INFRASTRUCTURE VICTORIA

Technical paper

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Abstract

This paper provides the first estimates of the effects of parks on house prices within Victoria. We estimate hedonic regressions of house prices on the distance to six types of parks as well as a wide range of other amenities that may impact on house prices. We find that moving from the median to the first percentile of distances from a park is associated with increased property prices of up to $86,000. Parks are more likely to have a positive effect on house prices in regional Victoria than in Melbourne, where we speculate that for some types of parks, congestion or other types of negative externalities may be present. The current guidelines for cost-benefit analysis for transport projects do not include values for amenity effects. So the results of this work can be used to construct estimates of the amenity value of a park for a rapid cost benefit analysis.

I. Introduction

When advertising a house for sale, access to parks is often included as a selling point. And how residents value a park is often not demonstrated until someone tries to remove it. However, parks are not static as government may choose to transform them, by adding a sporting or cultural facility, or neglect them, by failing to keep the grass cut. In addition, parks, or similar open spaces, can be added with other new infrastructure, such as public transport, or withdrawn to construct the same. Despite their apparent importance, the amenity values from parks are currently omitted in cost benefit analyses of such projects. For example, the official guidelines used for performing cost benefit analysis for transport projects provides no parameters to assist the analyst. Instead they are classified in the 2006 guidelines as non-monetised (Australian Transport Council, 2006; Table 2.1) and there has been no progress since. There is not a set of ready to use values from the academic literature either. Because economic theory indicates the value of amenities is likely to vary by location, Australian estimates are needed. Most previous Australian studies do not separately analyse different types of parks (e.g. Plant et al, 2017) or focus on a specific type of parks (e.g. Tapsuwan et al, 2009) with Mahmoudi et al. (2013) being the closest example to our work. There is nothing like a general study for Victoria.

This paper provides the first estimates of the effects of distance from six different types of parks on house prices across Victoria. We estimate a hedonic regression using data on residential property prices between 2013 and 2016 across Victoria, on variables controlling for house characteristics, distances to six different types of parks and similar amenities, and distances to a broad set of other commercial, transport and educational amenities. As well as estimating the model on all Victorian data, we also run separate regressions for samples from Melbourne and regional Victoria.

The regression results, for metropolitan parks, national and state parks and sport and recreational parks, tend to return a decline in house prices of between 0.01 and 0.03 per cent for a one percent increase in distance from the amenity. Community and cultural parks, reserves and the catchall “other parks” also return a negative relationship between house prices and distance in regional areas but not in Melbourne. These elasticities are broadly comparable to those from most of the other amenities we control for. We also calculate the average change in house prices from moving from the median distance from these parks to the first percentile distance. This is estimated, for the parks, to increase house prices between eight and eighty-six thousand dollars. We hypothesise some parks, as well as shops, increase with distance in Melbourne, compared with regional Victoria, because of congestion, or other activities with negative externalities there.

This work makes an important contribution for three reasons. First, it is the most comprehensive analysis of the contribution of parks to amenity values for Australia, the first general study for Melbourne and first general study for regional Australia. Second the parameters from this work fill a gap in cost benefit analysis, providing elasticities that can be used to calculate monetary values for an amenity that is currently non-monetised in the official guidelines for transport projects. The importance of this is demonstrated by the considerable expense taken to preserve amenity when building the EastLink freeway in Melbourne and the extensive tunnelling proposed for NorthEast Link. As major Australian cities grow along with the demand for road travel, the need for such estimates will be even greater.

In the second section we provide a general introduction to the econometric model and discuss the previous literature. This is followed by discussion of the data and identification issues. In the fourth section, results are presented. This is followed by a conclusion.

II. The models and previous literature

The size and direction of the effect of different types of parks on households is an empirical question. There are two broad approaches to measuring this effect which are based on stated or revealed preferences. We focus on the revealed preference approach which requires econometrically estimating a hedonic regression equation.

(i) The hedonic regression equation

The economic theory underlying the hedonic regression is that houses are differentiated products traded in a monopolistically competitive market. Each house is modelled as being a bundle of characteristics. In equilibrium the price for the i^{th} house can be expressed as a function of the characteristics of the house and its neighbourhood:

$$P_i = f(C_i, X_{A,I}, X_{OA,i}; \beta_C, \beta_A, \beta_O) \qquad (1)$$

where C_i is the set of characteristics of house i. $X_{A,i}$ and $X_{O,i}$ capture access to parks and other neighbourhood characteristics associated with the location of the house and the betas are the sets of parameters associated with each set of characteristics. The implication of the work of Rosen (1974) is that these parameters are determined by the cost of providing housing, including the land, and the demographics and income of potential buyers.[2] This makes the parameters very much location and time specific.

The first step in specifying a hedonic econometric model is to characterise how distance from a park affects its contribution to property prices. In the literature this has been done in two ways:

[2] See Sheppard (1999) as the most recent survey of the field, and Kuminoff and Pope (2014) as a recent influential theoretical treatment.

1. A zone, chosen by the researcher, is specified and dummy variables created for each house taking a value of 1 if within the zone of a particular amenity
2. The distance is calculated, for each house, to the nearest amenity of each type and include this as an explanatory variable.

We use the second approach in this paper for the regression model as it allows different rates of decay for each type of amenity.

There is a wide variety of functional forms that can be used for a hedonic regression equation. We use the common log-log form with price and all continuous characteristics logged. Discrete house characteristics are not logged. The basic model we estimate is as below in equation (2):

$$\ln\left(P_{ijt}\right) = \beta_0 + \beta_{CD} C_{D,ijt} + \beta_{CC} \ln\left(C_{C,ijt}\right) + \beta_{DA} \ln\left(D_{A,ijt}\right) + \beta_{DO} \ln\left(D_{O,ijt}\right) + \omega_j + \theta_t + \varepsilon_{ijt} \qquad (2)$$

where all houses, denoted *i*, are described in terms of the time of sale, *t*, and the geographical area within which they are located, *j*. We have four sets of explanatory variables: discrete and continuous house characteristics, denoted $C_{D,ijt}$ and $C_{C,ijt}$, distance to the nearest of each of six types of parks, $D_{A,ijt}$ and distance to other amenities, $D_{O,ijt}$.[3] In addition, we include ω_j and θ_t as the locality and time fixed effects.

The log-log specification implies that distance has a constant proportional effect on property prices. This implies the dollar value reported for access to parks is greater in high-property price areas than in low-property price areas.

[3] Note that although some of these characteristics do not change over time, we retain the time subscript as each observation is only recorded when the property is sold.

(iii) Previous literature

As highlighted in the previous section the value placed on a park depends very much on the characteristics of the local market. So in this review we focus on the previous Australian literature. These papers are summarised in Table 1. There is just a small number of studies focussing specifically on parks. Mahmoudi et al (2012) and Tapsuwan et al (2009) analyse the returns to living near parks in Adelaide and Perth. Pearson et al (2002) and Tapsuwan et al (2015) analyse the returns to being near specific parks on the Sunshine Coast and in the Murray-Darling Basin. Breunig et al (2018) do a particularly careful study of the effects on house prices in the inner Melbourne LGA of Moreland. Tapsuwan et al (2009) is the only study that also attempts to calculate aggregate values in addition to estimating hedonic regressions.

There are also a set of studies that include distance to parks as controls while analysing other issues such as urban tree coverage (Pandit et al, 2013; Pandit et al, 2014; Plant et al, 2017) or specific types of properties (Polyakov et al, 2013 and 2015). These studies also concentrate on estimating and analysing hedonic regression equations.

III. Data and identification

(i) Data

Table 2 lists the variables we use in the hedonic regression along with their source and units. The sale price of a house is used as the dependent variable.[4] We obtain data for three years between 2013 and 2016 on all property transactions within Victoria from CoreLogic – a housing data provider. The reported sale price, which is originally reported to the Valuer General, is adjusted to include estimated stamp duty. The stamp duty adjustment is estimated because we don't observe the actual stamp duty paid. So we assume the

[4] An alternative is to use the land valuation – see Murray (2017) as a recent Australian example.

official rates apply to all properties. This overstates the actual duty paid for first home buyers, who receive a discount. The number of first home buyers is relatively small so we are not concerned about this.

Matched with the sales price is a set of household characteristics, also provided by CoreLogic and the distance to the different types of parks and other types of amenities which is reported in various maps and converted to data using GIS software. In the original source maps parks are classified in over 20 different ways. Guided by discussions with Parks Victoria we combine them into seven broad categories: metropolitan parks; community and cultural parks; sports and recreational parks; national and state parks; reserves; marine and coastal parks; other parks. Metropolitan parks, like Albert Park, are located within Melbourne. They are typically large and there are about thirty of them. The national and state parks are mainly located in regional Victoria, like Wilsons Promontory. Community and cultural facilities, include a broad set of facilities including, for example, libraries like the State Library of Victoria. Sports and recreation parks also include a broad set of parks including ones just with an oval and more formal facilities such as swimming pools and croquet clubs e.g. the Horsham Aquatic Centre. For convenience, we will refer to all of these public amenities as parks. We omit marine and coastal parks as their effects cannot be separately identified from a distance to the coast variable. More details on the construction of the amenity variables are included in the Appendix.

The descriptive statistics for all variables are provided in Table 3. These imply there is a better chance of estimating the amenity values in the regional areas than in Melbourne. For the distance to amenity variables, the standard deviations and the third quartiles tend to be much greater in regional areas than in Melbourne. The first percentiles, quartiles and median values tend to be similar across the two subsamples.

(ii) Identification

Although we have an unusually comprehensive complete set of amenities for inclusion in the regression equation, the limitations of these measures with respect to their heterogeneity, creates three sets of potential identification problems.

The first set arises from unobserved heterogeneity of the amenities. While the specification allows for six different types of parks to have different effects on house prices, the effects of all other types of amenities are constrained to be identical. For example, a train station is constrained to have the same effect on house prices whether it is a very busy station from which trains leave every few minutes during peak hours or a station near the end of the line which is often skipped by express services. Similarly, all educational facilities are treated as the same whether they are a primary, secondary or tertiary facility. So we are unable to capture the price effects of being in the school zone of a high performing school. Another way in which amenities differ may be the extent to which they are accompanied by congestion. Amenities of the same type may or may not have congestion problems depending on whether they are in inner Melbourne, the outer suburbs or regional areas. An individual may value an amenity differently if there is congestion.

The second set of identification problems arise from using distance to the nearest example of the amenity. This could lead to certain specific types of amenities being over-represented in estimation. To make this more concrete, it is highly likely that for most households the nearest educational facility is a primary school. So the coefficient on educational facility is more likely to be with respect to a primary school rather than a secondary or tertiary institution. We also omit any gains from being near to more than one amenity at the same time or how amenities might combine with each other to create benefits e.g. parks that join each other.

The final set of identification issues arises from the different frequencies of different amenities. In urbanised areas, most households are likely to be near a primary school but there will be some houses that are close to a train station but many houses that are not. We might, therefore, expect a better chance of being able to separate out the effects of train stations than primary schools.

The first two measures we take to deal with these challenges is to include location of sale, by SA4 classification, and time of sale fixed effects. Because our dataset is comprehensive across locations but relatively short over time, the fixed effects should control for effects that are specific to a geographical unit but constant over time, and those which are vary over time but fixed across locations. Finally, we also estimate different specifications for subsamples of Melbourne and regional Victoria. Amenities not present in each subsample are dropped and distance to a tram stop is dropped for the regional Victoria subsample.

Using a broad geographical fixed effect, like that for an SA4, implies that if there are areas within the SA4 with parks, and these have higher prices, we will identify the effect of parks. If, on the other hand, the areas with parks have other positive features, then we will not be able to separately identify the contribution of the parks from these other features.

IV Results

In this section we present the results from estimating the hedonic regression models.

(i) Hedonic regression model

We have three main sets of findings. The first set of findings is all types of parks in regional areas provide positive amenity. The elasticity of price with respect to distance varies between -0.002 per cent (other parks) and -0.040 per cent (community and cultural parks). It appears that in regional areas, that access to community and cultural parks and, to a lesser extent, national and state parks, (for which the distance elasticity is -0.02) is relatively valuable for property owners.

The second set of findings is that in Melbourne, it is the metropolitan parks and sport and recreational parks that provide positive amenity (both with a distance elasticity of around -0.012 per cent). The value for sports and recreational parks is broadly similar across the two sub-samples. It is no surprise that many Victorians love their sport and value access to it.

The third set of findings related to the sign and significance of the amenity coefficients is that within Melbourne some parks are considered dis-amenities with positive distance elasticities – community and cultural parks (0.006 per cent), reserves (0.013 per cent) and other parks (0.002 per cent). Intuition and other results that we discuss below suggests that different reasons may be causing these results. We speculate that the positive value for community and cultural parks may reflect congestion and the loss of parking for residents around these facilities. There is a similar swap in signs on the distance elasticity to the nearest shopping district across the regional and metropolitan subsamples. For reserves, this may be due to a combination of their ubiquity and heterogeneity. The closest park for many households may be neighbourhood pocket parks which may have little amenity value to neighbours (and may even be a dis-amenity if not well maintained or if they attract noisy groups). Alternatively, the positive results of Breunig et al. (2018) for an inner Melbourne LGA suggest that there could be greater geographical heterogeneity associated with how small parks are valued.

We also review the signs, size and significance of the coefficients on the other non-park amenities because they are of interest in themselves (as well as being a further plausibility check on the model). In general they are plausible. The first result we note is the difference in sign for shopping districts across Melbourne and regional Victoria. Being near a shopping district has a positive effect on house prices in regional Victoria but a negative effect in Melbourne. This is consistent with congestion being a problem. It is also interesting to see that for the region-specific models that major roads have a greater effect than freeways – this is consistent with the greater resources such as trees and sound barriers that accompany freeways compared with relatively little publically provided resources for residents living alongside major roads.

To get a better sense of the effect of the different amenities we have calculated the marginal effects of moving from the median distance for a house, in the data, to the first percentile in terms of distance for a house e.g. moving from 3.3 kilometres from a metropolitan park to 180 metres away. These are reported in Table 6. They are quite substantial, in the tens of thousands of dollars – moreso in regional areas than for Melbourne with the exception of train stations.

To analyse the robustness of the results we also estimate the hedonic regression model using a linear specification. This model has the implication that the marginal effect is constant in all locations. Arguea and Hsaio (1993) argues that a linear form can be argued for logically where there is competition for all attributes i.e. different quantities of all attributes must have the same per-unit price. These results are reported in the Supplementary materials but are generally less plausible than those using the log-log specification so we do not persist with the linear specification.

V. Conclusion

Intuition and observation suggests parks are valued by local residents. But the value of parks to residents is not taken account of when doing a cost benefit analysis, for example, of a transport project (Australian Transport Council, 2006; Table 2.1).

We use data on 290,000 residential property transactions for all of Victoria to estimate a hedonic regression model which allows for distance of six types of parks as determinants of property values, while controlling for a wide range of other influences on property prices. To deal with identification problems, time and location and fixed effects are included as well as separate equations being estimated for all Victoria, Melbourne and regional Victoria.

We conclude that four types of parks have positive amenity for nearby residents across Victoria. In regional areas, being closer to all types of parks is associated with higher house prices. In Melbourne being closer to reserves and community and cultural parks has very small negative effects on property prices. This could either be due to congestion, negative externalities from activities in local parks, or perhaps they are too common to identify or even yield positive effects. The average effects on house prices from moving from the median distance to the first percentile of distance from a park are considerable, ranging from around eight to eighty-six thousand dollars.

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Table 1

Previous literature

Application	Study	Region	Sample period	Amenity variables	Key findings
Noosa National Park	Pearson et al. (2002)	Noosa	1999	Distance to park; view of ocean	Being in view of an urban national park increases land values by 6 to 7 per cent.
Wetlands	Tapsuwan et al. (2009)	Perth	2005-2006	Distance to nearest wetland	Moving 1m closer to nearest wetland (from an average distance of 943m) increases house prices by $42.40.
Parkland and open spaces	Mahmoudi et al. (2012)	Adelaide	2005- 2008	Distance to nearest and size of nearest park	Moving 1m closer: to Adelaide Parklands (from an average distance of 10.74km) increases house prices by $1.55; to Linear Park (from an average distance of 7.9m) increases house prices by $0.35; to a watered sporting ground (from an average distance of 488m) increases house prices by $3.80 (if water restrictions).
Urban trees	Pandit et al. (2013)	Perth	2005-2006	Distance to nearest and number of trees	Moving 1m closer to a large park (from an average distance of 1121m) decreases house prices by $9.60. Moving 1m closer to a sporting reserve (from an average distance of 409m) decreases house prices by $29.59.
Urban trees	Pandit et al. (2014)	Perth	2009	Gravity index to range of parks	Bush reserves, lakes and golf courses have significantly increase property prices. Small and sport reserves do not.
National-state parks	Polyakov et al (2013)	Central Victoria	2001-2011	Distance to park	For lifestyle properties moving 1km closer to a park increases the value by $3535.
National/state/ regional parks	Polyakov et al (2015)	Central Victoria	1990-2011	Distance to park interacts with area	No significant effects for lifestyle and farming properties.
Barmah-Millewa Forest	Tapsuwan et al (2015)	Murray-Darling Basin	2000 to 2011	Distance to forest	For an average property, 10km away moving 1km closer increases property price by $2000.
Urban trees	Plant et al (2017)	Brisbane	2008-2010	Distance to nearest park	Significant positive effect within 200m of a park.
Playgrounds	Breunig et al (2018)	Melbourne	2005-2014	Playground within 300m	Adds about 5 per cent to property values. Effect falls with distance

Table 2

Summary of variables and sources

Category	Variable	Units	Source
Property price	Property price	Thousand dollars	CoreLogic
Property characteristics	Land size	Square metres	CoreLogic
	Bedrooms	Number	CoreLogic
	Bathrooms	Number	CoreLogic
	Garages	Number	CoreLogic
	Car spaces	Number	CoreLogic
	Unit	Dummy variable	CoreLogic
Proximity to parks	Metropolitan parks	Distance to nearest	PLM25
	Community and cultural parks	Distance to nearest	Geomark Polygon and PLM25
	Sport and recreational parks	Distance to nearest	Geomark Polygon and PLM25
	Reserves	Distance to nearest	Geomark Polygon
	National and state parks	Distance to nearest	PLM25
	Other parks	Distance to nearest	PLM25
Proximity to services	Shops	Distance to nearest	Geomark Polygon
	Hospital	Distance to nearest	Geomark Polygon
	Police station	Distance to nearest	Vicmap Features Geomark
	Education facility	Distance to nearest	Geomark Polygon
Proximity to transport	Train station	Distance to nearest	PTV Train Station
	Train line	Distance to nearest	PTV Train Track Centreline
	Tram stop	Distance to nearest	PTV Tram Stop
	Freeway	Distance to nearest	Vicmap Transport – Road Network
	Major road	Distance to nearest	Vicmap Transport – Road Network
	Bike path	Distance to nearest	Vicmap Transport – Bike Paths
Proximity to disamenities	Disamenities	Distance to nearest	Geomark Polygon
Location	Coast	Distance to nearest	Framework – Vicmap Index
	Central business district (CBD)	Distance to	Google Maps

Table 3

Descriptive statistics

Variable	Melbourne					Regional Victoria				
	First Percentile	First Quartile	Median	Third Quartile	Standard Deviation	First Percentile	First Quartile	Median	Third Quartile	Standard Deviation
Sales Price	206	448	636	941	682	87	259	359	476	285
Land Size	0.09	0.32	0.57	0.72	25	0.12	0.52	0.66	0.87	55
Bedrooms	1	3	3	4	0.84	1	3	3	4	0.74
Bathrooms	1	1	2	2	0.69	1	1	2	2	0.59
Garages	0	0	1	2	0.99	0	1	2	2	1.1
Car Spaces	0	1	2	2	1.1	0	1	2	2	1.2
Unit		0.23			0.42		0.10			0.30
Distance to nearest amenity:										
Metropolitan park	0.18	1.9	3.3	5.0	2.4					
Commercial and cultural park	0.05	0.62	1.2	2.2	1.5	0.05	0.64	1.5	3.0	2.5
Sports and recreational park	0.04	0.25	0.42	0.62	0.35	0.04	0.28	0.50	0.84	0.85
Reserve	0.01	0.08	0.14	0.24	0.15	0.01	0.07	0.14	0.26	0.46
National and state park						0.23	6.8	13	19	10
Other park	0.12	1.3	2.2	3.4	1.9	0.07	1.1	2.3	4.8	3.4
Shops	0.04	0.39	0.90	2.2	2.4	0.23	1.6	3.8	14	25
Hospital	0.15	1.2	2.1	3.4	2.1	0.15	1.6	3.6	8.3	6.7
Police	0.27	1.3	2.0	2.8	1.2	0.20	1.3	2.4	4	2.9
Education	0.02	0.23	0.40	0.60	0.31	0.03	0.31	0.56	0.97	1.6
Train station	0.17	0.79	1.4	2.4	1.5	0.31	1.7	3.4	15	33
Train line	0.04	0.54	1.1	2.0	1.4	0.06	0.81	2.0	7.6	12
Tram stop	0.07	1.1	4.5	11	7.5					

Table continued over page

Table 3, continued

Descriptive statistics

Variable	Melbourne First Percentile	First Quartile	Median	Third Quartile	Standard Deviation	Regional Victoria First Percentile	First Quartile	Median	Third Quartile	Standard Deviation
Freeway	0.11	1.2	2.4	4.0	2.7	0.15	2.1	6.4	23.1	65
Major road	0.02	0.10	0.23	0.43	0.37	0.03	0.14	0.30	0.58	0.47
Bike Trail	0.03	0.31	0.61	1.0	0.61	0.05	0.70	3.0	17	46
Disamenity	0.22	1.2	1.8	2.5	1.0	0.21	1.2	2.0	3.4	2.0
Coast	0.24	5.6	11	18	8.3	0.18	3.5	23	75	77
CBD	2.45	11	17	24	9.1	23	46	68	136	91

Table 4

Estimated coefficients on amenities for the hedonic regression models

Variable	Statewide Coefficient	Statewide Standard Error	Melbourne Coefficient	Melbourne Standard Error	Regional Victoria Coefficient	Regional Victoria Standard Error
Log of distance to nearest:						
Metropolitan park	0.001	(0.0011)	-0.012***	(0.0012)		
Community and cultural park	-0.030***	(0.0008)	0.006***	(0.0012)	-0.040***	(0.0011)
Sport and recreational park	-0.013***	(0.00009)	-0.012***	(0.0012)	-0.009***	(0.0013)
Reserve	0.012***	(0.0007)	0.013***	(0.0010)	-0.009***	(0.0011)
National and state park	-0.0039***	(0.0011)			-0.020***	(0.0014)
Other Park	0.010***	(0.0008)	0.002*	(0.0011)	-0.002**	(0.0011)
Number of observations	292547		169842		122706	
F-statistic	13663***		9289***		3582***	
R^2	0.708		0.675		0.589	

Note: ***, **, *: significantly different from zero at 1%; 5%, 10%. Robust standard errors

Table 5

Estimated coefficients on other variables for the log-log hedonic regression model

Variable	Statewide	Melbourne	Regional
ln(land size)	0.085***	0.055***	0.142***
	(0.0015)	(0.0019)	(0.0022)
Number of bedrooms	0.115***	0.132***	0.094***
	(0.0012)	(0.0015)	(0.0018)
Number of bathrooms	0.195***	0.162***	0.248***
	(0.0013)	(0.0016)	(0.0022)
Number of garages	0.034***	0.041***	0.030***
	(0.0008)	(0.0010)	(0.0012)
Number of car spaces	0.030***	0.026***	0.032***
	(0.0008)	(0.0010)	(0.0011)
Unit	-0.171***	-0.258***	0.055***
	(0.0022)	(0.0025)	(0.0038)
Log of distance to nearest:			
Shops	-0.025***	0.010***	-0.032***
	(0.0007)	(0.0011)	(0.0009)
Hospital	-0.025***	-0.004***	-0.025***
	(0.0008)	(0.0012)	(0.0011)
Police station	0.005***	0.006***	0.006***
	(0.0010)	(0.0016)	(0.0014)
Education facility	0.004***	0.004***	0.002
	(0.0008)	(0.0010)	(0.0012)
Train station	-0.024***	-0.057***	-0.026***
	(0.0012)	(0.0023)	(0.0013)
Train line	0.008***	0.008***	0.019***
	(0.0009)	(0.0016)	(0.0012)
Tram stop)	-0.090***	-0.074***	
	(0.0016)	(0.0018)	
Freeway	0.019***	0.012***	0.008***
	(0.0007)	(0.0010)	(0.0010)
Major road	0.016***	0.019***	0.015***
	(0.0007)	(0.0008)	(0.0010)
Bike path	-0.004***	0.002**	-0.003***
	(0.0006)	(0.0009)	(0.0008)
Disamenity	0.011***	0.001	0.027***
	(0.0010)	(0.0014)	(0.0014)
Coast	-0.109***	-0.112***	-0.100***
	(0.0010)	(0.0015)	(0.0014)
CBD	-0.225***	-0.365***	-0.071***
	(0.0050)	(0.0077)	(0.0045)
Constant	16.81***	17.274***	13.562***
	(0.0381)	(0.0456)	(0.0574)

Note: ***, **, *: significantly different from zero at 1%; 5%, 10%. Robust standard errors.

Table 6

Change in the price of a house of moving from the median distance to first percentile distance in thousands of dollars

Amenity	Statewide		Melbourne		Regional	
Metropolitan park	-2.0		27.4	***		
Community and cultural park	60.0	***	-13.6	***	54.9	***
Sport and recreational park	19.6	***	21.8	***	8.8	***
Reserve	-19.3	***	-26.6	***	9.1	***
National and state park	86.0	***			32.0	***
Other park	-18.2	***	-4.3	*	3.1	**
Shops	52.9	***	-24.2	***	36.1	***
Hospital	44.0	***	7.1	***	31.9	***
Police station	-6.4	***	-8.9	***	-6.0	***
Educational facility	-6.8	***	-7.6	***	-2.4	**
Train station	34.0	***	98.1	***	24.4	***
Train line	-16.8	***	-20.8	***	-23.7	***
Tram stop	323.0	***	260.9	***		
Freeway	-35.2	***	-26.9	***	-11.8	***
Major road	-22.8	***	-33.2	***	-13.4	***
Bike Path	8.3	***	-4.1	**	4.7	***
Disamenity	-13.8	***	-1.7		-22.7	***
Coast	330.6	***	393.6	***	224.5	***
CBD	370.0	***	731.0	***	30.3	***

Note: ***, **, *: significantly different from zero at 1%; 5%; 10%

Appendix

This appendix includes additional information on construction of the dataset and the results of estimating a linear hedonic regression model.

First, Table A.1 lists the types of parks in the original sources that are aggregated to construct the seven sets of parks (and dis-amenities) used in the analysis in the paper. There is some overlap and ambiguities in the PLM25 and Geomark maps and associated databases. Details of how these are resolved are available from the authors.

Table A1

Types of features included in each aggregated neighbourhood characteristics variable

Variable	Types of features included	Sources
Metropolitan parks	Metropolitan parks	PLM25
Community and cultural parks	Community space; Community use area; Historic reserve; Landmark;	Geomark Polygon; PLM25
Sport and recreational parks	Alpine resort; Recreational; Sport facility	PLM25 Geomark Polygon
Reserves	Reserve	Geomark Polygon
National and state parks	National park; State park	PLM25
Other parks	Essentially natural catchment; Forest park; Natural features reserve; Nature conservation reserve; National Parks Act Schedule 3 – Other park; National Parks Act Schedule 4 – Park or reserve; Regional park; State forest; Wilderness park	PLM25
Disamenities	Dumping grounds; Excavation sites; industrial facilities; power facilities; others	Geomark Polygon
Marine and coastal parks	Coastal reserve; Marine national park; Marine sanctuary;	PLM25

Table A2 reports the data cleaning that is done to construct the final sample for estimation. We lose about a fifth of the sample for properties that are either commercial or residential properties that are not units or houses. This includes properties that are likely to have distinctive relationships to amenities, like farms and flats. Flats are excluded because some implausibly large sales prices suggested that some were being sold as a group. Note however, that units are included. The only difference between a unit and a flat is that a unit has its own title whereas a property is classified as a flat if it is one of several owned by a common owner.

Next we remove observations with missing values and unusual transactions. These are primarily composed of properties sold for less than $50,000 (32,589) and those with missing land size (38,431), bedrooms (21,613), or bathrooms (9,472). A very small number of outliers and properties with unusual GIS or locational features are also dropped.

Table A2

Data cleaning process for property sales

Variable List	Process	Observations
Observations before cleaning		513993
Adjustments:		
Commercial Property	Drop	18223
Drop if not a houses or a unit		90320
Drop if missing values	For latitude, land size, bedrooms, bathrooms	74133
Drop if unusual transactions	Remove if landsize less than 25 sq. m.; price less than 50,000 or number of bedrooms = 0	32902
Outliers		10
Drop if unusual GIS or locational observations		868
Observations after cleaning		292547

Thirdly, note that most LGAs were either solely in Melbourne or regional Victoria. There were eight LGAs that contained houses in both Melbourne and regional Victoria. Seven of these were classified as in Melbourne as the share of houses was at least 56% (Frankston; Hume; Melton; Nillumbik; Whittlesea; Wyndham; Yarra Ranges). Only one was classified as regional (Casey) as its share of houses in Melbourne is under 5%.

Finally, Table A.3 reports the regression results for the linear specification that was performed for robustness.

Table A3

Estimated coefficients for the linear hedonic regression model

Variable	Statewide	Melbourne	Regional
Land size	0.16***	0.072*	0.21***
Number of bedrooms	97259***	132848***	52018***
Number of bathrooms	198706***	224473***	127817***
Number of garages	18395***	38489***	6438***
Number of car spaces	17574***	20851***	14820***
Unit	-167222***	-222487***	-10709***
Distance to nearest:			
Metropolitan park	17***	4.3***	
Community and cultural park	-15***	15***	-7.7***
Sport and recreational park	-23***	-28***	-13***
Reserve	102***	365***	30***
National and state park	3.4***		0.14*
Other park	-2.5***	-2.6***	-1.2***
Shops	0.25***	9.8***	-0.47***
Hospital	1.41***	4.2***	0.12
Police station	-4.56***	3.7***	-2.8***
Education facility	6.27***	-32***	9.38***
Train station	-1.05***	-7.9***	-0.19***
Train line	-0.66***	-23***	1.07***
Tram stop	26.78***	19.34***	
Freeway	-0.28***	16***	0.37***
Major road	-39.16***	22***	0.17
Bike path	1.02***	-29***	-0.11***
Disamenity	4.49***	14***	13***
Coast	-0.53***	-7.7***	-0.14***
CBD	-44***	-55***	-0.28***
Constant	-178504***	634921***	-37248***
Number of observations	292547	169841	122706
F-statistic	3678***	2498	1391
R^2	0.48	0.47	0.33

Note: ***, **, *: significantly different from zero at 1%; 5%, 10%. Robust standard errors.