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Risks, returns and correlations for global real estate markets

Outside the Box

insight + process = results

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Executive summary

In this paper we attempt to provide estimates of the main inputs needed to construct a global real estate portfolio. Firstly we look at existing market sizes, in terms of both the total and the invested stock of real estate, the latter being a measure of the "market" portfolio. We then derive estimates of risks, returns and correlations for global real estate across around fifty markets, based on analysis of movements in nominal GDP. Though there are large margins of error in any such exercise, we believe that the results are sufficiently robust – on both technical and intuitive grounds – to be used as an input to real-world investment strategy.

Author's note:

This set of exercises – though ultimately relatively simple in execution – has been brewing for over a year and would not have been possible without the considerable help of colleagues at JPMorgan Asset Management. In particular, I would like to acknowledge the assistance of Jesse Bostwick and Quanwei Li in collecting and transforming data, and of Michael Giliberto and Sue Kolasa for their conceptual and technical guidance.

Outside the Box

Risks, returns and correlations for global real estate markets

One of the major trends in real estate capital markets in recent years has been the internationalisation of portfolios. The case for international diversification is compelling and well understood by most investors. It is based on four principal planks:

- Diversification: Real estate markets are generally poorly correlated with each other (generally less so than equity or bond markets), resulting in the ability to spread risk across markets;
- Ability to "ride cycles": Because of these low correlations, it is possible to add excess returns by choosing markets expected to outperform (perhaps more so in real estate where occupier markets, at least, seems to be relatively predictable than in other asset classes);
- Expanded opportunity set: This is an especially important consideration for investors from small countries such as the Netherlands and Australia;
- Ability to match markets to risk and return requirements: It is no coincidence that the first wave of cross-border investment came from US capital seeking higher risks and returns than were commonly available in the domestic market.

Chart 1: Capital inflows to European real estate, 2000-2006

Source: Jones Lang LaSalle

This paper is *not* about these arguments. The case for cross-border diversification has been made and, in large part, won. Alongside the surge in overall flows of capital into real estate globally over the past few years, there has been an impressive growth in the proportion of those flows that are cross-border. Chart 1 shows data for Europe from Jones Lang LaSalle; according to these figures cross-border investment into Europe grew from 37% to 62% of total investment over the first six years of the decade, and from €23.6bn to €149.5bn. In DTZ's *Money into Property: Asia Pacific* survey, 27% of Asian investors responded that they held non-domestic real estate in 2006 but this proportion was expected to grow to 45% by 2008.

The question more likely to be heard now and going forward is: How should I allocate a global portfolio? To clarify, we are talking here about *strategic* allocation – the process of deciding long-term target weights by country for a real estate portfolio. We do not cover here *tactical* weighting by which we mean the deliberate short-term deviation from those long-term weights which investors choose in order to take advantage of what they perceive to be temporary pricing misalignments.

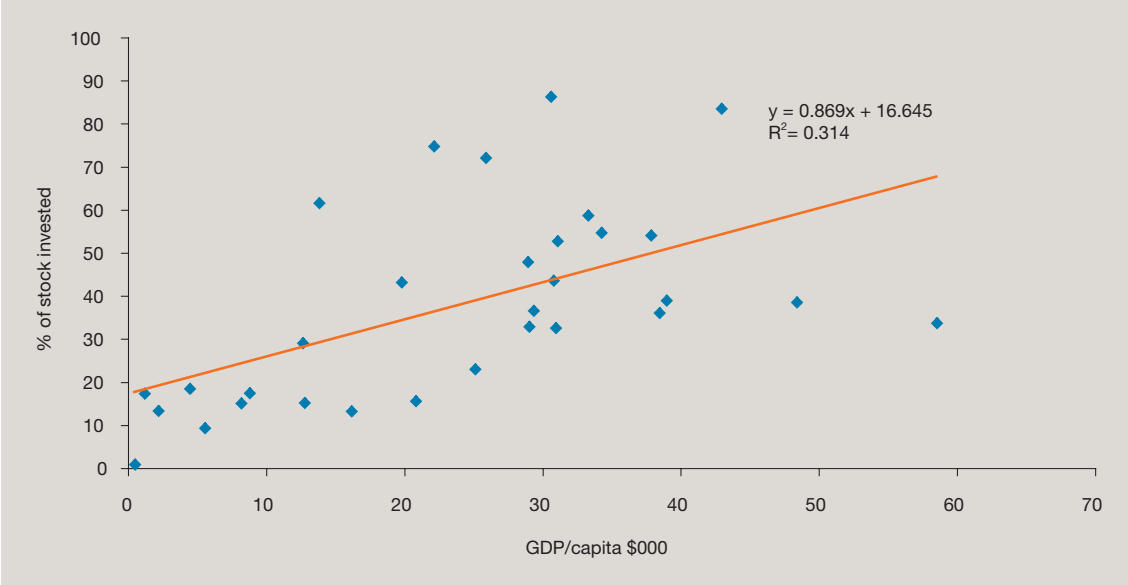
The "right" answer to this question clearly varies enormously between investors – in particular, it depends on risk appetite, the nature and role of liabilities, and the investor's country of residence. Nonetheless, there are certain key metrics that will need to be called upon by all who try to answer it. In particular, most models of asset allocation require estimates of risk, return and correlations. It is also useful to know – if only roughly – how much real estate is out there to invest in global markets, and what the market has chosen to hold. It is these issues that we address in what follows.

The global real estate stock

The first question that needs to be answered is: How much real estate is there to be invested? This is important for two reasons. Firstly, at the margin it places constraints on investment. If there is no investible real estate in Angola, for example, then there is no point worrying about the correct allocation to Angola. Secondly, and more importantly, the stock of invested real estate is what the market has chosen to invest in. The textbook capital markets theorem that the market always holds the efficient portfolio almost certainly does not apply to real estate, since most of the assumptions needed to derive it do not hold. Nonetheless, "the market" has chosen this allocation and in some way or other has processed a lot of information in order to reach this position. If nothing else, therefore, it provides a good starting point for a neutral allocation. If an investor chooses to take a strategic stance substantially different from this, then he or she ought to have good reasons for doing so.

Table 1 shows estimates of the total and invested stock of commercial real estate for 49 countries at end-2006. Many of these figures are based on DTZ's *Money into Property: Global* survey for 2007[i]; however, this source does not cover all the markets that are shown in the table – the Americas, in particular, are under-represented. The gaps have been filled by using estimates of the total real estate stock provided by EPRA[ii]; however, EPRA does not provide estimates of invested stock. We fill this gap by hypothesising that, generally speaking, the proportion of invested to total stock is likely to be higher in more developed countries, and that more developed countries are also likely to have higher levels of GDP per capita. Chart 2 shows the relationship between these two variables for the 31 countries for which we do have data on both total and invested stock; figures for invested stock in Table 1 for other countries (shown in italics) are derived by applying this relationship to GDP per capita and total stock.

Chart 2: Ratio of invested to total stock and GDP per capita, 2006



Source: EPRA, JPMorgan Asset Management

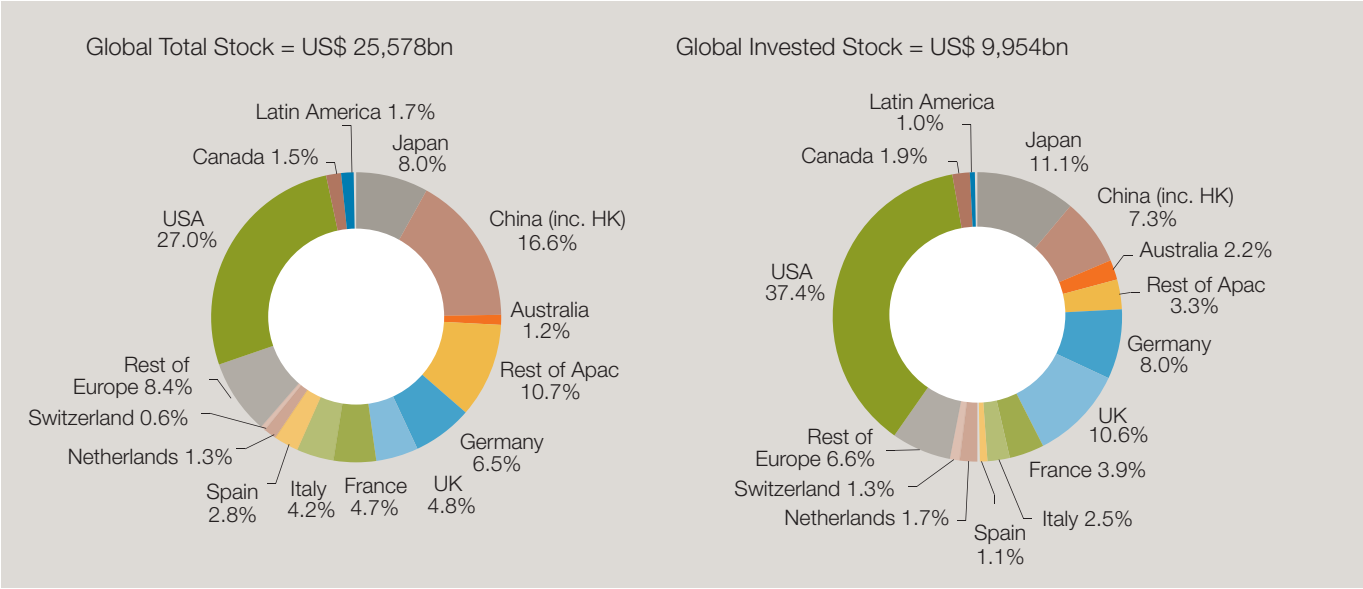
Table 1: Estimates of total and invested stock of commercial real estate, 2006

		Total stock US$ bn	Invested stock US$ bn	Ratio of invested to total stock (%)	GDP/capita US$
Asia Pacific	Japan	2,035	1,110	54.5	35,315
	China (inc. HK)	4,255	730	17.2	1,854
	S Korea	476	138	28.9	16,253
	India	1,390	10	0.8	717
	Australia	309	223	71.9	34,664
	Taiwan	329	49	15.0	14,965
	Indonesia	*38*	*7*	*17.7*	*1,255*
	Thailand	246	33	13.2	2,719
	Malaysia	119	22	18.3	5,618
	Singapore	64	48	74.6	27,381
	Philippines	*13*	*2*	*17.7*	*1,178*
	New Zealand	53	23	43.0	25,230
	Vietnam	*7*	*1*	*17.2*	*611*
Europe	Germany	1,662	793	47.7	33,811
	UK	1,221	1,052	86.1	36,906
	France	1,195	391	32.7	35,108
	Italy	1,085	248	22.8	30,357
	Spain	713	110	15.4	27,833
	Russia	*112*	*24*	*21.3*	*5,342*
	Netherlands	330	173	52.6	38,598
	Switzerland	156	130	83.4	49,302
	Belgium	215	78	36.4	35,645
	Sweden	180	105	58.6	40,125
	Turkey	*62*	*13*	*21.0*	*5,003*
	Austria	182	79	43.4	37,177
	Norway	131	50	38.4	7,643
	Denmark	124	48	38.8	64,471
	Poland	323	30	9.2	47,784
	Greece	157	21	13.1	21,082
	Finland	107	35	32.4	50,469
	Ireland	112	40	35.9	37,483
	Portugal	131	80	61.4	17,360
	Czech Rep	124	21	17.3	7,520
	Hungary	111	17	14.9	10,242
	Romania	*13*	*3*	*20.4*	*4,290*
	Ukraine	*9*	*2*	*18.1*	*1,659*
	Slovakia	*10*	*2*	*21.4*	*5,479*
	Slovenia	*11*	*3*	*31.0*	*16,583*
	Luxembourg	21	7	33.5	78,352
	Bulgaria	*5*	*1*	*19.7*	*3,482*
Americas	*Mexico*	*200*	*46*	*22.9*	*7,199*
	Brazil	*126*	*26*	*20.4*	*4,328*
	Argentina	*38*	*8*	*20.8*	*4,738*
	Venezuela	*26*	*6*	*21.4*	*5,436*
	Colombia	*18*	*3*	*19.0*	*2,735*
	Chile	*23*	*5*	*23.1*	*7,401*
	Peru	*13*	*2*	*19.2*	*2,891*
	USA	6,900	3,721	53.9	42,590
	Canada	*396*	*186*	*47.0*	*34,903*

Source: DTZ, EPRA, JPMorgan Asset Management

Chart 3 shows the data in Table 1 in a slightly more digestible format, with smaller countries grouped together. According to these calculations, the Americas account for around 30% of the total stock, and around 40% of the invested stock, largely because of the high proportion of invested to total stock in the US. Conversely in Asia total stock is 36% of the global total, but invested stock only 24%, primarily because of the impact of China and India. In Europe things are roughly balanced, with 33% of the total stock and 36% of the invested stock accounted for by the continent. In terms of invested stock, Asia and the Americas are dominated by Japan and the US respectively; things are more evenly spread within Europe.

Chart 3: Estimates of global total and invested stock, 2006



Source: DTZ Research, EPRA, JPMorgan Asset Management

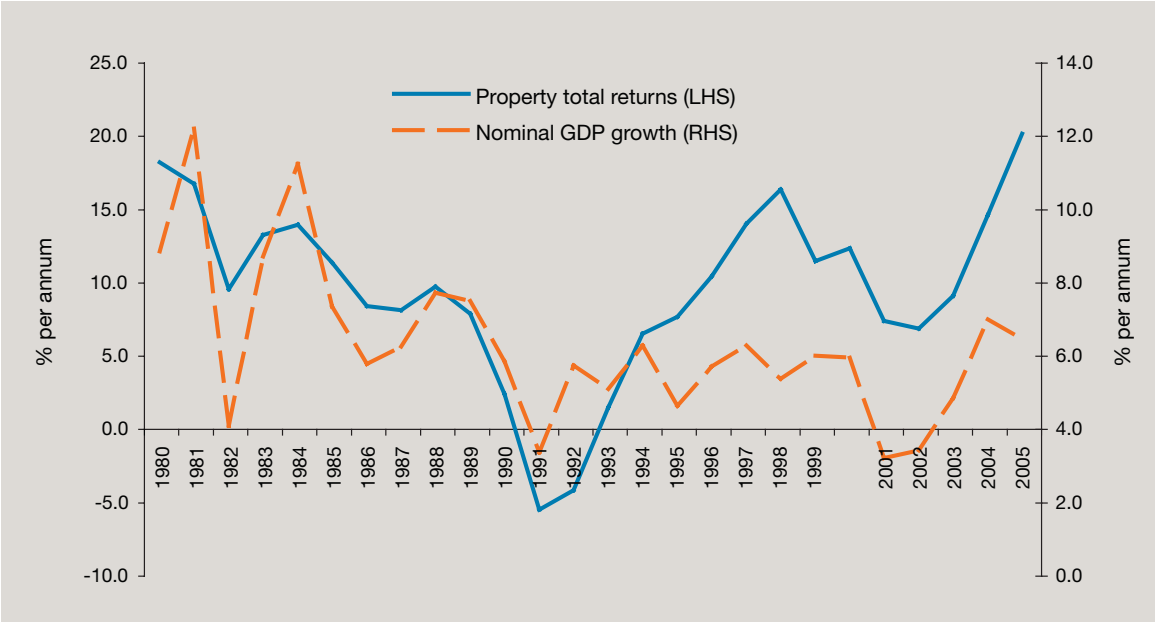
Estimating risks

If the market does not hold the efficient portfolio, how can we decide what that portfolio is? Textbooks tell us that we need to work out the mean, variance (a measure of risk), and covariance (a measure of cross-correlations) of real estate returns in the markets we intend to invest in, and then derive a set of portfolio weights that optimises some function. For example, an institution could choose a level of risk tolerance, defined as a portfolio covariance, and then work out the weights that maximise the returns for that level of risk; or it could choose a target return, and minimise risk. For a liability matcher, the exercise might be to maximise the difference between assets and liabilities; or perhaps to minimise the variance of that difference, subject to the constraint that the difference never becomes negative. Even if we don't follow such a technical route, common sense tells us that we are unlikely to be able to consider the composition of a portfolio without knowing at least the risks and returns pertaining to individual markets.

The usual way of computing mean, variance and covariance in financial markets is to rely on historical performance, modifying the assumptions (especially the mean performance assumption) where necessary to deal with known differences between the past and the future. The problem with applying this to real estate is that only a few countries have real estate returns time series that are long enough and reliable enough to enable this sort of calculation. So – do we have to give up, and find some alternative way of deciding on portfolio weights?

As a general rule, we would expect real estate to do well when one of two conditions are present; either real GDP is rising, boosting demand for rented space; or prices are rising, since rented space is a real asset whose nominal value would be expected to rise in line with other prices in the economy. There is one variable that captures both these trends, and is available for a wide variety of markets over a reasonable period of time: namely, nominal GDP. True, real estate returns are also affected by capital market trends which affect yields, and thus capital values. However, these trends are normally generated either by rental movements, or if not then by forces that are common across real estate markets (as is the case, for example, with the recent global yield downswing), and thus not highly relevant to the estimation of *relative* risks and returns.

Chart 4: Real estate returns and nominal GDP growth, USA



Source: NCREIF, IMF, JPMorgan Asset Management

Chart 4 shows unleveraged real estate returns and nominal GDP growth for one country – the largest, the USA. As can be seen, the two series are *broadly* correlated (in fact the coefficient of correlation is just over 0.5). Table 2 shows nominal GDP and real estate returns volatilities for the seven countries for which we have robust data on both, along with the correlation between the two series. This correlation is always positive and significant, ranging from 0.28 (UK) to 0.88 (Australia). The table also shows the standard deviation of both nominal GDP and reported real estate returns.

Table 2: Real estate returns and nominal GDP growth

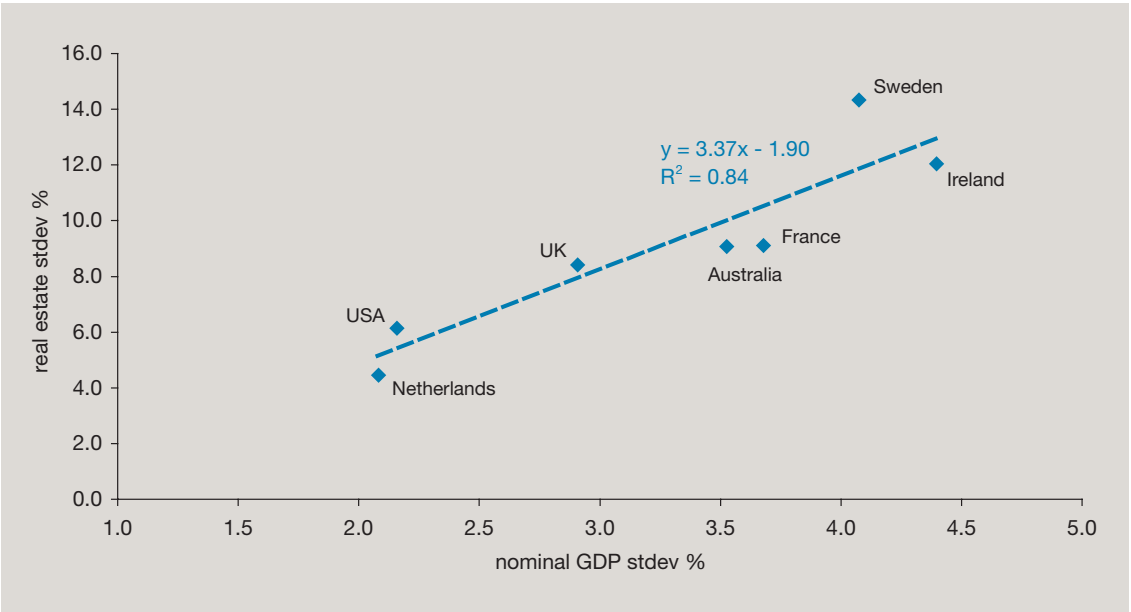
	Correlation RE/GDP	GDP stdev	RE stdev
Australia	0.88	3.5	9.1
USA	0.53	2.2	6.1
UK	0.28	2.9	8.4
France	0.59	3.7	9.1
Netherlands	0.34	2.1	4.4
Ireland	0.62	4.4	12.0
Sweden	0.52	4.1	14.3

Source: NCREIF, IPD, PCA, IMF, JPMorgan Asset Management

To be clear, we are not suggesting that nominal GDP growth can be used as a proxy for nominal real estate returns in any discrete time period. However, it does seem reasonable to suppose that there is information in nominal GDP data that could be used to help us make estimates of the statistical moments (mean, variance and covariance) of the underlying real estate markets.

We start by looking at variance, or risk. Chart 5 plots the GDP and real estate standard deviations reported above. Though there are only seven data points, the relationship between the two is highly significant and gives us some confidence that it might apply to other countries.

Chart 5: Correlations between nominal GDP growth and real estate total returns



Source: NCREIF, IPD, PCA, IMF, JPMorgan Asset Management

The results of applying this relationship to nominal GDP data for 48 countries are reported in Table 6 (page 14). Table 3 below reports a selection of these results.

Table 3: Actual and estimated standard deviation of nominal GDP growth and real estate returns

	Standard deviation of: Nominal GDP growth	Real estate (actual)	Real estate (estimated)
UK	2.9	8.4	7.9
France	3.7	9.1	10.5
USA	2.2	6.1	5.4
Germany	2.0	?	4.9
Spain	3.2	?	8.8
Czech Rep.	5.8	?	17.5
Colombia	9.1	?	28.7
Romania	68	?	228 (?)
Ukraine	838	?	2818 (?!)
Peru	1220	?	4106 (?!!)

Source: NCREIF, IPD, IMF, JPMorgan Asset Management

Applying the relationship to countries with relatively mature real estate markets seems to produce intuitively plausible results. For countries for which we know the standard deviation of real estate returns (the green section of Table 3), this exercise seems to produce reasonable approximations when compared to the actual. In the second (orange) section of the table, we list a number of real estate markets for which we do not know the standard deviation of real estate returns, either because there is no data, or because the data there is does not go back far enough in time (Germany, Spain) to enable us to compute volatility. Nonetheless, the results seem plausible; we don't really have that much idea what the standard deviation of real estate returns is in the Czech Republic or Colombia, but based on what we know about those markets and the results we get for more stable economies, somewhere in the 15-20% range seems reasonable for the Czech Republic, and somewhere in the 20-30% range seems about right for Colombia. Greece, Korea, Singapore and Thailand also slot into the former category, while China, Hong Kong, Hungary and the Philippines share the higher range with Colombia.

The problems start to come when we consider the sorts of countries included in the third, pink zone of Table 3. It seems unlikely that any country could really have a real estate volatility of over 4000% and attract any investment at all. It could be that the relationship in Chart 5 is non-linear at higher values, but we have no way of judging this. However, the more likely explanation is that these countries have suffered a period of hyper-inflation which would have affected both nominal GDP and real estate returns, but which is (perhaps) unlikely to be reproduced in the future. For this reason, the standard deviation estimates shown in Table 6 have a cut-off point at 40%. Eleven of our 48 markets fall under this axe.

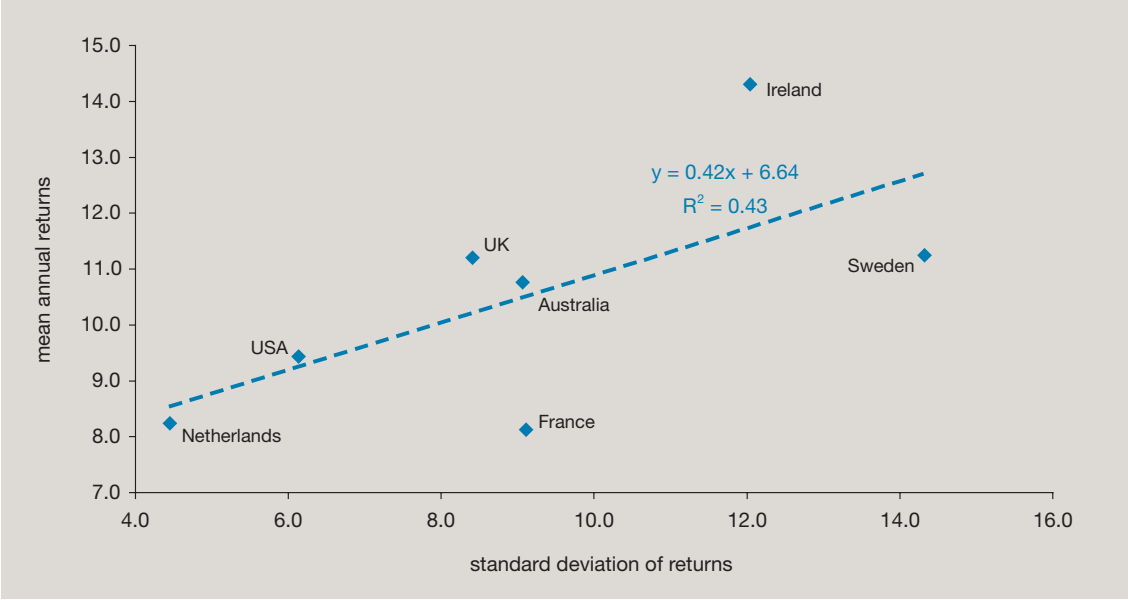
Estimating returns

In the long term, so long as capital markets are reasonably efficient and free-flowing, returns and risk should be two sides of the same coin. Even if, historically, a market had offered returns that were consistently above or below that required to compensate investors for the risk of investing in that market, it would be unreasonable to expect this over- or under-performance to continue into the future (if anyone believed that it would, this would certainly have a big impact on their portfolio allocation). We can therefore use these estimates of risk as a basis for computing expected returns.

Our methodology is as follows. We start by assuming that the US market has historically been correctly priced – it is difficult to be fully confident that this is true, but the US has the largest and most efficient market and one of the longest and most reliable series of real estate returns, so if we can't make this assumption it is difficult to know what other benchmark we could use[iii].

Using our results above, we can compute the additional risk attached to each country compared to the US. We now need to convert these into efficient market return expectations. To do this we need to have an estimate of the marginal risk/return trade-off, i.e. how much additional return the property market requires to compensate it for an extra unit of risk as measured by standard deviation. For this we can again turn to the information we have on our seven mature, data-rich markets. Chart 6 shows the trade-off between risks and returns. The relationship is not as close as that uncovered in Chart 5; this is what we would expect in markets which historically, at least, have almost certainly not priced real estate efficiently across borders. Nonetheless it is just about significant[iv], and, with a coefficient on the slope of 0.42, is roughly in line with the trade-off between risk and return that is generally observed in all asset space.

Chart 6: Risk/return trade-off in real estate space



Source: NCREIF, PCA, IPD, JPMorgan Asset Management

Next, we apply this trade-off to compute the additional returns that would be expected over and above those obtained in the US in an efficient market. Finally, we add this premium to the historical US returns (remembering that we are assuming the US market has been efficiently priced historically) to obtain an estimate of expected returns. These final two steps are shown in the last two columns of Table 6.

Table 4 below summarises these results by grouping countries into risk bands according to their expected returns. The results seem sensible *prima facie*, and are also broadly compatible with other studies that have used different methodologies, for example those of McIntosh and Liang (2000)[v] and Henderson Real Estate Investors (2001)[vi]. Nonetheless, except for the assumption of rational pricing going forward they are essentially backward looking, and thus may well need to be modified in line with users' understanding of future developments. In particular, some developing countries which are now, almost by definition, more mature than they have on average been during the past twenty-five years, may need to be reclassified to lie further down the risk spectrum.

Table 4: Markets grouped by risk/return category

High risk expected returns > 25%	**Medium to high risk expected returns 12-25%**	**Medium risk expected returns 9-12%**	**Low to medium risk expected returns 7-9%**	**Low risk expected returns < 7%**
Argentina	Chile	Finland	Canada	USA
Brazil	Colombia	Ireland	France	Austria
Ecuador	Portugal	Italy	Spain	Belgium
Mexico	Greece	Luxembourg	Denmark	Germany
Peru	Hungary	Czech Republic	UK	Netherlands
Venezuela	China	Norway	Australia	Switzerland
Poland	Hong Kong	Sweden	India	
Romania	Indonesia	Korea	Japan	
Russia	Philippines	Malaysia		
Ukraine	Singapore	New Zealand		
Turkey		South Africa		
		Thailand		

Source: JPMorgan Asset Management

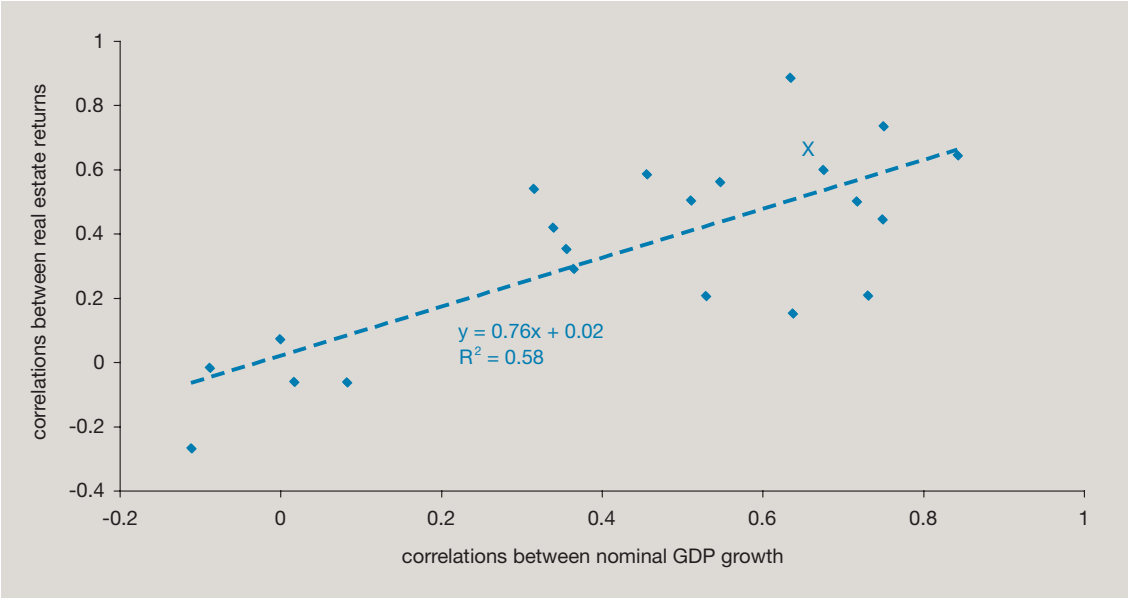
In our view however, the principal implausibility in Table 4 concerns India which, owing to a remarkable record of high and consistent growth in nominal GDP over the past quarter of a century, finds itself in the same group as the UK, Australia and Japan. This seems unlikely to truly reflect the risk of investing in this market – although it should be recalled that what we are doing here is estimating the behaviour of an IPD- or NCREIF-style index of largely stabilised, institutional properties, rather than the development projects that are currently the focus of international investors in the Indian market.

Estimating correlations

Can we use information contained in nominal GDP as an estimator for correlations between real estate markets as well? Chart 7 suggests that we can, though this needs a little more explanation than our earlier exercises. As stated above, there are seven markets for which we believe there is sufficiently robust data to compute accurate historical statistical moments, including correlations. This gives a total of 21 cross-correlations between real estate markets, plotted on the y-axis in Chart 7. The x-axis shows correlations between nominal GDP for the same countries. For example, the point marked "X" shows the GDP and real estate correlations for the US versus Australia.

Once again, it looks as though there is a clear and significant relationship between the two sets of correlations[vii], and we can use this relationship to estimate a correlation between real estate markets for any two countries for which there is a reasonable set of GDP data. At JPMorgan Asset Management we have derived estimates of cross-correlations between real estate markets in 48 major economies using this method. Although these estimates are rough and ready, they are probably little more so than estimates based on real estate data and certainly an improvement on having no correlations at all.

Chart 7: Comparison of correlations between real estate and nominal GDP



Source: NCREIF, PCA, IPD,IMF, JPMorgan Asset Management

The results are shown in Table 6; coefficients are reported to a single decimal place but this is probably about half an order of magnitude too precise. Nonetheless, large positive or negative coefficients should bias us towards believing that there is likely to be a correlation between the two real estate markets concerned. Note that many of the major correlations fall in line with intuition; +0.5 for US/Canada, +0.7 for Ukraine/Russia, or +0.6 for Spain/Portugal for example. Significant negative coefficients are seen for Hungary/Canada, China/Ireland, and New Zealand/Venezuela, among others. Others – for example the -0.4 shown between Russia and Finland or the +0.5 between Poland and Brazil – are perhaps more surprising.

Table 5: Summary of estimated correlation coefficients by region

	USA & Canada	Latin America*	Asia Pacific	Western Europe	Central & Eastern Europe
USA & Canada	1	-0.1	0.3	0.5	-0.1
Latin America*		1	0.4	0.0	0.5
Asia Pacific			1	0.3	0.4
Western Europe				1	-0.2
Central & Eastern Europe					1

Source: JPMorgan Asset Management

* includes South Africa

Table 5 summarises these correlation results by collapsing the matrix in Table 6 into major regions[viii]. As expected, there is a significant positive coefficient between North America and Western Europe, though it is considerably less than one. Asia shows modest but positive correlations with all other regions. Latin America and Central & Eastern Europe seem to provide the greatest diversification opportunities for North American and Western European investors.

Table 6: Estimates of real estate risks, returns and correlations

Correlation coefficients:

Argentina	Brazil	Canada	Chile	Colombia	Ecuador	Mexico	Peru	US	Venezuela	Austria	Belgium	Finland	France	Germany	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain	Denmark	Czech Republic	Greece	Hungary	Norway	Poland	Romania
1.0	0.4	0.0	0.2	0.3	0.5	0.1	0.6	0.2	0.2	0.4	0.4	0.2	0.1	0.5	0.0	0.2	0.2	0.1	0.2	0.3	0.1	-0.2	0.3	0.1	-0.0	0.7	-0.2
	1.0	-0.2	0.2	0.4	0.4	-0.1	0.5	-0.0	0.2	0.3	0.1	-0.1	-0.2	0.4	-0.2	-0.0	0.1	0.1	0.0	-0.0	-0.1	0.3	0.2	0.4	-0.2	0.5	0.3
		1.0	0.2	0.1	-0.0	0.3	-0.1	0.6	-0.2	0.2	0.4	0.6	0.6	0.0	0.4	0.5	0.2	-0.0	0.3	0.4	0.4	-0.4	0.2	-0.4	0.5	-0.1	-0.4
			1.0	0.6	0.5	0.4	0.2	0.3	0.0	0.4	0.3	0.2	0.2	0.4	-0.2	0.4	0.3	-0.1	0.4	0.3	0.1	0.3	0.5	-0.1	0.1	0.2	0.0
				1.0	0.5	0.4	0.3	0.2	0.1	0.6	0.3	0.2	0.3	0.4	-0.1	0.4	0.2	-0.1	0.5	0.3	0.3	0.4	0.6	0.1	0.1	0.3	0.2
					1.0	0.2	0.4	0.1	0.0	0.4	0.3	0.0	0.1	0.5	-0.3	0.2	0.1	0.0	0.3	0.2	0.0	0.1	0.5	0.1	-0.2	0.4	0.1
						1.0	0.0	0.2	-0.1	0.2	0.2	0.4	0.3	0.1	-0.0	0.4	0.1	-0.3	0.5	0.6	0.4	-0.0	0.4	-0.2	0.2	0.1	-0.3
							1.0	0.0	0.2	0.4	0.2	0.0	-0.1	0.5	0.0	0.1	0.1	0.2	0.2	0.3	0.0	-0.1	0.2	0.2	-0.1	0.7	-0.2
								1.0	-0.0	0.3	0.4	0.5	0.5	0.2	0.3	0.5	0.1	-0.0	0.3	0.3	0.4	-0.3	0.3	-0.3	0.4	0.0	-0.2
									1.0	-0.1	-0.1	-0.1	-0.3	-0.0	-0.2	-0.3	-0.1	-0.0	-0.3	-0.3	-0.2	0.2	-0.2	0.5	0.0	0.2	0.0
										1.0	0.5	0.3	0.4	0.6	0.2	0.5	0.3	0.2	0.5	0.5	0.4	0.1	0.6	-0.0	0.2	0.4	0.0
											1.0	0.5	0.5	0.3	0.2	0.4	0.3	0.0	0.4	0.5	0.5	-0.3	0.5	-0.2	0.4	0.3	-0.3
												1.0	0.6	0.0	0.5	0.6	0.2	0.1	0.4	0.5	0.5	-0.4	0.3	-0.2	0.4	0.1	-0.4
													1.0	0.2	0.4	0.7	0.2	0.0	0.5	0.6	0.6	-0.3	0.5	-0.4	0.4	-0.0	-0.3
														1.0	-0.1	0.3	0.1	0.1	0.4	0.3	0.2	0.0	0.5	0.0	-0.0	0.5	-0.0
															1.0	0.3	0.0	0.4	0.2	0.3	0.4	-0.3	0.0	-0.1	0.4	0.1	-0.2
																1.0	0.2	0.0	0.6	0.6	0.6	0.1	0.6	-0.3	0.4	0.1	-0.2
																	1.0	-0.0	0.3	0.2	0.2	0.1	0.3	-0.0	0.2	0.1	-0.0
																		1.0	-0.0	-0.0	0.0	-0.1	-0.0	0.1	0.1	0.1	0.1
																			1.0	0.6	0.5	-0.0	0.6	-0.3	0.2	0.2	-0.2
																				1.0	0.6	-0.3	0.5	-0.4	0.3	0.3	-0.5
																					1.0	-0.1	0.5	-0.4	0.4	0.1	-0.3
																						1.0	0.2	0.4	-0.1	-0.1	0.6
																							1.0	-0.1	0.2	0.3	0.1
																								1.0	-0.2	0.3	0.4
																									1.0	-0.1	-0.1
																										1.0	-0.2
																											1.0

Source: JPMorgan Asset Management

Russia	Sweden	Switzerland	UK	Ukraine	Australia	China	Hong Kong	India	Indonesia	Japan	Korea	Malaysia	New Zealand	Philippines	South Africa	Signapore	Thailand	Taiwan	Turkey	COUNTRY	Risks and returns: standard deviation of returns	risk premium % pa	expected return % pa
0.1	0.3	0.5	0.2	-0.0	0.2	-0.1	0.1	0.2	-0.0	0.4	0.2	0.1	-0.1	0.2	0.2	0.2	0.3	0.1	0.1	Argentina	>40	>20	>25
0.5	0.0	0.2	0.0	0.6	-0.1	0.4	0.2	0.3	-0.1	0.2	0.3	0.3	-0.1	0.1	0.1	0.3	0.4	0.2	0.3	Brazil	>40	>20	>25
-0.2	0.5	0.4	0.5	-0.2	0.6	-0.1	0.3	0.2	0.2	0.3	0.3	0.1	0.5	0.2	0.4	0.3	0.2	0.3	-0.0	Canada	8.8	1.5	7.8
0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.5	0.4	0.1	0.6	0.5	0.1	0.3	0.1	0.5	0.3	0.5	0.5	0.2	Chile	36.6	13.2	19.5
0.5	0.4	0.5	0.4	0.5	0.3	0.4	0.6	0.5	-0.0	0.6	0.6	0.1	0.3	0.2	0.5	0.4	0.5	0.6	0.3	Colombia	28.7	9.8	16.1
0.5	0.2	0.4	0.3	0.4	0.2	0.3	0.4	0.3	-0.1	0.5	0.4	0.2	0.0	0.2	0.3	0.3	0.5	0.3	0.1	Ecuador	>40	>20	>25
-0.0	0.5	0.3	0.6	-0.1	0.5	0.0	0.4	0.2	-0.1	0.4	0.3	-0.0	0.4	0.1	0.4	0.1	0.2	0.3	-0.1	Mexico	>40	>20	>25
0.1	0.2	0.4	0.1	0.1	0.0	-0.1	0.1	0.2	-0.0	0.3	0.2	0.2	-0.2	0.1	0.1	0.2	0.3	0.1	0.1	Peru	>40	>20	>25
0.1	0.4	0.5	0.4	0.1	0.5	0.0	0.4	0.3	0.2	0.4	0.3	0.2	0.4	0.5	0.3	0.3	0.2	0.3	0.0	US	5.4	0.0	6.3
-0.0	-0.2	-0.1	-0.1	-0.0	-0.1	0.2	0.0	0.2	-0.1	0.0	0.0	0.4	-0.3	0.2	-0.0	0.2	0.2	0.0	0.4	Venezuela	>40	>20	>25
0.3	0.5	0.6	0.5	0.2	0.3	0.0	0.4	0.4	0.2	0.6	0.5	0.2	0.2	0.2	0.5	0.4	0.5	0.4	0.2	Austria	4.5	-0.4	5.9
0.0	0.6	0.6	0.5	-0.2	0.5	-0.0	0.3	0.3	0.1	0.5	0.2	0.2	0.2	0.4	0.5	0.3	0.3	0.3	-0.0	Belgium	4.5	-0.4	5.9
-0.4	0.6	0.4	0.6	-0.3	0.7	-0.1	0.2	0.2	0.3	0.4	0.2	0.0	0.5	0.3	0.4	0.3	0.2	0.2	0.1	Finland	14.3	3.8	10.1
-0.3	0.6	0.5	0.6	-0.4	0.6	-0.2	0.4	0.2	0.2	0.5	0.4	0.0	0.5	0.2	0.4	0.3	0.2	0.3	-0.1	France	10.5	2.2	8.5
0.1	0.3	0.5	0.2	-0.1	0.0	-0.0	0.4	0.3	0.0	0.5	0.4	0.1	0.0	0.2	0.2	0.2	0.3	0.3	0.0	Germany	4.9	-0.2	6.1
-0.3	0.3	0.2	0.3	-0.2	0.3	-0.4	-0.0	-0.0	0.4	0.0	0.1	-0.0	0.2	0.1	0.2	0.1	-0.1	0.1	0.2	Ireland	12.9	3.2	9.5
-0.1	0.7	0.5	0.6	-0.0	0.5	-0.1	0.5	0.4	0.2	0.6	0.6	0.0	0.5	0.2	0.5	0.4	0.4	0.5	0.0	Italy	16.4	4.6	10.9
0.0	0.3	0.3	0.2	0.1	0.2	0.2	0.0	0.1	-0.1	0.3	0.1	-0.0	0.2	0.1	0.2	0.0	0.1	0.1	0.0	Luxembourg	13.2	3.3	9.6
-0.1	0.1	0.1	0.0	-0.2	-0.1	-0.2	-0.2	-0.1	0.3	-0.1	-0.0	-0.1	-0.1	0.0	0.1	-0.1	-0.1	-0.1	0.3	Netherlands	5.1	-0.1	6.2
0.2	0.6	0.5	0.5	0.1	0.4	-0.0	0.5	0.2	0.0	0.6	0.4	-0.2	0.6	0.2	0.4	0.1	0.2	0.5	-0.0	Portugal	30.7	10.7	17.0
-0.6	0.6	0.6	0.5	-0.5	0.6	-0.2	0.4	0.1	0.0	0.5	0.4	-0.1	0.5	0.2	0.4	0.2	0.2	0.3	-0.2	Spain	8.8	1.4	7.7
-0.2	0.5	0.4	0.4	-0.3	0.4	-0.1	0.3	0.1	0.0	0.4	0.3	-0.0	0.5	0.3	0.2	0.2	0.1	0.2	-0.1	Denmark	8.2	1.2	7.5
0.3	-0.1	-0.2	-0.2	0.5	-0.5	0.5	0.3	0.3	0.0	0.0	0.3	0.2	-0.1	0.0	-0.0	0.2	0.2	0.4	0.3	Czech Republic	17.5	5.1	11.4
0.3	0.5	0.6	0.5	0.3	0.4	0.1	0.5	0.3	-0.1	0.7	0.5	0.1	0.3	0.4	0.4	0.3	0.4	0.4	0.1	Greece	19.1	5.8	12.1
0.2	-0.3	-0.2	-0.2	0.2	-0.4	0.3	-0.1	0.2	0.0	-0.1	0.0	0.3	-0.5	0.0	-0.1	0.2	0.1	-0.0	0.6	Hungary	20.8	6.5	12.8
-0.2	0.4	0.3	0.4	-0.2	0.4	-0.1	0.2	0.1	0.2	0.3	0.2	0.3	0.3	0.3	0.3	0.4	0.1	0.2	-0.0	Norway	14.2	3.7	10.0
0.4	0.2	0.4	0.2	0.4	0.1	-0.1	0.1	0.3	-0.0	0.4	0.2	0.2	-0.2	0.1	0.2	0.2	0.4	0.1	0.2	Poland	>40	>20	>25
0.6	-0.4	-0.2	-0.3	0.6	-0.5	0.4	0.1	0.1	-0.0	-0.1	0.1	0.2	-0.2	-0.1	-0.1	0.2	0.0	0.2	0.3	Romania	>40	>20	>25
1.0	-0.4	0.0	-0.3	0.7	-0.3	0.4	0.4	0.3	-0.1	0.2	0.3	0.2	0.0	-0.2	0.2	0.3	0.3	0.4	0.2	Russia	>40	>20	>25
	1.0	0.6	0.7	-0.3	0.5	-0.1	0.4	0.3	0.2	0.6	0.5	0.1	0.4	0.3	0.6	0.3	0.3	0.5	0.1	Sweden	11.8	2.7	9.0
		1.0	0.6	-0.0	0.5	-0.1	0.4	0.3	0.1	0.7	0.5	0.1	0.3	0.3	0.5	0.4	0.4	0.4	0.1	Switzerland	6.3	0.4	6.7
			1.0	-0.1	0.6	-0.1	0.4	0.4	0.2	0.6	0.5	0.1	0.4	0.1	0.7	0.4	0.4	0.5	0.2	UK	7.9	1.1	7.4
				1.0	-0.2	0.6	0.4	0.3	-0.1	0.1	0.3	0.3	0.2	-0.2	0.3	0.4	0.4	0.5	0.3	Ukraine	>40	>20	>25
					1.0	-0.0	0.3	0.2	0.1	0.5	0.3	0.0	0.5	0.3	0.5	0.3	0.3	0.2	-0.1	Australia	10.0	1.9	8.2
						1.0	0.2	0.3	-0.2	0.1	0.2	0.2	0.0	0.1	0.1	0.2	0.3	0.1	0.3	China	24.7	8.2	14.5
							1.0	0.5	-0.0	0.6	0.6	0.2	0.4	0.2	0.5	0.5	0.5	0.6	0.1	Hong Kong	27.3	9.3	15.6
								1.0	0.2	0.4	0.5	0.3	0.1	0.1	0.4	0.5	0.6	0.5	0.3	India	8.9	1.5	7.8
									1.0	-0.0	-0.0	0.0	-0.0	0.0	0.2	0.1	-0.0	0.2	0.3	Indonesia	31.0	10.9	17.1
										1.0	0.6	0.2	0.3	0.3	0.5	0.4	0.5	0.5	0.1	Japan	9.4	1.7	8.0
											1.0	0.2	0.4	0.2	0.5	0.5	0.6	0.5	0.2	Korea	18.9	5.7	12.0
												1.0	-0.3	0.3	0.2	0.6	0.4	0.1	0.3	Malaysia	18.5	5.6	11.9
													1.0	0.1	0.4	0.1	0.1	0.4	-0.1	New Zealand	17.5	5.1	11.4
														1.0	0.2	0.2	0.1	0.1	0.1	Philippines	20.3	6.3	12.6
															1.0	0.5	0.5	0.6	0.3	South Africa	14.9	4.0	10.3
																1.0	0.6	0.4	0.3	Singapore	21.4	6.8	13.1
																	1.0	0.4	0.2	Thailand	17.2	5.0	11.3
																		1.0	0.3	Taiwan	17.3	5.1	11.4
																			1.0	Turkey	>40	>20	>25

Conclusions

We now have estimates of risks, returns and correlations – the three things that the textbooks tell us we need to compute an efficient portfolio. How do we go about marrying this information together to form a set of weights?

This question would require another paper to answer but in outline there are two approaches. The textbook approach, suited to those of a technical or theoretical bent, is to plug the assumptions for risks, returns and correlations into an optimiser and compute the most efficient portfolio. The problem with this is that it takes no account of how much real estate there actually is; and as mentioned earlier, this should act as a constraint on investment strategies not just because of the physical limitations of available stock but also because the stock of invested capital does at least provide a benchmark.

The danger with using such models for real-world strategic international real estate allocation is that they are likely to produce results hugely at odds with the received wisdom of the market. For example, on our methodology Spanish real estate shows a large and negative correlation (-0.5) with Romanian real estate, so any portfolio theory-based optimisation exercise is likely to give a large weight to Romania in a Spanish investor's portfolio. But of course, this is unachievable; the Romanian real estate market is currently tiny, not just in relation to that in Spain but even to some Spanish institutional portfolios. Moreover, any Spanish investor who took a large bet on Romanian real estate in order to achieve maximum diversification would actually be opening himself or herself to a good deal of risk; the fact that GDP data suggests that in the past the two real estate markets might well have been negatively related is only a weak indicator that this will be the case in the future.

An alternative therefore, suited to those of a more practical disposition, is to use the market weights as a benchmark and then re-weight according to liability profile and risk/return preference. For example, an institution with a higher risk tolerance is likely to re-weight towards those markets with higher risk/return profiles, and away from the core markets of the US and Western Europe. An investor with liabilities in his or her home currency is likely to weight domestic returns more heavily than one who is interested only in maximising absolute returns or minimising risks.

The problem with this approach is that it effectively ignores correlations – a critical factor in achieving portfolio diversification. An ideal method would combine elements of the two approaches outlined above. Whichever technique is adopted, we hope we have shown that the parameters needed to decide on a global strategic real estate allocation are not as obscure as has often been suggested.

Notes

[i] *Money into Property: Global,* DTZ Research, June 2007

[ii] *Global Real Estate Securities – Where do they fit in the broader market?* Hughes, F. & Arissen, J., EPRA, September 2005. Updated results (to end-2006) kindly provided by the authors.

[iii] In fact we would get very similar results if we were to use any of the markets that lie close to the regression line in chart 6 as our benchmark.

[iv] At 90% probability. The t-statistic on the slope is 1.96.

[v] *Country Risk Premiums for International Investing*, Liang, Y. & McIntosh, W., Prudential Real Estate Investors, January 2000

[vi] *The Global Property Market Risk Premium*, Henderson Global Investors, November 2001

[vii] This and all other relationships estimated in this paper were tested for heteroscedasticity using White's test. All remained significant.

[viii] This is achieved by converting correlation coefficients into covariance measures and applying the identity $\sigma_{AB} = \Sigma x_i y_j \sigma_{ij}$, where A and B are regions and x_i and y_j represent the in-region weights of the component countries. Weights used are those of the invested stock (Table 1).

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