.159***	0.31	0.68	0.68	0.68	Israel	−0.238	0.491*	0.310	0.07	0.04	0.09	0.13
Netherlands	−0.496*	0.311***	0.509***	0.11	0.26	0.26	0.31	Jordan							
New Zealand	−2.599*	0.975***	1.537***	0.04	0.45	0.46	0.50	Malaysia	−1.091**	1.332***	1.167***	0.14	0.88	0.88	0.88
Norway	−0.449	0.702***	0.691***	0.18	0.40	0.40	0.40	Mexico	−1.663	1.932***	0.441	0.39	0.34	0.43	0.54
Singapore	−0.180	1.782***	1.337***	0.33	0.87	0.87	0.87	Morocco							
Spain	−0.377	0.947***	0.841***	0.22	0.45	0.45	0.46	Pakistan							
Sweden	−0.269	1.006***	0.772***	0.14	0.26	0.26	0.26	Peru							
Switzerland	0.357	0.436***	0.615***	0.12	0.30	0.30	0.31	Philippines	−0.396	1.321***	1.068***	0.13	0.62	0.62	0.66
United Kingdom	−0.057	0.671***	1.099***	0.21	0.49	0.50	0.49	Poland							
United States	0.141	0.366***	0.480***	0.16	0.23	0.23	0.26	Portugal	−0.844	0.435***	0.256**	0.09	0.13	0.15	0.18
								Russia							
								South Africa							

								South Korea	−10.811***	2.186**	0.354**	0.41	0.44	0.62	0.58
								Taiwan	−3.349*	−0.064	0.928***	0.00	0.36	0.45	0.48
								Thailand	−0.107	2.995**	1.694***	0.08	0.28	0.28	0.37
								Turkey	0.991	0.608	0.944**	0.08	0.20	0.20	0.34
								Venezuela							
Regions															
Asia Pacific	−0.461	1.441***	0.523***	0.50	0.52	0.57	0.56	Asia Pacific	−1.853***	1.037***	0.932***	0.16	0.54	0.54	0.55
								Emerging							
Europe	−0.190	0.601***	0.727***	0.31	0.45	0.45	0.43	European	−0.278	1.165***	0.345*	0.12	0.11	0.15	0.18
								Emerging							
North America	−0.038	0.411***	0.463***	0.20	0.26	0.26	0.30	Latin America	−1.325	1.387***	0.467**	0.45	0.49	0.53	0.56
EPAC	−0.448	1.106***	0.575***	0.55	0.57	0.59	0.59	Mid-East, Africa	−2.135**	0.381*	0.218	0.10	0.13	0.14	0.23
World	−0.342	0.919***		0.56	0.56	0.56	0.55	Emerging markets	−1.618***	1.061***	0.899***	0.20	0.49	0.49	0.49

Reports results for two-factor models for property indices in emerging and developed markets. First, for each country, we estimate the following regression: $R_{it}-R_{ft}=\alpha_{1i}+\beta_{i1w}[R_{wt}-R_{ft}]+\lambda_{it}$, where R_{it} is the return for the BMI for country i, R_{ft} is the risk free rate and R_{wt} is the return on the world BMI. The value for β_{i1w} is the sensitivity of index i to the world factor and α_{1i} is the Jensen α in a one-factor model. The residuals (λ_{it}) represent the portion of each country's return that was not explained by the world BMI, and they are used in the following two-factor model: $R_{it}-R_{ft}=\alpha_{2i}+\beta_{i2w}[R_{wt}-R_{ft}]+\beta_{iL}\lambda_{it}+,_{it}$, where R_{it} is the return for the property index for country i, β_{i2w} is the sensitivity of country i's property index to the world factor, and β_{iL} is the sensitivity of country i's property index to the orthogonal factor. Abnormal performance is represented by α_{2i} (i.e., Jensen's α's from the two-factor model). RSQ_{2f} is the R^2 for the two-factor model. Table 3 reports the R^2 for a one-factor model based on each property index against a world index (RSQ_w) and a one-factor model based on each property index against a local market index (RSQ_L). Lastly, the R^2 (RSQ_{4f}) based on an expanded version of the two-factor model is provided. The expanded version includes first lags on the property and world BMI series, i.e., four variables are used producing the R^2 for the expanded model.

*Indicates significant at the 10% level.

**Indicates significant at the 5% level.

***Indicates significant at the 1% level.

Table 4
Provides measures of real estate diversification opportunities within local markets

Developed markets	Correlations market property vs. BMI	Min. var. alloc. within market to property (%)	Cut-off correlation within market	Emerging markets	Correlations market property vs. BMI	Min. var. alloc. within market to property (%)	Cut-off correlation within market
Real estate diversification opportunities within local markets							
Australia	0.814	86.81	1.000	Argentina	0.742	116.10	1.000
Austria	0.181	65.20	1.000	Brazil	0.792	128.67	1.000
Belgium	0.503	26.52	0.783	Chile	0.776	0.00	0.696
Canada	0.550	15.29	0.706	China	0.637	15.18	0.759
Denmark	0.407	13.77	0.606	Colombia			
Finland	(0.366)	64.10	1.000	Czech Republic			
France	0.545	65.42	1.000	Egypt	0.251	54.53	1.000
Germany	0.313	34.40	0.802	Greece			
Hong Kong	0.952	0.00	0.729	Hungary			
Ireland	0.422	0.00	0.400	India			
Italy	0.537	7.82	0.626	Indonesia	0.726	0.00	0.702
Japan	0.824	0.00	0.756	Israel	0.196	13.28	0.483
Netherlands	0.510	64.12	1.000	Jordan			
New Zealand	0.674	0.00	0.468	Malaysia	0.937	0.00	0.798
Norway	0.633	24.66	0.823	Mexico	0.586	3.88	0.627
Singapore	0.933	0.00	0.707	Morocco			
Spain	0.670	17.22	0.793	Pakistan			
Sweden	0.511	11.14	0.642	Peru			
Switzerland	0.542	45.05	0.956	Philippines	0.785	0.00	0.746
United Kingdom	0.697	12.83	0.782	Poland			
United States	0.481	57.58	1.000	Portugal	0.360	71.20	1.000
				Russia			
				South Africa			
				South Korea	0.664	28.07	0.859
				Taiwan	0.597	21.23	0.781
				Thailand	0.529	0.00	0.278
				Turkey	0.447	31.68	0.811
				Venezuela			
Regions							
Asia Pacific	0.718	16.49	0.818	Asia Pacific Emerging	0.733	11.61	0.801
Europe	0.671	47.56	0.984	European Emerging	0.339	27.37	0.728
North America	0.513	57.27	1.000	Latin America	0.700	7.74	0.753
EPAC	0.754	9.81	0.807	Mid-East, Africa	0.354	52.01	1.000
World	0.745	12.10	0.812	Emerging markets	0.697	3.71	0.723

Correlations between BMI and property indices within each market are reported. The allocation to property indices that would have produced the minimum variance portfolio for investors that held local BMI and property indices is reported. The "cut-off" correlations represent how high the correlation between property and BMI indices could get within each market before no further allocations would be made to the real estate indices.

Table 5
Provides measures of real estate diversification opportunities within global property portfolios

Developed markets	Correlation market property vs. world property	Min. var. alloc. to market property by global property investors(%)	Cut-off correlation for global property investors	Market	Correlation market property vs. world property	Min. var. alloc. to market property by global property investors(%)	Cut-off correlation for global property investors
Real estate diversification opportunities within global real estate portfolios							
Australia	0.487	63.37	1.000	Argentina	0.459	0.00	0.442
Austria	0.165	44.76	0.916	Brazil	0.206	12.34	0.474
Belgium	0.335	40.60	0.881	Chile	0.312	7.82	0.467
Canada	0.459	19.39	0.695	China	0.313	0.00	0.280
Denmark	0.275	21.46	0.632	Colombia			
Finland	0.176	38.08	0.819	Czech Republic			
France	0.436	61.45	1.000	Egypt	(0.207)	26.21	0.533
Germany	0.050	33.26	0.719	Greece			
Hong Kong	0.744	0.00	0.432	Hungary			
Ireland	0.270	2.57	0.340	India			
Italy	0.157	11.47	0.435	Indonesia	0.299	0.00	0.238
Japan	0.541	0.00	0.510	Israel	0.183	16.22	0.520
Netherlands	0.453	74.45	1.000	Jordan			
New Zealand	0.213	4.89	0.349	Malaysia	0.488	0.00	0.340
Norway	0.311	21.00	0.642	Mexico	0.549	0.00	0.308
Singapore	0.656	0.00	0.398	Morocco			
Spain	0.506	8.59	0.612	Pakistan			
Sweden	0.370	4.19	0.451	Peru			
Switzerland	0.397	46.73	0.961	Philippines	0.438	0.00	0.327
United Kingdom	0.613	29.32	0.848	Poland			
United States	0.494	76.49	1.000	Portugal	0.237	48.09	0.971
				Russia			
				South Africa			
				South Korea	0.267	0.78	0.242
				Taiwan	0.197	4.99	0.341
				Thailand	0.233	0.00	0.105
				Turkey	0.001	4.99	0.230
				Venezuela			
Region							
Asia Pacific	0.895	6.00	0.604	Asia Pacific	0.538	0.00	0.480
				Emerging			
Europe	0.683	69.93	1.000	European	0.191	6.16	0.361
				Emerging			
North America	0.531	78.10	1.000	Latin America	0.527	0.00	0.418
EPAC	0.965	0.00	0.827	Mid-East, Africa	0.061	34.95	0.747
World	1.000	50.00	1.000	Emerging markets	0.548	0.00	0.518

Correlations between a developed world property index and local property indices are reported. The allocation to local property indices that would have produced the minimum variance portfolio for investors that held world property and local property indices is reported. The "cut-off" correlations represent how high the correlation between global property and local property indices could get before no further allocations would be made to the local property indices.

Table 6
Provides measures of real estate diversification opportunities within global equity portfolios

Developed markets	Correlation market property vs. world BMI	Min. var. alloc. to market property by global equity investors (%)	Cut-off correlation for global equity investors	Emerging markets	Correlation market property vs. world BMI	Min. var. alloc. to market property by global equity investors (%)	Cut-off correlation for global equity investors
Real estate diversification opportunities within global equity portfolios							
Australia	0.476	43.45	0.933	Argentina	0.567	0.00	0.359
Austria	0.113	33.87	0.744	Brazil	0.780	0.00	0.385
Belgium	0.269	28.37	0.716	Chile	0.396	0.00	0.379
Canada	0.451	7.86	0.564	China	0.022	4.28	0.222
Denmark	0.209	14.89	0.513	Colombia			
Finland	(0.144)	32.92	0.665	Czech Republic			
France	0.362	43.95	0.925	Egypt	0.083	19.96	0.532
Germany	0.228	19.31	0.583	Greece			
Hong Kong	0.511	0.00	0.351	Hungary			
Ireland	0.267	0.27	0.276	India			
Italy	0.247	3.95	0.353	Indonesia	0.110	1.60	0.518
Japan	0.559	0.00	0.414	Israel	0.254	13.63	0.193
Netherlands	0.335	55.60	1.000	Jordan			
New Zealand	0.203	2.38	0.284	Malaysia	0.364	0.00	0.276
Norway	0.425	6.10	0.522	Mexico	0.620	0.00	0.250
Singapore	0.572	0.00	0.323	Morocco			
Spain	0.472	1.62	0.497	Pakistan			

Sweden	0.367	0.00	0.366	Peru			
Switzerland	0.338	31.95	0.781	Philippines	0.353	0.00	0.265
United Kingdom	0.462	18.60	0.688	Poland			
United States	0.393	56.39	1.000	Portugal	0.295	33.67	0.789
				Russia			
				South Africa			
				South Korea	0.641	0.00	0.228
				Taiwan	(0.016)	7.25	0.273
				Thailand	0.274	0.00	0.085
				Turkey	0.275	0.00	0.188
				Venezuela			
Regions							
Asia Pacific	0.705	0.00	0.491	Asia Pacific	0.403	0.00	0.390
Europe	0.556	41.16	0.924	Emerging European	0.341	0.00	0.293
North America	0.440	56.57	1.000	Emerging Latin America	0.668	0.00	0.339
EPAC	0.741	0.00	0.671	Mid-East,	0.322	17.69	0.607
World	0.745	12.10	0.812	Africa Emerging markets	0.444	0.00	0.420

Correlations between a global broad market index and local property indices are reported. The allocation to local property indices that would have produced the minimum variance portfolio for investors that held the global equity index and local property indices is reported. The "cut-off" correlations represent how high the correlation between global equity and local property indices could get before no further allocations would be made to the local property indices.

within geographic areas that were previously documented to be subject to strong continental factors (as reported by Eichholtz et al., 1998).

Besides providing diversification opportunities within individual markets and within real estate portfolios, real estate investments can provide diversification benefits for global equity portfolios. Table 6 reports the correlation between each individual market property index and the developed world global equity index. The average correlation between developed market property indices and the global equity index was 0.339. This is significantly less than the average correlation of 0.540 between property and BMI within each of these markets.[37] The average correlation between emerging market property indices and the global equity index (0.335) was also significantly less than the average correlation between property and BMI within these markets (0.602).[38]

Once again, real estate investments in emerging markets offered relatively low correlations, but their high variances resulted in very small allocations that would be made to emerging market real estate investments within world equity portfolios. On average, the minimum variance portfolio allocation to a property index investment in an emerging market would have been about 5.0%. Hence, there is an extension to the important insight for real estate investors within emerging markets. There may be even greater diversification opportunities for them than for investors in developed markets to be free to make equity investments outside their local markets.

Conover et al. (2002) report that foreign real estate had a lower correlation with US stocks than did foreign stocks in a period encompassing the stock market crash of 1987. They conclude that the lower correlation from real estate (unlike the correlation benefits of foreign equities) was relatively stable through time, suggesting diversification benefits even during times of crisis. In our data, Asian markets suffered through financial crises, especially in the latter half of 1997 and 1998.[39] Diversification benefits from real estate investments within markets in this region were less than those available from real estate investments within other markets. The average correlation between BMI and real estate indices in markets in the Asia/Pacific Rim region was 0.756, while the average correlation for markets outside this region was 0.470.

Tests comparing Asian markets (emerging and developed) versus markets outside the region (emerging and developed) indicate that property indices within markets throughout the rest of the world provided greater diversification benefits than did property indices within Asian markets. The results for parametric (p-value = 0.001) and nonparametric (p-value = 0.000) tests support the notion that diversification benefits from real estate indices were significantly less in Asian markets than in other markets during the periods examined. This result is consistent with a study of equity markets by Longin and Solnik

[37] Both a parametric test (p-value = 0.008) and nonparametric test (p-value = 0.000) indicate a significant difference in these average correlations for developed markets.

[38] Both a parametric test (p-value = 0.003) and nonparametric test (p-value = 0.005) indicate a significant difference in these average correlations for emerging markets.

[39] Much has been written about the Asian Financial Crises. For example, see Bulchandani (1998) and Shivakumar (1999). Kallberg et al. (2002) in particular examine real estate markets in Asia during 1992–1998 and conclude that the 1997–1998 period reflected a "regime shift" in which real estate contributed much to the chaos in those markets. They argue that increased risk and decreased diversification opportunities for real estate resulted within the markets.

(2001) who find that correlation across global equity markets increases in bear markets but not in bull markets.

Data reported in Tables 5 and 6 indicate that no allocation would have been made to real estate indices in several Asian markets when forming minimum variance portfolios within their markets, within global real estate, or within global equity portfolios. These results suggest that perhaps the diversification benefits from securitized real estate investments disappear during times of crises, i.e., real estate offered diversification benefits except when such benefits were really needed. On the other hand, some of the markets that suffered through the crises had property markets that rebounded dramatically soon thereafter, so that the diversification benefits measured across a longer time horizon may be greater than those measured over shorter intervals.

7. Conclusions and suggestions for future research

Real estate investments underperformed equity investments in both emerging and developed markets during the period we examined. However, only a few real estate indices significantly underperformed their BMI counterparts on a risk-adjusted basis. Overall, even during the period examined wherein real estate indices experienced lackluster returns, these investments offered diversification opportunities within emerging and developed markets. The results presented herein suggest that substantial diversification opportunities are available to real estate investors who presently invest only in their local markets. Indeed, policy-makers should recognize that such investors could be well served by being able to allocate part of their portfolios to investments (equity or real estate) outside their home countries.

While this research indicates that real estate investments in emerging markets can provide diversification benefits, large investors may have difficulty allocating a significant portion of their portfolio to securitized real estate investments in emerging markets due to relatively low levels of market capitalization for such investments. However, large investors may find that substantial investments in unsecuritized real estate are available to them in some emerging markets. It would be of interest to examine the diversification opportunities available from unsecuritized investments in emerging markets, especially during and around times of crises.

Can international real estate diversification capture benefits attributed to diversification across property types? There is a need for additional international evidence on diversification benefits by property type and/or geographic/economic areas across both emerging and developed markets.[40]

The Asian financial crisis illustrated that currency risk is an important consideration for both developed and emerging markets. Unlike developed markets, few emerging markets have readily available futures markets wherein local exchange rate risk can be hedged. The Asian financial crisis also highlights the need for research on international real estate investments that examine changes in correlations across time and diversification during times of crises for distinct time horizons.

[40] Unfortunately, company specific and property specific data is not available to us at this time.

Previous research in developed markets indicates that securitized real estate investments perform differently than direct real estate investments. For example, unsecuritized real estate has been documented to be a good hedge against inflation while securitized real estate has not.[41] Emerging capital markets provide a rich setting in which to examine this topic as these markets have experienced wide ranging inflation rates.

Many worthwhile research endeavors call for data on unsecuritized real estate investments in developed and emerging markets. Unfortunately, such data are difficult to obtain, especially in the case of emerging markets.

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References

Barry, C.B., Rodriguez, M., Lipscomb, J., 1996. Diversification potential from real estate companies in emerging capital markets. Journal of Real Estate Portfolio Management 2 (2), 107–118.

Barry, C.B., Peavy, J.W., Rodriguez, M., 1997. Emerging stock markets: risk, return and performance. The Research Foundation of the Institute of Chartered Financial Analysts, Charlottesville, VA.

Barry, C.B., Peavy, J.W., Rodriguez, M., 1998. Performance characteristics of emerging capital markets. Financial Analyst Journal 54 (1), 72–80.

Bekaert, G., Harvey, C.R., 1995. Time-varying world market integration. Journal of Finance 50 (2), 403–444.

Bekaert, G., Harvey, C.R., 1997. Emerging equity market volatility. Journal of Financial Economics 43 (1), 29–77.

Bekaert, G., Urias, M.S., 1996. Diversification, integration and emerging market closed-end funds. The Journal of Finance 51 (3), 835–869.

Bekaert, G., Erb, C.B., Harvey, C.R., Viskanta, T.E., 1997. What matters for emerging equity market investments. Emerging Markets Quarterly 1 (2), 17–46.

Bond, S.A., Karolyi, G.A., Sanders, A.B., 2003. International real estate returns: a multifactor, multicountry approach. Real Estate Economics 31 (3), 481–500.

Bulchandani, R., 1998. Asian currencies: crisis, contagion, and containment. Emerging Markets Quarterly 2 (1), 8–13.

Conover, C., Mitchell, H., Friday, S., Sirmans, C.F., 2002. Diversification benefits from foreign real estate investments. Journal of Real Estate Portfolio Management 8 (1), 17–26.

Eichholtz, P., Huisman, R., Koedijk, K., Schuin, L., 1998. Continental factors in international real estate returns. Real Estate Economics 26 (3), 493–509.

Errunza, V.R., 1983. Emerging markets: new opportunity for improving global portfolio performance. Financial Analyst Journal 39 (1), 51–58.

Gordon, J.N., Canter, T.A., Webb, J.R., 1998. The effect of international real estate securities on portfolio diversification. Journal of Real Estate Portfolio Management 4 (2), 83–91.

Gyourko, J., Linneman, P.D., 1988. Owner-occupied homes, income-producing properties, and reits as inflation hedges: empirical findings. Journal of Real Estate Finance and Economics 1 (4), 347–372.

Harvey, C.R., 1995. Predictable risk and returns in emerging markets. Review of Financial Studies 8 (3), 773–816.

Iman, R.L., Conover, W.J., 1989. Modern Business Statistics. Wiley, New York.

[41] See Gyourko and Linneman (1988).

International Finance Corporation, 1993. IFC Index Methodology. International Finance Corporation, Washington, D.C.

Introducing the Salomon Brothers World Equity Index, 1994. Available at http://www.ssbgci.com/data/pdf/introdoc.pdf.

Kallberg, J.G., Liu, C.H., Pasquariello, P., 2002. Regime shifts in Asian equity and real estate markets. Real Estate Economics 30 (2), 263–291.

Liang, Y., Gordon, N.M., 2003. A bird's eye view of global real estate markets. Prudential Real Estate Investors. Prudential Financial, Inc., Newark, NJ, USA, March.

Ling, D., Naranjo, A., 2002. Commercial real estate return performance: a cross-country analysis. Journal of Real Estate Finance and Economics 24 (1 and 2), 119–142.

Liu, C.H., Mei, J., 1998. The predictability of international real estate markets, exchange rate risks, and diversification consequences. Real Estate Economics 26 (1), 3–39.

Liu, C.R.H., Hartzell, D.J., Hoesli, M.E., 1997. International evidence on real estate securities as an inflation hedge. Real Estate Economics 25 (2), 193–221.

Longin, F., Solnik, B., 2001. Extreme correlation of international equity markets. Journal of Finance 56 (2), 649–676.

Mueller, G.R., Anderson, R.I., 2002. The growth and performance of international public real estate markets. Journal of Real Estate Portfolio Management 8 (4), 128–139.

O'Hara, M., 2003. Presidential address: liquidity and price discovery. Journal of Finance 58 (4), 1335–1354.

Quan, D.C., Titman, S., 1999. Do real estate prices and stock prices move together? An international analysis. Real Estate Economics 27 (2), 183–207.

Seiler, M.J., Webb, J.R., Neil Myer, F.C., 1999. Diversification issues in real estate investment. Journal of Real Estate Literature 7 (2), 163–179.

Shivakumar, R., 1999. Currency crashes and risk measurement. Emerging Markets Quarterly 3 (3), 5–13.

Standard and Poors, 2000. Standard & Poors Emerging Stock Markets Factbook. Standard & Poors Corp., New York, New York.

Stevenson, S., 2000. International real estate diversification: empirical tests using hedged indices. Journal of Real Estate Research 19 (1/2), 105–131.

Viezer, T.W., 2000. Evaluating 'within real estate' diversification strategies. Journal of Real Estate Portfolio Management 6 (1), 75–95.