Property Shares, Appraisals and the Stock Market: An International Perspective

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Abstract

A severe problem facing both real estate researchers and investors is the lack of reliable real estate returns data. Property shares, the shares of companies which invest in property and manage a portfolio of real estate, have been proposed as indicators of real estate performance. Property shares exist in many countries, are publicly traded, and their returns are not inherently biased. For three countries, we investigate the relationships with common stock and appraisal-based returns which property share returns exhibit. Our results indicate that property shares are closely related to the stock markets on which they trade, thereby confirming previous findings for the United States. However, property share returns also predict appraisal-based indices.

Key Words: returns, risks, appraisal, REIT, property share, international real estate

> At the least sophisticated level of economic theory lies the belief that certain pairs of economic variables should not diverge from each other by too great an extent, at least in the long run. (Granger, 1986)

The lack of reliable real estate returns data has hampered real estate research and performance measurement. Real estate is traded infrequently, is not homogeneous, and lacks a central marketplace where prices are made public. Researchers have tried to circumvent these problems by using appraised values to calculate returns on real estate. Especially in the United States, this has led to the emergence of indices based on appraisals of hundreds of commercial buildings. Such appraisal-based indices are also available for Australia, Canada, and the United Kingdom.

However, broad as the indices may be, they have serious drawbacks. Appraisal-based indices have been reported to be smoothed, to have an inherent time lag (see for example Firstenberg, Ross, and Zisler, 1988; Geltner, 1989b, 1991), and to be biased (Giliberto, 1988; Geltner, 1989a).

Appraisal-based real estate returns also have disadvantages of a less fundamental nature. Time series of these returns sometimes contain monthly observations such as the Investment Property Database index for the United Kingdom, but usually contain only quarterly or even biannual observations. Another problem with using appraisal-based real estate indices is that they only exist for the five countries mentioned. Efforts to start such indices in other

countries have occurred, for example, in the Netherlands, but the results neither have a very long history, nor are they very broad based. This has been a major obstacle for real estate research in countries other than the United States and the United Kingdom. It also limits the possibilities of performance measurement for international real estate investments.

Using the returns of publicly traded real estate companies has been proposed as a way to tackle these problems. Property shares, the shares of companies which invest in property and manage a real estate portfolio, look especially promising as indicators of real estate performance. Since the property shares are publicly traded, even though the underlying real estate is not, the problems of infrequent trading and lack of a central marketplace seem to be solved. Advantages of property share indices over appraisal-based indices are that they are not smoothed or biased, and do not have an inherent time lag. However, due to the closed-ended nature of property companies, they may be more volatile than the underlying real estate (Firstenberg, Ross, and Zisler, 1988). Property companies' leverage can have the same effect. Apart from that, property shares have two important practical advantages. There is no limit to the frequency of observations in time series of their returns, and they exist in many countries. This allows systematic research of the performance of real estate in countries for which this has been hitherto impossible. It also enables researchers and investors to study international real estate portfolio diversification issues.

All in all, the prospects for property shares as a basis for real estate research seem fertile. Studies of their performance, however, have shown that their returns have a higher contemporaneous correlation with the stock market than with appraisal-based indices (Mengden and Hartzell, 1986). This has led many researchers to conclude that returns on property shares are bad indicators of real estate returns (see, for example, Lusht, 1988). However, Giliberto (1990), Gyourko and Keim (1992), and Geltner (1993) have found that, although property share return indices are contemporaneously related to the stock market, they are also related to other real estate indices. The hypothesis of the first was that the residual of property share returns over stock and bond market returns should be a predictor for appraisal-based returns. The second study did not use residuals, but investigated the relationship directly. The third study unsmoothed the appraisal-based returns before examining the relationship. All three studies found a statistically significant relationship: property shares can predict the appraisal-based index.

In this study, we perform an international investigation of the relationship between property share indices, stock markets, and appraisal-based indices. We do this for the three countries for which quarterly appraisal-based property indices with sufficient history exist: Canada, the United Kingdom, and the United States. The remainder of the study is as follows. In section 1, we describe the data and the data sources, given sample statistics, and present graphic representations of the different time series we use for each country. In the next section, we examine the relationship between property share return indices and the stock market. We determine the stock market betas of property shares, and give some intuitive explanations of their differences across countries. In the third section, we examine how property share returns and appraisal-based returns are related. We investigate the predictive power of property share returns over appraisal-based returns. Using a distributed lag model, we also investigate the length of the time lag between appraisal-based and property share returns. The article concludes with a brief summary and some suggestions for further research.

1. The international real estate and stock data

We have appraisal-based property indices of total returns for Canada, the United Kingdom, and the United States. For all three countries the indices have the fourth quarter of 1993 as the last observation. The beginning of the time series varies per country. For Canada, we use the Russell Canadian Property Index™, which runs from the first quarter of 1985. For the United Kingdom, we use the Total Return Index of Jones Lang Wootton, which is from the second quarter of 1977. For the United States, the appraisal-based index we use is the Russell–NCREIF Property Index, which starts in the last quarter of 1977. All indices are broadly spread over types of real estate and over regions.

For property share returns indices, we use the Datastream Property Share Index for Canada, the Financial Times Actuaries Property Share Index for the United Kingdom, and the Real Estate Investment Trust Index of Wilshire for the United States. For each country, we use the same time series length which we have for the corresponding appraisal-based index. All indices incorporate both capital gains and dividends. With a few exceptions, the property companies included in the indices invest in real estate in their own country. The property companies' investments are broadly spread over different regions. All types of real estate are included in the indices.

We also need time series of common stock returns. For each country, we selected the most widely used index to capture the broader equity market. For Canada, this is the Toronto Stock Exchange Composite Index. For the United Kingdom, it is the Financial Times Actuaries All Share Index; and for the United States the S&P 500 Index. All indices represent total rate of return.

In Table 1, we have included the capital values of the indices we use, as well as the time period over which we have the data. Means and standard deviations of the indices are also included. Moreover, for each of the three countries in our sample, we have calculated the correlations among the three returns series. From this table, we can infer some interesting findings. Although there are substantial differences in risks and returns of the corresponding indices across various countries, the risk/return characteristics of the indices within each country confirm previous findings for the United States. Appraisal-based returns show very low volatility relative to their level, especially when compared to the property share returns, which are very volatile. In all three countries, standard deviations of property share returns are higher than the standard deviations of the broad equity index, and range from 8.26 percent for the United States to 15.75 percent for Canada. On the other hand, standard deviations of appraisal-based returns vary between 2.03 percent for the United States and 2.76 percent for the United Kingdom.

The correlations reported in Table 1 also confirm previous conclusions for the United States. Appraisal-based returns exhibit low contemporaneous correlations with property share returns, and their correlations with common stock returns are even lower. In fact, they are negative for all three countries. Furthermore, correlations between property share returns and the returns on the broad stock market index are high, varying from 0.52 for Canada to 0.79 for the United Kingdom.

Graphic representations of all three indices for each country are given in Figures 1 through 3. For Canada, we see the close relationship between the property share index and the Toronto Stock Exchange Index break down after 1991. From then on, the property share

Table 1. Appraisal-based, property share, and common stock indices.

Country Indices	Period	Value	Mean (Standard Deviation)	Correlations	
				Property Share	Equity
Canada	1/85–4/93				
Russell Canadian Property, Total		9,764	1.65 (2.63)	0.32	−0.10
Datastream Property Share		1,914	−0.60 (15.75)		0.52
Toronto Stock Exchange Composite		268,292	2.22 (6.77)		
United Kingdom	2/77–4/93				
Jones Lang Wootton, All Property		743	2.91 (2.76)	0.16	−0.08
FTA Property Share		21,571	3.68 (12.19)		0.79
FTA All Share		1,120,041	4.53 (8.85)		
United States	4/77–4/93				
Russell-NCREIF Property, Total		21,905	1.95 (2.03)	0.08	−0.09
Wilshire Real Estate Investment Trust		26,197	3.47 (8.26)		0.67
S&P 500		3,308,449	3.42 (7.52)		

Notes:

Index values are in millions of U.S. dollars, on 12/31/1993.

Means and standard deviations are based on quarterly logarithmic returns.

The number of companies included in the property share indices on 12/31/1993 are: Canada, 4; United Kingdom, 31; United States, 105.

market suffers from a severe crisis. The appraisal-based index runs smoothly through these developments, although its positive returns level off, and even become slightly negative from 1992. For the United Kingdom, the appraisal-based index and the property share index do not diverge to a great extent. The appraisal-based index is much smoother than the property share index, but a positive relationship obviously exists. However, here also, a strong relationship between property shares and the stock market is much more evident, although the property share index has severely underperformed the stock market from 1990 through 1992. For the United States, the property share index that we use does not follow the appraisal-
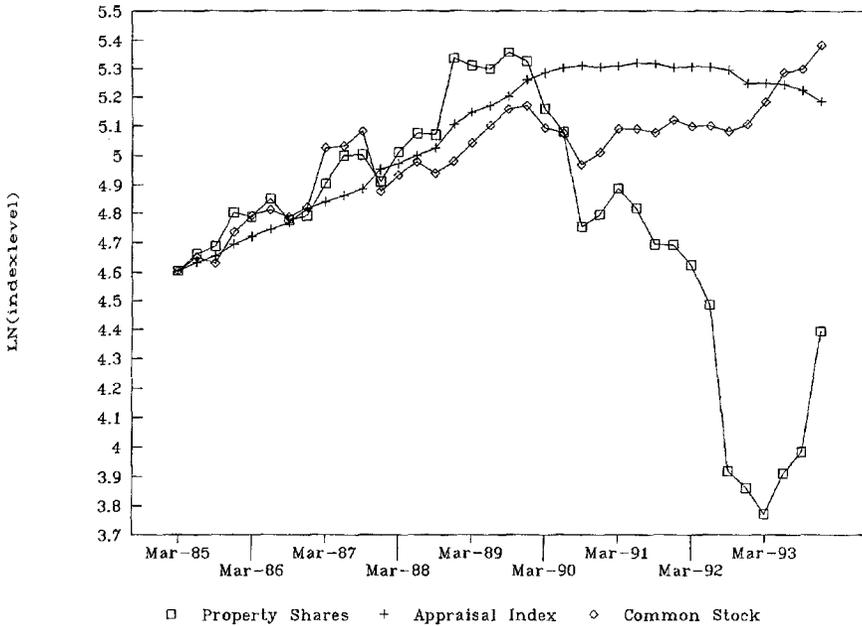
Figure 1. Canada: Property shares, appraisals and stocks.

based index as closely as in the United Kingdom, but, again, a positive relationship seems to exist. The relationship between the property share index and the common stock index seems to be stronger in the first half of the sample than in the second half. For all three countries, we can conclude that movements of the appraisal-based index clearly lag those of the property share index, and that these movements are of a lower order of magnitude for the appraisal-based index. This holds especially if the movements are downward.

2. Property shares and the stock markets

Before we investigate further how property share returns are related to appraisal-based returns, we first examine the relationship between property share returns and stock returns in a somewhat more formal way. We regress the monthly property share index returns R_t on a constant α and the stock market returns S_t: a standard market model. Results are in Table 2. Although the results are not the same for each country, they confirm previous studies for the United States (see, for example, Mengden and Hartzell, 1986). There is a strongly positive contemporaneous relation of the property shares with their national stock markets.

The close relationship between property shares and the stock markets on which they trade is no surprise, for we would expect real estate and the market to be related for various
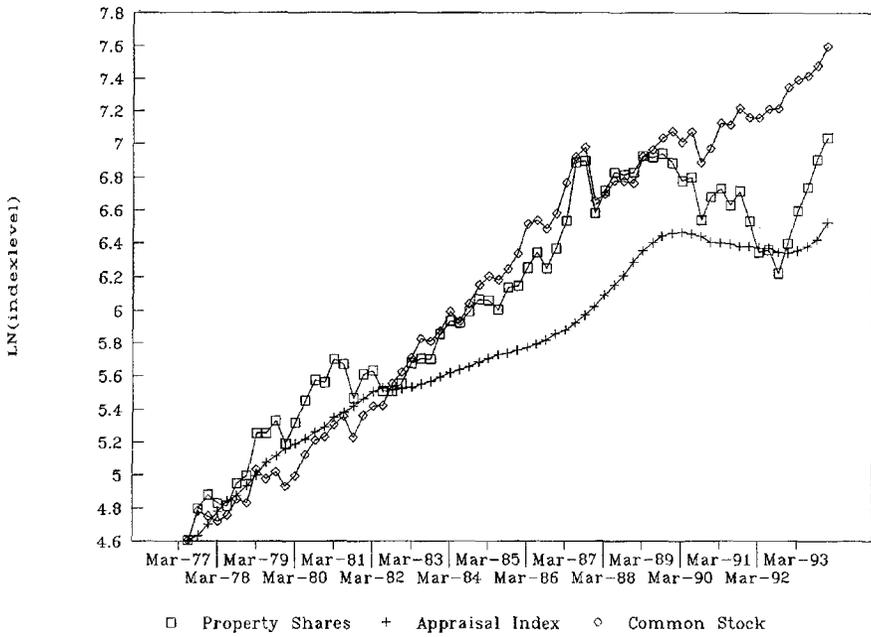
Figure 2. United Kingdom: Property shares, appraisals and stocks.

reasons. The first is the large real estate component in the value of corporate assets. For the United States, Zeckhauser and Silverman (1983) estimate the share to be between 25 and 40%, while Brueggeman, Fisher, and Porter (1990) report that about one-third of the total assets of the Fortune 500 is real estate. The second reason is that changes in the discount rate and in expectations of long-term economic growth are likely to influence both real estate and the value of corporate assets in the same direction. Finally, property shares are included in the stock market indices which we use.

Although the relationship between property share returns and the stock market is strong for all three countries, the nature of this relationship varies, as can be seen in Table 2. We find that the stock market betas differ by country. To examine whether these differences are significant, we do a simple *t*-test for the equality of each pair of betas. The results are presented in the right panel of Table 2. The stock market beta of United States property shares appears to be significantly lower than the beta of the other countries, while the differences across the other countries' betas are not significant.

Unfortunately, our sample of three countries is too small to do any formal cross-sectional test of potential factors influencing the different betas. However, we can give some intuitive explanations. One explanation could be the type of lease contracts used. If contracts and rents are renewed often, property companies' cash flows are highly dependent on tenants' cash flows, and betas should be high. In the United States, lease contracts are for five years with fixed rents, while the typical contract in the United Kingdom is for 25 years with
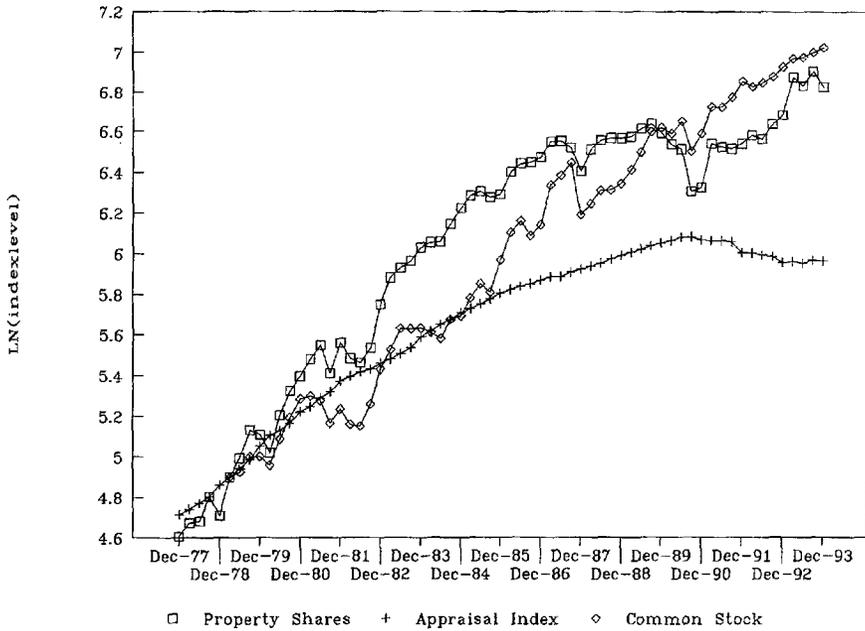
Figure 3. United States: Property shares, appraisals and stocks.

Table 2. Property share returns and stock market returns.

| | α | β | R^2_{adj} | Equality Tests of Beta Pairs, *t*-Values | |
				β_{Canada}	$\beta_{United\ Kingdom}$
Canada	−0.03	1.23	0.26		
	(0.02)	(0.34)			
United Kingdom	−0.01	1.09	0.62	0.39	
	(0.01)	(0.11)			
United States	0.01	0.73	0.43	1.41	2.42
	(0.01)	(0.10)			

Note: Standard deviations are denoted in parentheses.

upward-only rent adjustments every five years. In Canada, the most common lease contract is for two to five years with fixed rents. Comparing this with the betas in Table 2 gives a mixed picture. Canada, with the shortest contract period, has indeed the higher beta, but the United Kingdom, where contract periods are longest, has a beta which is not much lower.

In the literature, several other explanations of property shares' betas have been given. Gyourko and Keim (1992) argue that a positive relationship exists between the size of the sample of property shares and the level of diversification of that sample, which, in its turn,

is inversely related to the stock market beta of the sample. In Table 1, the sample size is given in terms of the market values of the indices used, and in terms of the number of funds included in the indices. Both the market values and the number of firms show a negative relationship with the betas reported in Table 2. However, our sample of three countries is far too small for any firm conclusions in this regard.

Allen and Gale have proposed market liquidity as another explanatory variable for beta (Working paper, University of Pennsylvania, 1991). Less liquid stocks are argued to be relatively volatile, and therefore to have a high beta. The United States, where we find the lowest beta, probably has the most liquid market for property shares. However, the British market for property shares, which is also highly liquid, shows a high beta. Another possible explanation of beta is information. Khoo, Hartzell, and Hoesli (1993) argue that the level of information about stocks is inversely related to their betas. In a formal test, they find that information is a significant explanatory variable of the decline of the betas of property shares in the United States. Of course, this could also hold cross-sectionally across countries, but we have no data on potential information proxies such as volume or the number of analysts following the market, and are therefore not able to investigate this possible explanation of the differences in the betas.

The last explanatory factor for property shares' betas could be their leverage: the higher the leverage, the larger the beta. Again, data limitations prevent us from investigating this possibility in depth, but we can make some tentative remarks. Although we do not have data on the leverage of the property companies included in the indices, we do have information on tax regulations in the three countries which we study. The relationship between taxes and financial leverage has been well documented in the financial economics literature. Tax rates and leverage are positively related. In our sample, tax regulations regarding property companies differ substantially. In the United States, property companies are treated like investment funds. They are tax-transparent: if they distribute the bulk of their profits to their shareholders each fiscal year, they do not have to pay corporate taxes. In Canada and the United Kingdom, property companies are treated like ordinary corporations and have to pay corporate taxes, 45% and 35%, respectively. Given the expected positive relationship between taxes, financial leverage, and corporate risk, this would imply the following expected ranking by beta: Canada, United Kingdom, United States. Although this is the order which we reported in Table 2, the sample is too small for any conclusions in this regard.

Thus, we must conclude that the causes of differences in property shares' betas across countries remain unclear. To obtain more insights into these causes, a larger sample of countries is needed. We will leave that for further research, and will now move on to the other main subject of this article: the relationship between property share returns and appraisal-based returns.

3. Property share and appraisal-based returns

Based on empirical results for the United States, property share indices have been argued not to be good indicators of real estate returns. This is due to the low contemporaneous correlations worth they exhibit to other known real estate indicators, usually on an appraisal basis. In section 1, based on sample statistics, we have confirmed this finding, both for

the United States and for the other countries in our sample. In this section, we investigate the relationship between property shares and appraisal-based indices more thoroughly.

Giliberto (1990), Gyourko and Keim (1992), and Geltner (1992) show that property share returns for the United States are significantly related to appraisal-based returns. Giliberto regresses the returns of equity property shares on common stock and bond returns, and does a similar regression with the Frank Russell Company (FRC) appraisal-based returns index as the dependent variable. He finds the residuals of these regressions to have a positive and significant correlation. He also regresses the current FRC residual on the current and past property share residuals. Fifty percent of the variation of the FRC residual can be explained in this way. This leads him to conclude that these residuals are influenced by a common factor, namely pure real estate. Thus, property shares are real estate with an important common stock characteristic: liquidity.

Gyourko and Keim argue that even if appraisals are perfectly accurate, changes in real estate market conditions will only slowly be incorporated into the appraisal-based index. One would expect appraisal-based indices to be lagging the underlying value by half the average time interval between two appraisals. The underlying real estate of the Russell–NCREIF Property Index is appraised with frequencies from quarterly to annually. This means that one would expect the property share index to lead the appraisal index by an interval of anywhere between six weeks to two quarters. Gyourko and Keim test regression models of the Russell–NCREIF returns on property share, stock, bond, and housing returns. Property share and housing returns appear to be significant predictors of appraisal-based returns.

Geltner proposes an approach to recover the true underlying market returns from appraisal-based index returns. His methodology involves a model which relates observed index returns to the unobserved market returns. The model corrects for appraisal smoothing by the appraiser, and corrects the appraisal-based index for construction effects of temporal aggregation and seasonality of reappraisals. Geltner applies the methodology to the Russell–NCREIF Index and the Evaluation Associates Index and compares the thus obtained estimates of real estate market returns to the unlevered NAREIT index. He finds a close relationship between them, although the NAREIT index is more noisy in the short run and leads the estimated market values by about a year.

To inquire into the relationship between property share returns and appraisal-based returns, we first use an approach similar to the one used by Gyourko and Keim, where current appraisal-based returns (A_t) are regressed on lagged property share returns (R_{t-1}). We also include an autoregressive term with a lag of one quarter in the equation to cope with the autocorrelation in the appraisal-based indices. This gives the following equation

$$A_t = \alpha_0 + \alpha_1 A_{t-1} + \alpha_3 R_{t-1} + \mu_t, \tag{1}$$

in which α_j are coefficients, and μ_t is a standard error term. The regression results are given in Table 3, model (1). For all three countries, the autoregressive term is highly significant, while the relationship between lagged property share returns and current appraisal-based returns is significant for all countries except the United States. The adjusted R^2s for this regression vary from 0.39 for Canada to 0.64 for the United Kingdom. The autore-

Table 3. Appraisal-based and property share returns.

$$A_t = \alpha_0 + \alpha_1 A_{t-1} + \alpha_3 R_{t-1} \qquad\qquad (1)$$

$$A_t = \alpha_0 + \alpha_1 A_{t-1} + \alpha_2 A_{t-4} + \alpha_3 R_{t-1} \qquad\qquad (2)$$

$$A_t = \alpha_0 + \alpha_1 A_{t-1} + \alpha_2 A_{t-4} + \alpha_3 R_{t-1} + \alpha_4 R_{t-4} \qquad (3)$$

	Model	α_0	α_1	α_2	α_3	α_4	R^2_{adj}	DW
Canada	(1)	0.01	0.54		0.05		0.39	2.10
		(1.58)	(3.49)		(1.99)			
	(2)	−0.00	0.13	0.82	0.07		0.79	1.65
		(−0.74)	(1.16)	(7.47)	(4.00)			
	(3)	−0.00	0.09	0.78	0.07	0.02	0.80	1.71
		(−0.09)	(0.80)	(6.99)	(4.20)	(1.29)		
United Kingdom	(1)	0.01	0.78		0.05		0.64	2.04
		(1.76)	(9.74)		(2.94)			
	(2)	0.01	0.79	−0.03	0.05		0.62	2.11
		(1.70)	(7.66)	(−0.32)	(2.58)			
	(3)	0.01	0.78	−0.03	0.05	0.00	0.61	2.10
		(1.69)	(7.17)	(−0.31)	(2.56)	(0.22)		
United States	(1)	0.00	0.70		0.03		0.49	2.70
		(1.65)	(7.59)		(1.34)			
	(2)	−0.00	0.31	0.58	0.03		0.68	1.93
		(−0.23)	(3.22)	(6.09)	(1.41)			
	(3)	−0.00	0.27	0.58	0.03	0.06	0.73	2.01
		(−0.95)	(3.13)	(6.60)	(1.78)	(3.34)		

Notes: *t*-values are denoted in parentheses.

All regressions are based on quarterly logarithmic returns.

DW is the Durbin–Watson test statistic for first-order autocorrelation in the regression residuals.

gressive term has most impact on the appraisal-based returns. The α_1 coefficient varies between 0.54 for Canada and 0.78 for the United Kingdom. The constant terms are zero for all three countries.

Since many properties are only appraised once a year, or are appraised four times a year, of which only one appraisal is performed by an outside appraiser, an autoregressive term with a lag of four quarters (A_{t-4}) would probably also have explanatory power over the appraisal-based return. This term is included in (2):

$$A_t = \alpha_0 + \alpha_1 A_{t-1} + \alpha_2 A_{t-4} + \alpha_3 R_{t-1} + \mu_t. \qquad\qquad (2)$$

The four-quarter autoregressive term appears only to be significant for Canada and the United States, as can be seen in Table 3, model (2). For these countries, the four-quarter, appraisal-based term is highly significant, and the inclusion of the term boosts the explanatory power of the regression model upwards: from 0.39 to 0.79 and from 0.49 to 0.68,

respectively. The economic significance of the A_{t-4} term is also high for both countries. The α_2 coefficient is 0.82 for Canada, and 0.58 for the United States. For the United Kingdom, on the contrary, this term is not significant at all, and it does not have any influence on the explanatory power of the model. These findings are confirmed if we also add another independent variable: property share returns with a lag of four quarters (R_{t-4}), as in the following equation:

$$A_t = \alpha_0 + \alpha_1 A_{t-1} + \alpha_2 A_{t-4} + \alpha_3 R_{t-1} + \alpha_4 R_{t-4} + \mu_t. \tag{3}$$

As can be seen in Table 3, model (3), this term is not significant for the United Kingdom, and does not influence the model's R^2, while it is significant for the United States, and influences the R^2s of both Canada and the United States. The results for the United States confirm those of Gyourko and Keim (1992).

Our findings suggest differences in the time lags between appraisal- and transaction-based indices. The next step in our analysis involves a closer look at these time lags. We estimate by how much time the property share returns lead the appraisal-based returns. Until now, we have used quarterly observations for all series. However, for the property share returns, we also have monthly observations. Using these can give a more detailed picture of property share returns' lead over appraisal-based returns. With this data, we are able to test a model of the form

$$A_t = \gamma_0 + \gamma_1 A_{t-1} + \gamma_2 A_{t-4} + \beta_1 R_{t-1/3} + \beta_2 R_{t-2/3} + \beta_3 R_{t-3/3} + \beta_4 R_{t-4/3}$$

$$+ \beta_5 R_{t-5/3} + \beta_6 R_{t-6/3} + \beta_7 R_{t-4} + \mu_t. \tag{4}$$

In this model, γ_j and β_j are coefficients, and $R_{t-i/3}$ is the monthly return on the property share index with an i-month lead over the appraisal index. The model is a distributed lag model. Based on the previous findings, we assume β_j to be zero for lags longer than six months, except for a lag of 12 months. According to the results in Table 3, we adjust this model slightly for each individual country. For the United Kingdom, we exclude the A_{t-4} and the R_{t-4} term, since they were found not to be significant. For Canada, the R_{t-4} term is excluded for the same reason. Only for the United States do we estimate the full model. The results are in Table 4. They look similar to the results for models (2) and (3). It is interesting to see that the transaction-based return with a lead of three months is significant for all three countries. For other lead-lengths, the significance differs by country.

Based on the coefficients in Table 4, determining the time lag between appraisal-based returns and property share returns is straightforward if we use impulse response analysis. In this approach, we investigate how a once-only increase in the transaction-based return R affects the appraisal-based return. We determine how much time it takes for the model to reach a steady state. In Figures 4 through 6, we provide plots of the cumulative response of a 1% increase in the transaction-based return. From these plots, it can easily be seen how long it takes for a market impulse to be completely absorbed in the appraisal-based returns. However, since the absorption process is asymptotical, it is more insightful to look at the half-life of an impulse. From the figures, we see a clear difference between Canada and the United States, on the one hand, and the United Kingdom, on the other. For the

Table 4. Appraisal-based and property share returns: The length of the time lag.

$$A_t = \gamma_0 + \gamma_1 A_{t-1} + \gamma_2 A_{t-4} + \beta_1 R_{t-1/3} + \beta_2 R_{t-2/3} + \beta_3 R_{t-3/3} + \beta_4 R_{t-4/3} + \beta_5 R_{t-5/3}$$

$$+ \beta_6 R_{t-6/3} + \beta_7 R_{t-4} + \mu_t \tag{4}$$

	γ_1	γ_2	β_1	β_2	β_3	β_4	β_5	β_6	β_7	R^2_{adj}
Canada	0.11	0.76	0.04	−0.01	0.09	0.08	0.07	0.08		0.83
	(0.96)	(6.59)	(1.41)	(−0.72)	(2.82)	(2.94)	(2.63)	(2.48)		
United Kingdom	0.73		0.04	0.03	0.11	0.07	0.02	0.03		0.67
	(8.77)		(1.05)	(1.11)	(3.30)	(1.72)	(0.56)	(0.79)		
United States	0.28	0.63	0.00	0.03	0.08	0.03	−0.02	0.08	0.06	0.74
	(2.91)	(6.20)	(0.10)	(0.93)	(2.35)	(0.69)	(−0.71)	(2.47)	(1.88)	

Notes: *t*-values are denoted in parentheses.

Results on the α_0-term are not presented here, since they are not relevant in determining the time lag between appraisal-based and property share returns.
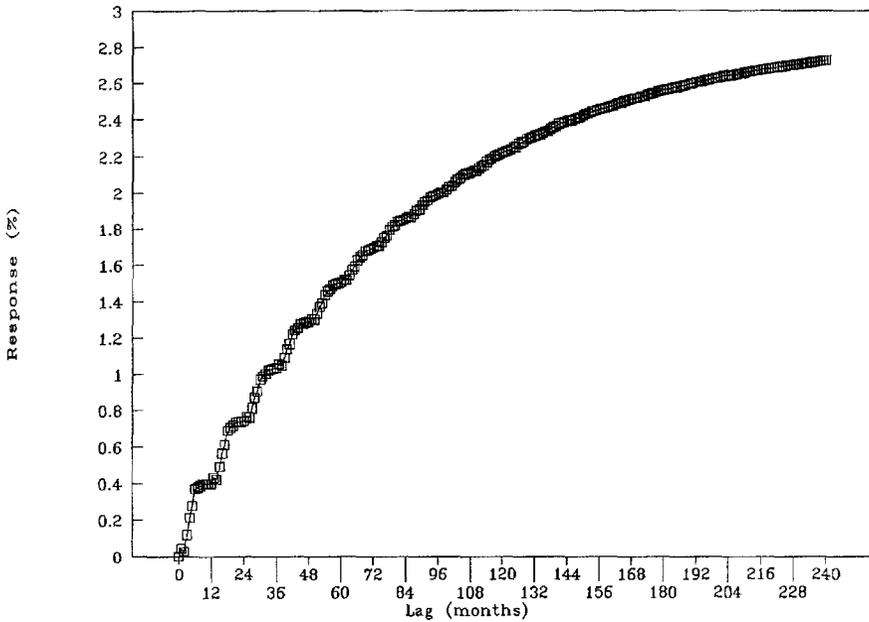

Figure 4. Canada: Cumulative response to market impulse.

latter country, the effect of the impulse dies down relatively fast. The steady state is reached after 60 months, and the half-life of the impulse is eight to nine months. A 1% increase in the transaction-based returns gives a cumulative increase of 1.13% in the appraisal-
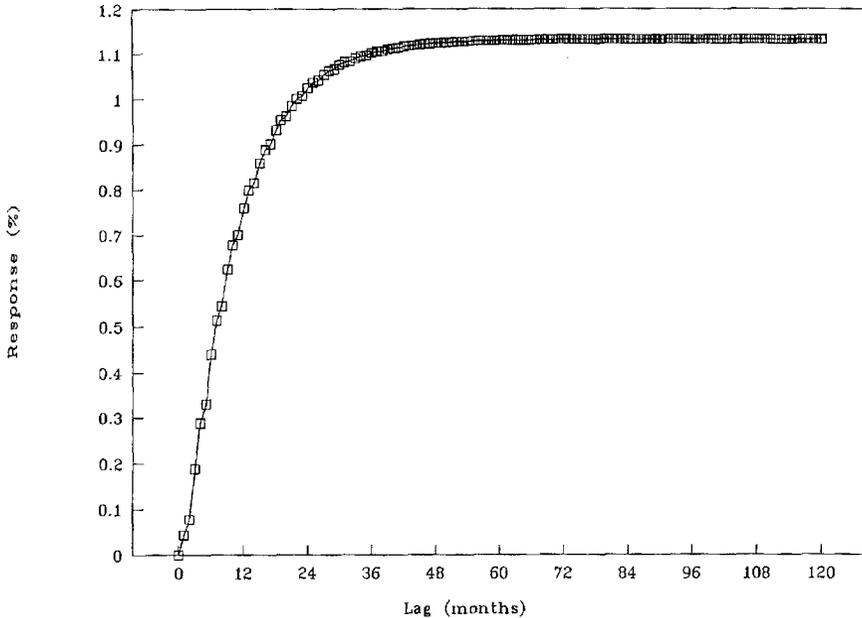
Figure 5. United Kingdom: Cumulative response to market impulse.

based returns for the United Kingdom. In the long run, one would expect a 1% impulse in the transaction-based returns to have a cumulative effect of 1% on the appraisal-based returns. The difference from 1% can probably be attributed to the standard deviations of the coefficients.

For Canada and the United States, we have a completely different picture. The model has clear trouble in getting to the steady state. After 240 months, the steady state has been reached in neither country. This effect is cause by the A_{t-4} term. Its significance brings persistence in the model. If we exclude this term, Canada and the United States show a pattern similar to the one that we found for the other country. Thus, we find clear differences in the time lags between appraisal- and transaction-based indices for different countries. This result suggests a difference between the appraisal process in North America, on the one hand, and the United Kingdom, on the other. It seem as if appraisals are more frequent in the United Kingdom than in Canada and the United States. However, we have not been able to find any such institutional differences.

The differences which we find could be attributed to the possibility that the indices are dominated by different kinds of real estate. Although all indices are spread over real estate classes, some classes could be more dominant in one index than in another. This blurs our picture of the relationship between transaction-based and appraisal-based real estate returns to some extent. Unfortunately, we have no way of solving this data problem.
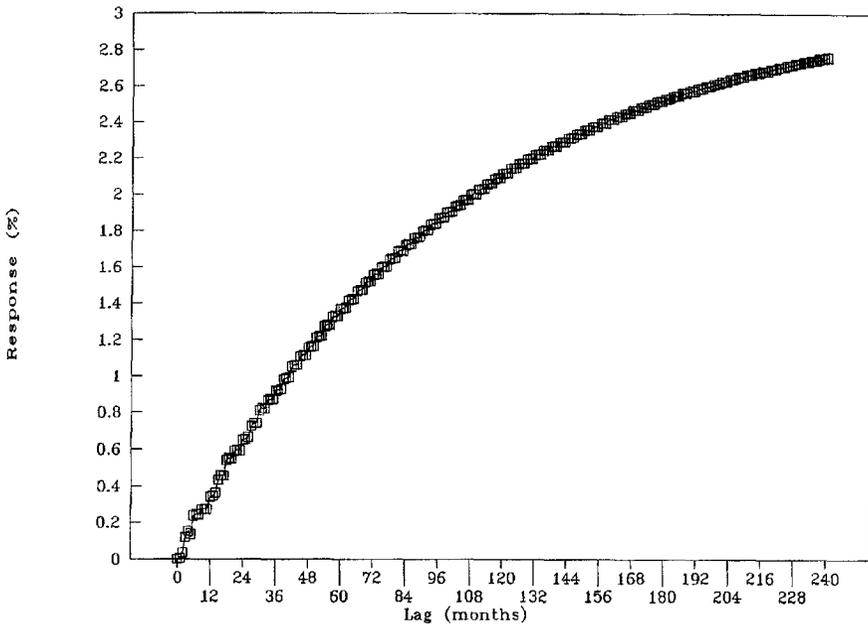
Figure 6. United States: Cumulative response to market impulse.

4. Conclusions

The conclusions of this article can be divided into two broad categories. The first concerns the relationship of property share returns to common stock returns. Our findings give an international confirmation of previous results for the United States, which report a strong contemporaneous relationship between property shares and the stock market on which they trade. We find the nature of this relationship to differ across countries. Due to data limitations, we are not able to explain these differences. However, we do have some tentative results which give directions for further research. Differences in tax regimes and size of the property share market look especially promising as explanatory variables for international differences in property share risk. Differences in rent contracts are another possible explanation. In order to do any formal cross-sectional tests, data from a more substantial number of countries than three are needed. Given the fact that property companies exist in 30 countries, this should be no problem.

The second issue with which this article is concerned is the relationship between property share returns and appraisal-based returns. We use some simple regression models to get a first insight into this relationship. The results show significance for all three countries in our sample. Appraisal-based returns appear to be determined to a large extent by their own history and the history of the real estate market. Again, however, the exact nature of this relationship varies. More specifically, the time lag between property share returns and

appraisal-based returns is not the same for each country. In the United Kingdom, appraisal-based returns incorporate market returns in a more timely fashion than in Canada and the United States. Based on the coefficients of a distributed lag model, we do impulse response analysis to measure the length of the time lag more precisely. For the United Kingdom, we find lags of about half a year. For Canada and the United States, our results are not very clear.

Again, data limitations preclude a further investigation. Using separate indices for different kinds of investment categories, such as offices, shops, and warehouses, the relationship between transaction-based and appraisal-based returns could be determined more precisely. For appraisal-based indices, these disaggregations are available, but for property share indices, they are not. Constructing these indices will, therefore, be a crucial first step for further research in this area.

Acknowledgments

Notes

1. In the United States, property companies which invest in property and manage a portfolio of real estate are generally called Real Estate Investment Trusts (REITs). Since this article is international in scope, we use the term property companies, even if we refer to United States' REITs.
2. As far as we know, publicly listed property shares exist in 30 countries—for Europe: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom; for North America: Canada and the United States; for the Far East: Australia, Hong Kong, Indonesia, Japan, Malaysia, New Zealand, the Philippines, Singapore, Taiwan, and Thailand; and for the rest of the world: Argentina, Mexico, and South Africa. Listed developing companies exist in more countries, but their returns do not reflect real estate returns as directly.
3. Liu, Hartzell, Grieg, and Grissom (1990) conclude, for the United States, that the market for property shares (they use REITs) is integrated with the stock market, even though the commercial real estate underlying these property shares is segmented from the stock market.
4. See Morrell (1991) for a description of the appraisal-based real estate indices available in the United Kingdom.
5. The Russell Canadian Property Index™ is a trademark of the Frank Russell Company. NCREIF stands for National Council of Real Estate Investment Fiduciaries. The Russell–NCREIF Index was previously called the Frank Russell Company (FRC) Index.
6. Exact information on the index composition and the changes in that composition over time is not available to us.

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