Modelling Dimensions of Height and View at Melbourne's Docklands

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Abstract: This study employs a large database of pooled data on transaction prices and associated apartment attributes to estimate a number of competing hedonic price equations with the end objective of isolating the separate contributions of height, view and apartment building on the value of high rise apartments in the Melbourne Docklands Apartments Precinct.

Keywords: hedonic regression modelling, value of height and view, isolating value attributes, valuation of apartment buildings.

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* The data used in this study were provided by the valuation department at Melbourne City Council (MCC). The paper is based on a research project that was carried out by Jenny Shellard while studying at RMIT and employed in the valuation department at MCC.

1. Introduction

There are several reasons that may be advanced for investigating the value of views from residential properties. Firstly, in societies such as ours where “quality of life” issues come to the fore it is not enough that the valuer is able to fulfil his/her responsibility by focussing solely on the value-impacts of the measurable and countable attributes of property (e.g. number of rooms and land area). Increasingly there is an imperative to adopt a more analytical approach to gauging the impact of intangible attributes such as the nature and quality of views that may be enjoyed by individuals living in such properties.

Secondly owner-occupiers and for that matter residential property investors have an interest in determining the value of a view before they commit to a purchase or sale.

Thirdly as outlined by Yu et. al. (2005) there are situations that arise when developers sell property units prior to construction. Under such circumstances they must draw up a price schedule for the units they intend to pre-sell. In the absence of a pricing model that seeks to account for the value impact of views on residential properties, the developer is unable to set prices in a suitably objective manner.

Fourthly, information about the value of the view may be used by developers to design apartment buildings whose orientation maximizes the aggregated premia that might conceivably be captured by the profit seeking developer (Yu et, al, 2005).

As a final rationale for developing pricing models for “the view”, Yu et. al. (2005) consider the case of urban planning bodies that may have to concern themselves with the value of the view in a wider context – say for commercial and retail as well as residential uses. For these applications the required pricing model of the view would have to be “more all-embracing”.

This study seeks to explore with the aid of conventional hedonic pricing, how “the view” exerts an influence on the value of apartments situated in two residential precincts of Melbourne Docklands – a large partially built waterfront development on the Western edge of Melbourne’s CBD.

Unlike many other studies that have relied on arms-length transactions data for the estimation of a hedonic relationship between the price of apartments and their intangible attributes, this study makes use of *pre-sales (off-the-plan) transactions data*. In principle then, the resultant hedonic equation enables one to determine the implicit values that *developers* have placed on the view from apartments after controlling for time-effects and other physical features of the units (e.g. floor level, gross building area, balcony area, number of bedrooms and car parks). As far as the authors are aware, no previous researchers have embarked on such an exercise using exclusively *pre-sales transactions data*.

One plausible objection to the use of such data is that when developers sell apartments off-the-plan they are able to exact ask prices that are inflated reflections of market value. Since each developer at the pre-sales stage is a price-making monopoly that is selling property that is still to be constructed, this heightens the extent of *asymmetric information* that arguably pervades the construction industry. In such an environment, the developer may be able to exercise a form of *producer sovereignty* that *persuades* prospective property buyers to pay more than they would were they better informed about the conditions of the market as well as the eventual product.[1]

Despite this objection, the authors contend there is substantial utility to be gained from using such data in an investigation of the value of views. Firstly it may be of interest to observe how different developers implicitly value the attributes of their respective properties. In the case of the present study, the data set offers researchers the ability to contrast the implicit values that developers attach to the views from their respective residential towers or how they differentiate the value of views from one building to the next in their own development precinct. Secondly, - though not possible in this paper - it would also be of interest to compare price models developed from arms-length transactions data with ones developed from pre-sales data. Such an investigation would then reveal the extent of *over exuberance* in the pricing of property attributes that often accompanies property booms and for that matter the *over corrections* that arise when demand is perceived to be faltering. Both phenomena have been widely commented upon in respect of the Docklands Project in the popular press.

The remaining part of this paper is structured as follows. Section 2, provides some background to the Melbourne Docklands area for the benefit of readers who are not too familiar with the geo-historical significance of area and the types of vistas that may be enjoyed from different high rise apartment buildings in this area. Section 3 provides a short discussion of various previous attempts at valuing views. Section 4 describes the data and methodology employed in the paper. Section 5 is devoted to a discussion of the estimation process as well as results. The last section is reserved for the conclusion.

2. Background to Melbourne Docklands

Ever since John Batman reputedly founded the City of Melbourne (Flannery T, 2002) 170 years ago, an area then known as *Batman's Swamp* and now known as *Melbourne Docklands* has experienced several waves of transformation (Historic Buildings Council & Docklands Task Force, 1991)

Prior to European settlement in the 1830's the area was populated by the Wurundjeri and Bunerong people (VicUrban, 2006a). When John Batman first viewed this area in 1835 it was part of a swamp and marsh environment the main feature of which was an

[1] This study covers a period of more than five years making it possible for new purchasers in the later years to observe the trend in prices across time and thereby mitigate, to some extent, the developer's ability to contrive the magnitude of the consumer surplus as well as appropriate it.

irregularly shaped lagoon surrounded by marshy flats on both sides of the Yarra River. (Historic Buildings Council & Docklands Task Force, 1991)

Whilst this area was ignored by Russell and Hoddle who prepared Melbourne's first grid-plan in 1837, it eventually became an "industrial park" for Melbourne's early industries particularly those associated with the livestock trade (VicUrban, 2006a). The significance of this area as an industrial and transport hub for the State of Victoria grew substantially following several important developments that occurred in the second half of the 19th century. These included the completion of *Batman's Hill Railway Station*[2], the opening of the *Coode Canal* which straightened the flow of the Yarra River and finally the development of *Victoria Dock* adjacent to the railway station (VicUrban, 2006a).

By the 1970's with the advent of containerisation and the move to larger sized shipping vessels, the importance of the area began to decline. Victoria Dock along with other neighbouring facilities was unable to cater for the expanded logistic task. Consequently more suitable as well as technologically advanced docking and berthing facilities had to be constructed downstream. The resultant under-utilisation of the Dockland's antiquated facilities, made the area ripe for redevelopment with the State Government of Victoria beginning to investigate – by the late 1980s - its potential as an adjunct to Melbourne's existing stock of inner-city space. (VicUrban, 2006a)

In 1990, the State Government of Victoria established the *Docklands Task Force* (a year later known as the *Docklands Authority*) to ascertain as well as evaluate the most promising re-development options for the area (VicUrban, 2006a). The *Docklands Authority* was later to merge with the *Urban and Regional Land Corporation* to form *VicUrban* - the State of Victoria's new urban development agency (VicUrban 2006b). In respect of the Docklands area this body is responsible for overseeing the future development of the area to ensure it conforms with the *VicUrban Act 1991* as well as five principles that are regarded as critical to its success. (VicUrban, 2006c). These are that the area must be *a place for everyone*, be *a thriving water place*, embody *design excellence*, and be both *financially* and *environmentally sustainable*. (VicUrban, 2006c, 2006d).

With its watchful eye on market demand, VicUrban is guiding the Melbourne Docklands Project through a series of strategically managed development phases that are designed to ensure a compatible pattern of development throughout the area. (VicUrban,2006e). An illuminating visual description of these sequential development phases over the next 15 years is available at the web link associated with the VicUrban (2006e) citation in the reference list.

The Docklands precinct when fully re-developed will comprise 200 hectares of land and water with approximately 7 kilometres of waterfront. Most of the developments

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[2] This station later came to be known as *Spencer Street Station*. Only recently it has been renamed *Southern Cross Station* and is currently being re-developed as a world class public transport interchange (Department of Infrastructure, 2006)

are being undertaken by the private sector and within 7 years it is envisaged that it will become the home of 20,000 residents, the workplace for 25,000 employees and the playground for an estimated daily average of 55,000 visitors (VicUrban 2006c). The entire area will comprise distinct inter-linked precincts that together are expected to provide a balanced mixture of space use (VicUrban 2006e). A more thorough pictorial explanation of these inter-linked precincts is available at the web link accompanying the VicUrban (2006e) citation in the reference list.

Two such precincts – *Yarra's Edge* and *New Quay* – are the direct focus of this paper.[3] *Yarra's Edge* is a north facing riverfront precinct developed by *Mirvac* (Vic Urban 2006g) whereas *New Quay* is a south facing riverfront precinct developed by *MAB Corp* (Vic Urban 2006h). Both developers have provided mixed space uses in their respective precincts.

The Docklands precinct possesses a number of water-view features that have implications for value. The precinct surrounds Victoria Harbour adjacent to the Yarra River providing many of the apartments with a river and/or harbour view. For those apartments that are located on higher floors their view is considerably enhanced with a view of Port Philip Bay some nine kilometers to the south. In addition to a variety of water views the Docklands offer desirable lifestyle features for residents that are attracted to the inner city region. These include amenities such as cafes, restaurants, a major sports stadium, a concert pavilion, and designated open air entertainment areas to stage concerts and other similar events. The precinct includes moorings for resident's pleasure craft and a variety of boating facilities, excellent access to rail, tram and water transportation facilities, and many others. The Docklands precinct is a short distance from Melbourne's central business district, which can be accessed by walking or by the free City Circle Tram service, but it experiences none of the pressures, such as congestion, noise, pollution, overcrowding, etc., that are a normal part of any large city.

3. Literature Review

At the level of general parlance, it seems easy enough to define a view. For instance, Davidson & Dolnick (1999) define it as a range of sight, including pleasing vistas or prospects such as geologic features, bays, oceans, skylines, bridges and cities. On the other hand, it is far more difficult to measure a view and for that matter empirically ascertain the market value of a "good view" (Rodriguez and Sirmans, 1994). Some obvious problems encountered include the smallness of the sample size and the difficulty of controlling for other value-impacting factors. For instance, in a very early study Correll et. al. (1978) found that a property's view was not a significant value-adding variable. Correll, et. al. (1978) analysed properties by classifying them into view categories of excellent, moderate and no views. In this particular study the view was of a valley. From the results of the investigation the authors contended that

[3] The Watergate tower (12 Waterview Walk) listed in Table 1 below has been included with the Mirvac Yarra Edge towers for convenience. Strictly speaking this building should not be included with the Yarra Edge towers as it has a somewhat different orientation and the developer was Pan-Urban.

view was not a statistically significant variable in the calculation of a property's value. This finding could be explained by the relatively small sample size of 36 properties and the severe winds that the properties with a premium view were exposed to.

Many early studies confirmed the high value people place on a positive view. Such studies recognised that as a result properties with views command premia over those that do not (Darling, 1973; Morton, 1977; Plattner & Campbell, 1978; Gillard, 1981; Millington, 1995). Darling (1973) analysed the effect a view of urban lake parks had on property values in California. From this study it was concluded that the value of properties with such a view increased by $2,362 or $2,756, depending on which lake was able to be viewed. Similarly, Morton (1977) studied four hundred homes in Orange County California to conclude that view was a significant value-adding variable. In particular, a positive view added an average of $19,748 to each sale price.

Plattner and Campbell (1978) focussed their analysis on the added value of water views. In this study the average sale prices of condominium units in Massachusetts, America were investigated to find that a water view added from 4% to 12% to the value of properties. The authors also found that views enjoyed by units at the lower end of the price range tended to have less of an impact on property value and that the percentage increase in value was greater for higher priced units. In their study Plattner and Campbell (1978) recognised the need to examine sales that occurred within a relatively short time frame to ensure that the effect of inflation on reported prices would be mitigated.

Gillard (1981) and Rodriguez and Sirmans (1994) undertook more complex studies using hedonic pricing models. Gillard analysed 392 single-family home sales in Los Angeles to explain the relationship between a property's value and its view. In order to do this Gillard (1981) incorporated dummy variables in a multiple regression model. By doing so Gillard was able investigate the influence of neighbourhood characteristics on property values. From this investigation, Gillard found that a view added on average, 9% to property values. Similarly, Rodriguez and Sirmans (1994) used sales of single-family homes in Fairfax County Virginia to confirm that a good view adds an average of 8% to property values

Later a study by Benson et. al. (1996) examined 397 residential property sales in Point Roberts, Washington. In this study each of the properties being investigated were individually inspected so that their view of the ocean could be carefully categorised. The findings indicated that an ocean view added 32% and a partial ocean view added 10% to the value of properties.

A comprehensive study by Rhinehart and Pompe (1999) investigated the impact of views of a creek, marsh, ocean, lake and golf course on property values in a coastal barrier island. In this investigation 297 vacant lots were analysed between the period 1989 and 1994. The results indicated that other significant value adding variables were land area and the length of time the property was listed. After adjusting for such additional variables, Rhinehart and Pompe (1999) concluded that on the average, views of the ocean added $78,558, views of a creek or marsh added $61,457 and views of a golf course added $20,842. Unlike previous investigations this study recognised that the monetary value of a view will vary depending on the surrounding community. For example, a significant proportion of the community in the area being studied consisted of retirees. The authors of this study noted that in this case, higher premia were being paid for a view because retirees had more time to enjoy it.

Lange and Schaeffer (2001) adopted a different approach in their analysis. In this study the authors examined the value of a view using hotel room rates and/or room occupancy rates. Lange and Schaeffer studied room rates in two Swiss hotels located in Zurich. Their investigation relied on the hypothesis that the value of a hotel would be enhanced if hotel profits increased. Their investigation relied on the hypothesis that the value of a hotel would be enhanced if hotel profits increased. In other words, the value of a hotel with a view will be higher than one without because the former hotel is able to charge higher room rates. The authors contended that any difference in room rates or occupancy rates between identical rooms with different locations within the hotel could be attributed to the value of the view. Like the preceding studies, this analysis confirmed that viewpoints and positive vistas do have a significant impact on value.

Bond et. al. (2002) recognised the desire of people to have a view of the water. Their study used sales prices from the preceding twenty-five years as well as tax assessment values for the year 2000. They attempted to examine the relationship between house prices and a view of Lake Erie in America. This investigation relied predominantly on transactions-based data, which was an improvement on some of the previous studies using solely tax assessment values. In this study, the authors accounted for other value adding variables that were found to be significant such as square footage of living space and lot size. After controlling for these variables it was concluded that a view of the lake was associated with a premium of $256,545 on average. The authors contended that in addition to lot size and square footage of living space, view was the most influential factor affecting property values.

Lake et. al. (1998, 2000a and 2000b cited in Yu et al, 2005) were the first to employ a Geographical Information System (GIS) approach to generate view scores for what could be seen from properties and then assessed their property-value influencing effects within a hedonic pricing framework. The results were mixed indicating that seemingly pleasant views of parkland water and vegetation exerted negligible positive influence whereas significant negative impacts arose from views of railways, roads and industrial parks.

Yu et. al. (2005) employed a 3 dimensional GIS approach to objectively measure the attributes of high-rise privately owned apartments located on the Eastern Coast of Singapore with respect to height, surrounding topography and the orientation of the subject property. They found that a variable that captures the extent of an unobstructed view of the sea augments the value of private high rise apartment dwellings by an average of 15 percent.

In another work Yu and Chai (2005) employ a technique known as *intervention analysis* (related to auto-regressive integrated moving average modelling) in conjunction with hedonic price modelling to investigate the impact on residential apartment prices in an existing building when views from it are obstructed by a newly erected building. The authors take two developments built by the same developer and located nearby one another on the East Coast of Singapore - one whose view would ultimately be obstructed by a newly erected third development and the other – the control development - which would not. At the conclusion of their analysis Yu and Chai (2005) find there is a significant negative price impact on the obstructed building almost as soon as the construction of the new building takes place and that over the long-term the price of apartments in the obstructed development are 8 percent lower than those in the control development.

By and large, the investigations summarised above suggest that the value of the view is largely dependant on the type of view, the extent of the view, the property price bracket, the location, the amenity and the demographics of the surrounding community.

4. Data and Methodology

This study will replicate the application of conventional hedonic pricing techniques in the context of the Melbourne Docklands precinct. It is the understanding of the authors that no econometric study of this type or dimension (over 1000 observations) has hitherto been conducted for this area and for this reason the work presented in this paper may be viewed as both explorative as well as experimental. The study also aims to extend the literature in a modest direction. Again, it is the understanding of the present authors, that no previous hedonic price study of the value of a view has been conducted that makes exclusive use of *off-the-plan* transactions data. Despite some understandable criticism that may be levelled at the use of such data, the authors contend that useful insights may nevertheless be gained. The estimation of hedonic price equations that reveal the shadow prices that *developers* - as opposed to valuers and/or the market - implicitly place on the tangible as well as intangible attributes of properties may be used for other interesting research objectives alluded to earlier in the introduction to this paper.

All data for this study were provided by the Valuation Department at The Melbourne City Council (MCC). The price-data along with associated apartment attributes were gathered/generated over a period of approximately five years (2000 to 2005). Apart from data on categorical variables developed by valuers at the MCC, all remaining data were initially provided to the MCC by the developers.

The sales price data employed for this study were set by developers for seven apartment buildings in the Melbourne Docklands precinct. Three of these buildings, belonging to Group 1 in Table 1, are located on the southern and eastern region of Victoria Harbour, on the edge of the Yarra River. The remaining four buildings, belonging to Group 2 in Table 1, are located on the northern edge of Victoria Harbour.

A clearer understanding of where these properties are located may be obtained by reference to Figure 1 in the appendix. The location of each of these two groups of buildings has important implications for the central focus of this study, namely the valuation of views.

Group	Building Name	Developer	Street address	Vic. Harbour Position	No. Obs	n
1	Yarra Crest	Mirvac	70 Lorimer Street	Southern end	120	
1	Watergate	Pan-Urban	12 Waterview Walk	South–East end	252	
1	Yarra Edge	Mirvac	90 Lorimer Street	Southern end	112	484
2	The Nolan	MAB Corp	23 Rakaia Way	Northern end	197	
2	St Elia	MAB Corp	30 Newquay Promenade	Northern end	41	
2	Boyd	MAB Corp	5 Caravel Lane	Northern end	167	
2	Palladio	MAB Corp	15 Caravel Lane	Northern end	194	599

Table 1: Position of Buildings around Victoria Harbour

As stated earlier, pre-sales price data were collected over the course of 5 years. To remove any distortions that would creep into the estimation process by a fluctuating price level, all prices have been suitably deflated by the quarterly Melbourne CPI (base year 1989).

The property attributes for which *implicit developer-prices* are obtained, may be grouped into several categories. Firstly there are the traditional objectively measurable or countable attributes that one would normally include in hedonic price equations for real estate: *floor level*, *building area*, *balcony area*, *number of bedrooms* and *number of car spaces*.

Then there are a group of five attributes (or categorical *valuer-variables*) that city valuers regard as additional important contributors to property value these being: *location*, *shape*, *view*, *style* and *condition*. City valuers assess each property on a scale of 1 to 5 in each of five dimensions represented by these variables and then use their own shadow prices for these variables to facilitate their own property valuations. To some extent, however the process of grading properties in this manner may be open to criticism on the grounds that the data are at best *ordinal* data and fall well short of being *ratio data*. Hence, if one property is accorded a style grading of 5 and a second property receives a style-grading of 1, it cannot be inferred that the first property is five times more stylish than the second. Another criticism is that the grading system – however diligently applied - may be too susceptible to subjective judgments.

A third group of property attributes are modeled as dummy variables which obviate some of the shortcomings associated with the previously described categorical valuer-variables. When a unit enjoys a particular attribute then the value of the associated dummy variable is 1 and 0 otherwise. In this paper dummy variables are used to indicate which apartment complex a unit belongs to, which development precinct the building belongs to, which year the pre-sale transaction took place, and which view orientation(s) are enjoyed by each property. For example a property at Yarra's Edge may provide a view to the East (overlooking the city) as well as the North (overlooking the Yarra River and beyond to New Quay).

Some experimentation with the cross-product of explanatory variables is also undertaken. For instance, a variable taken as the product of the floor level and a dummy variable for a given *view orientation* will enable the estimation of the implicit value for increments in the height of this *view orientation* in an apartment structure.

A full description of all variables (including their respective mnemonic symbols) is provided in the Appendix.

Hedonic regression analysis is employed to model the relationship between sale price and the variables assumed to contribute to value. Since all properties in the study are in a relatively small geographic area, the Docklands precinct, most of the variation in sale price should be explained by the chosen hedonic characteristics. The estimated models should therefore produce r-squared values close to 1, indicating that such models may be confidently relied upon to provide a good estimate of value for a non-transacted property with the same hedonic characteristics.

It is anticipated that sale price (P) will primarily be impacted by building area (BUILA); this variable is expected to be highly significant. Building area captures some aspects of height and exclusivity, most notably those apartments at or near the top of the various buildings, such as penthouses and sub-penthouses, which tend to have larger building area relative to the other apartments in the building. Balconies (BALCA) and floor level (LVL) are also expected to significantly contribute to value but to a somewhat lesser extent than building area.

Key variables of interest are those that attempt to capture the value of a view. A generally accepted hypothesis articulated by Rider (2006) is that water views add value and salt-water views command a premium. The distance from the ocean and the nature of the terrain between the subject property and the ocean will also have important implications for value.

5 Model Estimation and Discussion of Results

The estimated equations for Group 1 and Group 2 buildings are provided in Table 2. All models were estimated with EViews 4.0 and the Newey-West algorithm was employed to develop a variance-covariance estimator for consistent estimates in the presence of both heteroscedasticity and autocorrelation.

The data comprise several dummy variables, coded as 0 and 1, and the categorical *valuer-variables*: Views, Location, Cond, Shape and Style, that contain a value in the range 1 to 5. These variables are subjectively determined by the data collector who attributes a value of 1 when the attribute in question is considered to make the least contribution to value and a value of 5 to represent the best achievable contribution. A common problem experienced with models that contain a high number of dummy variables is the likelihood of inadvertently introducing perfect or near-perfect multi-collinearity to the data. This latter condition often leads to insignificant variable coefficients as well as counter-intuitive coefficient signs. In the case of perfect multi-collinearity it is not possible to estimate an equation. Whilst it was possible to include all five rating variables in the Group 1 equation without its being impaired by multi-collinearity, only the Views and Location variables could be retained in the Group 2 equation.

Group 1 Linear model			***Group 2 Linear model***		
Variable	Coefficient	t-Statistic	Variable	Coefficient	t-Statistic
C	-1536730.00	***(-8.42)***	C	-253839	***(-8.84)***
NCARPK	-50618.26	***(-3.16)***	NCARPK	21018.88	***(3.51)***
LVL	6445.63	***(10.02)***	LVL	4798.763	***(13.43)***
YarraEDGE	-278105.00	***(-3.69)***	STELIA	42099.81	***(2.23)***
WaterGATE	-841472.10	***(-4.84)***	PALLADIO	23724.05	***(8.26)***
			NOLAN	52704.1	***(7.44)***
YR1	-59852.05	***(-3.65)***	YR1	-10117.2	***(-1.6)***
YR2	-68410.32	***(-3.68)***	YR2	-19875.6	***(-1.9)***
YR3	-25699.93	***(-1.11)***	YR3	-30726.9	***(-2.83)***
YR4	-102743.70	***(-6.25)***	YR4	-91721.6	***(-5.12)***
YR5	-163440.90	***(-4.94)***	YR5	-93004.5	***(-7.8)***
BUILA	5592.37	***(17.85)***	BUILA	5193.358	***(34.73)***
BALCA	564.94	***(2.85)***	BALCA	550.4528	***(2.27)***
NUMBED	-12625.01	***(-1.41)***	NUMBED	-9427.27	***(-1.47)***
VIEWS	17096.06	***(3.29)***	VIEWS	11577.49	***(5.74)***
LOCATION	21938.52	***(3.74)***	LOCATION	23419.55	***(2.15)***
COND	495376.40	***(6.53)***			
SHAPE	-29502.50	***(-0.85)***			
STYLE	-48878.05	***(-3.21)***			
Adj. R-squared	0.959		Adj. R-squared	0.969	

Table 2: Estimated equations for Group1 and Group 2 buildings – preliminary analysis

While some of these *rating* variables are significant in the equations presented in Table 2 they will be excluded in later models. These variables are subjectively determined and it is difficult to meaningfully infer the incremental difference in value of, for example, an eastern view compared with that of a southern view. The inclusion of condition (COND) in the Group 1 equation has resulted in this variable making the largest positive contribution to value. The coefficient for this variable, while highly significant, is extremely large. This subjective classification is applied to a modest single bedroom apartment or to a large penthouse despite the apparent difference that is present in what are effectively two distinct sub-markets. The condition variable is distorting the equation and should be removed before a meaningful interpretation is given to the remaining coefficient estimates.

The estimated equations confirm the prior expectations outlined earlier. Highly significant variables are building area (BUILA) and floor level (LVL) with BALCA also significant at the 1% level. NUMBED is not significant and since this variable is highly correlated with BUILA (CORR = 0.87) it can be omitted without a significant decrease in the explanatory power of the model. The variable VIEWS is significant for both groups, this will be explored in greater detail later when the spatial characteristics of view are taken into account.

The value of properties in the sample has decreased over time. Year 2000 is the base year and each year may be compared with the price in the base year. For example properties in 2004 (Yr4) obtained a price, in real terms, that was $102,743 less than that achieved in the year 2000 for Group 1 properties. For Group 2 properties the decrease was $91,721 in the same year. This trend in prices reflects what has been occurring in this area of Melbourne during the sample period.

Residential property prices generally have experienced a decline in most major capital cities, particularly Melbourne and Sydney, since the boom period for residential property ended in late 2003. Prior to this the Docklands precinct received a good deal of negative publicity through the popular media as a result of the excess supply of apartments. Due to the large number of apartments available for sale *off-the-plan*[5] over the past five years, the Docklands experienced a sharp downturn in prices as the investor-purchaser began to withdraw completely from the market at the beginning of 2004.

In 2003 the major banks and many of the non bank lenders changed their lending criteria for *off-the-plan* purchases in areas such as the Docklands. Some lenders would not finance the purchase of apartments in this precinct whilst others restricted loan size to between 50 to 70 percent of valuations. From a lender’s perspective this was a prudent course of action. A large number of apartments were nearing the completion stage and a significant number were held by investors who would not be able to rent them out in the current climate of excess supply. For those apartments that were tenanted, rental yields were very low, close to 2 percent in many cases.

Separating each of the buildings in the sample has enabled the determination of the contribution to value of a specific building. The benchmark building for Group 1 is Yarra Crest. Apartments in both Watergate and Yarra Edge have a value that is significantly less than the benchmark building. The large negative coefficient for

[5] Off-the-plan purchases are popular with investors who are able to acquire future ownership of a property asset for as little as 10 percent of its value today. This is an effective investment strategy in a rising market, the property increases in value during the construction phase and the investor can make a superior return on funds outlaid by on-selling the property at completion. However, if the market is falling over the period in question the investor stands to make a substantial loss, which led to concern by lenders who were financing these purchases.

Watergate indicates the quality of apartments in this building compared with that of Yarra Crest.[6] It has been noted previously that the variable COND is distorting the value of the building coefficient. Accordingly the coefficient for a particular building should be viewed in conjunction with the coefficient of COND. The benchmark building for Group 2 is Boyd. The other three buildings in this group enjoy a substantial premium over the Boyd.

Table 3 shows the estimated models for Groups 1 and 2, and also these groups combined, with all categorical *valuer-variables* – apart from VIEWS – excluded**.** An additional variable was initially introduced to isolate the impact of apartments that had an unusually large building area in both groups of buildings. It was found to be significant for Group 1 buildings only. In the models presented in Table 3 these properties were removed from the sample data, two properties from each group. The VIEWS variable has purposely been retained at this point to observe its significance in the models.

Linear models:	***Group 1 (n=482)***		***Group 2 (n=597)***		***All data (n = 1079)***	
Variable	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**
C	-227833.7	***(-5.49)***	-203595.8	***(-33.97)***	-278933.9	***(-26.05)***
NCARPK	-47103.8	***(-3.35)***	22724.2	***(5.36)***	-3217.8	***(-0.68)***
LVL	6265.4	***(10.13)***	5264.6	***(21.83)***	5729.4	***(23.93)***
YarraEDGE	99231.0	***(5.69)***			78515.9	***(8.26)***
WaterGATE	125078.8	***(4.49)***			146090.7	***(14.23)***
BOYD					79133.4	***(10.97)***
STELIA			68326.9	***(10.1)***	147986.6	***(13.25)***
PALLADIO			25190.8	***(6.98)***	98924.2	***(12.59)***
NOLAN			57010.3	***(7.51)***	147037.1	***(15.56)***
YR1	-55157.4	***(-3.3)***	-11120.2	***(-1.52)***	-29946.7	***(-4.04)***
YR2	-64892.4	***(-3.45)***	-22838.9	***(-1.95)***	-34896.1	***(-4.17)***
YR3	-12869.9	***(-0.51)***	-32478.0	***(-3.2)***	-17145.3	***(-1.69)***
YR4	-102844.8	***(-6.35)***	-93213.9	***(-8.14)***	-90211.4	***(-9.6)***
YR5	-161119.7	***(-4.65)***	-104603.4	***(-5.3)***	-133481.2	***(-11.12)***
BUILA	6039.1	***(19.95)***	5559.7	***(43.3)***	5849.7	***(46.24)***
BALCA	417.5	***(2.65)***	607.9	***(7.3)***	506.1	***(5.96)***
NUMBED	-29638.8	***(-3.34)***	-17695.1	***(-3.51)***	-26103.2	***(-5.54)***
VIEWS	22153.1	***(4.48)***	10653.4	***(6.61)***	16374.6	***(8.94)***
Adjusted R-squared	0.946		0.960		0.948	

Table 3: Estimated Equations for Gr1, Gr2 and Combined Groups – Excluded variables

With the exception of number of car parking spaces (NCARPK) for Group 1 buildings, and number of bedrooms (NUMBED) for both groups, the coefficients for all variables exhibit the anticipated signs and magnitude. The coefficient of NCARPK for Group 2 buildings is positive which is in accordance with normal

[6] The resultant value generated by the model should be verified with the market outcome. It will become apparent later that when the model is revised this result cannot be supported. The signs for the building coefficients for both YarraEDGE and WaterGATE are positive using a revised model provided in Table 3.

expectations. The coefficient for NUMBED is negative and significant for the combined groups, which is contrary to expectations. This result is most likely due to its high correlation with BUILA. Removal of NUMBED from the models presented in Table 3 does not lead to a decrease in the adjusted r-squared value.

Attempts were made to introduce dummy variables to classify a property based on the number and type of car spaces associated with a given property in the Group 1 buildings. Inconsistencies in the coefficient sign for these dummy variables persisted. These results suggest that the coding of the data should be checked for accuracy before an equation using the Group 1 data are used for valuation purposes. Fortunately this unanticipated result will not unduly impact on the evaluation of views which is examined in the next subsection.

The combined groups, with 1,079 observations, provide a good indication of the variables that are highly significant. Building area (BUILA) and floor level (LVL) are the dominant variables in this equation. The identification of each building using, a building dummy variable, has resulted in a significant coefficient estimate across each of the groups and for the combined data set. This indicates that an apartment in a particular Docklands tower contains attributes that are unique to the tower in question.

The trend in prices across time, accounted for by the year variables, indicates that price falls were common for all properties over the study period. Table 3 clearly indicates that the VIEWS variable is highly significant when considered for each of the groups individually and its significance increases for the combined sample.

Modelling the Value of a View

A view has multiple attributes that cannot be captured in a single variable, which was attempted in the models provided in Tables 2 and 3. The direction of the view, particularly if the view in one direction is more attractive than in another, and the possible enhancement of the view due to elevation can also play a role. The location of each apartment in a building, because of its unique position relative to all other apartments in the same building, will experience a view that is unique. The variable employed to capture floor level, LVL, is highly significant for all models presented in Tables 2 and 3. The value of different views, which occur due to the position of an apartment in a given building, should take account of the direction the apartment faces and its floor level, that is, the quality of the view is determined by its location in space. The equations presented in Table 4 attempt to model this aspect of views.

The data for Group 2 buildings have been demonstrated to produce the most reliable and consistent coefficient estimates. A higher degree of confidence may therefore be placed on coefficient estimates that represent aspect of views using this data set. The three models provided in Table 4 were estimated using the data for Group 2 buildings.

Model A attempts to determine the contribution to value of direction without explicitly taking account of floor level. The benchmark direction is north, the view in this direction overlooks the Melbourne suburbs of North Melbourne, Kensington and other inner suburbs. There are no water views in this direction and this view is considered to have the least value. With reference to the benchmark direction, the views in each of the other directions should command a premium. The view in the southerly direction takes in Victoria Harbour and Port Phillip Bay beyond and should therefore command the highest premium. The results obtained using model A is consistent with this expectation.

To the West the Yarra River is visible for several kilometers. This direction also overlooks a number of inner city suburbs. The view to the east includes the Yarra River and the Melbourne CBD. Model A allocates a premium for an easterly view that is approximately double that of a westerly view.

Linear models:	***Model A***		***Model B***		***Model C***	
Variable	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**
C	-178606.9	(-24.17)	-163991.0	(-15.09)	-141407.4	(-10.73)
NCARPK	17725.7	(4.25)	18978.8	(2.93)	16136.2	(2.67)
LVL	6000.0	(24.61)				
STELIA	70355.9	(10.68)	61399.5	(4.03)	96277.9	(8.15)
PALLADIO	20362.9	(5.86)	21932.0	(6.09)	18923.4	(7.39)
NOLAN	62019.8	(8.2)	62093.3	(9.1)	66033.1	(9.32)
YR1	-10824.2	(-1.48)	-13490.8	(-2.18)	-11897.8	(-1.92)
YR2	-19232.6	(-1.64)	-22759.0	(-2.02)	-20054.2	(-2.14)
YR3	-28080.2	(-2.77)	-30736.8	(-3.42)	-27634.9	(-3.33)
YR4	-90185.9	(-7.89)	-86880.7	(-3.96)	-86337.1	(-4.74)
YR5	-94130.5	(-4.78)	-85614.9	(-3.43)	-85330.2	(-3.04)
BUILA	5021.4	(50.54)	5154.3	(30.16)	4793.6	(26.95)
BALCA	667.5	(8.19)	646.6	(2.13)	600.4	(2.55)
W2	8225.1	(2.01)	6232.6	(1.69)		
E2	15957.5	(3.98)	35586.5	(4.39)		
S2	42635.1	(6.81)	12971.7	(3.99)		
L6TO10			22771.8	(4.1)		
L11TO15			48855.6	(8.24)		
L16PLUS			89738.5	(14.43)		
LVL*N2					4233.8	(12.12)
LVL*W2					5484.0	(14.83)
LVL*S2					8970.1	(12.54)
LVL*E2					5983.0	(17.34)
Adjusted R-squared	0.960		0.957		0.963	
F-statistic	952.93		772.25		1038.68	

Table 4: Estimated Equations for Group 2 Buildings to Model Views (n = 597)

Model B takes account of view orientation and floor level somewhat differently than Model A. The floor level variable: LVL (in Model A) has been replaced by a new set of dummy variables (in Model B) that indicate the floor-range within which a subject apartment is located. The benchmark floor-range spans floors 1 to 5 inclusive. Since apartments located on these floors are expected to have less spectacular views than those enjoyed by apartments at higher levels, it is expected that the benchmark floor-range will contribute least to value. The three remaining floor-range variables are for apartments situated on floors 6 to 10, 11 to 15 and 16 and higher. It is anticipated that successively higher premia may be fetched by apartments associated with successively higher floor ranges. The results for Model B indicate that the premium obtained for higher floor-ranges is consistent with expectations. In this model the highest premium for view is attributed to the east, which is in contrast with the results obtained using model A and is not consistent with the intuitive expectation that a southerly view should command the highest premium.

It was noted earlier that view may be enhanced by height in a building. Hence the interaction between height and view should be taken into account to determine the contribution to value of this characteristic. Model C introduces four interaction variables to address this issue. These variables are constructed by multiplying the direction of view by floor level. A more consistent set of results is obtained using this model. The highest premium is obtained from a southern view whereas the lowest premium is associated with a north facing view. The east and west views command a similar premium.

Alternative functional forms were examined to determine the most appropriate relationship to explain how price is impacted upon by the chosen hedonic characteristics. The linear functional form adopted in this paper proved most consistent in capturing the underlying relationship between the variables. Given the large number of dummy variables that are necessary to account for the various hedonic features that contribute to value, the linear form is also the most intuitively appealing.

6. Conclusion

There is an extensive literature supporting the contention that a good view adds considerable value to a residential property. Apartments in the Melbourne Docklands precinct provide an ideal opportunity to explore the different dimensions of view and how developers incorporate the value of a view in establishing prices for *off-the-plan* purchases.

This study explores the difficulties encountered when valuer-rated variables are employed to explain variation in sale price. The results indicate that these variables cannot be used to meaningfully measure the contribution to value attributed to the different gradations within the variable. In addition, the use of these variables in hedonic regression models can seriously distort the coefficients of other variables, making their interpretation meaningless.

The principal conclusion of the study is that view is a multidimensional attribute that should be modelled in a manner that takes account of its spatial characteristics. For the Group 2 properties employed in the analysis it was found that both height and direction were simultaneously contributing to value.

The study also found that, where the results from a model were not supported by the underlying theory, the model cannot produce a reliable estimate of value. Caution should be exercised in the development and use of models whose results are not supported by direct observation in the marketplace.

Appendix

Description of Variables in the Study

P	sale price deflated by appropriate quarterly CPI (Base yr = 1989)
LVL	floor level
BUILA	building area
BALCA	balcony area
BAOL	building area outlier dummy (=1 if building area large)
NumBed	number of bedrooms
Views [1]	valuer's subjective evaluation of view quality
Location[1]	valuer's subjective evaluation of location quality
Cond[1]	valuer's subjective evaluation of condition quality
Shape[1]	valuer's subjective evaluation of shape
Style[1]	valuer's subjective evaluation of shape

1 these variables have a value in the range 1 to 5, where 5 represents the best choice, based on the subjective view of the valuer collecting the data.

N1, E1, W1, S1	dummy variables to capture view direction group 1
N2, E2, W2, S2	dummy variables to capture view direction group 2
NCarPk	number of car park spaces

Dummy variables to capture contribution of type of car parking space provided:

Single	single car space
Dble	two car spaces adjacent to each other
Single2	two car spaces that are not together
Tndm	two car spaces one behind the other
TndmSngl	two car spaces one behind the other plus a single

Group	dummy variable to distinguish between the different apartment buildings described in Table 1.

Dummy variables employed to isolate the contribution to value attributed to each building are:

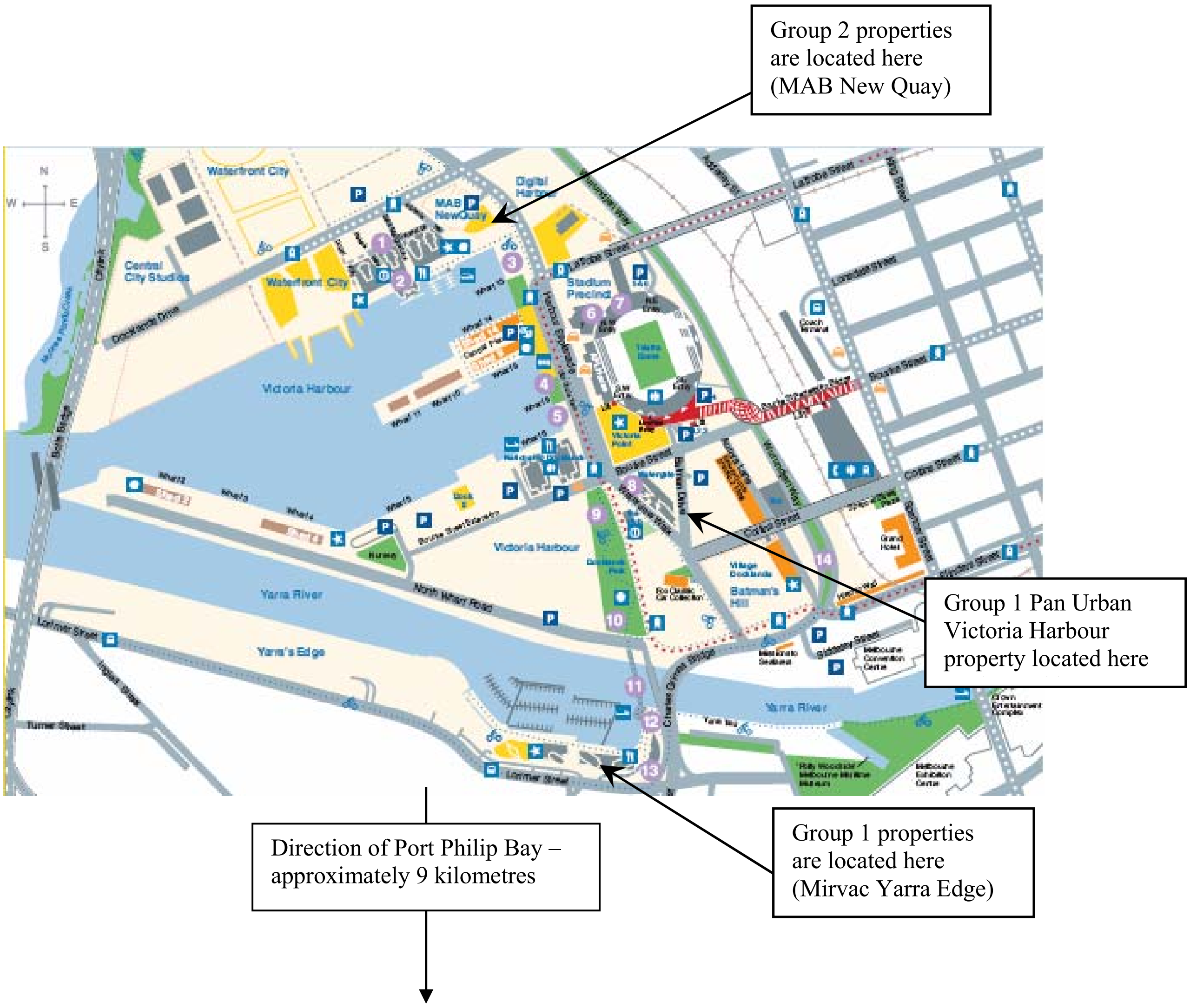
Yarra Crest	Yarra Crest Apartments, 70 Lorimer Street
YarraEdge	90 Lorimer Street, Docklands
WaterGate	Watergate Apartments, 12 Waterview Walk
Boyd	Boyd, 5 Caravel Lane, Docklands
StElia	St Elia, 30 Newquay Promenade, Docklands
Palladio	Palladio, 15 Caravel Lane, Docklands
Nolan	The Nolan, 23 Rakaia Way, Docklands

Yr1, Yr2, Yr3, Yr4, Yr5 dummy variables to capture the change in value over time. The base year is 2000, which is captured in the regression constant, and Yr1 represents sales transactions occurring in 2001, Yr2 sales transactions in 2002, etc.

L1to5, L6to10, L11to15, L16Plus dummy variables to capture the effect of height.

Figure 1: Melbourne Docklands Precinct

Map Source: http://www.docklands.vic.gov.au/docklands/neighbourhoods/newquay/mab.shtml



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