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AN ALTERNATE METHOD FOR RESIDENTIAL PROPERTY VALUATION.

(USING ECONOMETRIC MODELLING OF SOCIO-ECONOMIC AND HEDONIC VARIABLES)

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1. ABSTRACT

This paper sets out to address perceived deficiencies in valuation theory, methodology and practice.

It is argued that these deficiencies flow from the conceptualization by market participants and practitioners of property as an object rather than as a bundle of rights and obligations giving rise to anticipated future benefits.

More specifically the deficiencies include the over reliance on the comparable sales method and its derivatives, the high level of subjectivity in valuation practice and the misrepresentation of the relative value of property assets with respect to other assets in the community.

To attempt to address these matters this work suggests a possible long term alternative to traditional techniques in the form of a valuation methodology which revolves around price or value modeling.

The possible methods of undertaking such an analysis are discussed and a number of models are reviewed. Risk, for the purposes of the model sought to be developed, is considered to be a function of the way changes in property values in a sector relate to changes in the market as a whole and is measured using the beta for the LGA with respect to the market. The systematic risk of a sector or LGA is important in estimating a risk premium and thus a discount rate to be applied to and used with the valuation model.

Finally an example of a model is presented. It is concluded that whilst much more research is required to produce an effective model, the work should encourage the necessary investment in research.

SECTION 1 - INTRODUCTION

The importance of effective systems of valuation.
Valuation is a vital element in the efficient functioning of modern economies and of modern society. Without accurate valuations, scarce resources may be allocated incorrectly.

For an economy and therefore society to function properly, market participants need to correctly identify the marginal utility of a product such that the correct market price may be established where marginal utility equals marginal cost.

Ideally markets will adjust to changes immediately and information will flow freely. If this occurs market participants may act as knowledgably as possible, in accordance with the definition of market value, and market anomalies will disappear as quickly as possible.

If the marginal utility of an asset, in particular a housing asset, includes an incorrect or unrealistic assumption about future capital growth or return, the result will be market disequilibrium and an over supply of the product. Where supply is limited this will increase price and draw investment and consumption spending away from other more productive investment and consumption choices.

Being able to identify the long term equilibrium price of an asset may limit the misallocation of a communities scarce resources.

"In a well-functioning market we do not need a formal theory of value.
Market Value = True Value = Present Value" (Brown and Matysiak 2000). Conversely, if the property market is not a well-functioning market we may need a formal theory of value, and Market Value, True Value and Present Value are not equal. This paper takes the view that the property market may not be a perfect market and that we should have a theory of value. If Market Value, True Value and Present Value are not always the same, we should then inquire into the most appropriate method to estimate true value, present value, the long term market equilibrium value and their relationship with market value.

The overall general objective of this paper, therefore, is to attempt to develop a long term equilibrium valuation model which ultimately can be used to estimate the present value of anticipated future benefits of a property.

The focus is on residential property although much of the work may be extended to other classes of assets as indeed much of the methodology is drawn from techniques employed in the valuation of other assets.

Issues associated with property valuation theory and methodology.
Property valuations rely primarily on the comparable sales methodology where the subject property's value is inferred by referring to the sale of a similar property or properties. As will be illustrated shortly by reference to two tier marketing schemes, one of the principal criticism of this method is that it allows valuation errors, which are reflected in prices, to be compounded. It is only

a proxy for the formal analysis of future benefits. It also allows valuers to ascribe values to assets which they may know to be incorrect, simply because there are transactions which they can and/or must use as a basis for the value regardless of the fact that these transactions may have been entered into without the participants having an adequate knowledge, let alone perfect knowledge, of the market. The system is subjective and relies on reasonably knowledgeable valuers having access to good information and not being influenced by commercial pressures and conflict of interest. There can be an absence of scientific method and two valuers can justify arriving at different valuations. The comparable sales methodology and its entrenched use often ensures that valuers do not see beyond the process of comparing values of other properties in the market. They therefore do not undertake any analysis or provide any constructive contribution to the determination of a theoretically sound value of a property asset and do not provide the depth and breadth of analysis that may assist in producing a fully informed market. They may not adequately analyse the present value of anticipated future benefits of the property.

As a profession, it may be appropriate that we move beyond Spencer V The Commonwealth and the methodology set down by the Court, particularly as technology, research and education develops. We should move forward and provide a service to clients and users by analyzing the anticipated future benefits of the asset.

The valuation profession should attempt to advise clients and users of the long term value of the property asset in relation to other assets. This allows the client to make a more informed decision and therefore improves the allocation of resources within the community. Specifically, residential valuations rarely make use of modern methods of analysis, usually because they are time consuming and costly and there may be a lack of training within this area of the profession.

An excellent example of where the Valuation Profession has been brought into disrepute is evidenced by the two tier marketing system, particularly evident in Queensland. This system involves a non-local resident being subject to an intensive and controlled marketing process which may result in them contracting to purchase a property at as much as $110,000 above the otherwise normal market value. (Herriot 2001). Once one transaction in a development has sold for the inflated price, a valuer may select this sale as their comparable sale and often fail to give appropriate advice since they are contracted by the developer. The valuer has however complied with the requirement to evidence his value with a comparable sale and can therefore take the position that the value is justifiable. In a professional environment however where valuers were not able to rely on comparable sales alone this position would be hard to take even for the most unethical of valuers as they might be required to show justification other than the other sales as to the appropriateness of the value ascribed. By having an established standard analytical method it should not be possible for two valuers to arrive at two different results.

This is a situation where a theory of value and clear definition of value would be, invaluable. As would be a methodology and industry consciousness which looked outside the comparable sales methodology.

It may be argued that although the comparable sales method of valuation may often be the most expedient and nominally the most accurate, as technology and the availability of data improves,

valuers' and the valuations they undertake, should begin to include a more detailed analysis of the influences on property values.

The concept of the value of any asset being the *present value of anticipated future benefits* should be the starting point for any valuation, including residential property valuations. This is the philosophical basis of this paper.

If the data and necessary technology were available, it is argued that the anticipated future benefits, and therefore value, of a residential house could be estimated by using a valuation model based on socio-economic and hedonic variables after accounting for systematic risk.

This is the case because socio-economic and hedonic variables provide a proxy for, or analysis of, the benefits obtained from the ownership of the housing asset. If we assume that the community considers the relative value of benefits provided by particular properties or their attributes will be more or less the same into the future, then we can use this information to estimate the present value of these anticipated benefits.

It is for this reason that the proposed model is held to provided an estimate of the socio-economic benefits attributable to a property into the future. In this way it is intended to contribute to an estimate of the present value of anticipated future benefits.

It is appropriate therefore to examine the possibility of developing a valuation model which provides a prediction of property prices based on social, economic and hedonic variables after accounting for risk. It is important to identify and estimate systematic risk so as to estimate an appropriate discount rate for the property asset.

Predicting the future with certainty is impossible. In fact, if it were possible to do so this would allow the future to be altered and therefore render any prediction incorrect. It is none the less an object of economics and management to attempt to do so. Therefore whilst it is recognized that there are difficulties with producing accurate future estimates, this in itself cannot negate the need to make attempts to do so.

The method discussed has three elements. Firstly, the influences of the wider economy are taken to account within an econometric model at a city or market wide level. Secondly an adjustment is made to account for risk by adding a beta value determined using the Capital Asset Pricing Model at a local government or sector level. The next step would be to build in an hedonic model to allow and adjust for property specific attributes. By then estimating values for the variables into the future the properties future value can be predicted and used to estimate a present value at a time different from that on which the hedonic and macro analysis is based.

It is also possible that by being able to determine a predictable median price for a certain sector or location that the reliance on the need for individual property valuations can be reduced. This is

more particularly the case if it is known how or if an individual property is different from the median. Moreover, an hedonic model used in conjunction may also tend to provide better, more practical, results.

The need for an econometric or statistics based methodology.

The principal criticism of the comparable sales method is that it allows valuation errors to be compounded since short term changes in market conditions, which may not be underpinned by fundamental long term changes, result in changes in valuations. That is, valuers advise clients that the price at which they propose to purchase a property is acceptable since there has been a transaction at a similar, or slightly lower, price. These supporting valuations may then help to perpetuate and exacerbate the effects of short term price movements. This systematic compounding causes market fluctuations to be larger than they perhaps should be if valuations were carried out with reference to a broader range of factors other than just recent sales of comparable assets.

It is considered a key function of economic management to minimise market fluctuations whilst still ensuring that market information is reflected in price as soon as possible. This will occur where a fully informed market adjusts demand and supply as soon as possible after factors affecting them change.

It is worth noting that investments in stocks and shares often follow substantial analysis and research by professionals yet this is rarely the case in residential housing.

When the true economic and social factors which primarily determine values change, or are predicted to change, this should give us an immediate change in property valuations rather than waiting for them to be reflected, often too late, in actual sale prices. As a result it is relevant to look at macro economic links with variables such as, income, population changes, interest rates and the CPI such that changes or predicted changes in these variables can be translated into possible changes in property prices. Whilst the difficulties associated with this form of measurement and forecasting are acknowledged the view is taken that attempts should be made to overcome them as far as possible since the long term benefits to the property consumer and community may be substantial.

In this paper it is assumed that an asset's value is the present value of all future benefits discounted by the sum of the risk free rate and the asset's risk premium rate. The risk premium can be indirectly estimated by determining the historical standard deviation of return in excess of the standard deviation of the (risk free asset) market return. That is, the assets beta. Future benefits consist of all estimated future cash flows derived directly or indirectly from the ownership of the asset. This concept is integral to the need to formulate a valuation method which is based on an estimate of future value adjusted for risk. This future value can only be estimated however by analysing the underlying historical relationships between value and those factors which may

influence it. Future benefits can be better understood and estimated through an understanding of the historical relationships.

The model which this paper sets out to develop is intended to be an estimate of future benefits based on the influence of social and economic variables, adjusted for risk. It suggests that this can then be extended to incorporate the influence of property specific benefits by incorporating a further hedonic model.

It is suggested that valuation methodology should begin to focus on both providing market data as well as analysing data using the most up to date technology and methodology available to provide valuable advice to users including estimates of equilibrium values for assets. Equilibrium values may be considered to be where the marginal utility of a property equals the marginal cost in a perfect market. Where market price is greater or less than the long term historical equilibrium, the market can be said to be in disequilibrium and the market value is not equal to the true equilibrium value.

In light of this review a method for determining an equilibrium or long term average valuation model is sought to be developed.

SECTION 2 – LITERATURE REVIEW

Literature associated with valuation theory and methodology.

There is no such thing as absolute ownership of land in the way we can own a car or boat. We purchase a bundle of rights and obligations in a very similar way that we purchase a bundle of rights and obligations when we purchase company shares.

It can therefore be argued that since the ownership of land and real estate is the ownership of a bundle of rights and obligations that give rise to future benefits, we must analyse and estimate these anticipated future benefits when valuing a property asset.

Rost and Collins(1990) comment that "*Land is most commonly regarded as being merely a solid part of the earth's surface: ground, soil or an expanse of country. In a legal sense, however, and also as the subject of valuation, land means any ground, soil, earth or air-space whatsoever, whether above or below water level...and it includes all buildings and improvements on the land and everything else attached to, or appertaining to , the land, whether above or below the surface.*" (Rost and Collins 1990, p14) They then proceed to write a book on "Land Valuation and Compensation in Australia". This use of words, and the conceptual link it provides which may have resulted in the conditioning of generations of valuers, is arguably the principal problem with valuation practice today. Valuers are not valuing the land. They are valuing the future benefits that an interest in a property will provide to the beneficial owner.

Problems with valuation practice arise because valuers may incorrectly relate the value to the land and buildings rather than to the benefits they deliver the owner.

Property is arguably an intangible asset in the same way goodwill is an intangible asset. It is suggested that valuers should recognize this and begin by analysing the nature of the anticipated future benefits this particular asset can contribute to the owner.

Both by tradition and by the nature of current law we never actually pay for the land itself but rather the right, subject to a relationship with the government and community, to use the land in certain ways. The methods we use to value property are many and varied but few adequately reflect or analyse the asset being purchased. Traditional valuation theory has identified several valuation methodologies for use in different circumstances. These methodologies revolve around the comparable sales method. Many of the other methods are, in effect, variations of the comparable sales method. They include, the capitalisation method, hypothetical development, special value, security value, insurance value, productive value, statutory values, reversionary values and many more. In fact it is almost possible to point to a different valuation method for each set of unique circumstances.

Price is a function of demand and supply. According to traditional microeconomic theory equilibrium price will fall where marginal utility equals marginal cost.

If price equals value then in a perfect market marginal cost will equal market price and will reflect the utility of the property asset.

In valuation practice an asset has a utility which is a function of prevailing socioeconomic conditions and its position or location within the society, both physically and demographically..

By examining and analyzing the historic relationships between price and utility we can begin to draw out the relationships between anticipated equilibrium price and utility. We can therefore determine the price or value of the utility of a property.

It is suggested that at no time are we valuing a property object. We are valuing or attempting to value a bundle of rights and obligations which will result in future benefits, both financial and in other forms, to the owner.

Valuation is not just a property discipline**.** Valuation involves many fields including "*behavioural science, management, finance, economics, statistics, environmental science, marketing and*

law."(Boyd 2002). Each of these fields undertake valuations on a regular basis and do so often without the restricted mindset of the traditional property valuer who has been conditioned to believe that the true value of a property asset is in what someone has paid for a similar asset at some time in the past. This 'comparable sales' method is merely a way of deferring the analysis of value to a previous market participant whom often has a very limited knowledge of the factors and issues influencing values, and whom may well have had their own 'special' value for a particular property asset.

*"The status of the Spencer case as a statement of valuation theory cannot withstand intellectual examination if the concepts adopted or developed by the courts are used for any other purpose other than that which the court itself is petitioned for"(*Lawson 2002)

This comment identifies the a key problem for valuation practice, particularly residential valuation practice, in Australia. The conditioning of traditional property valuers to adopt this approach for valuations and the re-enforcing of it through the courts due to a lack of alternative assertions has brought valuation practice to the position it now finds itself in. This traditional concept must be abandoned in favor of a positive economic or price theory which predicts price based on the independent variables which affect it. It is also vital to identify the need for a purpose when attempting to estimate a value as the purpose of the 'valuation' is integral to identifying the attributes which are likely to influence the value and to be able to give adequate advice on the nature of that value for the purpose of the user.

Kummerow (2002) suggests that *"verbal value definitions lead to possible confusion and disagreement in value estimates. A mathematical definition of value is therefore proposed"* He suggests that valuation be defined as an estimation of summary statistics which include; *"measures of central tendency, measures of dispersion or variation, skewness, kurtosis and analysis of outliers"*

This work argues that all of the significant contributors to value should be accounted for in arriving at a property value and that by modeling value and arriving at a value with an estimated error term we are realistically providing advice on the variability of a valuation.

The above discussion suggests that the current direction of valuation theory supports the need for a model designed to predict a properties value, or price, based on variables which may influence the future benefits of the property asset. Further, it suggests that existing practice is to be viewed as an expedient method which is increasingly less able to be justified. To value a property correctly it is necessary to estimate the anticipated future benefits. To estimate those benefits it is necessary to analyse the long term historical relationships between price, socio-economic and hedonic variables. This analysis and the model developed by this analysis can then be used to help to predict the present value of the property on the assumption that these relationships may continue to hold in the

future. We are therefore using this socio-economic/hedonic model to estimate the future benefits which may be derived from ownership of the property asset.

In doing this we are estimating the present value of anticipated future benefits, based on historical relationships which are adjusted for any reasonably predictable future changes.

Literature associated with the proposed valuation methodology including regression, house price indices and the CAPM.

Many papers have been written within the property industry making use of regression to analyse data. Early work in the area includes Bailey et al(1963), *"A Regression Method For Real Estate Price Index Construction*", and Palmquist (1982), *"Measuring Environmental Effects on Property Values Without Hedonic Prices*". Perhaps, as a result of the increasing availability of computers and their increasing capability, the considerable quantity of research and analysis taking place in the finance world flowed over into property and, particularly from the late eighties to the present, perhaps the greatest portion of articles published in professional and research journals make at least some use of regression analysis. It is used almost universally where data analysis is undertaken between related variables or information. Many of the papers and theses however use regression to analyse the relationship 'within' the context of the comparable sales method. The models developed are hedonic models, that is, they use sales data to predict the effect on price of different attributes of a property. Examples include 'The Application of Personal Computers to Direct Comparison Valuation' (Fibbens 1993) or 'The Effect of Residential Investment on Nearby Property Values: Evidence from Cleveland Ohio' (Ding, et al, 2000).

Apart from a paper by Oluwoye & Higgins (1999) in which they "examine whether the determinants of aggregate house prices...are linked to financial and economic activity" there appears to be a dearth of research within Australia, attempting to link macro-economic or socio-economic factors to property values.

Mitchell(1993) identified *"six macro economic factors as influencing residential house prices in New Zealand between March 1970 and June 1991."* These included inflation, real disposable income, real interest rates and consumer confidence as critical economic factors influencing demand for residential property. Hendershott and Weicher (2002) look at lessons learned in forecasting housing markets with specific reference to Gau and Goldberg (1983) commenting that *"Forcasting changes in housing finance…,housing demand…., and housing production requires forecasting numerous exogenous factors-inflation, government policy, and demographic forces being the most obvious"*

Dolde and Tirtiroglu(2002) *"examine significant shifts in regional housing price changes….."and "find significant associations of volatility events and economic conditions, especially national and regional income growth, inflation, and interest rates"*.

House price indices have been used and analysed by numerous authors and many argue that to ensure homogeneity of the data the repeat sale method is preferable. Generally this method however is dependent upon large quantities of good data over long periods and this is often not available. The repeat sales method requires at least several years data.

Hybrid methods which combine hedonic and repeat sales methods have also been developed. (Case and Quigley 1991).

In their paper on 'A Comparison of Residential Rental Indices' Hargraves and Chen(2000) compare methods for measuring changes in residential rental levels in North Shore City (Auckland) New Zealand. The indices compared were median, hedonic, repeat rent, weighted repeat rent and hybrid. They report that 'technically the hybrid method appeared to be the most appropriate, but ....the method was more costly.'

Costello & Elkins(2000) create a quarterly hedonic price index for ten suburbs across Perth to confirm the existence of a 'price size effect' as a determinant of house price change. That is, cheaper properties exhibit lower rates of real price change in the longer term.

Goetzmann & Peng (2002) analyse the implications "of cross-sectional heteroskedasticity in the repeat sales regression" and look at bias in the average return estimate.

Leishman and Watkins(2002) point out that "*a further source of potential bias, associated only with the explicit inter-temporal hedonic method, is concerned with the necessary assumption that implicit physical and/or locational attribute prices are constant over time".*

One of the principal criticisms of repeat sales analysis is that it is likely to be weighted toward properties which have a higher turnover or churn. Clapp and Giacotto(1992) note that datasets comprising only repeat-sale transactions are likely to be over represented by frequently traded properties.

Other publications on indices include Gatzlaff and Haurin (1994) look at selection bias in indices and Gatzlaff and Ling(1994) look at alternate methodologies., Meese, & Wallace (1995) compare repeat sales, hedonic regression and hybrid approaches.

By developing or using a rigorous house price index it is anticipated that the analysis of the relationships between housing prices and socio economic and hedonic variables necessary for the development of a model will be of a higher quality.

To estimate the present value of future benefits we need to apply a discount rate or required rate of return. This discount rate will be a composite of the risk free rate and a risk premium rate. In analysing risk and the risk premium it is intended to focus on the Capital Asset Pricing Model (CAPM), since this is arguably the most effective way of determining a risk premium rate for the sectors or LGA's in the model. As is discussed elsewhere it is by projecting the historic relationships into the future that it is hoped to create a model that will emulate or represent a form of the discounted cash flow model.

"The CAPM defines risk as the co-variability of the security's returns with the market's returns. We can also say that risk is the volatility of the security's returns relative to the volatility of the market portfolios returns". In the CAPM "*risk is labeled beta. Beta can replace variance as the measure of risk because we are assuming that investors will hold only diversified portfolios"*. Harrington (1983)

The CAPM is defined as;

Equation 1 - CAPM

$$E(r_i) = r_f + \beta(E(r_m) - r_f)$$

Where: $E(r_i)$ = Expected rate of return on the asset
r_f = Risk free rate
r_m = Market rate of return.
β = Beta

Draper and Findlay (1982) comment that "variance (or it's square root, standard deviation) is the most frequently used measure of dispersion(which is, in turn, commonly interpreted as risk). Variance of return is defined as;

Equation 2 – Variance of return

$$\sigma^2 = E(R_a - R_m)^2$$ where R_m = market and R_a = the individual asset

"Systematic risk, or Beta, is a measure of covariance.

Low beta assets will have low expected returns and high values

High beta assets will have high expected returns and low values.

As systematic risk is a measure of co-variance it is the appropriate measure of risk to use for pricing individual assets."(Brown and Matysiak 2000)

Baum (1989) suggests a definition of risk as "*the possibility that a return will not be as expected"*. The proxy for the possibility that return will not be as expected is the historic volatility of returns, measured by the variance or standard deviation of those historic returns.

Blundell(1986) used standard deviation of historic returns. to analyse whether high value properties show lower returns. Baum(1989) argues that this seriously underestimates the riskiness of large properties largely citing the poor data quality in comparison to stock market data which is based on actual trading prices.

Ward et al(1998), comment that "*The Capital Asset Pricing Model implies that the expected return on any asset depends on only one type of risk attached to holding that asset*".

Baker(2000) defines risk in his model as;
"Risk of LGAi = change in return for LGAi as the market changes/total risk of the return on the market."…."The above will incorporate both systematic risk and unsystematic risk. Unsystematic risk will have a distorting effect on the conceptual purity of the calculation."

Baker(2000) points to capital budgeting approaches and in particular the CAPM, as the more appropriate method of analysing investment decisions

It has been argued in this work that the value of an asset is the present value of anticipated future benefits. In analysing the present value therefore it is necessary to not only look at the future benefits which may accrue, it is necessary to look at the possible risks associated with those future benefits. That is, it is appropriate to estimate the systematic risk associated with individual sectors. Non Systematic, property specific risk is more difficult to quantify however it is intended that this be dealt with by incorporating an hedonic model. The risks can be looked upon as the possible variation in benefits and as such it is relevant to look at the historical variation in benefits, in the form of price appreciation, to analyse the risk associated with the future benefits. The Capital Asset Pricing Model is used for this purpose, to estimate systematic risk.

SECTION 3 – METHODOLOGY

3. 1 Toward the development of a new valuation model.
The methodology to be used to achieve the objective of developing a model based on macro economic variables, adjusted for risk using the CAPM.

In this section a general discussion of the methodology leads to a review of the overall type of models used and then to a discussion of some of the specific issues associated with the methodology. Finally a pro-forma model is illustrated to indicate the overall long term direction of the work.

3.1.1 Discussion of the methodology sought to be used to achieve the objective.

If the data and necessary technology were available, it is argued that the anticipated future benefit and therefore value of a residential house should be estimated by using a valuation model which incorporates socio-economic and hedonic variables and is adjusted for or accounts for risk. If we include sufficient factors of this sort it may be possible to develop a model which has all the important and influential variables implicit in price or value.

The intention is to estimate from historical data the relationship between socio-economic factors such as income, interest rates, population changes and inflation, and property values. By undertaking this analysis we are attempting to identify the influence of these variables on historic property prices so as to be able to estimate their influence on current or future values. In modeling these relationships we are asking, how does the number of people (population) living in an area affect the values in that area? How does the median income of residents in an area affect the median value of properties in that area? Alternately, how is income reflected in the median value for that area? By asking these questions it may be possible to begin to understand and analyse the effect these variables may have on the current values of properties in an area. By doing this it may also be possible to start to understand the future benefits that particular market participants have anticipated may be generated by the ownership of a particular property, given these parameters or variables. For example if an individual is prepared to pay sixteen times their annual income to purchase a particular property, they place a relatively higher importance on the future contributions that property may provide than an individual who will only invest ten times their annual income. By analysing these relationships in the long term we are beginning to get inside the mind and motives of the market and in doing so we are beginning to be able to determine the estimated future benefits that market participants have historically placed on properties given particular parameters.

By estimating a reasonable long term perfect market or equilibrium value we are providing an arguably more accurate estimate of the perfect market value than may be achieved using the comparable sales methodology. This is the case because the comparable sales methodology only uses recent transactions which may take place in a non-perfect market environment where price does not occur at the intersection of the marginal utility and marginal cost functions. Factors which

may result in this include special conditions, an emotive and ill informed market, special marketing practices and incentives and many other factors which will cause a market to be less than perfect.

With this idea in mind it was considered appropriate to firstly analyse the relationship between macro variables and the overall market prices, then analyse the riskiness of these values using CAPM.

3.1.2 An Econometric Macro Socio-Economic Model

To analyse the macro relationships it is considered appropriate to relate a large market, for example Sydney, with macro variables such as interest rates, population and inflation. Many other variables may also be used however those mentioned represent the most likely available variables.

It is intended that if this methodology was statistically justifiable and accurate that we could undertake the analysis and produce a value for the hypothetical average or standard Sydney house. That is, if the value given by the model was $400,000 then we could state with a high degree of statistical significance that a standard or average residential property in Sydney is valued at $400,000.

The model proposed, for the median house price (MHP), is as follows,

EQUATION 3 – PROPOSED MACRO MEDIAN HOUSE PRICE MODEL.

$$\delta MHP_i = \beta_0 + \beta_1 INT_i + \beta_2 INCi + \beta_3 POPi + \varepsilon_i$$

where δMHP_i *is the change in Median Sydney House Price at time i.*

β_0 = constant

INT_i = Interest Rate at time i

INC = Income at time i

POP = Population at time i.

ε = error

This model along with the CAPM represents the primary focus of this work. It is presented again along with the CAPM later in this section to illustrate the use of the model in a what is proposed may be a more comprehensive overall model. It is possible that other independent variables such as consumer confidence, unemployment and the CPI could be included along with many others.

Numerous variations of the model are possible and in particular a model using macro variables such as interest rates could incorporate sector level independent variables such as the LGA income. Log models are also analysed along with models incorporating dummy variables for LGA's. A

suggested combined model will be presented toward the end of this section however it is reasonable to suggest that the most appropriate model may differ with each set of data available.

Using CAPM to account for Systematic risk at an LGA/Sector Level.

If we look more specifically at a property in a particular area or LGA we need then to adjust the above value to account for the riskiness of that location or sector with respect to the market as a whole. The purpose of this is to identify an appropriate effective discount factor for this class of asset or LGA, that can be applied to the macro model. It can also provide an estimate of an appropriate discount rate which may be applied to estimate future benefits. If a specific property within a particular LGA or sector has a price which is relatively more risky than the market or the hypothetical standard property, then the valuation theory applied argues that the value ascribed to the property should be less than the median or average market price, with all other things being equal. To analyse this risk the Capital Asset Pricing Model is employed. The CAPM has been discussed earlier however it is important to reiterate that the use of this model is simply to adjust the macro model for the market by an appropriate risk premium applicable to the general area or submarket in which the property exists. The principal behind this is that insofar as the individual property is affected by macro influences it's price should move in line with all other prices in the market. Except, that is, for the fact that it exists as part of a locational or sectorial subset of assets whose price may move differently to that of the market as a whole. It is this variation in price movement that is being defined as the sector or LGA risk and is being analysed by using the CAPM. It is acknowledged that in an ideal world we would have price points or transactions for the individual asset or property which we may be seeking to value. Unlike in the stock market where stocks or assets are traded frequently, properties are traded much less frequently and as such there is not always the transactions for an individual property to analyse against the market. It is suggested that the sector or market subset that is used should be as small as is possible or practicable so as to as closely as possible represent the possible price movements of the particular property being valued. In the case of this study that subset is the LGA.

3.3 A Combined Macro/CAPM/Hedonic Equilibrium Valuation Model.

Having looked in general at the methodology and discussed some of the relevant issues relating to it, attention is now turned to the possible models that may be used within the context of this methodology.

To this end it is appropriate to provide a brief overview of the intended direction of this work in the long term by illustrating a series of models which are intended to present a possible combined equilibrium valuation methodology.

Below is the Capital asset pricing model for the change in the median house price for a region or sector (r).

EQUATION 4 – THE CAPM MODEL.

$$\delta MHP_{r} = R_f + \beta_r (\delta MHP_{m} - R_f) + \varepsilon_i$$

Where; δMHP r the change in or return on the median house price of the region/sector

R_f is the risk free interest rate, 10 year government bonds.

β_r is the beta for the Sector/region

δMHP_m is the median house price change for the whole market.

By taking the CAPM model (Equation 4 above) and inserting the Macro model (Equation 3 above) we obtain the combined macro model (equation 5). It is noted that here the macro model is being used to determine a the estimated change in the sector median house price.

EQUATION 5 – COMBINED MACRO AND CAPM MODEL

$$\delta MHP_{i_j} = R_f + \beta_s((\beta_{oi} + \beta_{1}INT_i + \beta_{2}INC_i + \beta_{3}POP_i) - R_f) + \varepsilon_3$$

Where δMHP is the change in the median house price at time i given the independent variables at time i, as defined above.

This model represents the median house price change for the sector at time i. We then turn to the hedonic house price model which could be expected to have variables including land size, the number of bedrooms in the house and the number of garage spaces.

EQUATION 6 – HEDONIC MODEL

$$HHP_{i_j} = \beta_o + \beta_{1,ls} + \beta_{2,no.bed} + \beta_{3,parkg} + \varepsilon_i$$

Where HHP_i = The Hedonic house price at time I for the subject property.

ls = The land size of the subject property.

No. Bed = The number of bedrooms in the subject house

parkg = The number of garage parking spaces in the subject house

If we assume the hedonic house price will change by the amount the median house price in a sector will change with changes in the macro independent variables, then we can take an hedonic model such as that presented below (equation 7) and obtain the predicted price of the property at some time in the future being i + n.

By combining the macro model, the CAPM and the hedonic model above we can obtain an estimate of the amount by which the property price may change per period i.

EQUATION 7 – CHANGES IN THE HEDONIC HOUSE PRICE PER PERIOD

$$\delta HHP_{ij} = \delta MHP_{r}(\beta_{o.i} + \beta_{1,ls.i} + \beta_{2,no.bed.i} + \beta_{3,parkg.i} + \varepsilon_{ij})$$

EQUATION 8 – A COMBINED MACRO/CAPM/HEDONIC EQUILIBRIUM MODEL OF THE INDIVIDUAL PROPERTY VALUE.

$$EHP_{i} = HHP_{i-1} + (\delta MHP_{r}(HHP_{i-1}))$$

The above model represents the hedonic house price at a time in the past (one period) say time i minus 1 plus the increase in the median house price for that sector based on the macro socio-economic variables adjusted for the systematic risk associated with assets in that sector or location.

If we assume there are unlikely to be changes in the hedonic variables into the future we can assume that the value of the property in the future will be the value at present or at some specified time compounded at the rate given by the macro/capm model or δMHP.

That is;

$$FVHP_{n} = PVHHP(1 + \delta MHP)^{n}$$

where $FVHP_n$ is the future value of the house at period n.

PVHHP is the present value of the house determined using an hedonic house price model.

δMHP is the change in the median house price determined using the macro/capm model.

This model is complex enough that any errors may be reasonably large depending on the quality of the data used. It is presented here as a possible method for a reasonably comprehensive property valuation model which may be a basis for further research and investigation.

Conclusion

The principal behind the analysis is that once we have an estimate of a rate of change or even a discrete price for a particular sector we can then extrapolate the influence of the macro variables and the sectorial risk to a price estimate for a particular property. Therefore if our macro model is based on twenty years of data and we are analysing a property which last traded twenty years ago we might argue that by applying the estimated macro/capm price change we can produce a hypothetical value for the property today.

The combined macro and CAP (Macro/CAPM) model could be used to estimate the regional or sector house prices and includes an adjustment for risk. By using it in conjunction with an hedonic model, such as that illustrated above, which analyses specific attributes for a sector we may be able to obtain an estimate of an individual property equilibrium value at some time in the future using data of actual transactions available. That is, by using macro data for say 2000 and hedonic analysis for the same period a value for a property can be estimated for 2002. Alternately if predictions are to be made of future macro values, such as population or CPI, a prediction might be made of a possible value for a particular house in 2004.

This methodology arguably requires substantial further work however it is presented here to give an indication of the possible direction of and use for the macro/capm analysis.

There are various means by which we could predict current/present values or future values from the models. By incorporating an hedonic model we are able to take account of key utility attributes to estimate prices for individual properties. The key element is that we analyse the socio-economic influences and elements of the risk which will affect the properties price. By looking back at long term historical influences we are beginning to look at the possible price the property would tend to exchange for where perfect competition existed. This is where marginal cost equals marginal utility equals marginal price and is an estimate of the price or value where the market is in equilibrium. Where perfect competition exists and therefore all market participants have perfect knowledge we can say that the present value of anticipated future benefits equals market price which equals market value which also equals true value. The equilibrium value therefore gives an estimate of the market value under perfect competition.

The argument may be made that this is the value we should be reporting when asked to assume the buyer and seller "acted knowledgably". If the buyer and seller had perfect knowledge they would only transact at the perfect competition or equilibrium market price.

For the valuation profession to be able to contribute to the community into the future it clearly needs to be able to improve the service it provides by doing more than simply recording market activity. There is a need for a clear theory of value and this should revolve around a definition of the value of an asset being the present value of anticipated future benefits. The profession should seek to provide an analysis of the benefits of the property asset for clients using all available technology and techniques.

It is evident from the literature that there has for some time been a movement toward a system of price modeling. Clearly this is a methodology which warrants much more attention as a method of property valuation and analysis.

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