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LIVEABILITY AT HEIGHT: CONSUMERS' WILLINGNESS TO PAY

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ABSTRACT

As housing costs increase, transport congestion worsens and decreased affordability plagues growing cities, more people are considering high-rise living. This research empirically investigates the liveability, applying a nested framework of neighbourhood, building and apartment amenities. the relationship between liveability features, and apartment prices. This empirical analysis uses a bayside municipality as a pilot case study with planned future research to expand to Melbourne. The paper will provide insights into the main liveability elements consumers desire and are willing to pay for in the context of a city in transition to higher density living. This research helps developers in similarly changing markets select appropriate locations and incorporate socially sustainable elements into the design of buildings and individual apartments to improve the social impact for residents and provide direction for policy makers in determining mandatory and suggested requirements for increased density in urban areas.

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INTRODUCTION

Cities around the world face rapid growth pressures as they come to accommodate an increasing share of the world's population (UNDESA 2018). Cities face the challenge of guiding this growth into a built form that mitigates transport congestion, sprawl and the loss of surrounding agricultural and environmentally sensitive lands. High-rise communities offer a solution to these related challenges. Efforts to develop high-rise communities in developed and mostly low-rise cities face local concern and market apprehension about the value of what critics characterise as emerging vertical slums (Horne and Nethercote 2015). Developers and policy makers alike must consider which liveability and sustainability factors owner, investors and tenants desire in apartments, as improved liveability can encourage uptake by residents to live at height. The scale of high-rise developments enables developers to consider including a variety of in-building amenities to improve the attractiveness of high-rise living. This research will investigate the market value of liveability characteristics in Melbourne's apartments market, measuring liveability attributes at three scales jointly: the neighbourhood, the building and the apartment. This study also explores how the value of amenities at one scale may be affected by the presence of related or substitute amenities at other scales. This exploration will help developers understand what in-building amenities need to be provided in future developments given amenity availability near development sites.

Why might the market value liveability in high rise differently? A literature measuring the effects of high rise living on mental, physical and social well-being offers inconclusive results (Yuen et al. 2006; Gifford 2007; Gillis 1974). While some of these studies find a positive association between the number of floors and adverse effects, others report that these do not exist or are limited to the lower floors of a high-rise (Verhaeghe, Coenen, and Van de Putte 2016). Recent research suggests that households in tall buildings experience a lower quality of life than demographically similar residents in low rise suburban environments (Du et al. 2017). In Australia in particular, researchers have carefully examined the aspects by which high-rise living adversely impacts residents, namely through overcrowding and stress

(Giles-Corti, Foster, and Ryan 2012). Studies on the small but growing demographic of high rise families in Melbourne expose clear challenges for those families, particularly with respect to the safety of balconies, windows and carparks, as well as access to sunlight and places for children to play (Andrews, Warner, and Robson 2018). In-building amenities and resident-only communal spaces can improve social interactions among residents in buildings, but residents must also often adapt to the increased "micro-frictions" present in high rise living (Nethercote and Horne 2018). The extent to which these impacts on resident wellbeing effect apartment prices have only been studied in piecemeal.

The authors selected a bayside municipality in Melbourne as a case study for this analysis, drawing on sales and valuation data from 2011 through 2016. Melbourne ranked among the fastest growing cities in the developed world during this period (Bagshaw 2018). The city's stock of high rise apartments also increased significantly during this period, leading local academic commentators to accuse developers and city planners of enabling "vertical sprawl" (Trounson 2017). This growth spurt in vertical Melbourne's trajectory makes this a particularly valuable time frame in which to assess the importance of liveability amenities in apartment prices. Whilst the bayside municipality has a combination of low-rise, medium-rise and some high-rise building stock for comparative analysis; to examine whether if provided a variety of options whether the benefits of high-rise are as clear in consumer preferences.

CONCEPTUAL FRAMEWORK

Numerous studies have modelled premiums for specific neighbourhood attributes, but have not considered the totality of neighbourhood urban liveability variables or their interactions with unit-specific amenities. Researchers find that views can increase property values, particularly in units closer to waterfront (Bourassa, Hoesli, and Sun 2003; Jim and Chen 2009). Parks and open space can raise apartment values up to 16% in high-rise cities like Hong Kong (Jim and Chen 2010). Transportation access also exhibits a positive impact on values (Mohammad et al. 2013; Mulley et al. 2016), with neighbourhood walkability independent of public transport also increasing prices (Li et al. 2015; Cortright 2009). Few of these studies consider how each of these piecemeal aspects of liveable neighbourhoods may interact to create a total liveability premium or if they may minimise the benefits of other liveability attributes. Close proximity to highway corridors, for example, mean increased noise and air pollution that mitigate the uplift effects of living in an accessible location (Allen, Austin, and Swaleheen 2015).

Unit specific liveability attributes also strongly effect prices. Green or sustainability features in homes can command significant price premiums (Fuerst and Warren-Myers 2018; Fuerst and Shimizu 2016). However, the market value of green features in apartments is more related to healthy building materials than green amenities among buyers in rapidly development cities (Hu, Geertman, and Hooimeijer 2014). The market may not value all green amenities evenly, with Swiss research suggesting water efficiency commands a stronger premium than other green building features (Feige, Mcallister, and Wallbaum 2013). Balconies also offer enhanced liveability as private outdoor space that generally increase prices regardless of the quality of views they provide, although this effect appears weaker on lower levels with security concerns (Wing Chau, Kei Wong, and Yim Yiu 2004).

Building level amenities are under researched compared to unit and locational attributes. An older literature has considered the importance of building amenities like swimming pools and gyms in major housing estates in Hong Kong (Mok, Chan, and Cho 1995), but not in the context of emerging high-density cities such a Melbourne. Developers in Melbourne have meanwhile created new building amenities to attract urban residents, including rooftop

gardens (Mackenzie 2017), that have not yet been examined as premium bearing substitutes to neighbourhood park access.

The relative importance of neighbourhood, building and unit amenities may change as cities become taller in response to sustainability challenges. Urban economists are only now beginning to understand how the effects of both locational and unit attributes may interact with the attributes unique to tall buildings in developed cities. Apartment prices in taller buildings are higher on the ground floor and on floors high enough to command premium views, with recent research suggesting these effects are stronger if the buildings are located in already expensive neighbourhoods (Danton and Himbert 2018).

The literature has not yet examined all the bundled characteristics of liveability specifically, through a combined analysis of apartment features, building facilities and neighbourhood amenities and purchasers willingness-to-pay. The literature has not considered how these variables might interact in the market place. For example, is willingness to pay for private balcony space lower in buildings with adequate rooftop amenities and other shared outdoor environments? Is the value of parking spaces linked to proximity to rail stations? Planners and policymakers appear to believe that the answer to the latter question is yes, as cities across the globe, including Melbourne, are reducing parking requirement near rail stations (). Knowledge of the interactions between apartment, building and neighbourhood amenities and attributes will enable developers and cities to provide better liveability outcomes in high rise developments while minimising duplication of services.

To that end, this research asks: How do markets value in-building amenity versus neighbourhood amenity? How does the presence of different amenities at different scales (apartment, building, neighbourhood), interact to influence market values for individual amenities?

RESEARCH APPROACH

The authors selected a bayside municipality in Melbourne as a pilot to examine the various liveability aspects within an inner-city municipality experiencing rapid growth. We model amenities in three categories; firstly, the features of the apartment itself; secondly, the features and amenities provided within the building; and thirdly the amenities associated with neighbourhood. We deployed traditional Hedonic Pricing methods through Ordinary Least Squares (multiple regression). The implicit prices of property attributes and the effect of apartment attributes, building features and neighbourhood amenities on sale prices and rents can be found using a hedonic regression of the following functional form:

$$P_{it} = \propto_i + \sum_{j=1}^{J} \beta_j X_{jit} + \sum_{k=1}^{K} \delta_i SU_i + \sum_{t=1}^{T} \gamma_i C_t + \sum_{l=1}^{L} \theta_i E_{it} + \mu_{it}, \quad (1)$$

where P_{it} is the sale price of the property (the natural log of the sale price or the log of the weekly rent in Australian dollars), X_{jit} is a vector of variables representing area and physical characteristics, βj are the parameters to be estimated and SUi is a set of indicator variables controlling for suburb-level unobserved heterogeneity. C_t contains time-fixed effects for each quarterly observation, and u_{it} is a random error and stochastic disturbance term. The variables of interest are captured using a set of indicator variables for the various apartment attributes, building features and neighbourhood amenities building with parameters θ_i to allow for non-linear variations in the effects of these elements on prices. The hedonic parameters obtained from each significant regressor are equivalent to their overall contribution to the price. For

ease of interpretation, the obtained parameters of interest approximate the percentage premiums for sale prices.

DATA

The data comprises a valuation set provided by the bayside municipal council. The valuation site includes building level details of apartments such as exterior building quality, number of bedrooms, baths, square footage. The authors joined this data with sales records of all arms-length transactions recorded by the Australian Property Monitor between January 2011 and December 2016. The sales dataset also contains the sales listing description of the apartment, which has been datamined to identify further features and nuances of the property. This enables the authors to identify additional apartment level features. The authors then geocoded the joined dataset to acquire neighbourhood level liveability characteristics. The authors gathered extensive data on neighbourhood amenities from government sources, the Australian Urban Infrastructure Research Network (AURIN) and through web scrapping of amenity data from google maps. The authors then measured walking distances from listings to the nearest of the following: public high schools, public primary schools, childcare, healthcare, pharmacies, libraries, public transport stops, parks and social services. The ArcGIS Origin-Destination Matrix tool was used to identify the walking distances to the nearest amenities on a road and path network provided by the state government. The author's estimated distance to the beach using a Euclidean distance function in R, software for statistics.

RESULTS & DISCUSSION

Our initial analysis identified a cluster of relatively traditional fundamentals driving price points for apartments within the bayside municipality. These results featured a separation between the apartment, building facilities and neighbourhood amenities. Table 1 defines the variables used in this initial pilot hedonic price regressions for improved residential property, whilst table 2 shows the regression results.

The list of explanatory variables in Table 1 provides detailed notation of apartment features; building facilities identified through both the valuation data information and datamining of the sales information; and a range of neighbourhood amenities. The lack of information pertaining to the size of the apartment presents a weakness in the model. However, size effects are largely captured through the number of bedrooms and bathrooms, as well as indicator variables for sales descriptions mentioning separate lounge rooms, studies and dining rooms.

The hedonic regression analysis is shown in Table 2. As anticipated, traditional hedonic variables for modelling in housing research are stronger drivers of price with number of the bedrooms alongside the number of bathrooms (in particular modern bathrooms) having the strongest influence on sales prices. Several liveability variabilities at the apartment level also significantly predicted price. Views commanded a premium, confirming the prior work of Bourassa et al. (2003) and Kong et al (2007). Private outdoor space was negatively associated with prices, which contrasts with findings by Chau et al. (2004), who found a positive effect on value. In the context of this municipality, the researchers could not estimate or identify balcony size, which may be an omitted variable biasing these results. This sample also contains a significant number of low-rise properties wherein balconies may pose a security risk at lower levels, as suggested by Chau et al. (2004). Several variables derived from apartment descriptions that might suggest greater sized apartments were also significant and positive, like the presence of a separate dining room and a separate study. However, these results were only significant in our baseline apartment model.

The building facilities, including rooftop activities such as roofdecks and rooftop garden, exhibited strong and positive effects on price. Interestingly, other key features often noted in apartment buildings like pools and spas are positive but insignificant. We note, however, that our sample contains only a small segment of listings in buildings containing these amenities. The age of the building did have a positive significant effect, demonstrating that the market values newer builds over older stock, holding everything else constant.

In the examining of neighbourhood characteristics greater distance from the beach has a negative and significant co-efficient; yet other locational features did not produce the anticipated results. Distances away from transport and local amenities like grocery stores and public pools had no effect on prices. These results contrast sharply with evidence in the literature suggesting walkability to key amenities commands a premium in the market (Cotright 2009). The models also contradict evidence of a price premium for proximity to light and heavy rail stations (Mohammad et al. 2013; Mulley et al. 2016). The examination of the neighbourhood characteristics saw the beach being a key attraction, with the expected result that distance from the beach has a negative implication on price.

Several postcode indicators had a strong influence on value, including areas that had a combination of high levels of apartments and some distance from the bay driving a negative and significant effect on price; and expected suburbs with quality historic housing and apartments driving a premium, that also connect directly with the bay. The locationality of the property was a key determinant of price alongside the apartment feature, however, the location effects were not directly correlated with any of the distance considerations to neighbourhood amenities in the area. The exception being noted, that 'land-locked' suburbs/areas furthest from the beach appeared to have a negative and significant effect on price.

Finally, three of our interactions between livability variables at different scales were weakly significant, and one strongly so. The presence of a pool in the building and distance to the nearest public pool proved strongest. To illustrate this interaction, we plot it in Figure 1. Figure 1 demonstrates that as distance away from the nearest public pool increased, the effect of a building having a pool increased significantly. These results make intuitive sense, and they hint at the role of substitution effects between building and neighbourhood level.

Table 1: *Summary Statistics*

Variables	Minimum	Median	Mean	Maximum
Natural Log of Apartment Price	12.23	13.19	13.23	14.51
Year Listed	2011	2014	2014	2016
Has Natural Light	0.00	0.00	0.07	1.00
Has Views	0.00	0.00	0.11	1.00
Log Number of Bedrooms	0.00	0.69	0.52	1.39
Number of bathrooms	0.00	1.00	1.29	4.00
Private Outdoor Space	0.00	0.00	0.26	1.00
Has Air Conditioning	0.00	0.00	0.47	1.00
Has Study	0.00	0.00	0.02	1.00
Number of Carparks	0.00	1.00	1.01	2.00
Has Separate Dining Room	0.00	0.00	0.06	1.00
Energy Efficiency Attributes	0.00	0.00	0.00	1.00
Has Fireplace	0.00	0.00	0.08	1.00

Has Storeroom	0.00	0.00	0.01	1.00
Building Year Built	1945	2015	2005	2015
Building Quality/Style	2.00	3.00	3.07	4.00
Building Has Roof Activities	0.00	0.00	0.01	1.00
Building Has Spa	0.00	0.00	0.00	1.00
Building Has Pool	0.00	0.00	0.12	1.00
Distance to Rail (100m)	1.11	17.52	20.35	50.00
Distance to Beach (100m)	0.28	6.92	9.60	31.82
Distance to Tram (100m)	0.02	3.14	4.27	17.09
Distance to Grocery Store (100m)	0.09	4.58	5.23	15.38
Distance to Public Pool (100m)	2.12	15.25	16.95	51.23
Distance to Public Primary School (100m)	1.05	10.08	10.57	22.72
Distance to Public Secondary School (100m)	1.08	16.58	17.61	36.37
Shops Nearby	0.00	0.00	0.07	1.00

Table 2: *Regression results using LogPrice as the criterion*

Predictor	Unit Model	Unit + Building	Unit, Building, N'hood
(Intercept)	-25.65**	-27.73**	-29.07**
Year Listed	0.02**	0.02**	0.02**
Has Natural Light	0.00	-0.02	-0.00
Has Views	0.10**	0.06**	0.09**
Log Number of Bedrooms	0.50**	0.45**	0.45**
Number of bathrooms	0.20**	0.22**	0.21**
Private Outdoor Space	-0.03**	-0.03^	-0.01
Has Air Conditioning	-0.01	-0.01	-0.01
Has Study	0.07*	0.03	0.04
Number of Carparks	0.15**	0.17**	0.24**
Has Separate Dining Room	0.06**	0.04^	0.04
Energy Efficiency Attributes	0.34^	0.35^	0.35*
Has Fireplace	0.16**	0.13**	0.11*
Has Storeroom	0.13*	0.07	0.08^
Building Year Built	0.00*	0.00*	0.00*
Building Quality/Style		0.08**	0.08**
Building Has Roof Activities		0.18*	0.25**
Building Has Spa		0.41*	0.36*
Building Has Pool		0.06**	-0.12*

Distance to Rail			0.00
Distance to Beach			-0.01**
Distance to Tram			-0.00
Distance to Grocery Store			0.00
Distance to Public Pool			-0.00
Distance to Public Primary School			0.00
Distance to Public Secondary School			0.00
Has Shops Nearby			0.04
postcode3006	0.08		
postcode3181	-0.16*	0.03	0.03
postcode3182	0.02	-0.01	-0.07*
postcode3183	-0.09**	-0.09**	-0.05
postcode3184	0.07**	0.07*	0.04
postcode3185	-0.11^	-0.04	-0.02
postcode3205	0.00	0.10*	0.19**
postcode3206	0.29**	0.31**	0.18*
postcode3207	0.17**	0.10**	0.00
Unit Private Outdoor Space: Building Roof Activities			-0.29^
Carparks: Distance to Rail			-0.00^
Has Views: Distance to Beach			-0.00^
Building Has Pool: Distance to Public Pool			0.01**
R^2	.722**	.769**	.782**

Note. A significant *b*-weight indicates the semi-partial correlation is also significant. *b* represents unstandardized regression weights. sr^2 represents the semi-partial correlation squared. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively. ^ indicates $p < .10$. * indicates $p < .05$. ** indicates $p < .01$

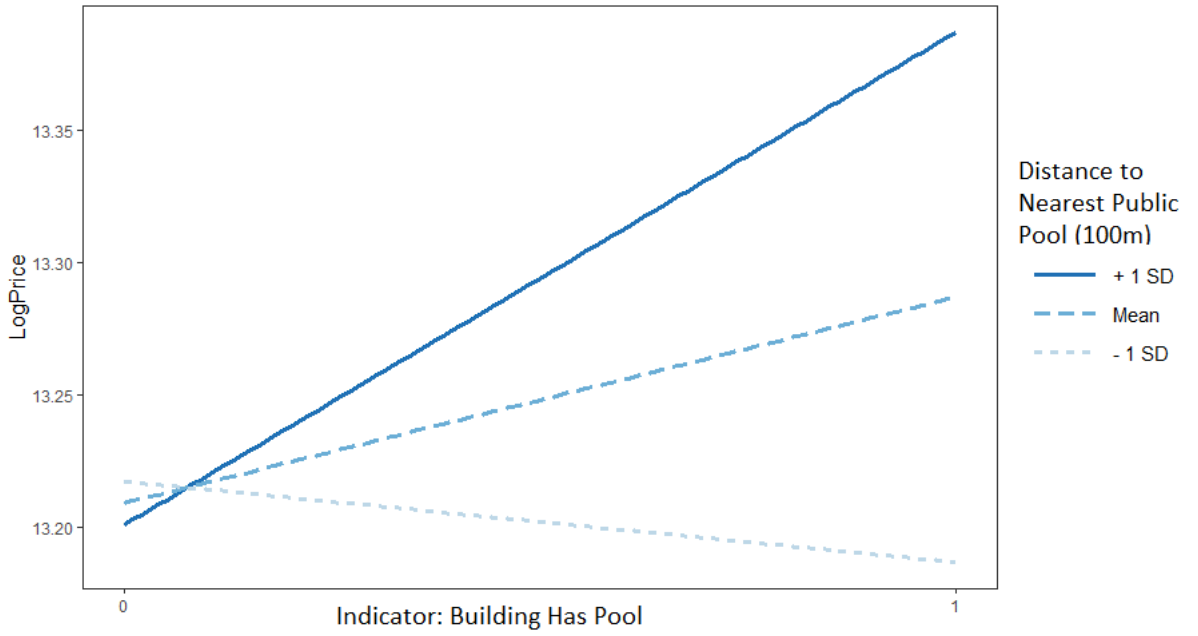

Figure 1:Plot of Interaction Between Building Having Pool and Distance to Nearest Public Pool

LIMITATIONS AND FURTHER RESEARCH

This pilot study has several limitations. The sample could be significantly larger. Future research could include a walkability matrix that collapses all walkability characteristics into a single factor, as well as building level data enhanced to identify greater details of the building amenities and quality and apartment sizes. Further research will explore use of nested and stepwise regressions which will enable researchers to value in-building amenities conditional on the availability of those amenities in the existing neighbourhood. Further research will also include the City of Melbourne, which contains the highest concentration of high-rise and supertall buildings in the region.

DISCUSSION & CONCLUSIONS

This pilot study set out to examine the value perceived by the market of various liveability aspects of apartments; and whether features within the apartment, building facilities and neighbourhood amenities had a greater role to play in apartment living.

Despite the spatial limitations of the present study, the findings suggest that in-building amenities have a strong positive effect on property prices, however the in-building amenities area focused on the apartment itself, rather than the broader building. This was expected in the analysis of this particular municipality, due to many apartment buildings having limited building facilities. However, the presence of in-building amenities correlated significantly and positively with prices. The presence of significant interaction effects also hints at an interrelationship between amenity provision at the building and neighbourhood level.

Once a larger data sample can be obtained with a range of apartment features, detailed building amenity study and neighbourhood amenities expanded, this research will enable development organisations to better understand the markets they supply. They will be able to use this to inform their development decision making framework for locational consideration of the site; and amenities associated with the building and apartments. Further, the research will inform government and policy makers in control of high-rise development requirements and specifications, contributing to their understanding of the needs of residents within their community and then subsequently incorporating this into development guidelines and policy.

Finally, the full research project will produce a tested empirical methodology and results, which will add to the existing scholarship in this area and will be used to inform the development of a larger and international comparative study for future research.

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