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**A LOCATIONAL AND RISK ADJUSTED
INDIVIDUAL INVESTOR MODEL FOR
RENTAL RESIDENTIAL REAL ESTATE
IN METROPOLITAN MELBOURNE**

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Introduction

Home ownership has long been an Australian cultural icon - 'the great Australian dream' (Hayward 1992; McCormack 1995). But the decline in the past decade in the proportion of Australians purchasing their own homes (Yates 1999:29), coupled with recent federal governments moving away from the direct provision of public rental housing is resulting in increasing demand for privately-provided rental residential accommodation. On the other hand, an ageing population and the limitations this will place on government-funded aged-pensions means that Australians wishing to maintain their standard of living in retirement will increasingly have to fund their retirement income from investments made during their working careers. There is a strong case for the inclusion of rental residential real estate in individuals' investment portfolios. This study will draw on financial theory to develop an applied financial model for rental residential real estate investment in metropolitan Melbourne. It will be adjusted to incorporate locational risk and return measures by local government area. To move from local government area to individual property, the model will use hedonic pricing, adapted from the standard hedonic residential property approach to incorporate rental property characteristics. Finally, in recognising the importance of taxation to property investment, personal taxation rates will be factored into the model.

Need For Economically Rational Real Estate Investment

Research shows that many rental residential real estate investment decisions lack economically rational analysis (Maher & Burke, 1991; Housing Industry Association 1993; Australian Bureau of Statistics 1994a; Boyd, MacGillivray and Schwartz, 1995; O'Dwyer, 1998; Compton 1998). Anderson concluded that:

“Private landlords do not behave as
economic, rational, and efficient actors.”

(Anderson, 1998:177)

Given the above indication that the need for private rental residential accommodation will intensify, and given the prudence of individuals building their own retirement income-producing investment portfolio, it is important that investors have available to them a sound conceptual body of knowledge to guide them in their specific choice of real estate investments.

The literature in this area can be classified into three tiers:

1. The popular 'how to' approaches
2. Traditional financial approaches
3. Modern capital budgeting approaches

The 'how to' approaches are typified by their 'wealth pyramiding' approach. The 'how to get rich' formulae these authors provide in their self-labelled 'best seller' texts typically portray real estate as the investor's best opportunity to 'create personal wealth'. The internet is crowded with such titles. The key element of this approach is to borrow heavily to buy as many properties as possible. These properties are then re-mortgaged to draw on equity build-up to provide the deposit for the next investment property. The implicit assumption of these authors is of a continuing strong growth in property values. Leading American writers have included Bockl (1972); Steele (1975); Haroldsen (1976); Allen (1980); Nickerson (1980); Allen (1983); Norton (1985); Miller (1995); McLean & Edred (1996) and Thomsett & Thomsett (1998). In Australia, exponents of this approach have included Johnson & Whiting (1979); Falkson (1989); Lang (1991); Szekely & Cordato (1991); Somer (1994); Robinson (1996); and Johnson & Johnson (1997).

These authors recognise that the property market is less competitive than the stock market. It can therefore offer outstanding buying opportunities for the astute, well informed investor. But most of the literature in the 'how to' category adds little to the development of a balanced, theoretically rigorous body of real estate investment knowledge. It emphasises high rates of return, tends to downplay - or ignore - risk, offers simple formulae for success, and depends very little on analytical techniques or empirical research, other than selective anecdotal case studies.

Traditional financial approaches, on the other hand, measure financial dimensions, and provide quantitative data on which real estate investment decisions can be based. The most widely used of all financial ratios - in real estate or any other investment - is 'return on investment' (ROI). In attempting to define and quantify the investor's required rate of return, this area of the literature provides a more analytical approach than the 'how to' authors. Typically, the ROI approach is used to measure performance 'ex poste' - after the event. As evidence of this, American authors, Mei and Saunders found that real estate investments by U.S. financial institutions had been driven largely by past real estate returns, rather than expected future returns. The authors showed the sub-optimality of such a strategy (Mei and Saunders 1992:22). Five years later, the same authors confirmed that this apparent 'trend-chasing' by major institutional real estate investors had resulted in poor performances of their real estate investments (Mei and Saunders, 1997). Where the widely-used ROI approach falters is that it gives little consideration to income taxes, changing cash flows over time, and the time value of money. Most notably, it does not include risk in its analysis.

The third approach, modern capital budgeting, recognises that today's (present) value of an investment asset is the cash flow it can generate in the future, not the returns it has provided in the past. Accordingly, investment appraisal must adopt an 'ex ante' - forward-looking analysis - as distinct from the backward-looking focus of the traditional financial approaches typified by the ROI calculation. Modern capital budgeting, also known as 'modern financial theory,' focuses on deterministic discounted cash flow, and the probabilistic approaches of project risk analysis (Pyhrr, Cooper, Wofford, Kapplin, and Lapidés (1989).

The required return on an investment is a function of its risk: the higher the risk, the greater is the required return. This is illustrated by Tower Perrins, who were commissioned by the Australian Stock Exchange to compare after-tax returns on mainstream investments for the ten years to February 1995. Their report shows the annualised returns:

Shares	12.3%
Property	9.8%
Fixed Interest*	6.5%
Cash Deposits	5.1%
Inflation over this period averaged	5.3%

* Government bonds or company debentures/notes

(Ord Minnett, 1995)

However, what the above study also showed was that, in one or other of the ten years, all four of the above mainstream investments had provided the top annual return. This negative correlation of returns indicates the importance of investment diversification. 'Markets move in different cycles, so it is reasonable to assume that if one type of investment is going down, some other will be appreciating' (Courage in Diversity: The Weekend Australian, 1998:7).

In searching the literature to develop a practical model applicable to rental residential real estate investment (RRREI) it became clear that capital (investment) asset pricing is the most promising contributor to the development of a simple, but conceptually sound RRREI model. Capital asset pricing, which has evolved into the capital asset pricing model (CAPM), the keystone of financial theory (Frankfurter 1995:104) has been developed and tested over the past four decades in the financial securities (stock exchange) markets (Prohaska 1995). The reason for turning to financial markets in seeking a real estate investment model is that

"The financial markets are perhaps the most carefully documented human phenomena in history".

Ibbotson. (Ross, p 301)

A record exists of every transaction on the New York Stock Exchange going back more than a century. The data generated by these transactions - and others around the world - are quickly analysed and disseminated, and made easily accessible by computer. Finance, in Ibbotson's view, has 'increasingly come to resemble one of the exact sciences' (Ross, p. 301). Because phenomena in the financial markets are so well measured, finance is the most readily quantifiable branch of economics. Researchers are able to do more extensive empirical research than in any other field of economics, and the research can be quickly translated into action in the market place. But the principles of financial market theory need to be reviewed to determine their applicability to real estate.

The Capital Asset Pricing Model

In reviewing the capital asset pricing model, one of the key problems faced by an investor is determining the future value of an investment. For a given rate of return, the value at some point in the future of an investment made today can be determined by calculating the 'future value' (FV) of that investment by compounding the annual rate of return:

$$FV = I(1+r)^n$$

Where

FV	=	Future value
I	=	Today's investment
1	=	Unity
r	=	Annual rate of return
n	=	Number of periods

For example, \$100 invested today, for three years, compounded at 10 percent per annum, will result in a future value of:

$$\begin{aligned} \text{FV} &= \$100(1.1)^3 \\ &= \$133.10 \end{aligned}$$

Conversely, today's present (PV) value of future cash flows can be derived by discounting those future returns at the appropriate discount rate (r), which factors in risk:

$$\begin{aligned} \text{PV} &= \text{FV}^n / (1 + r)^n \\ &= \$133.10 / (1.1)^3 \\ &= \$100 \end{aligned}$$

Subtracting the original investment of \$100 gives a net present value (NPV) of zero, proving that the investment generated an internal rate of return (IRR) of 10%. If, however, an astute, well informed investor has been able to select an investment which has generated a positive net present value, then he has earned an abnormal return. Assuming the discount rate equals market expectation of return on the investment, he has out-performed the market. And in so doing, he has increased his current wealth by the amount of the positive net present value.

With shares, today's (present value) price is a combined discounting of future cash flows from dividends and eventual sale price. To illustrate this, assume investors can buy a share today which is expected next year to pay a 10% dividend, and which is anticipated to sell for \$7 in a year's time. Given the relative uncertainty (risk) of it's future dividend and price, investors, we will assume, require a return (r) of 25%, to derive today's theoretical purchase price of \$5.68:

$$\begin{aligned} \text{PV} &= (7 + 0.1) / 1.25 \\ \text{P}_0 &= \$5.68 \end{aligned}$$

In algebraic form:
$$\text{P}_0 = (\text{P}_1 + \text{D}_1) / (1 + r)$$

Where

$$\begin{aligned} \text{P}_0 &= \text{Today's price} \\ \text{P}_1 &= \text{Price in a year} \\ \text{D}_1 &= \text{Dividend in a year} \end{aligned}$$

Net present value (NPV) can be derived by inserting today's investment (I) in the above equation:

$$\begin{aligned} \text{NPV} &= [(P_1 + D_1) / (1 + r)] - I \\ 0 &= [\$7 + 0.1) / 1.25] - \$5.68 \end{aligned}$$

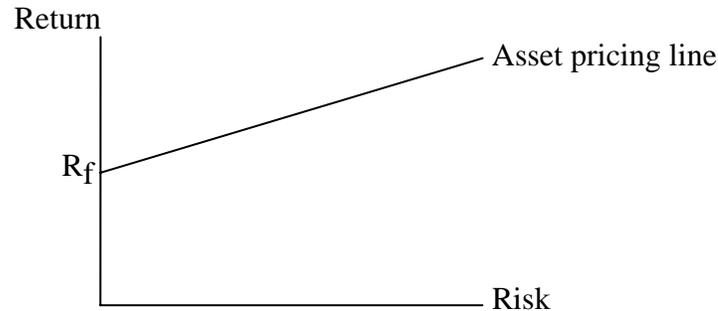
The fact that the NPV is zero confirms that the internal rate of return (IRR) on today's investment (share market price) of \$5.68 is 25%. An investment should be accepted if its NPV is zero or positive (if it is positive then actual IRR exceeds r). But if it is negative, the investment should not be proceeded with, as its internally generated return is less than the risk involved in undertaking the investment.

The recognised starting point in modern financial theory is 'portfolio theory.' Famed 20th century economist J.R.Hicks' 1935 paper on the 'theory of money' can be considered a fore-runner of modern macro-economic portfolio theory (Maes 1991). Portfolio theory recognises that an investor, by assembling a portfolio of investments with less than perfect correlation of returns, and each of which can be defined in terms of its risk and return, can maximise his expected return for a specified level of risk.

The measure of risk used in financial theory is the standard deviation of returns, which, when squared, gives the variance of returns. Markowitz showed that the 'efficient frontier' is that selection of investments which offers the optimal overall risk-return relationship (Markowitz, 1959). This was followed by Samuelson's 'general proof that diversification pays' (Samuelson, 1967). Each investor will have his own attitude (indifference) towards risk. Conceptually, he will have a family of indifference curves radiating out from the point of origin on a two axis risk-return graph. He will optimise his return to risk by moving to the highest indifference graph touching the efficient frontier. The mean-variance approach postulated by Markowitz requires considerable data input to calculate the covariance between each pair of returns. Sharpe (1963) showed how the computational task could be considerably reduced by reference to a common index.

The mean-variance approach has been the basis of considerable research in relation to shares. But there has been only limited work in applying it to real estate. Friedman (1970) attempted to adapt mean-variance analysis to the construction of real estate portfolios. Findlay, Hamilton, Messner and Yormark (1979) rejected Friedman's use of index models on the grounds they were poorly specified. They attempted a more extensive analysis of mean-variance analysis in real estate markets. But these early approaches are of little help in constructing efficient real estate portfolios, for at least two reasons. The first is that Markowitz's model was based on the premise that portfolios could be instantaneously liquidated to adjust relative asset weightings - a virtual impossibility in real estate. The second is that most investors acquire real estate on a sequential, not a concurrent basis.

By including government bonds (technically defined as risk-free (R_f)) in a portfolio, an asset pricing line can be constructed. To maximise his wealth, the investor will move to the highest indifference curve touching this line:



This shows the asset line to be the efficient frontier. Inefficient portfolios will lie below this line, as the return will be inadequate to compensate for the investment risk. The asset pricing line represents the transition of portfolio theory into the capital asset pricing model. But the capital asset pricing line relates only to portfolios: the efficient portfolio has eliminated all risk which can be diversified away. This shows there are two categories of risk:

1. Specific, or individual-asset risk, which, in real estate, will include location, structure, quality, social, depreciation and taxation factors, and which, in concept, can be diversified away by selecting negatively correlated portfolio investments, and
2. Systematic, or market-wide risk, such as a general rise in interest rates, which cannot be diversified away, as all portfolio investments will be affected.

Systematic risk is thus a measure of overall market volatility. Risk is expressed as a coefficient which is related to overall market index movements. This risk coefficient is known as 'beta' (β). Government bonds held to maturity will be non-volatile and will therefore have a beta of zero. Investments with the same volatility as the overall market will have a beta of 1.0, whereas investments showing greater volatility in their returns will have a beta exceeding 1.0, and conversely the beta of assets with less volatility will be less than 1.00.

Subsequent authors have shown how the same concepts implicit in the capital asset pricing line can be used to develop a similarly shaped securities market line, to provide a general model of capital asset pricing applicable to individual investments (Sharpe, 1964; Lintner, 1965; and Mossin, 1966. What Sharpe, Lintner and Mossin in turn showed is that plotting rates of return for individual investments, together with their respective levels of systematic risk, will provide a linear relationship. This is known as the security market (investment asset price) line, which has the same shape as the capital asset pricing line shown above for efficient portfolios. Assuming market equilibrium, if an asset is

correctly priced, it will lie on the security market line (SML), as its price will equate to a net present value of zero. An under-priced asset lying above the SML will be regarded as abnormally priced. This will provide a buying opportunity for the astute, well informed investor, as it will provide him with a positive net present value, and move him to a higher (preferred) indifference curve.

Regarded as the major advance in financial (investment) theory, the capital asset pricing model has generated much academic debate. As summarised by Jagannathan and McGrattan (1995), those who have supported it include Black; Black, Jensen, and Scholes; and Fama and MacBeth. Those who have challenged it include Banz; and most notably, Fama and French (1966). Others have challenged those challenges, including Amihud, Christensen, and Mendelson; Black; Breen and Korajczyk; Jagannathan and Wang; Kothari, Shanken, and Sloan. The main critics, Fama and French, argued that returns cannot be explained by the single causal variable. Their view was that beta alone cannot explain expected return. Following Fama and French's claim, Ross (1976) developed the arbitrage pricing model as an alternative to the capital asset pricing model. Ross's arbitrage pricing model, like the capital asset pricing model, is based on the premise that investors require compensation for taking on risk, and that the market will only reward investors for bearing risks that cannot be eliminated by diversification. The difference between the two models is that, whereas with the capital asset pricing model, return is a function of only one factor - risk, under the arbitrage pricing model there can be a number of causal variables.

However, the number of causal variables making up the arbitrage pricing model has not been resolved. Roll and Ross (1980) claimed there were three, and possibly four causal variables. Sinclair (1984) who used Australia data, argued for three variables, Chen (1983) supported a five factor model, and Cho, Elton and Gruber (1984) claimed there were either five or six factors causing return variations. But Sinclair concluded that, notwithstanding his claim of three factors, the evidence of the existence of the second and third factors was much weaker than the first - risk itself. Faff (1988) has concurred that while additional factors cannot be 'categorically rejected,' the data set he studied conformed best to the existence of a one-factor structure (Peirson, Bird, Brown and Howard 1995:167). More recent authors have indicated that the two approaches provide essentially the same results (Corhay, 1990; Khan and Sun, 1996).

In recent years, a number of authors have reinforced the validity of the capital asset pricing model with its risk-return focus (Leusner, J., Akhavein, J.D, and Swamy, P. 1996; Berk, 1997; Bouyssou and Lefoll 1997; Jagannathana and McGrattan, 1997; and Levy, 1997). But their research has been carried out essentially in the sharemarket, the market on which financial theory has concentrated throughout its four decade history. The question which is of relevance in the present study is whether the principles of modern financial theory can be adapted to rental residential real estate investment.

In considering the adaptation of capital asset pricing theory to real estate investment, four of the key assumptions require discussion:

- **Distribution of returns:** portfolio theory is based on the assumption that the probability distribution of returns is 'normal.' But compared with the sharemarket, there is a lack of evidence on the correlation of real estate returns. Given the specific factors (unsystematic risk) applying to individual properties, correlation is likely to be low.

- **Divisible assets:** unlike shares, each property will likely represent a significant percentage of an individual investor's portfolio. Accordingly, the capital asset pricing model would argue that a real estate investor would be holding a sub-optimal portfolio. However, Mayers (1972) has shown that by defining assets as either perfectly liquid or perfectly non-liquid, the capital asset pricing model can be adapted to incorporate the covariance of returns based on valuations of unsold properties with the balance of the investor's portfolio.

- **Unequal lending and borrowing rates:** in practice, the asset pricing market line will only be linear if both lending and borrowing rates are the same - which, of course, is unlikely. With the difference between the two rates, the line will no longer be straight, so that there is no longer a single optimal combination of risky assets. The intercept of the market line will shift to where it represents the return on an asset which has zero covariance with the market portfolio. However, while this applies to real estate, in practice it also applies to the sharemarket, and does not jeopardise the capital asset pricing model.

- **Multi-period investment:** for analytical purposes, the assumption is made that all investments are single period, whereas real estate investments are typically multi-period. Fama (1970) has demonstrated, however, that under general conditions, investors will behave as though they are maximising single-period utility.

To summarise, even when the assumptions on which the capital asset pricing model are relaxed, as they are above, the model still remains robust (Ang and Lai, 1988; Green and Keating, 1988; Jagannathan and McGrattan, 1995; Khan and Sun, 1996; Bouyssou and Lefoll, 1997; and Elton and Gruber, 1997). Hence, it is an appropriate basis for developing a rental residential real estate investment model (Friedman, 1970; Cook, 1971; Sykes, 1981; Brown, 1982; Draper and Findlay, 1982; Findlay, 1983; Sykes, 1983; Brown, 1986; Hartzell, Hekman and Miles, 1986; Grissom, Kuhle and Walther, 1987; Baum and Crosby, 1988; and Brown, 1988). Its attraction is that it provides an intuitive way of looking at the performance of investments in a manner which is simple and direct.

Capital Asset Pricing Model As A Basis For A Rental Residential Real Estate Investment Model

In terms of the capital asset pricing model, real estate investments should be included in an investor's portfolio only if, for a given level of systematic risk, they lie above the

security market line, ie they are under-priced. Using this criterion for selection will ensure that the value of the portfolio increases. As each investment will yield a positive net present value, the investor's wealth is increased (Brown, 1991:28). Miles and Rice (1978) and Ward (1979) have attempted to construct overall market indices which have included real estate. But the fact remains that any attempt to construct an index which includes real estate runs into difficulties because of:

- the lack of reliable real estate time-series data on a sufficiently frequent basis
- the indivisible nature of real estate, preventing the construction of an efficient investment portfolio
- the sequential nature of most real estate acquisitions, further countering efficient portfolio construction

Mei has summarised that 'despite huge success of modern finance in shaping up the financial industry, it has made little impact on real estate investment' (Mei, 1994). Accordingly there can be no inviolate policy for real estate diversification (Durez-Demal, 1981; Draper and Findlay, 1982). It may well be that the attitude to diversification will depend on where real estate fits into an individual investor's portfolio. 'A fundamental decision facing the intending property investor is whether to aim for high yield on funds invested and low capital growth, or low yield and high capital growth' (Lethlean, 1980:41). Additionally, the choice of properties for inclusion in a portfolio is likely to be motivated in large part by tax reasons (Wood and Watson, 1999).

The importance of market efficiency is that in an efficient market, it is unlikely that an asset will be significantly above or below the security market line. This is because current prices adjust quickly when new information is announced, and legislative provisions apply to curb 'insider trading' - which is individuals taking advantage of information not available to the general investing public (Damodaran and Liu, 1993). Thus, based on available information, there is no reason to believe that the current price is too high or too low. Prices will move frequently as new information is published. The difference between efficient markets, such as the stock exchange, and less efficient markets, such as real estate, is an instant price correction, versus either over-reaction and correction, or delayed reaction.

The lesser the quality of the information, the more inefficient the property market is likely to be, and the greater the chance there is to earn abnormal returns. Herein lies an opportunity for a well informed and cashed-up investor to acquire under-priced properties. Empirical evidence is that the property market is only a weak form of market efficiency, as indicated by fire sales, special purchases, and even developers quietly aggregating adjoining properties without the market being aware there is a common owner, so that the property values change without public awareness (Gau, 1984; Rayburn, Devaney and Evans, 1987; Arnott; 1988; and Brown, 1991:67). There is no legislation against insider trading in the property market. This is not surprising, as the majority of residential property sales are by private treaty, and are thereby deal-oriented.

Because of the lack of a central market-place where properties can be bought and sold, as exists with the sharemarket, real estate agents, with their varying network of contacts, will conduct trades which can represent only an inefficient market (Brown 1991).

Although it is reported that, for simplicity, most valuers prefer to make use of past yields and price data from recent sales of comparable properties - rather than expected rates of return and growth rates, given the level of risk - this does not invalidate the assumptions underlying the capital asset pricing model (Brown, 1991:74). The economically rational real estate investor should therefore assess the required rate of return, suitably adjusted for risk, and the expected growth rate in income, having regard to the type of property, its condition, and its location, together with the economic prospects of the area. Once these variables have been established, assuming the investor can glean the relevant information, a real estate investment model adapted from the principles of the capital asset pricing approach can form a conceptually sound basis for identifying under-priced properties.

But there are two key aspects of real estate investment where only the philosophy, rather than the mechanics, of the capital asset pricing model are able to be adopted:

1. The difficulty of constructing an efficient real estate portfolio
2. The fact that, unlike shares, every property is unique, if only for its location

1. In assembling an investment portfolio, the concept of diversification is important, given its potential for reducing overall risk. Perhaps the seminal sharemarket study has been that of Evans and Archer, who randomly constructed share portfolios of increasing size, each time calculating the average standard deviation of returns to show that overall risk reduced as portfolio size increased (Evans and Archer, 1986). They showed that most of the risk reduction that does occur in a typical share portfolio has taken place by the time the number of shares held reaches between 15 and 20. Most unsystematic (specific) share risks have been diversified away. However, with real estate, being a heterogeneous form of investment, unsystematic or asset-specific risks will be more dominant, and will be harder to diversify away. These will include, in respect of each property:

- land size
- location
- distance from city centre
- proximity to economic and social infrastructure
- socio-economic characteristics of neighbourhood
- construction of building

- age
- condition
- the type of tenant
- the conditions of lease

Portfolios including property are likely to be sub-optimally diversified because of the small number of properties held. Thus, in addition to the non-feasibility of constructing a diversified portfolio including real estate - because of lack of pricing data and the indivisibility of property - the large component of unsystematic, asset-specific risk would require a portfolio of at least 200 properties to offset asset-specific risk (Brown, 1991:211). This is an impossibly large holding for most individual investors, given the Australian Bureau of Statistics (1994) finding that most Australian landlords hold six properties or less. While the spirit, rather than the achievement, of efficient diversification should be followed by the investor who properly includes real estate in his portfolio, his asset selection will depend on his personal requirements. For instance, if he is risk averse and favours passive long term investment, he will have a pre-disposition towards real estate. But if short-term liquidity is important, then his selection will tend towards cash deposits, and if short-term price volatility is not a major concern he will favour shares.

2. The fact that, unlike shares, every property is unique requires analysis of the specific factors which contribute to the value of each investment asset. In real estate this fundamental analysis of the attributes making up the value of each property is called hedonic analysis or implicit pricing. The theoretical value of an individual property is derived as the dependent variable of an equation in which the physical, locational and qualitative aspects of the property provide the independent (causal) variables.

The above commentary has sought to show that it is feasible to adapt to property investment the principles, if not the precise procedures, of financial theory as they have been developed and applied to the sharemarket. The key principles are the diversification philosophy of portfolio construction, and the benchmark of the security market line, to establish the theoretically correct asset price in an equilibrium market.

As indicated above, there are a number of different approaches used by property investors. But it does not follow that the accuracy of the resulting valuations will depend on the sophistication of the model used. Indeed, a contention of this study is that it not necessary to use a complex model to achieve adequate accuracy of prediction for the economically rational real estate investor. The correct role of valuation models is to define the economic relationship between the relevant variables in order to arrive at values which would establish a market in equilibrium. By this is meant a market which would clear if a group of properties were for sale at prices equal to their equilibrium values. The principal function of valuation models is to establish whether the individual

properties offered for sale are mis-priced relative to their equilibrium market values. As the valuation of an investment asset should be drafted in terms of expected future cash flow and growth, discounted at a rate which reflects the investor's risk perception, the resulting value will reflect the amount and quality of the information available to him.

Because rental residential real estate investment in metropolitan Melbourne ($RRREI_m$) is a risk-bearing investment, measurement of its internal rate of return (IRR) must combine the government bond rate plus the risk premium for $RRREI_m$:

$$IRR_{RRREI_m} = R_f + R(RRRREI_m - R_f)$$

Where:

IRR_{RRREI_m} = average internal rate of return on rental residential real estate investment in metropolitan Melbourne

R_f = risk free rate of return

$RRRREI_m - R_f$ = risk premium for rental residential real estate investment in metropolitan Melbourne

Data To Be Tested In RRREI Model

The data to be used will be:

1. Median Melbourne residential real estate average annual prices by local government area (LGA) for the continuous period of time (27 years) that this data has been available in consistent form. Given the heterogeneity of real estate, the sample of properties comprising annual sales statistics is likely to differ from year to year. For example, in the Melbourne suburb in which the author resides, the average price of houses sold last calendar year increased 47% over the previous year's sales. Given that there were no exceptional developments or planning proposals within the suburb, more than 50% of this increase can be attributed to compositional factors in the sales sample. The period of time encompassed in the above 27 years of data is considered sufficient to balance out these compositional variations and to encompass sufficient real estate pricing cycles to provide a statistically acceptable data sample. This data has been compiled from records held by the State of Victoria's Valuer General's Office. This will provide the growth (capital gain) component of the return to be measured by the model.

2. Annual rentals for the same period by LGA. In Victoria, a State residential tenancies bond authority was only set up in mid-1998. To match the 27 years of residential sales prices, earlier rental details have had to be obtained from other sources,

notably rental advertisements in ‘The Age’ newspaper. This introduces a data bias in that ‘asking’ rents often exceed ‘going’ rentals paid by continuing tenants. But as the purpose of the exercise is to compare statistics on a trend basis, the bias is not deemed to be serious.

3. Rates for ten year government bonds. These are the defined risk-free investment in financial theory, as the interim payments of interest and the repayment of principal at maturity are guaranteed by the federal government. These rates are available from Reserve Bank bulletins and the Australian Bureau of Statistics.

For inspection, combined RRREI returns (rentals and capital gain) for each suburb will require to be plotted on semi-logarithmic graph paper, so that a given movement above the trend line is equivalent in percentage terms to the same movement below it, at any point on the horizontal scale. The two things which will require to be measured are the slope of the mathematically fitted trend line (rental returns and capital gain) and annual movement about that line (risk). These may conceivably range from high slope (return)/low variability (risk) to low slope (return)/high variability (risk).

Given that return is a reward for bearing risk, an RRREI pricing theory must be able to quantify risk. This can be done by adapting from financial theory the concept of the beta coefficient, recognising that beta measures the amount of systematic risk present in an individual risk-bearing asset, relative to an average risky asset. From the above quantitative analysis, it becomes possible to compile a return on rental residential real estate investments, at local government level:

$$R_{LGAi} = R_f + \beta_{LGAi}(R_m - R_f)$$

Where

$$R_{LGAi} = \text{RRREI return for local government authority } i$$

$$R_f = \text{ten year government bond rate}$$

$$R_m = \text{average return for Melbourne metropolitan RRREI}$$

$$(R_m - R_f) = \text{risk premium for Melbourne metropolitan RRREI}$$

$$\beta_{LGAi} = \text{beta (risk) coefficient for local government authority } i$$

The returns, by LGA, can be plotted on a risk-return graph. In an efficient market, with prices in equilibrium, all returns would fit on an upward sloping line:

$$R_{LGAi} - R_f / \beta_{LGAi}$$

This positively sloping line will describe the relationship between systematic risk and expected return. In financial market theory, this is known as the security market line (SML). Adapting it to this real estate study, it becomes the RRREI line.

Applying it to the entire Melbourne metropolitan RRREI, and bearing in mind the model is based on expected (E) returns, it would have a slope of:

$$\begin{aligned} & E(R_m) - R_f / \beta_m \\ &= E(R_m) - R_f / 1 \\ &= E(R_m) - R_f \end{aligned}$$

Where

E	=	expected
R _m	=	average market return for Melbourne RRREIs
R _f	=	ten year government bond rate
β _m	=	average beta coefficient for Melbourne RRREIs

The slope of the RRREI line is the difference between the expected average return on Melbourne RRREIs and the ten year 'risk free' government bond rate. The fundamental relationship between beta and expected return is that, in a situation of market efficiency (and, therefore, price equilibrium), all assets would have the same reward to risk ratio:

$$E(R_{LGAi}) - R_f / \beta_{LGAi}$$

By substituting $E(R_{LGAi})$ and β_{LGAi} for the expected return and beta for a particular LGA, we know it should plot on the RRREI line, as it's reward to risk ratio, in a situation of market efficiency, would be the same as for the overall market:

$$E(R_{LGAi}) - R_f / \beta_{LGAi} = E(R_m) - R_f$$

This can be rearranged to write the equation for the RRREI market line as:

$$E(R_{LGAi}) = R_f + \beta_{LGAi}[E(R_m) - R_f]$$

$E(R_{LGA_i})$ becomes the internal rate of return (IRR) for investment in LGA_i . This is the rate used to discount future returns back to today's present value: it provides the RRREI pricing model. For a particular LGA, this depends on:

1. R_f : the pure time value of money - the reward for merely waiting for future returns, without taking any risk.

2. $[E(R_m) - R_f]$: the reward for bearing systematic risk - ie the reward the overall Melbourne RRREI market offers for bearing an average amount of systematic risk in addition to waiting.

3. β_{LGA_i} : the amount of systematic risk present in RRREI in a particular LGA, relative to the overall Melbourne market.

However, in a non-efficient market (Melbourne RRREI lies between a weak and semi-strong efficient market), not all LGAs will plot precisely on the RRREI market line. Nevertheless, this revelation contains information content which is of relevance to RRREI investors. Given the inverse relationship between return and price, if LGA_i plots above the RRREI line this could indicate that future prices in LGA_i will trend upwards. Conversely, if yields in LGA_{ij} are lower than what the market indicates they should be, this suggests prices could trend downward in LGA_{ij} .

What the semi logarithmic graph will do is combine rental income and capital gain (or loss) to give a total return on an annual basis for each LGA. This will require to be superimposed on a graph of aggregate figures for metropolitan Melbourne. The reason for doing this is to measure risk for each LGA, relative to overall market risk:

$$\text{Risk of } LGA_i = \frac{\text{change in return for } LGA_i \text{ as the market changes}}{\text{total risk of the return on the market}}$$

The above exercise will incorporate both systematic and unsystematic risk. Unsystematic risk will have a distorting effect on the conceptual purity of the calculation. However its effect will be reduced to the extent that the analysis is not involving individual RRREIs, but is averaging properties for an entire LGA. This will achieve a partial portfolio effect, and should thereby reduce the unsystematic risk component. The above exercise will enable the variance, and, in turn, the standard deviation to be calculated, to measure RRREI market risk:

$$\begin{aligned} &= \text{standard deviation of RRREI market return} \\ &= \sigma \end{aligned}$$

Comparison of how the return for a particular suburb changes relative to changes for the overall market can be obtained by calculating the covariance for each LGA:

$$\text{Risk of LGA}_i = \text{cov}(R_{\text{LGA}_i}, R_m) / \sigma$$

Where

$$\text{cov} = \text{covariance}$$

$$R_{\text{LGA}_i} = \text{return for local government area } i$$

$$R_m = \text{return for the RRREI market}$$

$$\sigma_m = \text{standard deviation of the market return}$$

This will enable the calculation of the beta coefficient for each LGA:

$$\begin{aligned} \beta_{\text{LGA}_i} &= \text{risk LGA}_i / \text{risk}_m \\ &= \text{risk LGA}_i / \sigma_m \\ &= \text{cov}(R_{\text{LGA}_i}, R_m) / \sigma_m / \sigma_m \\ &= \text{cov}(R_{\text{LGA}_i}, R_m) / \sigma_m^2 \\ &= \text{beta for } R_{\text{LGA}_i} \end{aligned}$$

We can now re-write the equation for the RRREI market line as:

$$\begin{aligned} (R_{\text{LGA}_i}) &= R_f + [(R_m - R_f] \\ &\quad * \beta_{\text{LGA}_i} \\ &= R_f + [(R_m - R_f] \\ &\quad * \text{cov}(R_{\text{LGA}_i}, R_m) / \sigma_m^2 \\ &= R_f + [(R_m - R_f) / \sigma \\ &\quad * \text{cov}(R_{\text{LGA}_i}, R_m) / \sigma_m \end{aligned}$$

This will enable return from rental residential real estate investment to be determined for each local government area. However, the mathematical weakness of the covariance term, $\text{cov}(R_{\text{LGA}_i}, R_m)$ is that its value depends upon the absolute value of returns. This

can be overcome by substituting the correlation coefficient (ρ) for the covariance methodology:

$$(\rho_{LGA_i, LGA_{im}}) = \frac{\text{cov}(R_{LGA_i}, R_m)}{\sigma_{R_{LGA_i}} * \sigma_m}$$

Where

$\text{cov}(LGA_i, R_m) =$ covariance of the return for LGA_i

$\sigma_i =$ the standard deviation return by LGA_i

$\sigma_m =$ the standard deviation of the return on the market

This equation can be transformed to

$$\rho_{LGA_{im}} * \sigma_{LGA_i} * \sigma_m = \text{cov}(R_{LGA_i}, R_m)$$

This can be substituted into the equation for the RRREI market line:

$$\begin{aligned} R_{LGA_i} &= R_f + [(R_m - R_f)/\sigma_m * \rho_{LGA_{im}} * \sigma_{LGA_i} * \sigma_m / \sigma_m] \\ &= R_f + [(R_m - R_f)/\sigma_m * \rho_{LGA_{im}} * \sigma_{LGA_i}] \end{aligned}$$

These formulations are based on past data. For the model to have practical application, it must be predictive. Therefore it will be necessary to mathematically extrapolate trend and actual lines by LGA, so that

$$E(R) = (R_h + a_i \dots + a_n)$$

where historical returns (R_h) are extrapolated to project expected future returns. Just as for the capital asset pricing model and its application to the sharemarket, these extrapolations will require adjustment as additional market information becomes available.

If an investor could fully diversify his investment portfolio, which is possible in concept, but not feasible in practice, he would seek a portfolio return which approached perfect correlation with the expected returns for the RRREI market:

$$\rho_{pm} = 1$$

Where

$$\begin{aligned} E(R_p) &= R_f + [E(R_m - R_f)/\sigma_m * 1 * \sigma_p] \\ &= R_f + [E(R_m - R_f)/\sigma_m * \sigma_p] \end{aligned}$$

In this ideal state, the portfolio would be efficient, because it would comprise only systematic risk. This would provide the capital market equation, which explains the expected return for efficient portfolios. However, this is beyond the scope of this study, which seeks to derive a working model, and therefore does not need to go beyond the RRREI market line, the real estate equivalent of the financial markets' security market line (SML).

Writers such as Pyhrr, Cooper, Wofford, Kapplin and Lapidés (1989) have argued that the shape of the annual return line (as distinct from the trend line) will be of significance to the RRREI investor. They argue that optimising returns from RRREI is, in part, a function of timing. This approach holds that real estate, being a derived demand, is slower to rise in price than shares, commodity prices and overseas reserves. Conversely, it is slower to fall. This line of argument holds that the rational RRREI investor requires to factor timing into his decision model. A number of other authors have stressed the importance of timing, some basing their approach on the investment clock, which indicates at what time on the twelve hour clock face the various mainstream investments will rise and fall (de Fraga, 1994; Huntley, 1995; Ord Minnet Investment Planning, 1995; Australian Property Investor, 1997:47).

Pyhrr et al. Have argued that the real estate investor's general aim should be to concentrate on investments whose prices are out of line with the expected long term inflation trend. This can be accepted as a normative statement. But it would have to be tested. And therein lies a problem, because perfect timing, apart from mere coincidence, is possible only in hindsight. The efficacy of switching could be tested against historical data, factoring in known switching costs. But the unknown variable is the predictive ability of the individual investor to get his timing 'right.' As the often repeated saying goes: "Nobody rings a bell at the top or the bottom of the market." (Australian Property Investor, 1997:47). It is not apparent where the cycle is at a given time. Graham has classified investors as either active or passive (1998:6). What this study has sought to do is develop a model which the long term real estate investor can utilise as a passive or part-time activity during his working life to invest in properties which will give him abnormal returns, and thereby increase his wealth. Opportunities to switch always exist in dynamic markets - at a cost. But to quote Collins:

“Timing entry (to) or exit (from) a market usually does not work ...a diversified portfolio helps reduce volatility”

Collins (1998:4)

Because timing is a subjective evaluation, with an immense number of possible outcomes, it is outside the scope of this study.

‘Location’ The Point At Which Financial Theory Ceases To Be Of Relevance To The Real Estate Market

Location is of fundamental importance in real estate valuation. To illustrate, a BHP share sells for the same price at the same time on the Perth stock exchange as it will sell on the other side of the Australian continent, in Brisbane, Sydney, Melbourne, or Hobart. Indeed, it will sell simultaneously around the world at the same price, allowing for currency differences. Any price variations will be fleeting: they will be almost immediately arbitrated out, given the speed of electronic communication.

However, identical houses in any of the Australian state capitals are unlikely to sell for exactly the same price. In fact, identical houses in the same local government area, and even in the same street, are unlikely to sell for identical prices, though the differences should be diminished. These price variations are due in part to the fact that, unlike the sharemarket, most negotiations are conducted in secret. But they are due mainly to the difference in location, the catchcry of real estate practitioners (Hewat, 1994; Hopkins, 1994; Maher, 1994; Walsh, 1994; and Clitheroe, 1994). It is at the point of the specific (unique) location of each property that financial market theory ceases to be of aid in RRREI pricing analysis. Adaptation of financial market theory will take us as far as individual suburbs, with their risk and return differentials. But it will not take us as far as modelling present values (prices) of individual RRREIs, especially given the significant unsystematic risk present at individual property level.

To complete this final step, from individual suburb to individual property, it becomes necessary to seek out a theoretical concept which encapsulates the price-determining characteristics of an individual property. That concept is hedonic pricing, otherwise known as implicit pricing, developed in the United States (Rosen, 1973; Dale-Johnson, 1980; Can, 1990; Allen, Springer and Waller, 1995), and extensively tested empirically in the United Kingdom (Fleming and Nellis, 1981), but only touched on, with limited empirical testing, in Australia (Abelson, 1993; Hopkins, 1994).

With the hedonic approach, variations in the price of houses (given supply and demand conditions) are considered to depend on the specific attributes or characteristics making up the housing 'package'. These include characteristics of the house itself: its neighbourhood, ie amenities, aesthetics, economic and social status; and its location within the metropolitan area. As different combinations of these qualities or attributes are present in each property, the value of each of these characteristics can be estimated. Fortunately, most of them are quantifiable. Others may be denoted by a dummy variable,

such as whether or not the building was built in 1985 or later, and therefore offers tax deductible depreciation, or to indicate the presence or absence of a qualitative factor, such as social infrastructure, eg a school nearby.

In hedonic price modelling, the functional relationship is usually assumed to be linear, semi logarithmic, or logarithmic, with the characteristics or attributes of each house 'package' (the independent variables) regressed on the dependent variable: its sale price (Coulson, 1983). In simplified form, the hedonic price model is expressed as:

$$p = f(z_1, z_{11}, \dots, z_n)$$

Where

$$\begin{aligned}
 p &= \text{observed price of house} \\
 f &= \text{function of} \\
 z_i &= \text{amount of characteristic or} \\
 &\quad \text{attribute } i \text{ per house, for } i = 1, \\
 &\quad \dots, n \text{ characteristics}
 \end{aligned}$$

Believed to be the largest of these hedonic pricing studies was that carried out in the early 1980's by English researchers, Fleming and Nellis (1985). Using information from 150,000 building society mortgage approvals, they used multi-variate regression analysis to construct a full hedonic pricing index. The variables they included in their housing characteristics were the type of dwelling, type of rooms, number of garage spaces, lot size if more than 0.4 hectares, central heating, location by economic planning region, road charge liability, number of habitable rooms, age of the property, and whether freehold or not. To construct their hedonic price model, they adopted a weighted average of the estimated regression coefficients, with each coefficient being regarded as an implicit characteristics price.

A potential source of bias in regression-based studies, such as hedonic pricing, is wrong specification of the functional form of the model. After thorough testing, Fleming and Nellis confirmed that the semi-logarithmic functional form, with the dependent variable (price) expressed in natural logarithms, provided a reliable measure. The overall explanatory power of their equation for housing prices (as measured by the adjusted coefficient of determination - R^2) was seventy three percent. Their hedonic index series was carried on by the largest provider of home mortgage finance in the United Kingdom, the Halifax Building Society, publishing quarterly hedonic house price indices at national and regional levels. The literature reveals that in Australia, we have produced only partial hedonic house price models. Abelson, who in December 1993 reported on the results of the Federal Government's 1990 study into housing costs, found that within each of the three cities surveyed in the housing cost study (Sydney, Melbourne and Adelaide) approximately seventy five per cent of variation in housing prices was explained by:

- distance from central business district
- environmental quality
- house size

But he did not develop this into an index. The only known housing price index maintained in Australia is that of the Melbourne-based Australian Property Information Centre. Since December, 1989, it has published a monthly newsletter which models hedonic price movements on housing size, construction, location and land size, based on Melbourne auction results (Hopkins, 1994). The Real Estate Institute of Victoria provides member subscribers with a report of the past month's individual sales, together with limited hedonic characteristics of each property sold.

Importance Of Taxation To RRREI

Any RRREI pricing model that seeks completeness should incorporate the financial characteristics and objectives of the individual investor. For an RRREI investor, a major consideration is his equity cost/return. This is a difficult question to answer because there is no direct way of observing the equity cost/return that RRREI (or, indeed, investors in any other asset) require on their investment. In practice, many thousands of investors are heavily geared in RRREI. There are at least three reasons for this:

1. RRREI is a widely adopted, low risk means of building wealth, by borrowing most of the capital cost. Because it is low risk, RRREI offers attractive collateral for mortgage lenders to secure their loan.

2. Many RRREI investors deliberately choose these high gearing levels, as a strategy to increase their long term wealth.

3. High borrowing levels often result in negative cash flow, with the expectation that capital gains will more than compensate for the short term cash deficit. These negatively geared investors reduce taxation by offsetting their current investment loss against other tax assessable income. To see why this is so, the next reality to be introduced to the RRREI model is that of graduated personal taxation. The importance of taxation to the real estate investor has been demonstrated by a number of authors (Aaron and Pechman, 1981; de Leeuw and Ozanne, 1981; Pellechio 1988; Wood and Yates, 1997; and Wood and Watson, 1999). The relative attractiveness of negative gearing is a function of the RRREI investors's marginal tax rate. Current personal tax rates in Australia are in five bands (Australian Taxation Office, Taxpack 1999:112):

Income Range	Marginal tax rate
	%
1. Up to \$5400	0
2. \$5401 to \$20,700	20
3. \$20,701 to \$38,000	34
4. \$38,001 to \$50,000	43
5. Over \$50,000	47

The Medicare levy cuts in at a taxable income of approximately \$13,500, adding one and a half cents to the marginal tax rate (Australian Taxation Office, Taxpack 1999:117).

The effect of progressive marginal tax rates can be easily seen: assume \$100,000 RRREI, 6% earnings before interest and tax (EBIT), and 12% interest on borrowings of 80%. Assume also that 10% of capital value comprises depreciable components of the purchase price, depreciable at 10% per annum. Average annual nominal capital gain is estimated at 8%, and inflation is estimated at 5% per annum (high by comparison with today's low inflation, but appropriate for purposes of illustration):

Net yield	\$6000
Less depreciation	(\$1000)
Less interest: \$80,000 * 12%	(\$9600)
Reduction in taxable income	(\$4600)

TAX BAND	1	2	3	4	5
Net profit(loss)	(4600)	\$4600)	(\$4600)	(\$4600)	(\$4600)
Tax shield	\$0	\$989	\$1633	\$2047	\$2231
Net deficit	(\$4600)	(\$3611)	(\$2977)	(\$2553)	(\$2369)
Depreciation	\$1000	\$1000	\$1000	\$1000	\$1000
Cash deficit	(\$3600)	(\$2611)	(\$1977)	(\$1553)	(\$1369)
Real gain	\$3000	\$3000	\$3000	\$3000	\$3000
Capital gains tax	\$0	(\$645)	(\$1065)	(\$1335)	(\$1455)
Net cash flow	(\$600)	(\$256)	(\$42)	(\$112)	(\$176)

Two comments are required regarding this table:

1. Capital gains tax liability will be deferred until the RRREI is sold. However, the above example assumes a sale at the end of the first year.

2. The above table indicates RRREI is unprofitable for 80% geared investors with a taxable income of less than \$38,001.

The explanation of this second point is that in a situation of high gearing in RRREI, it takes several years to reach cashflow break-even point. This can be illustrated by drawing on the data used in the above example, (recognising that, on average, net rentals increase in line with RRREI price appreciation):

YEAR	1	2	3	4	5
Net yield	\$6000	\$6480	\$6898	\$7558	\$8163
-Depreciation	(\$1000)	(\$1000)	(\$1000)	(\$1000)	(\$1000)
- Interest	(\$9600)	(\$9600)	(\$9600)	(\$9600)	(\$9600)

Taxable inc.	(\$4600)	(\$4120)	(\$3702)	(\$3042)	(\$2437)
Depreciation	\$1000	\$1000	\$1000	\$1000	\$1000

Cash flow	(\$3600)	(\$3120)	(\$2702)	(\$2042)	(\$1437)

YEAR	6	7	8	9	10
Net yield	\$8816	\$9521	\$10,283	\$11,106	\$11,994
-Depreciation	(\$1000)	(\$1000)	(\$1000)	(\$1000)	(\$1000)
-Interest	(\$9600)	(\$9600)	(\$9600)	(\$9600)	(\$9600)

Taxable inc.	(\$1784)	(\$1079)	(\$317)	\$506	\$1394
Depreciation	\$1000	\$1000	\$1000	\$1000	\$1000

Cash flow	(\$784)	(\$79)	\$683	\$1506	\$2394

This shows, for the figures adopted here, that it takes the RRREI to break even:

1. 7.1 years in terms of cash flow, and
2. 8.4 years in terms of taxable income.

It has been shown above that the RRREI investor will increase his return on equity by gearing. However, gearing in turn increases financial risk. It is essential that this be considered in property investment, given the propensity for high gearing. Negatively gearing an investment requires that the investor has sufficient cash flow from alternative earnings to cover the deficit cash flow on his investment. This can be scaled per the following formula:

$$R = \text{SCFPNGI} / \text{NGIDCF}$$

Where the numerator is:

Surplus cash flow pre-negatively geared investment

and the denominator is:

Negatively geared investment deficit cash flow

The dependent variable 'R' is 'Rating:' if this is less than one (unity), the negatively geared investment should not be proceeded with. Financial risk, in a situation of negative gearing, is in turn a function not only of rental vacancies and property damage, but also of the probability of continuing and stable cash flow from the investor's non-RRREI income sources. This is outside the bounds of the proposed RRREI model. Instead, what is proposed in the current study is that the guidelines followed by leading mortgagee loan institutions be used as the measure of financial risk. Mortgagee institutions cover their financial risk in two ways:

1. By basing mortgage repayments on a universally adopted proportion of the RRREI investor's gross income, less existing contractual financial commitments. The guidelines followed by the largest home mortgage lender in Australia, the Commonwealth Bank, will be adopted in this study. The Commonwealth Bank's policy is to lend to the point where mortgage principal and interest payments do not exceed 30% of the borrower's gross income. If the prospective borrower already has loan liabilities, these will be subtracted from the 30% ceiling, so that the borrower is limited to borrowing within the residual (Commonwealth Bank, 2000).

2. By having the RRREI investor take out mortgage insurance, which is levied on high loan to value (LTV) mortgages. Where the mortgage is 80 to 95 percent of the assessed value of the property, the lending institution will pass on a charge for mortgage insurance, and in addition the State Government will charge the borrower ten percent stamp duty on the one-off mortgage insurance premium. The Housing Loan Insurance Corporation, which is Australia's largest mortgage insurer, charges 0.4% of the total mortgage when the LTV ratio reaches 80%, ranging up to 1.4% when the LTV ratio reaches 95%, the usual upper lending limit on residential property (Commonwealth Bank, 2000).

Mortgage insurance compensates the lender for the mortgage repayment shortfall, where the borrower defaults on his repayments, and if a mortgagee sale does not fully pay out the loan and associated costs. But this does not reduce the borrower's risk. To do this, he would have to take out mortgage loan protection to protect his estate from the mortgage loan liability in the event of his death. In addition, he would have to also take out income protection insurance to safeguard his cash flow to meet mortgage commitments. His risk profile is, in part, a function of whether he takes out these two insurances, and again this is outside the scope of the practical RRREI model proposed here.

This begs the question of what loan to value ratio the RRREI investor should operate at. What the Commonwealth Bank and the Housing Loan Insurance Corporation are both indicating is that financial risk becomes significant from 80% loan to valuation. Below 80% they don't regard the risk as sufficient to warrant insuring against. The prudent RRREI investor, seeking to avoid significant financial risk, should therefore restrict his borrowing to less than 80% of assessed value. The investor who is seeking to add to his RRREI portfolio will presumably remortgage when he has built up sufficient equity in his

present real estate holdings to provide a deposit for further RRREI. His deposit will need to be at least 20% of the new RRREI, plus he will need to cover buying costs of, say, 5%, a total of 25%. On a \$100,000 property, this amounts to \$25,000. This gives a loan to value (LTV) operating range, on a \$100,000 RRREI of:

$$\$80,000 - \$25,000 = \$55,000$$

ie, 55% to 80% of valuation

Presumably, when his equity climbs to 45% (and his LTV falls to 55%, as above), he will remortgage, to extract \$25,000 equity and therefore reduce his equity to 20% (and increase his LTV to 80%). Technically, to avoid mortgage insurance cutting in, he would restrict his mortgage borrowings to \$79,999. As it is assumed the RRREI investor will operate within the 55% to 80% LTV band, financial, as distinct from business risk, does not have to be factored into the model.

The RRREI Model To Be Tested

The components of the RRREI pricing model can now be formulated:

$$\begin{aligned} \text{RRREI price} = & \text{The cost of money (risk free rate)} \\ & + \text{risk premium for overall riskiness of RRREI} \\ & * \text{adjustment for risk-return of local government area} \\ & * \text{adjustment for hedonic characteristics of RRREI}_i \\ & * \text{adjustment for mortgage borrowings} \\ & * \text{adjustment for marginal tax rate of individual investor} \end{aligned}$$

Because it is a discounted cash flow (DCF) model (to calculate the differing present values according to the timing differences of future cash flows and imputed capital gains), the dependent variable must be expressed as expected cash flow (E):

$$E(R_{Ii}) = [E\{R_f + \beta_{LGAi}(R_m - R_f)\} * H_i * D * T_i]$$

Defining the independent variables first:

$$E(R_{Ii}) = \text{expected return from investment } i, \text{ where } i = 1 \text{ to } n$$

$$R_f = \text{ten year Federal Government bond rate}$$

- β LGA_i = risk of RRREI investment in suburb i relative to the median Melbourne metropolitan RRREI market risk
- $E(R_m - R_f)$ = the average risk premium of RRREI investments over and above the risk free rate
- H_i = adjustment for hedonic characteristics of individual house
- D_i = debt on individual RRREI
- T_i = adjustment for personal tax rate of individual investor

Defining the dependent variable:

- $E(R_i)$ = $E(IRR_{RRREI_i})$
- = Expected rate of return on RRREI_i. This will be the dependent variable in a linear equation. $E(IRR_{RRREI_i})$ is the discount rate at which expected future net cash flows and nominal capital gains will be discounted back to present value (PV) to provide today's theoretical market price for RRREI_i, where i equals investment properties 1 to n.

In the absence of switching, capital gains tax will be based on a ten year holding period (when the depreciation tax shield on non-construction components is assumed to run out), discounted back to the present at the expected internal rate of return.

The form of the RRREI pricing model is expected to be analogous to the security market line of financial (share) market pricing theory. The model will equate the coefficients for the independent variables with the dependent variable, $E(R_i)$, which in turn serves as the discount rate to equate future expected cash flows and imputed capital gains back to today's equilibrium market price.

Conclusion

In Australia, there is a growing need for private investors to provide rental accommodation. But given this represents a substantial investment, and heavy borrowing by most individual investors, the investment decision is one which should be made on rational economic grounds. The model which has been proposed here has been adapted from financial theory tested over the past four decades in the stock market. This RRREI model will in turn be tested against 27 years of historical real estate financial data, in an effort to provide a practical model for private rental residential real estate investors in metropolitan Melbourne.

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