ASSET MANAGEMENT: THE RELATIONSHIP BETWEEN ECONOMIC VARIABLES AND PROPERTY VALUES.

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ABSTRACT

An important function of asset management is forecasting risks and returns. However, investment decisions are made on the basis of relative performance within an expected set of financial and economic conditions. The aim of this paper is to examine if a model could be developed to explain the relationship between capital values and financial variables of Sydney CBD office market performance. The time-series data between Dec 1984- June 1998 was used to establish the relationship.

The results of the final model are statistically acceptable. The results of the data analysis reveal that property capital values are correlated with 90-day bank bills (interest rates) and the one-year lagged risk-free return, represented by the real 10-yr. government bond rates. The conditions in the stock market, proxies association. Annual Sydney inflation rate (CPI) is negatively correlated with property capital values, that is, higher inflation is connected with a fall in property capital values. The paper concludes that the model may throw some light on theoretical hypotheses.

Introduction

This research quantitatively investigates several commonly held beliefs about the economics of property. It is a widely held belief that real estate prices are influenced by interest rates. It is also believed that real property is no more than another form of capital, and that property growth is closely linked to general price inflation. Despite these common beliefs, quantitative studies have tended to be ambivalent. Small & Oluwoye, (2000) reviewed several studies that found little or no relationship between interest rates and property, cycle researchers appear to be comfortable with the realisation that property and equities at least have a distinct phase error and there appears to be equivocation regarding the inflation-hedging ability of real property.

This study explores the linkages between the Sydney C B D property market, major interest rate variables, equities and inflation in an attempt to shed some light on these issues. It briefly reviews the common theoretical beliefs, then uses a regression analysis of Australian data to test how theory is found in the performance of the market.

Property and interest rates

Interest rates could be expected to affect property in many ways. Figure (1) summarises some of the more conspicuous mechanisms by which lowered interest rates could facilitate capital value rises in real estate. These may summarised as follows:

1) **Expanded access to funds**: Lower interest rates means that purchasers have access to more funds for a given debt service capacity. Assuming most purchasers use debt, and the effect is market-wide, the greater access to funds will translate into higher prices. This is no more than a special case of monetary theory.

2) **Expanded equity funds for property investment**: resulting from investment capital fleeing from lower returns in fixed interest securities due to falling interest rates.

3) **Lower discount rates**: due to the linkage through the Capital Asset Pricing Model will upwardly revalue property assets. A lowered regime of returns may also be expected to lower capitalisation rates with a similar upward effect on values.

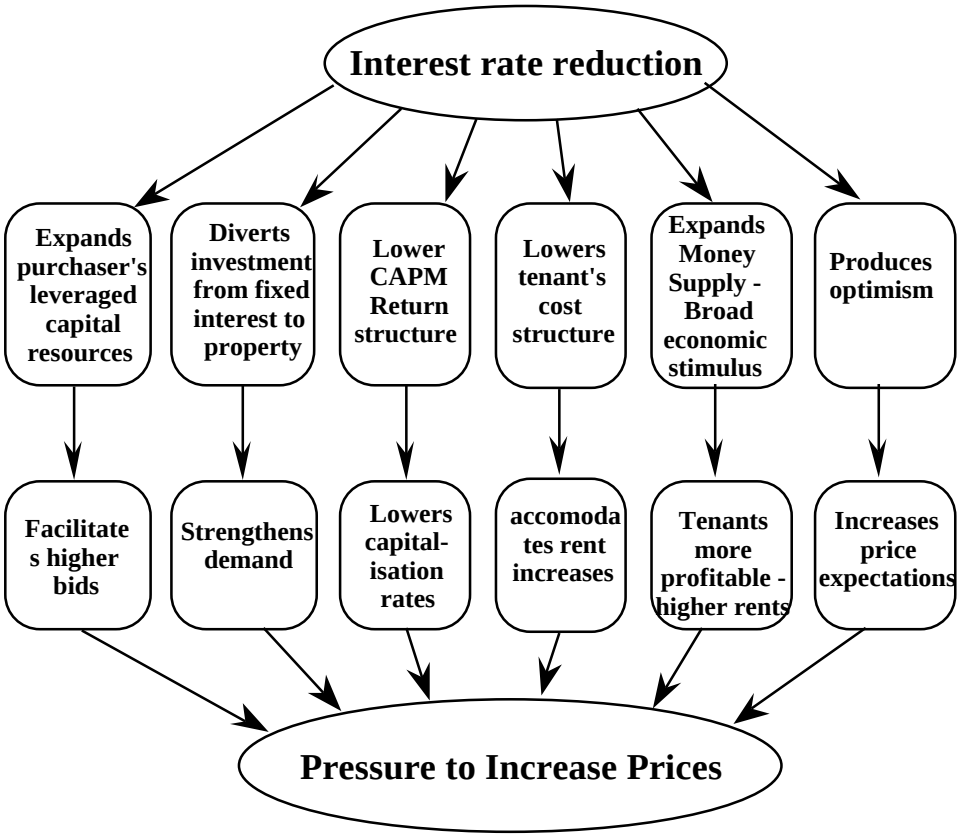

Figure 1: Interest rates and its impact on property prices

4) **Greater profitability for leveraged tenants**: Assuming most tenants are moderately leveraged, and their interest rates respond to the market, lower interest rates mean lower financial expenses across the community of tenants almost regardless of industry, hence higher potential rentals. This is an application of Adam Smith's classical observation that any improvement in productivity will end up taken as higher land rents.

5) **Higher tenant profitability due to general business stimulation**: independent of (4) above, lower interest rates are believed to stimulate business and inflation. If tenant business is stimulated they will be more profitable and will be able to afford higher rents. Also, in an inflationary environment, rents and property values could be expected to grow with the rest of the economy.

6) **Enhanced general economic optimism**: low interest rates signal economic growth and therefore inspire market confidence. This confidence in the economy will translate into an expectation that property will become more valuable, along with other productive assets.

This set of mechanisms is not exhaustive, but illustrates several things about the relationship between interest rates and property price. Some of the relationships only affect demand (items 1 & 2), some affect rental potential (items 4 & 5) and some affect value expectations based on the expected objective and subjective investment performance of the property asset (items 3 & 6 respectively). Hence, all aspects of the property equation could be expected to push property values upwards in the light of interest rate falls. Interest rate rises could be expected to cause the opposite effect in each of the mechanisms.

The timing of the various mechanism may be expected to vary, with some taking longer to affect the market. This could be expected to make the lag between a change in interest rates and its impact on property vary depending on the dominant mechanism at a particular time. This may make empirical observation difficult. Each mechanism may also vary in its resultant impact depending on where in the economic cycle it occurs. A fall in rates in a rising market may be a strong stimulus, but in the midst of recession will hardly be noticed, as evidenced in the falls in rates in Australia in the early years of this decade.

The task of this study is to see how the impact of interest rate changes on property is reflected in the data. In addition to interest rates, the general movement of prices reflected in the consumer price index (CPI) and the movement of equities will be studied to see if property is also linked to these.

Property and Equity Markets

Property is usually assumed to be part of the general offering of capital assets. The capital market could be considered to consist primarily of debt securities (fixed interest bonds), equities, and real property. Investigation of the relation between property and interest can be interpreted to study the relationship between bonds and property. This leaves equities and property. There should be considerable interaction between property and equities. Property competes with equities for investment dollars, and if equity performance is any indication of profitability, then equity performance may indirectly flow into property expectations regarding future rental movements. In addition, equities tend to contain a significant property component of many firms, sometimes in large amounts. Equities and property both have values capitalised from returns through yield expectations that should be linked through the CAPM. Lastly, both commonly rely on debt leverage somewhere in their structure to enhance profitably, so both should respond similarly to interest rate shifts.

It could be expected that property and equities should be correlated in some way. Because of the actual complexity of this relationship, a simple correlation may be clouded. The fact that there is an evident segmentation in investment markets, with many investors preferring either property or equities, together with recognition that the performance of equities bears only loose short term correlation to underlying profitability further clouds a clear relationship. The current interest the question of the place of property in investment portfolios suggests uncertainty over the relative investment performance of equities and property. This implies a lack of practical support for any simple linkage between equities and property.

CPI (Inflation) and Property

Given that inflation affects all assets, and that property is commonly believed to be a natural hedge against inflation, it is apparent that inflation should be investigated connected to property values. There have been studies of long-term trends in the real performance of property that suggest a small long-term out-performance against general price levels (Ball, Wood, and Morrison, 1995; Eichholtz, Theebe, and Jianping, 1999). The short-term behaviour may be more equivocal, but it is clear that inflation should be investigated as causal factor of property values.

Aim and Objectives

The aim of this paper is to examine if a regression model could be developed to test the relationships between capital values and financial variables expected from theory using Sydney CBD office market performance. The specific objectives are:

(1) to identify the determinants of capital values;

(2) to examine existing patterns(if any) of the relationship between capital values and their determinants;

(3) to model and test the relationship; and

(4) to estimate the significance and predictive ability of these determinants of capital values.

Method

Multiple regression analysis of interest rate, equity and inflation time series data was attempted using SPSS statistical computer package. The stepwise regressions analysis was used to verify the model.

The time-series data between Dec 1984 - June 1998 were obtained from Colliers Jardine and Australia Bureau of Statistics and used to establish the relationship between capital values and its determinants. All data have been collected six monthly from 1984 onwards (See figure 2, below).

Model Construction / Working Hypothesis

It is assumed that property values are a function of economic variables. In particular: A grade Sydney CBD capital values are a function of bond rates, bank bill rates, the Australian Stock Exchange All Ordinary Index and the Sydney Consumer Price Index (inflation). That is:

Sydney A grade property = f(BR, BB, AO, CPI)

where: BR = 10 year bond rate

BB = 90 day Bank Bill rate

AO = Australian Stock Exchange All Ordinary Index

The actual relationship may include lagged connections.

General Model

By using a principal of arbitrage pricing as developed by Ross (1976) property values can be related to other market data. However, the principle of arbitrage merely asserts rates of return on portfolios are riskless, that is, they have zero variance, their return must be the same as the return obtained from the market riskless rate Using a similar approach to the above principle, all relevant variables were tested. The linear equation was specified from the results of the statistical tests.

If interest rates are causal for property prices, the inverse relationship between interest rates and price change should manifest as a correlation between them, lagged dependant on the dominant causal mechanism. Close inspection and preliminary analysis confirmed the appropriateness of lagging interest rates by one year. Adopting lagged data introduces interesting hypothetical issues. If both data are genuinely cyclical, then their relationship will be correlated but out of phase. This justifies lagging the data to reveal a positive, though phase separated, correlation, even though the actual relationship is a negative correlation. The six theoretical mechanisms linking property value to interest rates all suggest negative correlation, but they vary in terms of the expected phase delay.

Using the Arbitrage Pricing Theory approach, we define the property values as a functional relationship of the kind:

$$Pv_t = f(\, BRY_{t\text{-}1yr},\ BBY_t\ ,\ ARD_{t\text{-}1yr},\ CPI_t\ ) \qquad \text{Eqn. 1}$$

Where	Pv	= Property Values
	BRY	= Real 10yr government bond rate
	BBY	= Interest rate differential (90-day bank bills)
	ARD	= All Ordinary Index
	CPI	= Consumer Price Index
	t	= current time period
	t – 1yr	= One year prior to current period

The mathematical form of the Pv function, assuming the relationship between Pv, BRY, BBY, ARD, and CPI is linear, and where U_i is a random component, is given as:

$$Pv_i = a_0 + a_1 x\ BRY_i + a_2 x\ BBY_i + a_3 x\ ARD_i + a_4 x\ CPI_i + U_i \qquad \text{Eqn. 2}$$

That is, variations in *Pv* are fully explained by changes in its determinants.

Results and Data Analysis

Empirical Analysis

Table 1 shows the correlation matrix of the variables in equation 2 above. This correlation matrix provides a useful introduction to the more powerful regression analysis. The table also reveals how closely two variables move together. The positive sign from the above table suggests that an increase in the value of one variable is associated with an increase in the value of the other variable and negative sign indicate an increase in one variable is associated with a decrease in the value of the other.

TABLE 1. CORRELATION MATRIX

VARIABLES	PV	BRY $_{t-1}$	BBY	ARD $_{t-1}$	CPI
PV	1.000				
BRY $_{t-1}$	0.453	1.000			
BBY	0.589	0.887	1.000		
ARD $_{t-1}$	-0.014	-0.811	-0.729	1.000	
CPI	-0.243	-0.813	-0.802	0.867	1.000

Table 2 shows the OLS estimates of the property values. The equations appear to fit the data well.

TABLE 2: SHORT-RUN COEFFICIENTS AND MODEL DIAGNOSTICS

EQUATION	DEPT VARIABLE PV	CONSTANT	INDEPENDENT VARIABLES			
			BRY $_{t-1}$	BBY $_t$	ARD $_{t-1}$	CPI $_t$
3		2279.8 (638.35)		203.29 (55.85)		
4		-5311.3 (1437.37)		425.87 (425.87)	3.14 (0.56)	
5		-7720.8 (3018.5)	312.74 (171.31)	305.28 (84.88)	3.99 (0.829)	-10.80 (24.84)

MODEL DIAGNOSTICS 1.

EQUATION	R^2	SER	F VALUE	SIG.F	DF	DW
3	0.346	1369.2	13.25	0.0012	$F_{1,25}$	
4	0.713	926.0	29.81	0.0000	$F_{2,24}$	
5	0.753	897.6	16.75	0.0000	$F_{4,22}$	0.646

MODEL DIAGNOSTICS 2.		
VARIABLES	**T-STATISTICS**	**SIG.T.**
BRY $_{t-1}$	P(1.826?1.717)=0.05	0.0815
BBY $_{t}$	P(3.596?1.717)=0.05	0.0016
ARD $_{t-1}$	P(4.805?1.717)=0.05	0.0001
CPI	P(-0.435?1.717)=0.05	0.6679
CONSTANT	P(-2.558?1.717)=0.05	0.0179

NOTE: t-1 means lagged for one year prior to current period; t means current time period, T-statistics p(t=1.717) indicates significance at 95 percent level, where R^2 is the coefficient of determination for degrees of freedom. Standard error of B in parentheses, SER is the standard error of the regression. DF is the degree of freedom, F value of regression, DW is Durbin Watson df statistics.

Autocorrelation Test

To test for the existence of autocorrelation (property values being a function of their own previous values), a Durbin Watson test was applied to the data.

The null hypothesis is

$$H_o : p ? o$$

Or, Ho: the u's are not autocorrelated with a first order scheme

This hypothesis is tested against the alternative hypothesis:

$$H_1 : ? \square 0$$

Or, H1: the u's are autocorrelated with a first order scheme.

DW = Durbin Watson Test = 0.64580

Since DW lies below DL (1.12), we reject the null hypothesis and accept the alternative hypothesis that there is positive first order autocorrelation present in the data. This suggests that property values are partially determined by their own previous values. Higher order autocorrelation has not been examined at this point.

The relationship between property price movements and interest rates is visible in a plot of the rates of change of capital values and interest rates as shown in figure 2, below.

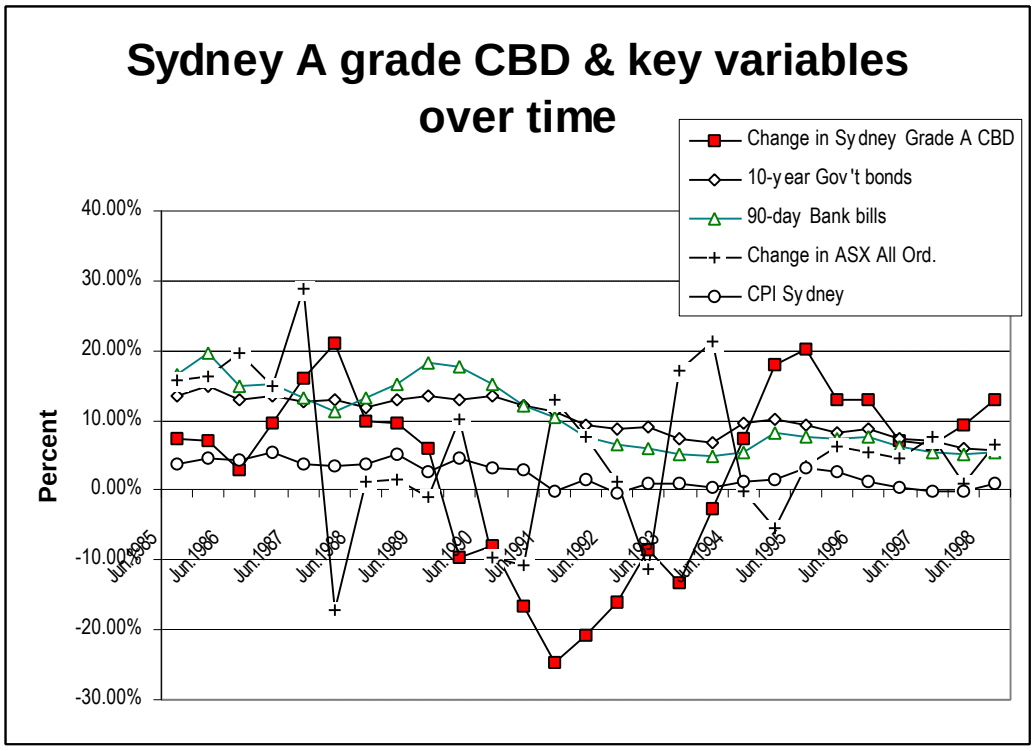

Figure 2: Property, Interest Rates, Equities and Inflation over Time

Discussion

Step wise regression offers of the advantage of progressively identifying significant variables. In this case the bank bill rate displayed the strongest correlation and was analysed first. The other interest rate variables were found to have diminishing, though significant impact, on property prices.

Overall, the results display statistical significance. The positive correlation between bill rates and property values was unexpected, given the theoretical connections. This may suggest the development of new linkages between the two. The phenomenon of combined stagnation and inflation (stagflation) first evident about three decades was an example of such a novelty in economic experience. At that time, high inflation was linked with property investment growth in a way that anaesthetised markets to the retardant of elevated interest rates. Grieder (1987) noted the way that during the late nineteen seventies, investors even perceived increased interest rates as a signal of future investment growth that actually stimulated borrowings. It may be this rather unorthodox mechanism that is operating here. Commercial markets are also affected by new construction, and there was considerable new construction that came on line in the early part of this time series that impacted on prices, though it is beyond the scope of this study.

The lagged linkage to equities that has been revealed is consistent with experience. The existence of a lag suggests that the common belief that the two assets are undifferentiated aspects of capital may be simplistic. In Australia it was the case that investment funds fled the equities markets following their rapid growth and collapse in 1987 to fuel the property market that took off about a year later. It may be useful to examine the phase relation between the two markets through previous booms.

The lagged linkage to the ten year bond rate may suggest that it is the downward trend in the bond rate that stimulates property under suitable conditions of confidence. It may be appropriate

to study the relationship between the first derivative of the bond rate and property values. Such a study may shed light on the actual mechanism that is in operation, but would probably require better data than was available for this study.

The adoption of multiple measures of interest rates for the correlation raises the question of multicollinearity. The use of stepwise regression goes some distance to overcoming this difficulty. Likewise, many believe that real estate markets can be predicted in the short term future using past market data. This translates into auto correlation and is evidenced by the Durbin Watson test. There is no way to avoid this problem in market data if regression is to be used. A closer investigation into the importance of both of these issues and their implications for the use of regression for property value modelling through time is recommended.

Conclusions

The study has revealed a significant correlation between interest rates and property values. The correlation is not strong, and is not in the expected direction, suggesting either additional significant factors, or a relationship between the variables that is not sufficiently linear to satisfy the requirements for correlation analysis. The study does not provide answers to either of these possibilities, and it is possible that each is to some degree true.

The study illustrates both the strengths and shortcomings of quantitative methodology. By identifying the relationship between interest rates and price, a generally held and theoretically predicted relationship has been empirically tested. The results appear to contradict theoretical expectations. Time series data would appear to be to only data relevant to the positive analysis of the relationships, and regression is currently the dominant analytical tool. Regression requires orthogonal independent variables and the absence of autocorrelation in the dependent variable, amongst other things. These conditions may never be met in time series economic data However, the assumption implicit in the method, that human decision-making is deterministic and linear may also be at issue. It is not supported it in the data. The conclusion from this observation is that while quantitative methods may throw some light on theoretical hypotheses, their ability to definitively resolve them may be compromised by methodological anthropological assumptions.

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