Market Fundamentals, Risk and the Canadian Property Cycle: Implications for Property Valuation and Investment Decisions

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Abstract. The dramatic decline in commercial property values in recent years has changed popular perception about real estate investment risk. This paper aims to generate new insights into real estate investment risk and its implications for real estate valuation. It shows that the risk premium on unsecuritized commercial real estate varies over time and is strongly related to general economic conditions. A vector autoregressive model developed to forecast real estate returns reveals that time variation in real estate risk is partly predictable, and thus can help us to forecast future movements in commercial property values. The analysis suggests that in periods surrounding major market movements, changes in commercial property prices are driven more by changes in expected (required) returns than by changes in current and expected future property income. Changing expected returns may reflect rational revisions of real estate investment risk, or alternatively investor psychology or sentiment.

Introduction

In the past fifteen years real estate has emerged as an important component of many institutional investment portfolios. Growth in the percentage of pension fund portfolio assets allocated to real estate is due in part to the large number of studies reporting that real estate returns are comparable to those of other asset classes, generally uncorrelated with stock returns, negatively correlated with bond returns and positively correlated with both expected and unexpected inflation. Hence, real estate offers attractive risk-return characteristics, provides important diversification benefits within mixed-asset portfolios, and acts as a hedge against inflation.

Recent events in the Canadian real estate and financial sectors, however, have led many to question real estate's role in investment portfolios. Specifically, a number of banks, trust companies and insurance companies heavily exposed their portfolios to real estate risk at the peak of the last real estate cycle and subsequently suffered huge losses when the market turned down. This behaviour suggests a lack of clear understanding of real estate market fundamentals, investment risk and the relationship between real estate and other asset classes held in institutional portfolios. It also suggests that continued growth of institutional real estate investment depends critically on two factors: (1) investors' ability to accurately measure real estate investment risk and return, and (2) investors'

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understanding of the relationship between real estate assets and other assets in their portfolios.

The objective of this study is to obtain new insights into the determinants of commercial property prices over the Canadian property cycle, and the implications for real estate investment strategies. It investigates the linkages between economic and real estate cycles, the effects of market cycles on pricing and property income, and the implications for buy-and-sell decisions.

The remainder of the paper has four main components. The first is the construction of a time series of real estate returns dating back to 1978. This involves combining and then unsmoothing the Morguard Property Index and Frank Russell Canadian Property Index (RCPI) appraisal-based real estate return series. The second part of the paper uses the constructed real estate return data to determine the stylized facts about Canadian property cycles. It analyzes the timing of real estate cycles and their linkages with both real estate market data and general economic and financial data. This exercise highlights the extent to which real estate and financial assets are affected by common economic forces, which in turn provides insight into how real estate risk varies with economic conditions.

The exploratory analysis in the second part of the paper sets the groundwork for a formal investigation of the determinants of real estate risk in the third part. Specifically, this section addresses the following questions: (1) How do changing economic conditions affect the risk premium to real estate—is it related to general business cycle conditions? and, (2) Do risk premiums on real estate, stocks and bonds move together, where the real estate risk premium is defined as the difference between the return to real estate and the risk-free rate (e.g., T-bills)? A multi-factor model, which relates changes in asset risk premiums to movements in a common set of economic and financial variables, is employed to investigate these issues. The exploratory analysis in the second part guides the selection of variables to be used in the model.

Part four of the paper investigates the implications of predictable variation in real estate risk for property valuation and market timing, or buy/sell decisions. If variation in real estate risk (expected return) is partly predictable and related to business cycle conditions, then investors may be able to benefit from market timing. This section develops a forecasting model that simultaneously generates predictions of total real estate returns and property income. The model forecasts are combined with a trading rule to produce "buy," "sell" or hold signals to help investors time their purchase and sale decisions over the cycle. The forecasting model is also used to investigate the relative contributions of real estate market fundamentals and capital market influences on property price volatility.

The final section of the paper summarizes the results and discusses their practical relevance to the decisionmaking of real estate market participants.

A Time Series of Canadian Income-Property Returns

A prerequisite to studying real estate cycles is a historical time series of commercial property returns. The key source, or benchmark, of Canadian investment performance is the Frank Russell Canadian Property Index (RCPI), an index of institutional-grade commercial property returns, extending from December 31, 1984 to the present.[1] Though

an important source of information, the RCPI tracks only one decade of real estate performance, or one cycle, too short a time frame to document stylized facts about real estate price cycles. To generate a longer time series, the Morguard Property Index is combined together with the Russell Canadian Property Index to form the Morguard/ Russell Canadian Property Index (MRCPI), extending from 1978 onwards.[2]

A widely recognized limitation of all benchmark real estate return series, is that the capital or appreciation component of index returns is determined primarily by changes in appraised property values. With infrequent trading of properties there is not sufficient transaction data to generate a market-determined index of real estate returns.[3] It is believed that the use of appraisals as a substitute for actual transaction prices causes benchmark performance measures such as the MRCPI to lag actual property market conditions and to understate the true volatility of property returns. Smoothing, therefore, complicates portfolio allocation and market timing (acquisition and disposition) decisions.

The good news is that with an understanding of the causes of smoothing, a model can be developed to undo the lags in, or "unsmooth," the data. As a result we can infer a "true" property value series offering a more accurate picture of what is happening in the market today and what happened in the past. In this paper, the MRCPI appreciation returns are unsmoothed using the procedure developed by Geltner (1993) and Barkham and Geltner (1994) (see also Fisher, Geltner and Webb, 1994). Applying this unsmoothing methodology to the Canadian appraisal-based return data, Clayton and Hamilton (1996) find that annual appraisal-based appreciation returns can be unsmoothed to recover an estimate of the underlying true property value index, by adjusting the MRCPI appreciation returns in the following way:[4]

$$ar_t = \left(\frac{ar_t^* - (0.35)ar_{t-1}^*}{0.65} \right) \qquad (1)$$

where ar^* is the observed MRCPI appreciation return, ar is the unsmoothed return, t indicates the current year and $t-1$ the prior year.

Exhibit 1 shows the capital (value) component of the MRCPI and the simulated property value series where the appraisal-induced lags have been removed using equation (1). While the two series follow the same general trend, they do exhibit different behaviour in periods of large price fluctuations. Unsmoothed prices rise more quickly and go higher in market upswings, and fall faster and further in market downturns, as compared to the appraisal-based values. Hence, the results match up well with the perception that the MRCPI lags actual market conditions and fails to capture the timing of major movements.[5]

To generate a time series of total real estate returns we first create an index of property income or income, from the published MRCPI capital and income return data.[6] The NOI series is then applied to the unsmoothed value index to generate a simulated income return index.[7] This new income return series is combined with the simulated value data to derive the total return series. The unsmoothed data forms the basis of the analysis to follow in the remainder of the paper. It is important to keep in mind, therefore, that the accuracy of the results of this study are conditional on the accuracy of unsmoothed real estate return series.

Exhibit 1
Commercial Property Values: MRCPI versus an Unsmoothed Value Index

——— MRCPI Value Index   – – Unsmoothed Index
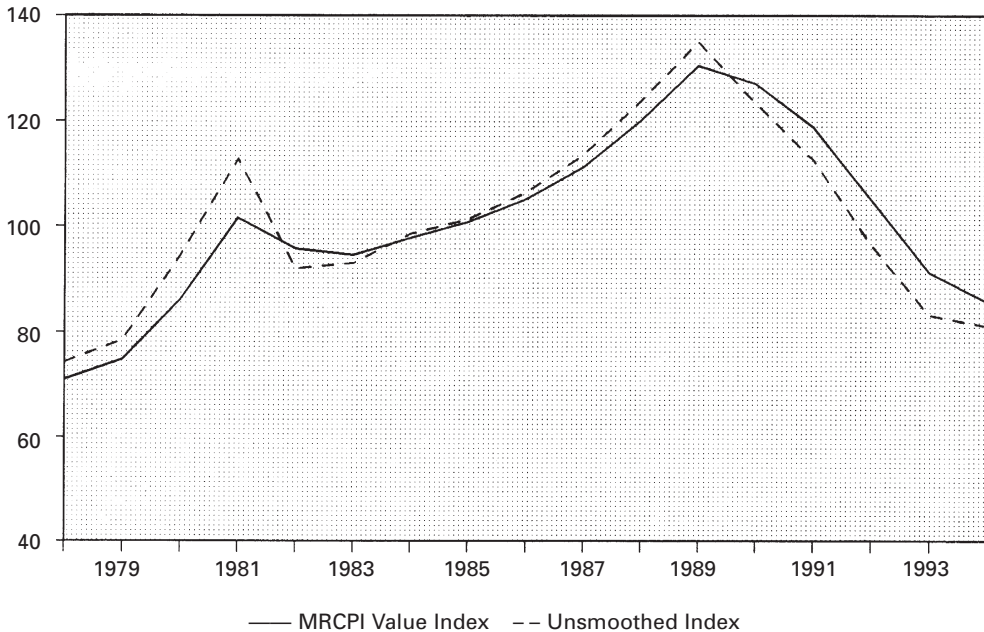
Both series are scaled so that their average values are set to equal 100.

An Analysis of Commercial Property Cycles

This section examines the commercial property cycle in Canada. Specifically, it provides a descriptive analysis of past cycles, investigates the relationships between property cycles and wider economic cycles and examines the linkages between real estate cycles and those experienced by financial assets. The principal aim is to highlight the extent to which real estate and financial assets are affected by common economic forces, which may in turn yield new insights into how real estate risk varies over time and ultimately impacts upon property valuation.

The value series in Exhibit 1 clearly illustrates the cyclical nature of the commercial property market over the past fifteen years, as evidenced by distinct periods of market upswings followed by subsequent downturns in total real estate returns. The data also reveal that we have gone through two complete cycles since the mid-1970s. What factors drive variation in property values over time?

Property values change as a result of revisions in expected property income and/or required returns (investment yields). Exhibit 2 compares the year-to-year percentage change in property values with the percentage change in property income (NOI). It is apparent that variation in property cash flow is an important component of price volatility, as the two series exhibit the same general patterns over the two cycles. This is not the whole story, however, as the link between price and income growth weakens in

Exhibit 2
Commercial Property Price Movements versus Changes in Property Income

— Property Value   – – Net Operating Income
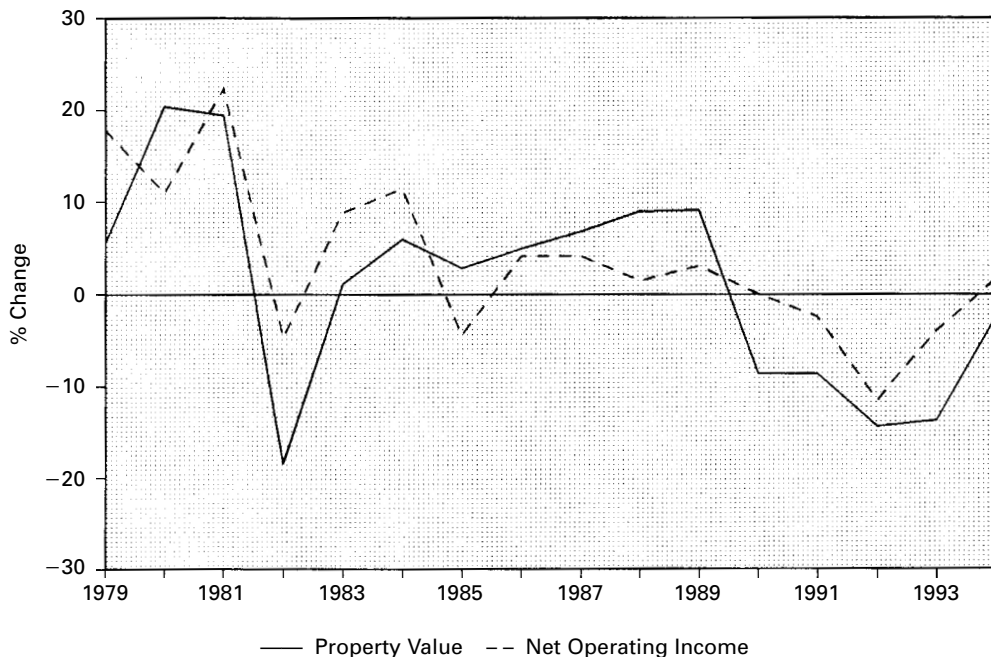
periods of significant market movements. Price movements exhibit wider swings than changes in NOI in these same periods.

These two observations suggest that changing required returns (yields) play a more important role in price determination in periods surrounding major market turning points. To see this, compare price and NOI growth in the years prior to the severe downturn of the late 1980s/early 1990. The rate of growth in property income peaked in 1986 and decreased steadily thereafter until 1993. This contrasts sharply with the behaviour of commercial property prices, which continued to grow for two additional years and eventually crashed at a much faster rate than property income fell.

While this behaviour is consistent with a market that consistently guessed wrong about NOI growth, it is also consistent with a market in which, at times, changes in commercial property values are driven more by changes in the market's required returns than by changes in the market's expectations of future NOI. That is, capital market influences become relatively more important than real estate demand and supply fundamentals (i.e., income) in real estate pricing during these periods.

Alternatively, these price dynamics could be the result of mispricing in periods surrounding episodes of wide swings in market conditions; real estate values detach from fundamental or intrinsic values. In this case, the price of commercial property is driven not only by current and expected future market fundamentals (supply and demand factors) but also by investor sentiment. That is, investors may follow technical trading

rules and base future resale price projections on recent price changes rather than rational projections of future market conditions, and thereby "jump on the bandwagon" and pay overinflated prices for properties when prices are rising. If real estate cycles are driven in part by irrational expectations or investor psychology, rather than changes in market fundamentals, property values will exceed intrinsic or fundamental values in market upswings. Eventually, the "bubble" collapses and prices return to fundamental or intrinsic value.

Real Estate and the Economy

Real estate cycles are in part determined by the wider economic or business cycle. General economic conditions impact on commercial property values in two ways. First, the demand for space in real estate user markets is directly linked to the state of the economy, and specifically the demand for the goods and services produced by the firms that occupy space. Change in net operating income is therefore strongly influenced by the rate of economic (GDP) growth. Second, the rate at which property income is capitalized into property values (required returns) is a function of general capital market conditions, which are related to the stage of the economic cycle.[8]

Exhibit 3 displays the relationship between total real estate returns, property income, and Gross Domestic Product (GDP) over the 1979–1994 time period (all values are

Exhibit 3
Real Estate and the Economy
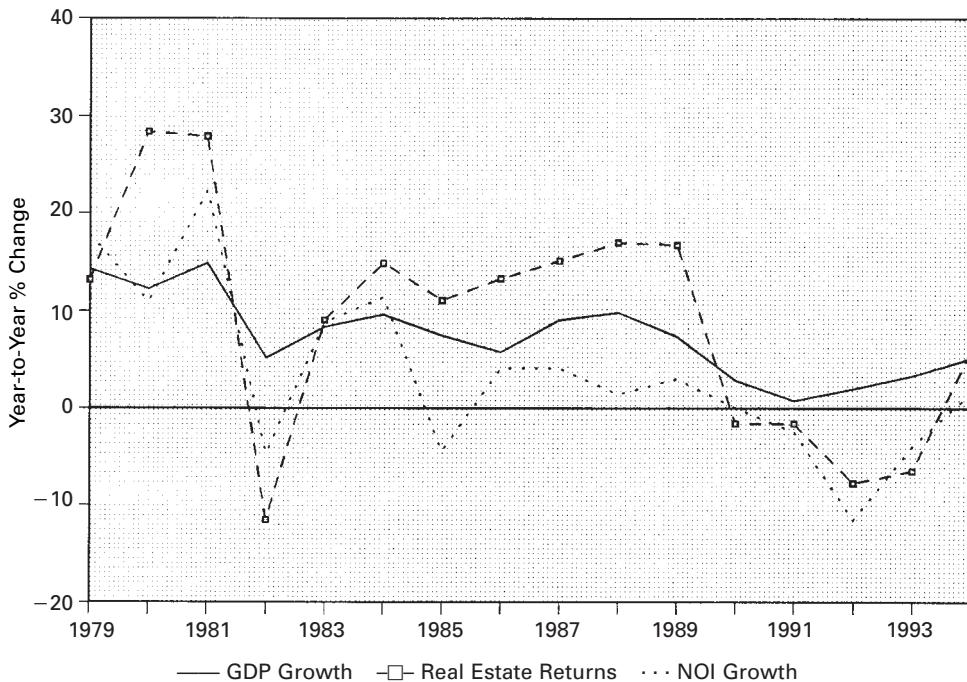
nominal or unadjusted for inflation). Looking first at total returns and GDP growth, the two series follow the same general pattern, with the exception of the 1979–1981 period. It does appear, however, that real estate returns tend to pick up prior to GDP growth, hang on a little longer near the end of each expansionary phase, and exhibit significantly wider swings in the two cycles. The correspondence between property income growth and general economic growth seems to be stronger than that between GDP and total returns. This observation, along with the relatively larger movements in property values in both cycles, suggests that changes in expected returns play a crucial role in price determination during periods of large price changes.

This finding is consistent with the conclusion reached above concerning the relative impacts of price and income changes on total returns (seen in Exhibit 2). Fluctuations in commercial property values are driven by both changes in expected future property income and changes in expected returns (or possibly investor overreaction to good economic news and, hence by investor sentiment). The relative contribution of these components appears to change over time. It is important therefore that market participants are aware of which factor is the primary driving force when making property valuation and investment decisions.

Risk Premiums and the Economic Cycle

Based on the above descriptive analysis it is evident that real estate *returns* are strongly influenced by the economic cycle. This section looks at how real estate investment *risk* varies over the business cycle and compares it with the risk of common stock.

Typically, investors derive their required return for real estate investment as the sum of the risk-free rate (i.e., a default-free rate such as that on government bonds) plus a risk premium. We can turn this around and derive a real estate risk premium series by subtracting the one-year T-bill rate from unsmoothed total property returns. Exhibit 4 displays the resulting (ex post) risk premiums, or returns in excess of the risk-free rate, for both real estate and common stock, along with growth in real GDP.

It is apparent that the real estate risk premium varies widely over time. Exhibit 4 also reveals that real estate risk premia are highly correlated with real GDP growth, but not with excess stock returns. Statistical analysis confirms this, as the correlation between real estate risk premia and GDP growth is 0.76, between stock risk premia and GDP is 0.27 and between stock and real estate risk premia, only 0.19. Moreover, the correlation between real estate risk premia and real GDP growth is significantly different from zero, whereas the correlation coefficient between stock risk premia and real GDP growth is not statistically different from zero. This supports the conjecture that real estate and stock risks behave differently over the economic cycle. These findings are consistent with a positive, but low, correlation and systematic risk between total real estate and stock returns, and hence suggest an important role for commercial property in mixed-asset portfolios.

The analysis up to this point provides support for the notion that *both* expected real estate return and cash flow expectations change over time. Moreover, changes in the market's expected return are related to general economic conditions, and may therefore be partly predictable. Specifically, if we can forecast real GDP growth, then given the relatively high correlation between the real estate risk premium and this variable, we may be able to forecast future excess real estate returns (risk premiums).

Exhibit 4
Risk Premiums and the Business Cycle
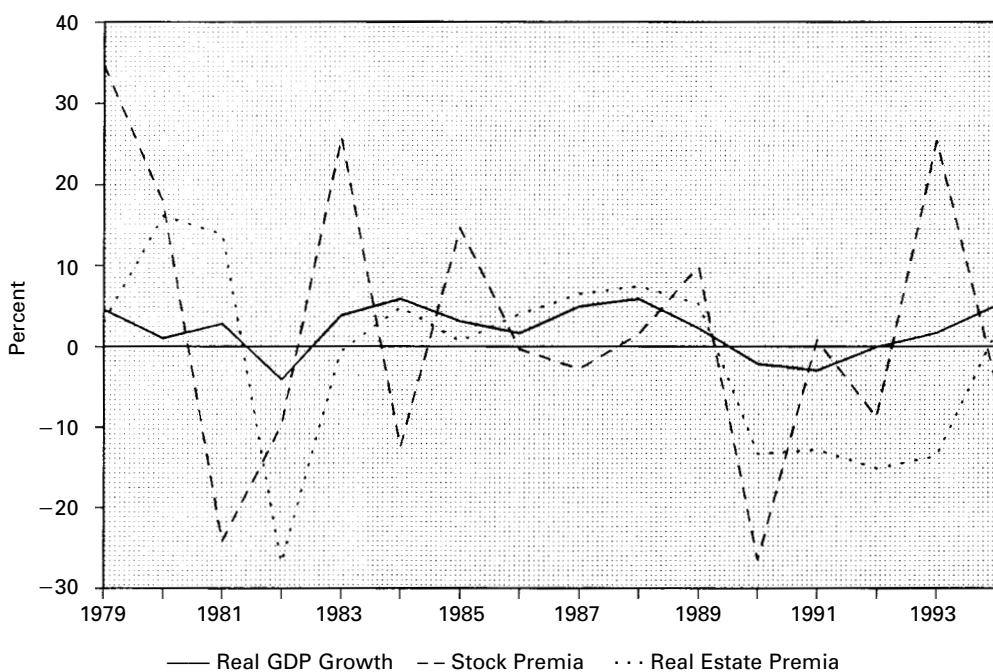
Risk premia are measured as total annual asset return in excess of the one-year T-bill rate.

To investigate this possibility, a regression model for forecasting real GDP growth is developed. Specifically, the ability of current observations on the term structure of interest rates, the current one-year T-bill rate and the Price/Earnings multiple on the Toronto Stock Exchange (TSE) 300 Index to explain growth in GDP over the next year is examined. These specific variables are chosen because they all incorporate the "markets" expectations about the future direction of the economy, and are commonly found in leading indicators of future economic activity.[9] There are additional variables one could use, but given the relatively small number of datapoints available, it is important to limit the number of explanatory variables.

The term structure of interest rates (Term) is measured as the difference between long-term federal government bonds and the one-year T-bill rate. All else being equal, we would expect a steeper yield curve to imply slower economic growth in the future. Relatively higher future interest rates would be expected to dampen growth in real GDP. Hence, we should find an inverse relationship between the steepness of the yield curve (the term structure) and future growth in real GDP. Generally, higher current short-term interest rates, as measured by the yield on one-year T-bills, are associated with periods of economic expansion. Specifically, rates tend to rise following periods of strong growth as the Bank of Canada aims to slow inflationary pressures in the economy. We should therefore expect that higher T-bill rates today imply a decrease in GDP growth in the future.

The final explanatory variable is the TSE 300 price/earnings multiple. Stock prices fluctuate in part due to "news" about future economic conditions. Given current earnings, prices will rise in response to good news about future earnings, assuming required returns remain unchanged. Therefore, we would expect a higher price-earnings multiple to imply an expected increase in real GDP in the future. This may, however, only be a short-term relationship. That is, it may only hold true with monthly or possibly quarterly frequency data. In the longer term, there might actually be a negative relationship between future GDP growth and the current price-earnings multiple, because the cyclical increase in GDP predicted by relatively high stock prices may in fact be realized before a year has passed. Thus, it is difficult to predict the exact effect. We will have to let the data indicate the result.

The first row of results in Exhibit 5 reports the output for the GDP forecasting model.[10] The results are quite favourable. The three explanatory variables explain about 50% of the variation (R^2 is 0.47) in annual growth in real GDP over the 1979–1994 time period. Current T-bill yields and the TSE 300 price-earnings multiple are relatively more significant in forecasting future GDP than the term-structure of interest rates. The fact that this simple model has power to explain GDP growth suggests that the same three variables should be useful in forecasting real estate risk premia, in light of the high correlation between real estate risk premia and real GDP growth reported earlier in the paper.

The remaining two rows of Exhibit 5 report the ability of T-bills, the term structure and price-earnings multiple to forecast risk premia on stocks and commercial property, respectively. As might be expected given the relatively small correlation found between stock risk premia and GDP growth, the model has essentially no power to forecast future risk premia to common stock. Only about 9% of the variation in stock returns above the

Exhibit 5
Estimation Results: Forecasting Excess Returns

Dependent Variables	Explanatory Variables					
	Constant	T-bill(-1)	Term(-1)	P/E(-1)	R^2	Adj. R^2
RGDP	10.87	-0.764	-0.203	-0.033	0.47	0.35
	(3.95)	(3.10)	(0.39)	(1.85)		
ExTSE	26.05	-2.11	-0.367	-0.033	0.09	-0.12
	(1.22)	(1.10)	(0.09)	(0.24)		
ExRE	35.07	-2.67	-5.00	-0.137	0.42	0.29
	(2.10)	(1.79)	(1.57)	(1.25)		

Variable Definitions
   RGDP = year-to-year percent change in Real GDP
    T-bill = yield on one-year Treasury bills
    Term = yield on long-term government bonds minus the one-year T-bill rate
      P/E = price-earnings multiple for the TSE 300
 ExTSE = year-to-year percent change in the TSE 300 index minus the one-year T-bill rate
  ExRE = unsmoothed total real estate returns minus the one-year T-bill rate

Note: The numbers in parentheses below each coefficient estimate are the *t*-statistics associated with tests of statistical significance.

risk-free rate is captured by the three variables and none of the coefficients are statistically different from zero. In contrast, the forecasting model explains more than 40% of the variation in annual real estate returns in excess of the risk-free rate; real estate and common stock risks and returns behave quite differently over the economic or business cycle.

In summary, we have found that both real estate returns and risks vary over time and that the variation is strongly related to economic conditions. These results suggest that commercial property prices may be forecastable, and that major market movements may be detectable in advance. Hence, it may be possible to derive a model to forecast future expected returns and income, using currently available information. Such a model may be a useful tool to help investors in timing their acquisition and disposition decisions. It may also be beneficial for other market participants, including appraisers and lenders, for risk assessment and property valuation purposes.

A Forecasting Model for Real Estate Returns

The previous section showed that both property income and risk premiums vary over time and the variation is related to general economic conditions. Moreover, the variation in risk is partly predictable with currently observed financial data. Time variation in expected return above the risk-free rate has important ramifications for commercial property valuation. Property is typically valued using discounted cash flow (DCF) methods in which forecasts of future property income are discounted at a *constant* discount rate.[11] The finding of a time-varying real estate risk premium, that is partly forecastable, suggests that this constant discount rate assumption is invalid, and thus has important implications for property valuation. Specifically, by combining forecasts of required returns with forecasts of future property income we should be able to derive a better valuation model.

This section employs the techniques introduced by Geltner and Mei (1995) and estimates a vector autoregressive (VAR) model that simultaneously forecasts expected total returns (the discount rate) and property income using current observations on these variables and a small set of other currently observable variables. The model is first used to form fifteen-year forecasts of total commercial property returns and income. It is then shown how we can use the model's forecasts along with a simple trading rule to assist in market timing (acquisition and disposition timing decisions). Finally, the VAR model forecasts of expected returns and property income are combined with the present value model for real estate price determination that allows the expected discount rate to vary over time, to generate an improved present value model.[12]

The Forecasting Model

The forecasting model consists of a five-variable VAR system. The following variables are included in the VAR: total unsmoothed real estate returns, estimated net operating income (the level of property cash flow in dollars), the real estate sector subindex of the Toronto Stock Exchange (TSE) 300 Index (year-to-year percentage change), appraisal-based total returns (the MRCPI), and appraisal-based income returns.[13] With the exception of property income, which is measured in dollars, all the variables are percentage returns, based on nominal (unadjusted for inflation) values. The first two

series are our main concern and the ones we need to forecast to operationalize the modified present value model. TSE Real Estate returns are included because several U.S. studies have shown that REIT returns have power to predict future appraisal-based returns (see Gyourko and Keim, 1993, and Barkham and Geltner, 1995, for example), and Clayton (1995) reports that the TSE real estate component may be a leading indicator of RCPI returns over the 1985–1994 time period. While the relationship between real estate stock returns and appraisal-based returns is likely in part driven by the lags in the appraisal-based data, it may be that real estate values determined in the public stock market reflect changes in market conditions at a faster rate than the private (unsecuritized) market. Either way it seems reasonable to include TSE Real Estate returns into the forecasting model. Appraisal-based returns are included in the model because they are observed and used by real estate market participants. Moreover, recent price changes and income yields may be employed by investors to infer future market conditions, as they are in the stock market.

The VAR model consists of five regression equations, one for each of the variables discussed above. Each equation relates the current value of one variable to the values of all five variables in the previous year.[14] Exhibit 6 presents the model structure and contains the regression results. The model fits fairly well as evidenced by the R-squareds. More than one half the variability in unsmoothed total property returns and a significantly higher proportion of property income can be predicted with the previous

Exhibit 6
Vector Autoregressive (VAR) Model Estimation Results

Dependent Variables		Explanatory Variables						
	Constant	Re Ret (−1)	Inc. Ret (−1)	Income (−1)	App Ret (−1)	TSE RE (−1)	Adj. R^2	R^2
Re Return	−51.70	−0.757	6.544	1.567	−0.213	0.500	0.549	0.323
	(0.85)	(1.36)	(0.69)	(0.48)	(0.25)	(2.52)		
Inc Return	2.56	−0.011	0.912	−0.109	−0.052	−0.009	0.661	0.491
	(1.26)	(0.61)	(2.85)	(0.99)	(1.87)	(1.34)		
Income	1.71	−0.02	−0.011	0.866	0.029	0.011	0.862	0.793
	(0.55)	(0.71)	(0.02)	(5.17)	(0.67)	(1.12)		
App Return	−21.22	−0.302	3.439	0.090	0.398	0.206	0.736	0.603
	(0.85)	(1.32)	(0.87)	(0.07)	(1.15)	(2.52)		
TSE RE	−82.25	−1.97	24.618	−7.439	0.153	0.587	0.636	0.453
	(0.70)	(1.85)	(1.35)	(−1.19)	(0.09)	(1.55)		

Variable Definitions
  Re Return = total nominal real estate returns estimated by unsmoothing the MRCPI
  Inc Return = income return component of the MRCPI
  Income = estimated property cash flow level (net operating income) obtained from MRCPI income and appreciation return components
  App Return = total appraisal-based real estate return (the MRCPI)
  TSE RE = TSE 300 real estate index nominal annual percentage change

Note: The numbers in parentheses below each coefficient estimate are the *t*-statistics associated with tests of statistical significance.

years values of the five variables. This is encouraging given our aim is forecasting these two key quantities.

Forecasting Returns and Income

Exhibit 7 presents the historical model fit and VAR model forecasts for total unsmoothed property returns. It is evident that overall the forecasting model does a good job tracking actual return movements. Interestingly, in 1988 the model predicted a large drop in returns over the next year with returns expected to continue to fall. Actual returns however, increased over the next year and remained high for an additional year before crashing to the ground. A similar set of events took place in the early 1980s crash.

These findings suggest that in these time periods the market may have overreacted to good economic news, and hence overvalued real estate, and then subsequently overreacted on the downside and undervalued commercial property. This in turn suggests that successful market timing may be very profitable. It also further supports the idea that investors, appraisers, lenders, and other real estate market participants should attempt to track both current *market* and *intrinsic* property values.

The fifteen-year forecasts indicate that Canadian commercial property markets will perform strongly in 1996 and 1997, peak in the latter year and slowly decline until they bottom out sometime during 2003. The forecasts indicate that real estate markets exhibit

Exhibit 7
VAR Model Estimates of Total Real Estate Returns
Past Performance and Forecasts to the Year 2010
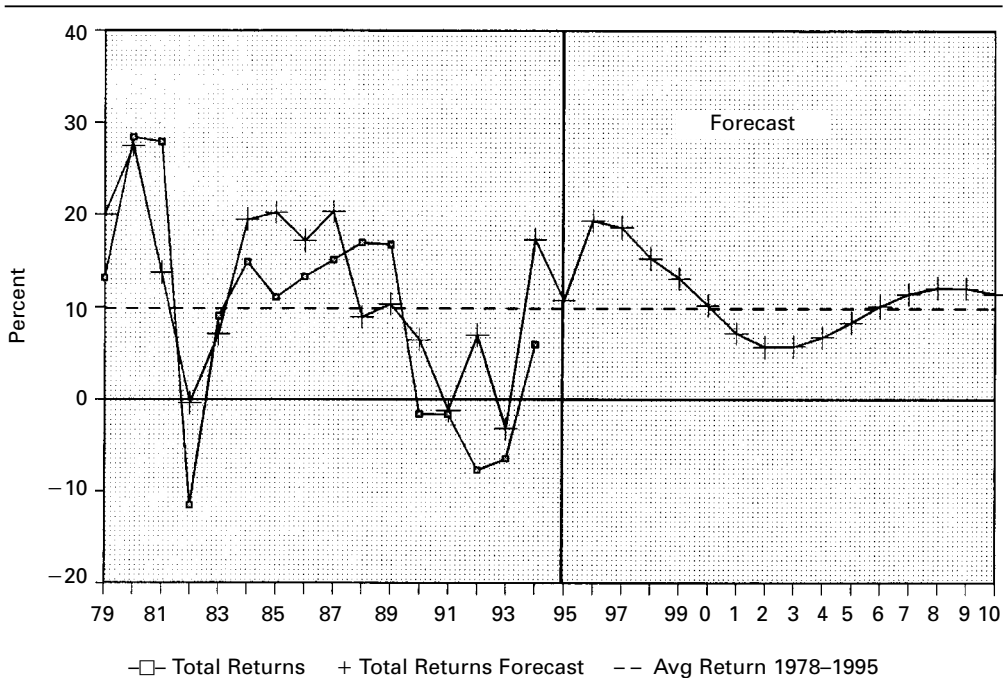
mean reverting behaviour; returns follow a cyclical pattern but slowly revert back towards their long-term average value.[15]

Using the Model to Aid in Market Timing

The case for real estate in pension fund portfolios is usually made based on real estate's strategic role as an asset class that provides important diversification benefits in mixed-asset portfolios and acts as a hedge against inflation, while at the same time offering competitive risk-adjusted returns. Given that real estate assets are relatively lumpy or indivisible and property markets are characterized by relatively high transaction costs, commercial property has generally been viewed as a long-term investment. Little attention has been devoted to the timing of purchases and/or sales. If a fund decided to allocate funds to real estate it did so on the basis of strategic portfolio allocation decisions and gave little thought about whether this was the "right" time to enter the market.

The dramatic decline in property values in the latest downturn has changed this thinking somewhat. Many investors who saw the values of their holdings plummet in 1990 were asking themselves why they did not see this coming. On the other hand, the recent downturn led many funds to search out good deals once they believed the market had bottomed out. Investors have begun to combine strategic portfolio allocation decisions with market timing decisions. The work in this paper suggests that market timing may be a fruitful endeavor. The manager who can buy low and sell high can potentially earn superior returns. While this is pretty obvious, the difficult part, of course, is implementation.

This section shows how the VAR forecasting model can be employed to assist in market timing decisions. More specifically, it illustrates how we can combine forecasts of total expected returns with a trading rule in an attempt to generate "buy" and "sell" signals. This may allow investors to take advantage of the predictability of expected returns.

To see how this might work consider the following strategy.[16] At each time period, use current observations on the five variables and the VAR model coefficients to forecast total (unsmoothed) property returns and the other variables in the next year. Then use the resulting forecasts and the VAR model to estimate total returns in the following year. In the end we have used the model to generate expected return estimates in each of the next two years.[17] We now compare these to some benchmark values, or develop a trading rule, in order to decide what the appropriate action is.

One possible trading rule is that if the VAR model forecasts that each of the next two years' total returns exceed the long-run average return (9.90% from the unsmoothed total return data), then this is a "buy" signal. If on the other hand it predicts two consecutive years of below-average returns, this is a "sell" signal. When neither a buy or sell signal is given we sit and wait for more information.[18] Notice a "sell" signal can also be taken to mean "don't buy" or "don't lend" for investors and lenders, respectively.

Exhibit 8 displays the results of implementing this trading strategy over the 1978–1994 sample period. More precisely, it shows the historical simulated or unsmoothed commercial property value index from Exhibit 1, and illustrates for each year the signal indicated by the VAR model and the trading rule described above.[19] Over this period the VAR model and our trading rule appear to perform quite well. Buy signals are indicated

Exhibit 8
Investment Timing Signals Based on the VAR Model and
Illustrative Trading Rule
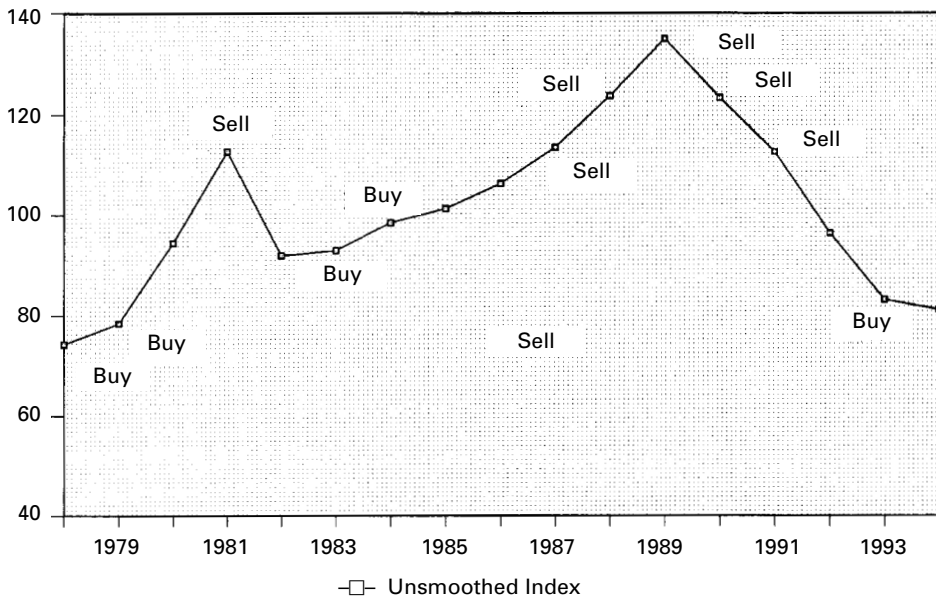
The series is scaled so that the average value is set equal to 100.

two and three years prior to the 1981 peak, again in 1984 and 1983 at the beginning of the market upswing of the late 1980s, and finally in 1993, the bottom of the latest cycle.

Sell signals are given at the peak of each of the two commercial property cycles. The model indicates sell in each of the two years prior to the 1989 peak, which at first glance might seem illogical given that prices continue to rise in the subsequent year. Upon further reflection and a reexamination of Exhibits 2 and 7, it appears the model detects that property is overvalued. That is, market values exceed intrinsic or fundamental property values. The more overvalued property is, the greater the likelihood of an inevitable correction, as prices are ultimately anchoured by market fundamentals. It is evident in Exhibit 2 that property income growth peaked in 1986 and this is reflected in the VAR model forecasts of Exhibit 7, which show that estimated total returns turn down two years prior to actual returns. An investor who obeyed the sell signal would have missed out on some short-term appreciation on the upswing but saved a great deal of financial pain over the last five years.

Property Valuation with Time-Varying Discount Rates

The forecasting model derived above appears to be a valuable tool for market timing decisions.[20] It forecasts both property income and expected total returns. It has been emphasized throughout the paper that the risk premium to commercial property investment is not constant, and its variation through time can have important implications for property price dynamics.

This section examines the present value model of real estate price determination with time-varying discount rates. It generalizes the traditional present value model, which combines cash flow forecasts with a *constant* expected return (discount rate), and allows both expected property income and expected returns to vary over time with economic conditions. This allows us to decompose real estate risk into cash flow and discount rate components, and also incorporate additional information into the valuation process. Ultimately, it may help us to better understand what is driving property price fluctuations (cash flow fundamentals or capital market factors?) and do a better job of valuing commercial property.

Commercial property is typically valued by estimating both expected future property income (or NOI) over a planned holding period, and reversion or sale proceeds, and then discounting these by a constant required return. That is, based on a planned holding period of n years, the current value of a property at time t, P_t, given forecasts of future net operating income, I_{t+i}, the future sale price, P_{t+n}, and the required return, R, is given by:

$$P_t = \sum_{i=1}^{n} \frac{I_{t+i}}{(1+R)^i} + \frac{P_{t+n}}{(1+R)^n}. \tag{2}$$

If, however, required returns change over time, then the present value model in equation (2) may be inaccurate. That is, failure to incorporate time variation in the discount rate may cause investors to either over- or undervalue potential property acquisitions.

To illustrate how time variation in expected returns can impact property valuation, consider the following scenario: an investor is considering an all-cash purchase of a property today (at time $t=0$) for price P_0. Income over each of the next two years is estimated to be I_1 and I_2, respectively. The investor believes the property can be sold for price P_2 at the end of two years. The current price should reflect the present value of expected future income. That is,

$$P_0 = \frac{E[I_1]}{(1+R)} + \frac{E[I_2] + E[P_2]}{(1+R)^2},$$

where R is the investor's required (expected) return on this project. $E[.]$ is the expectation operator and denotes that these are estimates or expected values—we do not know the income with certainty. In this world, the required return between any two successive years is constant.

To see how changing required returns impact upon property valuation, suppose the investor expects increased economic activity in the second year, and therefore demands a larger return in year 2 than in the first year to compensate for added risk. In this case, the maximum price the investor would pay for the property is given by:

$$P_0 = E\left[\frac{I_1}{(1+R_1)}\right] + E\left[\frac{I_2 + P_2}{(1+R_1)(1+R_2)}\right],$$

where R_1 is the required return over the first year and R_2 over the second. Under the time-varying discount rate scenario the investor would bid less for the property than under the constant expected return case. The greater risk associated with year 2 income results in

these being more heavily discounted.[21] This result suggests that in periods of economic growth, investors who fail to recognize the changing nature of real estate risk may overpay for property.

To directly investigate the effects of time-varying discount rates on commercial property valuation we need to generalize the present value model. Modifying equation (2) to allow for time-varying expected returns, the present value (price of a property at time t) takes the form,

$$P_t = \sum_{i=1}^{n} I_{t+i} \prod_{j=1}^{i} \frac{1}{(1+R_{t+j})} + \prod_{j=1}^{n} \frac{P_{t+n}}{(1+R_{t+j})}$$

$$= \frac{I_{t+1}}{(1+R_{t+1})} + \frac{I_{t+2}}{(1+R_{t+1})(1+R_{t+2})} + \ldots + \frac{I_{t+n}+P_{t+n}}{(1+R_{t+1})(1+R_{t+2})\ldots(1+R_{t+n})}, \quad (3)$$

where $\prod$ is the multiplication or product operator. In equation (3) property income is discounted by the product of one plus the discount rates for each year up to that year. In effect the traditional discount factor is replaced by a term structure of discount rates.

The aim is to use forecasts of property income and expected total returns from the VAR model to value commercial property with the modified present value model, that allows for time variation in both future NOI and expected returns. One complication with this generalization is that the pricing model is now nonlinear in the discount rates and property income.[22] This makes it difficult to work with. Fortunately, Campbell and Shiller (1988) derive a linear approximation to equation (3) in terms of the logs of expected future cash flows and returns, as follows,

$$p_t = \frac{k}{(1-\rho)} + (1-\rho)\sum_{i=1}^{\infty} \rho^i inc_{t+1+i} - \sum_{i=0}^{\infty} \rho^i r_{t+1+i}, \quad (4)$$

where p, inc and r are the natural logs of price, income and expected total return, respectively, ρ is a constant number slightly less than one, and k is constant, that is a function of ρ.[23] Equation (4) implies that once we allow for time variation in expected returns, we can explain price changes in terms of revisions in both future cash flows and required returns. For example, an increase in property values can result from either an increase in expected future cash flows *and/or* a decrease in expected returns. In light of the findings presented earlier in the paper, this appears to be an important extension of the basic valuation model.

In order to operationalize the present value model with time-varying discount rates we require forecasts of future property income and total returns. We employ the estimated VAR model regression results to forecast these quantities.[24] At any given year we use the VAR model regression results along with current observations on all five variables to forecast future values for the logs of property income and total returns into the infinite future. These forecasts are put into the linearized present value model (equation (4)) to arrive at an estimate of the current log price. Taking the exponential of the log price yields the price-level estimate. This exercise is repeated for each year over the 1979–1994 time period. The end result is a time series of simulated property values.[25] Exhibit 9 displays the simulated present values, (shown as "Sim. PV-Variable") along with the unsmoothed value (capital) index (from Exhibit 1). Simulated values with time-varying discount rates track unsmoothed (estimates of true market) values closely.

   This approach allows us to examine the relative contributions of changes in future property income versus changes in return expectations to commercial property price volatility. Specifically we can re-simulate prices while holding expected returns constant (the traditional present value model). The resulting series is displayed as "Sim. PV-Constant" in Exhibit 9. It is very apparent that the wide swings in property values in both the early and late 1980s were primarily the result of changes in return expectations, and not a result of changes in expected future property income. Simulated property values with expected returns held constant essentially exhibit none of the volatility shown when returns are allowed to vary over time.

   These findings are consistent with those found earlier in the paper. Price cycles are driven primarily by changes in required returns; capital market forces (and/or investor sentiment) become relatively more important than supply and demand fundamentals in price determination in market upswings.

Conclusions

In response to the sharp downturn in commercial property markets many investors have become disenchanted with real estate as an asset class. The findings presented here should help to convince investors that market volatility is not necessarily something to fear. Real estate returns are predictable to some degree, and hence market movements may be detectable in advance.

Exhibit 9
Simulated Present Values: Time-Varying versus Constant Required Returns
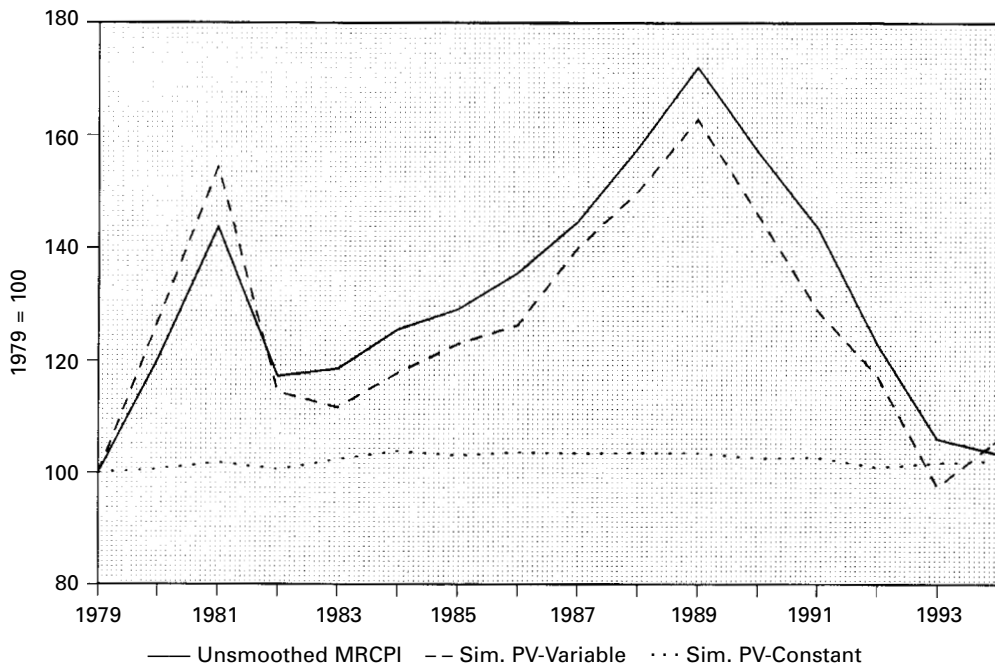
The principal findings of this study are that real estate risk varies over time and is related to general economic conditions, and that in periods surrounding major market movements, changes in commercial property prices are driven more by changes in expected (required) returns than by changes in current and expected future property income. Changing expected returns may reflect rational revisions of real estate investment risk, or alternatively investor psychology or sentiment. In either case, the link between price and income growth weakens in periods of significant market movements. This implies that capital market forces become relatively more important than real estate supply and demand fundamentals in real estate pricing during these periods. Hence, it is important for market participants to be aware of which factor is the primary driving force behind commercial property price changes, when making valuation and investment decisions, as the stage of the real estate cycle has important impacts on property pricing and the implications for buy-and-sell decisions. This makes a strong case for attempting to time real property acquisitions and dispositions.

A real estate return forecasting model was developed that, when combined with a simple trading rule, yielded sensible investment signals over the 1979–1994 time period, and hence appears to be a potentially valuable tool. The analysis presented here dealt with data on the national level, with all commercial property aggregated. At a more practical level, investors will want to run this type of analysis on data disaggregated by property type and metropolitan area.

Notes

[1]The RCPI was introduced in 1991 but backdated to the first quarter of 1985.

[2]Morguard Investments Limited began publishing The Morguard Property Index (MPI), a quarterly benchmark real estate return series for institutional investors, in 1982. The MPI has become part of the Russell Canadian Property Index. Morguard Investments Limited is one of seventeen Canadian Real Estate Managers that participate in the RCPI. The MPI actually extends back to 1972. There are, however, concerns about the reliability of the data during the first few years. For this reason only MPI figures from 1977 onwards are used. Hence, the return data extends from 1978 to the present.

[3]In theory we can construct a transaction-based index using hedonic models. This involves estimating an econometric model in which observed transaction prices of properties sold from the RCPI are regressed against (explained by) a set of physical, locational, time, and financial characteristics of the properties. That is, differences in quantity and quality of properties must be controlled for to create a constant quality price index. This method is extremely data intensive (see Fisher, Geltner and Webb, 1994, for details). Moreover, it requires a relatively large, random sample of property transactions in each quarter, something which is not available with the RCPI. Hamilton (1994) reports that 117 properties were sold from the RCPI database over the 1986–1993 period. Thus, on average, 14-15 properties, or about 1% to 5% of the properties in the index, were sold from the index annually. This implies an average of only about three to five transactions per quarter, which does not provide enough data with which to estimate a hedonic model.

[4]Geltner (1993) derives an exponential smoothing model to relate appraisal-based appreciation returns to underlying "true" appreciation returns. He shows that, under plausible assumptions, appraisal-based returns are a weighted average of past true returns and that this relationship can be approximated by a first-order autoregressive model of the form, $ar_t^* = \alpha ar_t + \alpha(1-\alpha)ar_{t-1}^*$. This relation can be used to "unsmooth" the appraisal-based return series, by solving for the unsmoothed or simulated annual return as

$$ar_t = \left(\frac{ar_t^* - (1-\alpha)ar_{t-1}^*}{\alpha} \right).$$

The value for α is based on an assessment of the extent of noise present in property value appraisals and an assumption of the true volatility of real estate returns. Clayton and Hamilton (1996) find that α=0.65 for Canadian data. Geltner (1993) and Barkham and Geltner (1994) report values of 0.40 and 0.65 for benchmark U.S. and U.K. appraisal-based real estate return series.

The RCPI suffers from a fourth-quarter seasonality problem similar to that of the Russell-NCREIF data (see Clayton and Hamilton, 1995, for details). As discussed in the unsmoothing literature, modeling the effects of appraisal and aggregation smoothing is simplified greatly if we first eliminate the seasonality effect by working with annual data. In addition, the use of quarterly return data is further complicated by the fact that the RCPI and MPI appreciation returns exhibit very different seasonality patterns. Specifically, the RCPI is affected to a greater extent by the seasonality of appraisals. Thus, in this paper real estate returns are derived by taking the percentage change in index values from the fourth quarter in one year to the fourth quarter in the next year.

[5] The term *property value* is used synonymously with market value—the most probable sale price that can reasonably be expected given an adequate amount of time on the market. It is important to realize that this is a "constant liquidity" concept of value. That is, the value series used here implicitly assume that changing liquidity does not affect market value.

[6] The terms *property income* and *net operating income* (NOI) are used interchangeably throughout the paper. These refer to the property-level income (NOI) reported to Frank Russell by the participants in the RCPI. Frank Russell requires that participants report NOI as the "excess of all normal revenues derived from a property over its operating expenses (excluding mortgage interest and depreciation expenses)" and that "the NOI reported to the RCPI must be consistent with property performance only." See the RCPI *Data Collection and Reporting Procedures Manual* for additional details. For any given year, the NOI is calculated as that year's income return times the value index number from the beginning of the year.

[7] The starting value for the NOI series is derived as the income level that flowed from a $100 property in 1978. It is important to realize that NOI will differ from effective rent on recent leases. The cash flow from properties in the MRCPI derives from both existing and new leases and hence will be a weighted average of rents being paid by tenants depending on when they signed their lease. Thus the NOI series in Exhibit 2 is less volatile than would be a graph of effective rent, but it does correspond to the property cash flow received by an investor whose portfolio mimics the MRCPI holdings, and is therefore the relevant measure for this study.

[8] A comprehensive analysis of real estate cycles would incorporate the supply side of the market (i.e., development), specify demand, supply and vacancy functions, and a mechanism through which they interact to determine market rents. Such an exercise is beyond the scope of the present paper and not required to achieve the objectives of this study. The property income series used in this study can be viewed as the end result of the interaction of supply, demand and vacancy, and hence incorporates each of these.

[9] Previous studies that have found a relationship between economic growth and these financial variables include Chen (1991) and Estrella and Hardouvelis (1991).

[10] The explanatory variables are lagged one period relative to the dependent variable because I am testing the ability of these variables to forecast future movements in real GDP and risk premiums to both real estate and common stock.

[11] The exception to this is that investors and appraisers commonly estimate a future resale or reversion price by assuming a cap rate at reversion. The reversion value and expected annual future income are then discounted by a constant required return.

[12] The analysis presented here examines the implications of the predictability of property income and risk premiums for valuation and market timing over the property cycle at the macro level. A related literature investigates the impacts of both macro and micro (property-specific) forces on property values over market cycles. See Pyhrr, Webb and Born (1990) and Born and Pyhrr (1994).

[13] The TSE Real Estate subindex is derived from the stock prices of publicly traded real estate companies. These firms are engaged in developing, acquiring and/or operating commercial real estate.

[14] In a VAR model the current value of a particular variable is explained by past values of the other variables in the model. In theory one should experiment with different lag structures to find the one that best captures the model dynamics and hence yields the best model fit. In practice, however, this

is not always possible. In this study, with sixteen annual datapoints for each variable, and five explanatory variables in each equation it is infeasible to examine higher lag lengths, as degrees of freedom would quickly disappear. This shortcoming of the analysis should be kept in mind when interpreting results presented later in the paper.

[15]It is a property of autoregressive time-series models of the type employed here that forecasts approach the (constant) mean value of the series as the forecast horizon becomes larger. In addition, the confidence intervals attached to return forecasts from the VAR model widen with the forecast horizon. As a result, the VAR model is best suited to short-term forecasting and therefore requires regular updating.

[16]For comparison purposes the same trading rule as Geltner and Mei (1995) is employed.

[17]It should be pointed out that you cannot determine the buy-and-sell signals simply by looking at Exhibit 7. The VAR forecasts shown there are one-year forecasts, whereas the trading strategy used here involves forecasts out two years ahead. That is, the one-year forecasts are put back into the model to generate additional one-year-ahead forecasts.

[18]This is simply an illustration of the approach. It is straightforward to incorporate alternative trading strategies as well as benchmarks.

[19]The buy-and-sell signals are imposed on the value series to show the results of the trading strategy over the real estate price cycle. You cannot infer the signals from the plot of the unsmooth value index.

[20]It is worth noting that the VAR model employed to forecast future returns is not meant to be the "best" model available for detecting future market shifts. That is, the model could probably be improved upon if it included net effective rents, vacancy rates, absorption, and new construction, which are all important indicators of market supply and demand conditions. In addition the model would likely do a better job if estimated on a disaggregated basis, by property type and geographic area. The aim of this paper is not to derive the best model but to illustrate the approach. Moreover, the ultimate goal in this section is to use forecasts of future returns and property income from the VAR in the present value model. Given the small number of datapoints it is important to minimize the number of variables to conserved degrees of freedom.

[21]Notice, if $R_1 = R_2 = R$ then we get back to the original present value relation with a constant discount rate.

[22]To see this consider the present value of the expected cash flow in year 2, in the scenario above. We require an estimate of the expected present value,

$$E\left[\frac{I_2 + P_2}{(1+R_1)(1+R_2)}\right].$$

With the VAR model we obtain estimates of the cash flow and expected returns individually. That is, the VAR model yields $E[R_1]$, $E[R_2]$ and $E[I_2]$. But, as a result of the nonlinearity in the present value relation,

$$E\left[\frac{I_2 + P_2}{(1+R_1)(1+R_2)}\right] \neq \frac{E[I_2]}{(1+E[R_1])(1+E[R_2])}.$$

Therefore we cannot simply forecast returns and incomes, and substitute these into the modified present value model.

[23]

$$k = -\ln(\rho) - (1-\rho)\ln\left(\frac{1}{\rho} - 1\right).$$

This linearized version of the PV model was first derived for the stock market. ρ is equal to one divided by the sum of one plus the dividend payout ratio. See Geltner and Mei (1995) for additional details.

[24]In fact, the VAR model was reestimated using the logs of returns and property income, since these are required in the modified present value model.

[25]The simulated present value prices are estimated with a Fortran-based program written in the SHAZAM econometrics program. The SHAZAM code is available from the author upon request.

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