IARIW 2021

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Monday 23 – Friday 27 August

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Paper prepared for the 36th IARIW Virtual General Conference
August 23-27, 2021
Session 14: Measurement in the Housing Market I
Time: Wednesday, August 25, 2021 [16:30-18:30 CEST]

Impact of Community Voice on Housing Supply Constraints: Case Study of Melbourne*

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This version: August 6, 2021
Prepared for presentation at the 36th Annual General Conference of the International Association for Research in Income and Wealth.
Hosted by Statistics Norway, 23-27 August 2021

Abstract

This study investigates a possible link between household "voice" and residential house prices through land use regulation by bringing together two streams of literature from political economics and urban economics. Even in an environment of compulsory voting, the data shows that council elections experience weak turnout. Fischel (2001) "Homevoter Hypothesis" provides an explanation by making the connection between homeownership and local election turnout. The weak election turnout serves as a significant predictor of community objections to proposed development in the modelling. A model of voter turnout was used in addition to binary outcome models of objection and refusal rates for planning permits. It was found that household "voice" had a direct role in explaining regulatory restrictiveness that in turn, explains house prices, even with the inclusion of income and demographic controls. Shifting the distribution of development and densification in favour of vocal groups could contribute to income divergence, gentrification and associated productivity costs if restrictive land use constraints and increasing house prices act

*Funding from the Australian Research Council LP160101518 is acknowledged. The Views and Opinions Expressed Are Those of the Authors and Do Not Necessarily Reflect the Official Policy or Position of the Department of Treasury and Finance, Victoria Government.

†This is a revised version of the work conducted and submitted as an Honours thesis while a student at The University of Queensland.

as barriers to entry for diverse and lower income residents.

Keywords: homevoter hypothesis; voter turnout; permit objections; refusal rate; price-income elasticity
JEL: R31; R14

Contents

1 Introduction

This work explores issues across four main areas: the effect of land use regulation on house prices; endogeneity of the supply constraints; the power of households in affecting policy; and the effect of political competition on regulatory restrictiveness. Restrictive land use controls and zoning policy can increase house prices by limiting the flexibility of housing supply to respond to fluctuations in demand. This creates a friction that inhibits the available quantity of housing, thus distorting prices above their neoclassical competitive market equilibrium levels and raising the willingness to pay for an extra dwelling.
Improper management of the endogeneity and reverse causality observed between regulatory variables and house prices leads to bias in the calculated value of land.

Endogeneity of the permit refusal rate in house price models comes from the positive amenity created by the certainty and value protection of tighter planning policy, inducing greater willingness to pay by households and demand for regulation in wealthier areas. This channel can be exacerbated in an economic boom, when prices are already higher due to the raised demand and the greater number of submissions for development authorities receive, usually for larger and riskier projects so as to capitalise on such price surges. Homeownership is believed to be endogenous to regulation as it inflates house prices and consequently provides greater motivation to own, increasing housing demand and prices.

The seminal paper by Fischel (2001) established the "Homevoter Hypothesis"; a theory whereby households use their influence in local elections to control land use regulation and protect their largest asset. This theory assigns homeownership as the main determinant in the decision by a household to participate in municipal elections, due to the opportunity to choose policies that best align with their desire to protect property values. Sole-Olle and Viladecans-Marsal (2012) use the vote margin of a sitting representative to quantify the level of competition in politics, where more competitive pressures - and thus a thinner margin - are negatively associated with development in an effort by the representatives to keep homeowners happy and protect their term in power. Their study between 2003 and 2005 involved 2000 Spanish municipalities, wherein voting is not compulsory, and found a rise in vote margin of one standard deviation lead to a 17% increase in land released for development. This wider margin of victory induces a less competitive political environment and more freedom for the representative to engage with developers without fear of not being re-elected. This effect was found to be amplified in municipalities comprised of a greater share of constituents who owned their home, under left-leaning governments, the more residents who travelled for work, and further from the central business district (CBD). They conclude the thinner the vote margin with which representatives are successful in local elections, the lower the probability of developer influence on planning outcomes. Homeowners comprise a large proportion of voters who attend non-compulsory elections in Spain, so representatives can't afford to lose favour, supporting the Homevoter Hypothesis.

Fischel's hypothesis was first used to explain attendance at non-compulsory municipal elections. Unlike many other countries, Australia has compulsory voting, yet data from the Victorian Electoral Commission (VEC) show that the turnout to local elections in Victoria can be as low as 44 per cent in some wards. This is the first study of its kind (to our knowledge) to directly explore the homevoter hypothesis in a compulsory voting environment as well as the role played in land use regulation by household voice, characteristics, demographics and political influence that enables and intrinsically motivates households to put pressure on local government to achieve a desired land use policy.

Shifting the distribution of development and densification in favour of vocal groups could contribute to income divergence, gentrification and associated productivity costs if restrictive land use constraints and increasing house prices act as barriers to entry for diverse and lower income residents.

2 Land supply restrictions and house price growth

Land use controls and regulation can be driven by community development, financial motives, or historically, social exclusion. However, land use regulation slows the rate of growth of the housing stock available to satisfy demand and puts upward pressure on price growth and price volatility in the existing housing stock. The extent of such regulation affects urban boundaries, city size and forms of new development (Gyourko and Molloy, 2015). Restrictions that limit supply in turn boost demand as buyers are willing to pay more for certainty and protection of housing prices. This increased demand leads to higher prices, with tighter zoning controls inducing a steeper rise after a demand shock (Jackson, 2016). Constrained housing supply amplifies the effect of bubbles, based on evidence from the 1980s and 90s reported by Gyourko et al. (2008).

The persistent deviation between sale price and the marginal cost of dwelling construction resulting from constrained housing supply has been defined in related literature as a "zoning tax"; Kendall and Tulip (2018) describe the price distortion as a "zoning effect" as it is not necessarily a tax by governments to compensate for negative externalities from development.

While literature connecting such regulation with high house prices is not uncommon, many studies are unable to determine causality (Glaeser et al., 2005). Problems of endogeneity exist that confounds the results owing to possible omitted variable bias and increased housing supply (land being developed) in areas where prices are increasing. Lejcak et al. (2020) estimated a panel IV model of detached house prices for the Greater Melbourne area at the SA2 level using a restrictiveness measure. This study was related to that of Hilber and Vermeulen (2014), which is a seminal work in this regard as it addresses this issue by using a panel IV model with a direct restrictiveness measure. This is done in place of categorical index or survey data, which had been the norm in models of housing supply constraints. The present study explores the applicability of the Hilber and Vermeulen (2014)'s model of UK regions to the case of a single urban centre. The study uses a panel of the Greater Melbourne Wards to estimate Hilber and Vermeulen (2014)'s model given by (1),

$$
\begin{aligned}
log(PI^{*}_{it}) = \quad & \beta_1 log(income_{it}) + \beta_2 log(income_{it}) \times \overline{\mathbf{RefusalRate_i}} \\
& +\beta_3 log(income_{it}) \times \mathbf{SDL_{it}} + \textstyle\sum_{i=1}^{8} \beta_{3+i} D_t \\
& + \textstyle\sum_{i=1}^{128} \beta_{11+i} D_i + \epsilon_{it}
\end{aligned}
\tag{1}
$$

where,

Wards are indexed by i, $i = 1, ..., N$, and years by t, $t = 1, ..., T$

$log(PI^{*}_{it})$ is a quality adjusted price index for Ward i

Supply restrictiveness is captured by:

1) $\overline{\mathbf{RefusalRate_i}}$ -on all times of development - and
2) $\mathbf{SDL_{it}}$ - shared of developed land -

D_i and D_t are Ward and time dummies

An added complication to these models of house prices is that both the permit approval rate and share of developed land are both believed to be endogenously determined. To address this endogeneity, the generalised method of moments is used to apply an instrumental variables estimator; two-stage least squares (2SLS) in this case given the use of overidentified models. Instruments (Z) chosen must satisfy two criteria; validity and relevance. Firstly, the nominated instrument must be valid, meaning it is uncorrelated with the within estimator transformed error term. Secondly, the success of the instrument depends on the strength of correlation between it and the endogenous variable (X) it is being used to explain, referred to as the requirement for relevance.

$$E[Z'\epsilon] = 0 \quad ; \quad E[Z'X] \neq 0 \tag{2}$$

Given the used of fixed effects – based on Hausman test results – the instruments are allowed to be correlated with the unobserved heterogeneity α, however, not the idiosyncratic error ϵ. Post-estimation diagnostics will include model significance indicated by the F statistics, the model R-squared as well as several tests of instrument performance in order to select the strongest and most appropriate. Firstly, the Hansen H test statistic will be used to test the null hypothesis of valid over-identifying restrictions, thus we look for a high p-value in order to not reject the null of valid instruments. Next, the Kleibergen-Paap rk LM statistic is used to assess underidentification. Here, we seek to reject the null of zero covariance between the instruments and the endogenous regressor, supporting the existence of sufficient evidence with which to conclude the chosen instruments are relevant (Greene, 2012). The significance of the instruments in the first stage will also be used to select strong instruments. Table 1 presents a list of the instruments available in this study

Table 1: Proposed Instrumental Variables & Sign of Correlation

Endogenous Variable	Instrument	Expected Correlation
Refusal Rate	Federal Labor Share	Negative
	Vote Share per Councillor	Negative
	Candidates	Positive
	Informal Vote Share	Negative
	Turnout	Positive
	Objected	Positive
	Complex Assessment	Positive
	Time to Decision (Wks)	Positive
	Same Address 5y	Positive
Share of Developed Land	Population Density 90s	Positive
	Health Worker Share	Positive

The "share of developed land" is instrumented using population density for 1991, following several examples from the literature discussed in Hilber and Vermeulen (2014). These authors argue that population density is highly correlated with the share of developed land, and since it increases with development, the use of a lagged value avoids the issue of reverse causality with contemporary house prices. In place of a 'historic' population density as used by Hilber and Vermeulen (2014), 1991 was the earliest year in which data feasible to be matched to the ward level was available, as described in Section 3. For the Greater Melbourne, the 1991 population density is 77% of the modern figure representing a growth of around 30%, whereas in the city centre – at the SA2 level[1] – there has been remarkably higher growth with the 2016 value nearly 25 times that from 1991. Melbourne is a much newer city that has experienced much of its new development over the past 30 years, compared with much of the transformative development across England which would have taken place much earlier.

A second instrument proposed for the share of developed land is the share of workers employed in the health industry, found to be highly correlated with the share

[1]Australian Standard Geographical Classification (ASGC) framework. See Australian Bureau of Statistics (2019) for the hierarchy of ABS structures)

of developed land. The rationale is that there are more health services and concentrated prevalence of health specialists closer to the city and in more developed areas with greater population density. The identifying assumption is that the density of residents employed in health has no effect on house price outside of the channel through which it is associated with the share of developed land, satisfying the validity assumption.

In order to inform the selection of appropriate instruments for the endogenous' 'permit refusal rate', we model key variables capturing household voice and their relationship with regulatory restrictiveness. These models firstly test the application of the Home-voter Hypothesis via a panel model of election turnout, followed by binary outcome econometric models of development permit objection by the community and refusal by council (Section 4.1). This will act as a proxy first stage regression for the Hilber and Vermeulen's housing price-income elasticity model and provide insight into factors influencing heterogeneity in development outcomes. The estimation of this model is presented in Section 4.2.

2.1 Household Voice and Voter Turnout Modelling

Models of voter turnout and the probability of permit objection are estimated to explore household voice and the homevoter hypothesis in some detail.

The "homevoter hypothesis" by Fischel (2001) states that the decisions of local governments are driven by homeowners wanting to maximise the value of their houses. Households will use their influence in local elections to control land use regulation and protect the value of their largest asset. According to the theory, homeownership is thought to be a main determinant of a household to participate in municipal elections as it is an opportunity for the household to choose policies that best align with their desire to protect property values (Fischel, 2001).

There is strong motivation amongst owner-occupiers to be a proponent for regulation as the only channel through which to insure against property devaluation, given insufficient alternative means of diversifying this asset. This is done by fighting development and expansions to local housing supply that would lead to downward pressure on prices (Gyourko and Molloy, 2015).

Homeowners often oppose activity classified as "Locally Unwanted Land Uses" (LULU) such as a public dump, development with excess pollution or traffic, and tend to be the most vocal in preventing such local disamenities from becoming capitalised into their property prices. Homeowners also protest based on economic, social political and environmental concerns, supporting action on behalf of minority causes or communities. Homeowners and community groups capitalise from strength in numbers in opposition to development and rely on this network effect for increasing returns to scale on their resistance (Helsley and Strange, 1995). Associated characteristics of such active homeowners include higher educational attainment, wealth and a greater propensity to coordinate and be involved in meetings and local events. The costs of involvement in certain groups - in addition to opportunity cost of homeowner time – are outweighed by the value they stand to gain from action (Schively, 2007).

Given the surprisingly low rates observed across Greater Melbourne, local election turnout is modelled here in an attempt to explain drivers of attendance and identify the characteristics of residents most involved in local politics. This, in turn will assist in understanding the factors influencing permit refusal rates; active expression of voice in a community signals engagement and a raised level of accountability for local councillors, which may have implications for planning outcomes. Communities exhibiting higher turnout rates indicate an increased propensity for involvement and higher likelihood of opposition to unfavourable developments. Fischel's Homevoter Hypothesis predicts the most important determinant in the household decision to attend a local election is their status as a homeowner and the opportunity to choose policy to best protect their largest asset. To test this, a two-way fixed effects panel model of voter turnout is used, in line with the one used in (McGregor and Spicer, 2016):

$$Turnout_{it} = \alpha_i + Homeownership_{it} + \sum_{k=1}^{K} \beta_k x_{it,k} + \sum_{\tau=1}^{T} \delta_\tau D_{it,\tau} + \epsilon_{it}, \qquad (3)$$
$$i = 1, ..., N,\ t = 1, ..., T$$

where,

$Turnout$ refers to the local council election for each ward;

$Homeownership$ is the homeownership rate for the ward;

x_k, $k = 1, \ldots K$ capture the ward average socio-economic and demographic variables; and

D are the time dummies

Permit level data is used in binary outcome models, merged with corresponding election and demographic data (see Section 3) in order to preserve the binary status of the key data.

A Probit model[2] is fitted to explore determinants of permit objection and refusal rates. The reasoning here is that the only source of misspecification leading to

[2]logit and linear probability models were fitted for robustness and are not presented here.

inconsistency of the maximum likelihood estimator is a misspecified probability – that is, incorrect choice of F(.) – given the distribution of the outcome variable is known.

$$Pr[y_i = 1|\mathbf{x}_i] = E[y_i = 1|\mathbf{x}_i] = F(\mathbf{x}_i'\beta) = \Phi(\mathbf{x}_i'\beta) \tag{4}$$

$$Pr[y_i = 0|\mathbf{x}_i] = 1 - \Phi(\mathbf{x}_i'\beta) \tag{5}$$

The vector x represents a selection of planning, election and demographic controls used as factors that could explain variation in the probability of permit objection and refusal, in conjunction with year dummies to control for time-specific effects and council dummies to control for broader heterogeneity. The errors are clustered at the ward level.

Marginal effects depend on the specific x_i at which it is evaluated, thus average marginal effects are reported. These average marginal effects are calculated and interpreted slightly differently for continuous and binary explanatory variables, according to Equations 6 and 7, respectively. Since we're dealing with planning data at the permit level in this model, many of the variables are binary dummy variables[3]. The interpretation of the average marginal effect will be the effect on the probability of success of a change from an explanatory variable value from 0 to 1 (Cameron and Trivedi, 2005)

$$AME_{cts} = \tfrac{1}{N}\sum_{i=1}^{N}\phi(x_i'\beta)\beta \tag{6}$$

$$AME_{DV} = \tfrac{1}{N}\sum_{i=1}^{N}[\Phi(x_i'\beta|x_i^k = 1) - \Phi(x_i'\beta|x_i^k = 0)] \tag{7}$$

This model is estimated firstly using the entire dataset for Greater Melbourne, then separately for the inner, metro and outer regions to test for differences in observed effects. In the above specification, the regressors in x are assumed exogenous. Exogenous regressors correlated with homeownership and believed to be significant indicators of community motivation to demand more restrictive land use regulation are included[4].

[3]We specify factor notation in STATA

[4]A second version was estimated using an IV Probit model to incorporate continuous endogenous explanatory variables. This is not shown here

3 Data

This study merges four datasets: demographics, election results at both the local and federal government levels, unit record transactions of property sales and planning permit data for Greater Melbourne. Data are spatially aggregated to the local council ward level spanning 2008 to 2016 (see Table 2). The rest of the section provides details on each dataset and how these were linked.

Table 2: Component Data Frequencies

Year	**PPARS**[1]	**Elections**		**ABS**		**Housing Sales**[2]
		VEC[3]	AEC[4]	Income & Population	Census	
(Previous)		(2004)	(2007)		(2006)	
2008	x	x		x		x
2009	x			x	.	x
2010	x		x	x		x
2011	x			x	x	x
2012	x	x		x		x
2013	x		x	x	.	x
2014	x			x	.	x
2015	x			x		x
2016	x	x	x	x	x	x
Method of Reconciliation		Previous election	Previous election		Interpolation	

[1] Planning Permit and Activity Reporting System. Victorian Department of Environment, Land, Water and Planning's (DELWP) data

[2] CoreLogic settled sales data; [3]Victorian Electoral Commission; [4] Australian Electoral Commission

3.1 Geographic Scope – Greater Melbourne

The Victorian State Government refers to three component regions of Greater Melbourne, spanning a total area of 9,992.5km^2 (Australia Bureau of Statistics, 2016). Indicated by graduating colours in Figures 1 and 2 below, these regions divide the greater capital city statistical areas (GCCSA)[5] into distinct zones of density and economic characterisation. The inner region contains the four central councils including the City of Melbourne, which are then surrounded by the metro region in a concentric ring. The outer region surrounds the former two in a similar way, characterised by significantly larger local councils of lower density. Greater Melbourne comprises 31 of the 79 local councils in the state of Victoria, which can be further separated into their component electoral subdivisions called wards (Victorian Electoral Commission, 2019). Local council populations in the study period range from 64,280 in Nillumbik in the north of the outer region, to 313,521 in Casey in the

[5]see Australian Bureau of Statistics (2019)

south-east of the same region.

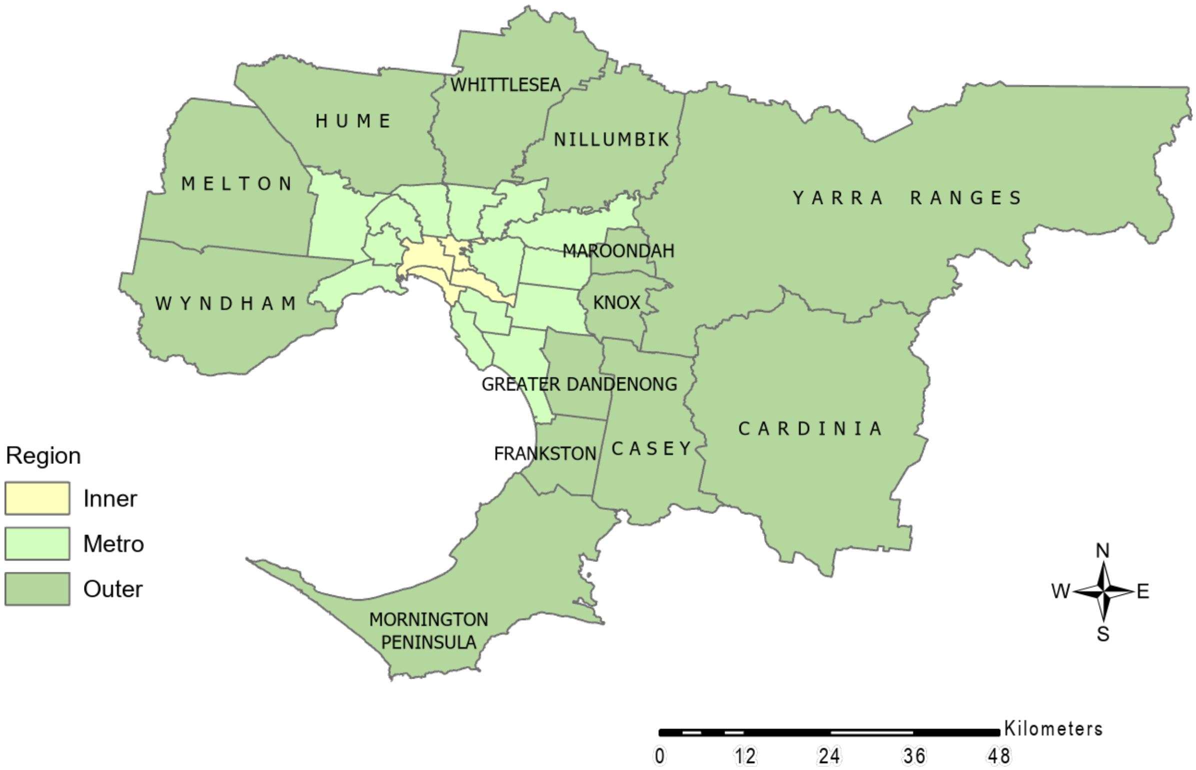


Figure 1: Map of Local Councils in Greater Melbourne by Region

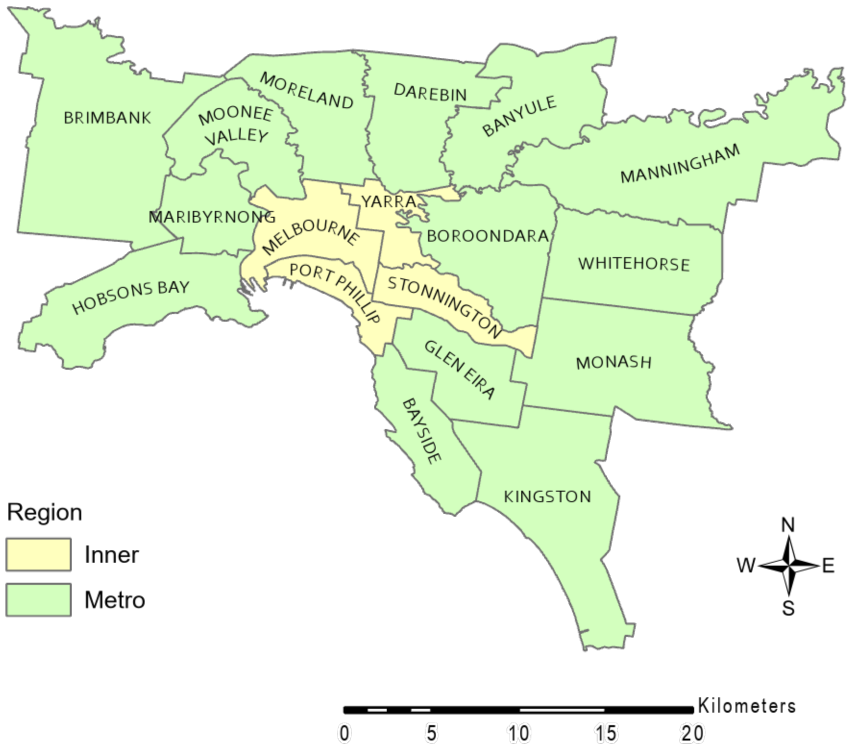


Figure 2: Map of Local Councils in Greater Melbourne; Inner and Metro Regions

It is important to note that the inner region – particularly Melbourne City – is unique in that it is occupied by a large share of tourists and transient population, given the large share of commercial buildings alongside a low share of detached dwellings. With a low share of residents living in the same address as five years prior, it is likely that the population of the inner region have much less incentive to engage in local matters and given these irregularities, the mechanisms of voice we observe many not apply in the same way. Results will be reported for completeness, however, not as much stock will be placed in their interpretations.

3.1.1 Data Availability

Given the limited availability of data from sources including census data and government elections, methods of reconciliation were needed to complete the dataset between 2008 and 2016. Table 2 lays out the frequency of each source of data. In the case of election results, those for the most recent election were carried forward through until they could be updated with the next election result. It was assumed that this data reflected the given sentiment of a ward until new information was received. Similarly, when no results were available due to the rare case of an uncontested election, results from the previous year were applied, assumed to still represent the attitudes of the community given the lack of new nominations and continuation of the same councillors. In the case of local elections, Victorian Electoral Commission (VEC) data from the 2004 election was also collected so a lag of the corresponding variables could be used. Given that there was no federal election in the first year of the dataset, 2007 Australian Electoral Commission ()AEC) data was collected and used for 2008 and 2009 before the next federal election in 2010. Linear interpolation was used to smooth the five year steps in ABS data as the most reasonable way to account for demographic trends given the available information.
In the construction of this dataset, 2016 ward boundaries were used in all aggregations and mapping using shapefiles from DataVic, originally created by the VEC. Where slight changes in boundary definitions or ward merges occurred over the 2008 to 2016 period for reasons detailed below, spatial data from each year were used in ArcGIS to map previous wards to the 2016 definitions for consistency. As a robustness check, a variable indicating if a given ward had experienced such changes was included in each model to identify and control for any impact this may have, but was found to be insignificant and have had no effect on the presented results.
The local council ward was chosen as the geographical level of aggregation for this study in order to best take advantage of council election data. This data is otherwise difficult to allocate to lower levels of aggregation defined by ABS structures, which were the original target for the study. Election data and spatial coordinates were obtained from the VEC at the voting centre level in order to match these locations

to corresponding SA2's, however, only six of the 31 councils undertook attendance elections in 2016, preceded by seven in 2012 and nine in 2008 (Victorian Electoral Commission, 2019). This severely limited the size of the panel dataset and precluded the use of early, postal and absent votes, as well as requiring assumptions about residents voting in the centre nearest to their place of residence. The remaining councils administered postal elections from which data is not possible to be allocated to component areas.

3.2 Election Data

An important element of the theoretical structure of models explored is the structure of local government in Victoria, as well as the election process and council operation. As the lowest level of government in Australia, the local government supports state and federal governments through the management of local business development, health, environmental management and a range of public services. Among the most significant of the Local Council responsibilities is the management of town planning, building control and development (Victoria State Government, 2015). Each council in Greater Melbourne comprises of several wards, allocated to best represent constituent needs and interests.

The number of wards per council in Greater Melbourne range from a minimum of one – in the case of Melbourne City, the only unsubdivided council – to a maximum of ten, with a median of three wards. Ward boundaries are determined and reviewed by the VEC to reflect demographic, geographic and community interest aspects of the council constituents in order to ensure that they are represented in an equitable manner. A contributing consideration with any proposed change is that the number of voters per councillor in each ward are kept within 10% of the ratio of councillors to voters within the entire council (Victorian Electoral Commission, 2019). In the case of a single councillor ward, a preferential system of voting is employed to elect the councillor who receives the absolute majority of votes. In multiple councillor wards, a proportional system is used whereby the fixed number of vacancies – usually two to four – are filled sequentially in proportion to the share of votes received. Successful candidates must obtain a quota of the votes, determined by the following formula:

$$\mathsf{Quota} = \frac{\mathsf{Number\ of\ formal\ votes}}{\mathsf{Number\ of\ vacancies\ to\ be\ filled} + 1} + 1 \tag{8}$$

If the ward quota is not obtained from the first preference votes, the candidate with the fewest votes is excluded from the count and their votes are redistributed to the remaining candidates based on the next highest preference. This process is repeated until all vacancies are filled.

Given the incidence of multiple councillor wards, a slightly different measure of vote margin had to be devised in order to replicate this theoretical feature of the research by Sole-Olle and Viladecans-Marsal (2012). The government structure and electoral systems in Spain – where this research was conducted – differ from that of Victoria. Local government 'municipalities' are very small and comprise an average population of 5,000 residents whereas Australian local councils are much larger in comparison; however, the ward level is more comparable. Another difference is political alignment; Spanish local council elections involve politically endorsed representatives and thus a vote margin of the elected party over another is easily compared and calculated as the excess over 50% of votes that the successful party attained in each municipality. This represent the relative power of the elected party; their support in the area and the safety of their position in future elections. In Australia, councils are subdivided into wards, each of which may have several councillors who are not always endorsed by a political party. This information is not displayed on the ballot paper nor always formally advertised, thus the party system assumes a less important role than in Australian state or federal elections (Victorian Electoral Commission, 2019). Given the prevalence of multiple councillors per ward, the 50% hurdle is not appropriate, thus a new variable is created to reflect councillor support and safety; vote share per councillor:

$$\text{Vote Share per Councillor} = \frac{(\text{Number of votes received by elected councillors/Total votes})}{\text{Number of councillors elected}} \tag{9}$$

This is used to proxy relative support for the ward councillors on a comparable scale, such that wards with one councillor who commands a high share of the vote is distinct from a ward of several councillors each receiving a small fraction of the support, but in aggregate represent a similar total vote share. When used in the modelling, this variable is also interacted with an indicator variable to control for the different dynamics depending on the size of the ward, classified as small, medium or large. Indicator variables were created to equal one if the ward contains 1 (Cr (S)), 2-3 (Cr(M)), or 4 or more (Cr(L)) councillors, respectively. A Herfindahl-Hirschman Index measure of vote share concentration was calculated and considered describe the spread of support between candidates, though not included in any final models.

An important feature of this study is the compulsory voting policy in Australia and specifically for Victorian local council elections. Fines of $81 apply for failure to vote, in the absence of a valid justification, unless the enrolled person is aged over 70 in which case they are exempt. If no payment is made 28 days after the receipt of a failure to vote notice, an additional $25.8 fine applies, after which the matter may be escalated to court (Victorian Electoral Commission, 2019). This is in contrast to the meagre $20 fine that applies for failure to vote in a federal election, in which voting is also compulsory (Australian Electoral Commission, 2019). Finally, voting is compulsory in Victorian local elections for residents over 18, however, eligibility is also granted to owners of land in a different council to the one in which they reside, via enrolment on the Chief Executive Officer's list (Victorian Electoral Commission, 2016). Only one vote per person per election is allowed, regardless of the number of properties owned. No data was available for property ownership outside of homeownership, so this represents a limitation of the data that cannot be controlled for and may account for some of the unexplained component of the turnout model.

Election results and distribution reports by voting centre were collected in spreadsheet format from the VEC, from which a dataset was compiled containing new variables to quantify political competition and relevant indicators of voice[6]. In addition to the above vote share variable, other statistics computed include:

$$\text{Informal Share} = \frac{\text{Informal votes}}{\text{Total votes}} \tag{10}$$

$$\text{Turnout} = \frac{\text{Total votes}}{\text{Number of enrolled voters}} \tag{11}$$

$$\text{Candidates per vacancy} = \frac{\text{Candidates}}{\text{Councillors elected}} \tag{12}$$

Federal election results data were obtained from the AEC website in order to replicate an instrument use by Hilber and Vermeulen (2014); the share of federal election votes to the Australian Labor Party, henceforth referred to as Federal Labor Share. Data on a two party preferred basis by polling place in conjunction with coordinates of polling locations, were used to spatially map polling places to wards in order to obtain the desired variable.

A striking result from the summary statistics (Appendix Table 10) is the very low local election turnout in the inner region; a median value of 51.8% attendance compared with the 73.5% median overall. This lack of turnout to a compulsory election motivates the modelling of election turnout to explain the high variation between wards and across regions. Informal voting appears more prevalent in the inner region. The mean share of federal Labor voters seems to decrease with distance from the CBD, while candidates per vacancy and vote share per councillor increases and is higher in the metro and outer regions than the inner.

[6]Thanks to Paul Thornton-Smith, Manager in Information and Research at the VEC, who facilitated this data collection and advised on Victorian council processes.

3.3 ABS Data

Demographic data were collected from the ABS in order to include controls in the panel models and characterize the attributes specific to each ward. Analysis of demographic data allows the capture of local heterogeneity which can be used to building a profile of household voice and to analyse factors influencing regulatory restrictiveness. A wide range of data was collected including population, income, homeownership, educational achievement, Labor force statistics, age brackets, religious affiliation, marital status, citizenship status, volunteering, disadvantage, family composition and household type.
As a local council ward is not an ABS geographical structure, the data were gathered at the lowest level of aggregation at which the ABS publishes such data (limited by the need to preserve confidentiality) and then matched using spatial software to the corresponding ward. This low level of aggregation was the Census CD prior to 2011 and at the SA1 level from 2011 onward, following the update of the Australian Standard Geographical Classification (ASGC) framework to the Australian Statistical Geography Standard (ASGS) for the hierarchy of ABS structures. Greater Melbourne contained 6,326 CD's, each comprising of approximately 200 dwellings, or can alternatively be disaggregated under the current framework into 10,289 SA1's, with an average population of 400 accounted for in each (Australian Bureau of Statistics, 2019). Time series data are not available at these low levels of aggregation so data was obtained from individual census datapacks and the ABS TableBuilder. Measures of income are available for each year, however, are not available at these low building block levels of aggregation, again due to confidentiality, so SA2 level median income data was used instead, allocated to the ward level in the same way. Mean income and average earnings data were also collected to be used in robustness checks.

The homeownership variable is calculated as the share of total private dwellings that are owned, either outright or with a mortgage. This is capturing the prevalence of owner-occupiers, given the ABS Census data used is by place of usual residence. The share of developed land variable was calculated following the process detailed in the Hilber and Vermeulen (2014) paper, whereby land use categories on mesh block data were categorised as 'developable' or 'undevelopable', and the final variable was computed as the share of developable land that has been developed. This variable serves as the second supply constraint in the HV house price-income elasticity model to reflect the scarcity of land available to develop into housing. It is also worth noting that the homeownership variable measures the prevalence of owner-occupiers; the share of private dwellings occupied by residents who own it.

The 1990s population density variable was computed to replicate an instrument used by Hilber and Vermeulen (2014) for the share of developed land variable. Population data from 1990 was the earliest available at an appropriate geographic level to be allocated to wards

Statistics pertaining to ABS structures on the boundary between more than one ward were allocated to each ward that spatially overlapped the area. Given the small scale of these component areas, measurement error is expected to be minimal. For comparability between wards, most of the demographic data are expressed as shares of the population. Where the statistic was in the form of a population count, the aggregation was performed by taking the sum of the values for each component area and dividing this by the total population of each area matched to a particular ward. If the statistic was already a rate or specific value such as age, the average of all component rates was taken. Data in each period were then merged by the unique ward identification number, and interpolated between census years to form the demographic panel dataset.
Summary statistics for the main demographics used in the final models are presented in Appendix Table 11. Median income and higher education are more concentrated in the inner region, and lowest in the outer region. The opposite is observed for homeownership, the married share, median age and share of residents living in the same address as 5 years prior. Of note is the degree of contrast in homeownership rates between the regions; the median value of just over 44% in the inner region is 25.5% lower than that of the metro region, which in turn is 7.5% lower than the statistic for the outer region. While there doesn't appear to be a significant difference in the median or average unemployment rate across Greater Melbourne, the interquartile range in the metro and outer regions is just over double that of the inner region. It can be seen that the share of residents employed in traditionally blue-collar jobs also increases with distance from the CBD. While median age is several years lower in the inner region, the median and mean share of population under 20 is almost half that of the outer region, with a lower share of residents over 55 as well, suggesting a younger demographic though fewer families. This fits the usual perception of Melbourne city as populated by many young professionals and single business people in white collar jobs, yet to have children and settle down in the metro or outer area where housing is more affordable.

3.4 Planning permit process & data description

The planning data was sourced from the PPARS within the Department of Environment, Land, Water and Planning (DELWP) of the Victorian State Government. Planning permits grant legal permission for an applicant to undertake development

on a plot of land and authorizes specific usage. This dataset contains details on many features of the planning permit process and descriptions of the nature of each application lodged. Recorded data include date received, address of the site to which the permit pertained, category of development proposed, estimated assessment effort and cost of works, current and proposed land use, whether public notice had to be issued, if any objections were received and - most importantly - the final outcome relating to approval, as well as whether or not this was appealed. The data has been collected and aggregated across all local councils – or 'responsible authorities' as referred to in the dataset – across Greater Melbourne (Victoria State Government, 2019). This dataset is a revised version of that used by Lejcak et al. (2020) which had been published in 2016. The version used in this study was published in October 2019. We have aggregated it to a new spatial level (Ward) and we merge to several other datasets to expand our understanding of the topic.
Each permit application is classified into specific categories according to the nature of work proposed, where more than one can be assigned if relevant. The PPARS data used has been filtered to only retain applications that satisfy at least one of the categories listed in Table 3 to focus the analysis on permits that propose an increase to housing supply (via new dwellings or lots), density or improvements to the stock. All undetermined applications were dropped as they are unable to contribute to the analysis on refusals.[7]

Table 3: Permit Application Categories Used in the Study

Application Category			
3	Extension: dwelling / associated structure	14	Subdivision (1-10 lots)
5	One or more new buildings	15	Subdivision (More than 10 lots)
6	Single dwelling	16	Subdivision buildings
7	Multi-dwelling (2-9)	25	Multi-dwelling
8	Multi-dwelling (10+)	26	Subdivision of land

This data was obtained in October 2019 but records for 2017 and 2018 were dropped as there were an insufficient number of complete records and too many applications had yet to be determined. This is to be expected, due to lags in the data entry and administrative process by DELWP in updating the PPARS data. We note that it can take over two years to finalise a permit and the maximum of 6,827 days.

We calculate a 'time to decision' variable as the number of days between the permit lodgement and advice of final outcome. Of the applications with a time to decision

[7]Categories 7&8 are no longer in use, now fall under category 25. Similarly Application 26 is the new classification of both categories 14 and 15 (DELWP, 2019)

of zero days – indicating same-day decision outcome - 55% pertain to records that are amendments of previous applications. This creates a downward bias on how quickly decisions are reached in different wards that isn't reflective of the efficiency or application composition. This makes the planning authority appear more efficient when in fact it could capture a demographic quality to the opposite effect, indicating lack of preparation or organisation on the part of the applicant. As a result, the time to decision variable used will relate only to new applications to remove the amendment bias.

Cultural heritage management plans are an important attribute of planning permits as they acts as a barrier to development and supply that is not a direct reflection of the planning authority's restrictiveness. An area with cultural heritage restricts the type of development allowable, but may be used by local residents as a tool to secure protection from development. If a sufficient amount of support is gained, a place or object could become included in the Victorian Heritage Register and residents may use this outcome to restrict potential densification and work on this site. A recent example can be seen in the addition of Federation Square to the Register this year after more than 750 submissions were made by the public, which lead to the rejection of plans to build a big new Apple store on the site ("Melbourne's Federation Square granted heritage status for historical, social significance", 2019). In order to be incorporated into the panel dataset prepared for analysis, the geocoded permit level planning data were spatially matched and aggregated to the corresponding local council ward using ArcGIS spatial software. The aggregation by ward and year involved specific treatment of the data, whereby variables recording counts of data such as total approvals or new dwellings were aggregated using sum as the operation and dummy variables were aggregated as the mean. This aggregation[8] of dummy variables by mean yields a variable that represents the share of applications in a given ward that satisfy the particular dummy variable, in decimal form. Variables including estimated cost and time to decisions were also aggregated by taking the mean to reflect the average values for the ward.

Several measures of regulatory restrictiveness are used, the main measure referred to as the 'refusal rate'. The refusal rate pertains to all permits in the constructed dataset and the calculation used to compute it is given below:

$$\text{Refusal Rate}_{it} = \frac{\text{Number of permits refused}_{it}}{\text{Total number permits lodged}_{it}} \tag{13}$$

As a robustness check, as well as to assess a specific type of restrictiveness focussed

[8]This aggregation was performed through the collapse function in Stata.

on direct additions to housing supply, another refusal rate used is the dwelling permit refusal rate:

$$\text{Dwelling Permit Refusal Rate}_{it} = \frac{\text{Number of dwelling permits refused}_{it}}{\text{Total number of dwelling permits lodged}_{it}} \tag{14}$$

where a dwelling permit is a permit that proposes the creation of any new dwellings, and will be referred to as such henceforth. Again, this is calculated as the average for each ward and year when aggregated, and captures the sensitivity to additions to housing supply in the rate of permit refusal where the recorded number of new dwellings proposed by a permit is positive. A similar rate is used for specific levels of additions to housing supply, including the refusal rate on permits that propose more than three new dwellings and more than five new dwellings. The regulatory restrictiveness variable used in the HV house price-income elasticity model is the refusal rate on major residential projects, calculated as:

$$\text{Refusal Rate on Major Residential Projects}_{it} = \frac{\text{Number of MRP permits refused}_{it}}{\text{Total number of MRP permits lodged}_{it}} \tag{15}$$

where an MRP permit is a major residential project permit, define by Hilber and Vermeulen (2014) as involving the creation of ten or more new dwellings.[9]
Appendix Table 12 presents the descriptive statistics.

3.5 Detached Dwelling Sales

Settled sales data was obtained from CoreLogic. Detached and semi-detached dwellings are the focus of the study, given the multitude of assumptions involved when including apartments as additional storeys require no extra land purchase for a given parcel. The data included contract price, dwelling type and address, as well as hedonics such as area of land, floor size, number of bedrooms, bathrooms, car spaces and the year in which the structure was built. This dataset was cleaned and trimmed for outliers following a process developed by the ARC Linkage Grant team (it is also an updated and revised version of that used by Lejcak et al. (2020)), then the geocoded addresses were matched and spatially aggregated to the ward level using ArcGIS and Stata. Spatial software was also used to calculate the distance to CBD variable, measured from the centroid of the ward polygon. Dummy variables created to indicate number of bedrooms, bathrooms, car spaces and year built were aggregated as a mean, again to indicate shares per ward of sales with a given number of the feature, whereas level values of these variables were aggregated using the median per ward, as was done for price and area.

[9]This is computed to replicate the model in the original paper by Hilber and Vermeulen (2014).

Appendix Table 13 contains summary statistics for the detached dwelling sales data and highlights that the median sale price across Greater Melbourne has grown by 62% over the 9 years between 2008 and 2016, with mean price increasing by 65%. Such significant growth again reiterates the motivation for this study. The standard deviation and interquartile range is also growing, indicating that house price growth is not evenly distributed at all price levels. Ward level planning outcomes, election results and demographics will be used to try and explain this trend.

4 Results

4.1 Voter Turnout Modelling

Despite higher penalties, turnout at municipal elections is significantly lower than at the federal level. There is high variance in attendance, even though compulsory, and a significant portion of this variation can be explained by the relative prevalence of homeowners in a ward since those with the most at stake in the scope of local politics.

Figure 3 presents the average over the sample period of voter turnout at the Ward Level using municipal election data on the left panel. The right panel presents the rate of objections to development applications computed from planning permit data (PPARS)[10].

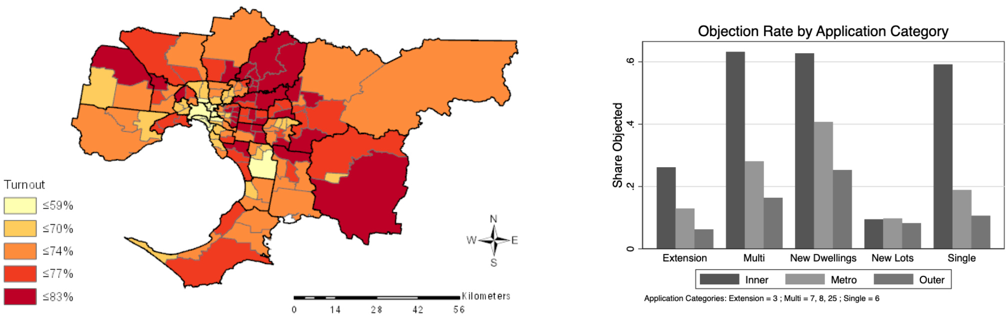


Figure 3: Voter turnout (left) and Objection rate, average 2008-2016

Table 4 presents the estimates of the two-way fixed effects panel regression of voter turnout (refer to model (3)) at local council elections between 2008 and 2016. Homeownership is the variable of interest. The results reveal an interesting pattern and

[10]The descriptives for the inner region show that it is unique, particularly Melbourne City, in that it has a large share of commercial buildings alongside a low share of detached dwellings. Residents rarely live in the same location for more than five years suggesting that they are less likely to engage in local matters. The usual mechanisms for local "voice" may not apply in the same ways in this council. However, results are reported for completeness.

imply that homeownership is indeed an important determinant of voter turnout at local elections. As discussed in Section 1, Fischel (2001) built the Homevoter Hypothesis around the notion that homeowners have the greatest interest in municipal elections as an opportunity to select the government and policies that would best benefit and protect their largest asset; housing. The strength of this effect can be observed in model (1), which indicates that a 10 percentage point increase in the homeownership rate in a Greater Melbourne ward is associated with a 2.7 percentage point increase in voter turnout. As a further robustness check, model (2) uses only the homeownership rate amongst detached and semi-detached dwellings and suggests a weaker effect whereby a 1.7 percentage point increase in turnout is associated with a similar increase in ownership. The coefficients for the other explanatory variables do not appear to differ materially between the first two specifications, so the total homeownership rate is used in the region specific models. The homeowner effect appears even stronger in the model specifically applied to the outer region of Greater Melbourne (4) with a coefficient indicating nearly double the associated increase in turnout for a given increase in homeownership. The effect is not significant for the inner/metro area. The low election turnout observed, especially in the inner region, has potential implications for the level of media coverage and community awareness of local elections, and calls for consideration on the effectiveness of postal elections in ensuring an acceptable level of community engagement.

The PPARS data include a record of when permit applications receive written submissions by third parties, referred to as objections. This creates an opportunity to understand directly the permit features that and circumstances that attract opposition by local residents. In this subsection the binary outcome of a permit receiving any objections is modelled, where the dependent variable is a dummy variable taking the value of 1 when at least one submission has been received pertaining to a specific permit. The results are in Table 5. The average marginal effects of a variety of explanatory variables from the merged dataset on the probability of objection are presented below to create a profile of the features that make an application more likely to receive opposition from the community in a demonstration of household voice, as well as the characteristics of a ward with a higher propensity to object to unfavourable development. The probabilities are firstly evaluated over the entire dataset for Greater Melbourne in model (1), then separately for the inner, metro and outer regions, respectively.

Dummy variables for year and local council were used in each model, as well as a few extra controls, with standard errors clustered to the ward level to allow dependence within wards. The results across all models indicate that among the most significant factors that determine whether a permit application is objected is whether public notice was issued. Understandably, the likelihood of residents submitting written opposition to a permit application is higher when the outcome of the permit will im-

Table 4: Panel Modelling of Local Council Election Turnout by Ward and Region

	(1)	(2)	(3)	(4)
REGION	G. Melb	G Melb	Metro[1]	Outer
DEPENDENT VARIABLE	Turnout	Turnout	Turnout	Turnout
Homeownership	0.268**		0.0492	0.417***
	(2.61)		(0.21)	(3.25)
Homeownership (Detached)		0.169***		
		(3.13)		
Age_Under45	-0.286***	-0.342***	-0.256	-0.282**
	(-2.78)	(-3.30)	(-1.45)	(-2.28)
Age_Over65	-0.323**	-0.457***	-0.303	-0.296*
	(-2.27)	(-3.01)	(-1.08)	(-1.90)
Candidates per Vacancy	0.00123**	0.00105*	0.00213	0.00116**
	(2.18)	(1.92)	(1.24)	(2.33)
Log Median Income	0.151*	0.128*	0.127	0.111
	(1.90)	(1.67)	(0.93)	(1.20)
Bachelor Degree +	0.190	0.189	0.415	-0.0603
	(1.06)	(1.10)	(1.08)	(-0.30)
Diff. Language	0.0691***	0.0729***	0.0606	0.0756***
	(3.84)	(3.75)	(1.31)	(3.86)
Share Developed Land	-0.0261***	-0.0304***	0.0216	-0.0259**
	(-2.81)	(-3.24)	(0.48)	(-2.48)
Constant	-0.974	-0.642	-0.675	-0.623
	(-1.21)	(-0.81)	(-0.46)	(-0.67)
Observations	387	387	171	186
Clusters	129.00	129.00	57.00	62.00
Fixed Effects	Yes	Yes	Yes	Yes
R-squared	0.50	0.51	0.39	0.68

t statistics in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
[1] Inner and Metro areas together.

pact nearby properties and landowners. The provision of public notice is estimated to increase the probability of a permit being objected by 100% on average over the sample, with an even greater impact in the inner region of 190%. This impact is lower in the metro region and lower again in the outer region, yet still indicates the probability of success would almost double from a base level of no public notice. The higher relative magnitude of this attribute in the inner and metro regions is perhaps a result of the higher density and likelihood of greater impact from develop in one property on another, combined with the different demographic attributes of residents in these areas and ability to coordinate joint efforts more efficiently in higher density areas closer to the city.

Table 5: Probit Modelling of Permit Objection by Region

	(1)	(2)	(3)	(4)
Region	G. Melb.	Inner	Metro	Outer
Dependent Variable	Objection	Objection	Objection	Objection
Permits Characteristics				
Public Notice	1.007***	1.962***	1.752***	0.662***
	(10.13)	(9.45)	(16.22)	(8.02)
Complex Assessment	0.0237	0.283***	0.157***	-0.174**
	(0.48)	(4.98)	(4.96)	(-2.27)
Time to Decision (Wks)	0.0154***	0.0200***	0.0142***	0.0162***
	(18.48)	(13.40)	(17.97)	(10.32)
Vacant	-0.146***	-0.184*	-0.174***	-0.140***
	(-3.62)	(-1.93)	(-3.71)	(-3.78)
Log Estimated Cost	0.0248	0.145***	0.118***	0.00989
	(1.31)	(7.44)	(6.96)	(0.90)
Ap:3 Extension	-0.528***	-0.479***	-0.401***	-0.509***
	(-7.57)	(-4.40)	(-4.44)	(-5.51)
Ap:5 New Buildings	-0.153**	-0.428**	0.108	-0.315***
	(-2.18)	(-2.31)	(1.23)	(-3.52)
Ap:6 Single Dwelling	-0.0879	0.0959	-0.125	-0.0997
	(-1.47)	(0.96)	(-1.36)	(-1.18)
Ap:7 Multi-dwell(2-9)	0.236***	0.237*	0.259***	0.138
	(3.66)	(1.78)	(2.86)	(1.17)
Ap:8 Multi-dwell(10+)	0.512***	-0.138	0.641***	0.308**
	(5.85)	(-0.80)	(5.57)	(1.97)
Subdivision	0.0481	0.0885	-0.0814	0.165**
	(0.92)	(0.60)	(-1.07)	(2.20)
Ward Characteristics				
Federal Labor VS	-1.027**	-0.630	-0.657	-2.627***
	(-2.21)	(-0.39)	(-1.39)	(-3.14)
$\text{Turnout}_{t\text{-}1}$	-0.945	2.966	1.835**	-0.865
	(-0.55)	(1.47)	(2.02)	(-0.32)
Log Median Income	-0.793	1.935	-0.723	-1.655
	(-1.05)	(1.16)	(-1.43)	(-1.12)
Bachelor Degree +	2.008***	12.55	2.776***	3.295***
	(4.26)	(1.50)	(5.62)	(3.30)
Median_Age	-0.00208	-0.106	0.0180	-0.0242
	(-0.15)	(-1.57)	(1.16)	(-0.97)
Same Address 5y	-0.451	-5.127	-2.253**	-0.179
	(-0.61)	(-0.85)	(-2.22)	(-0.14)
Unemployment Rate	-0.649	10.87	-3.952	11.68**
	(-0.21)	(1.08)	(-1.54)	(2.26)
Constant	7.846	-23.09	3.713	17.26
	(0.82)	(-1.36)	(0.60)	(0.98)
Observations	88295	7632	41150	39480
Clusters	129.00	10.00	57.00	62.00
Council & Year Dummies	Yes	Yes	Yes	Yes
Other Controls	Yes	Yes	Yes	Yes
Pseudo R-square	0.31	0.49	0.29	0.32
Overall Correctly Classified	77.90	83.98	75.70	80.66
Area Under ROC	0.86	0.93	0.84	0.87

t statistics in parentheses; * $p < 0.10$, ** $p < 0.05$, $^{***}p < 0.01$
$t - 1$ subscript denotes previous election; Ap = Application Category

Explaining Refusal Rate

To assist with determining variables that can be used as instruments in the house price-income model (see model (1)), a number of models were estimated for the refusal rate. Suitable instruments are variables that are highly correlated with the refusal rate but not directly explain movements in property prices. Table 6 highlights factors that most significantly influence the probability of permit refusal, which here can be seen to include several planning, election and demographic qualities. As expected, public notice, heritage, complexity and scale of a project increase the probability of permit refusal, with permits deemed to be complex increasing the probability of refusal by nearly 20% and those relating to vacant land estimated as less likely to be refused. Whether a permit has received objections boosts the probability of refusal by 20% or higher, and is particularly strong in the outer region where this effect increases to 34.2%. This also indirectly confirms all of the factors that influence the probability of objections have an effect on permit refusal via this channel of active expression of voice.

Table 6: Probit Modelling of Refusal by Region

MODEL:	(1)	(2)	(3)	(4)
REGION:	All	All	Inner & Metro	Outer
DEPENDENT VARIABLE:	Refusal	Refusal	Refusal	Refusal
PERMIT CHARACTERISTICS				
Public Notice	-1.543***	-1.548***	-1.724***	-1.405***
	(-20.56)	(-20.64)	(-17.46)	(-13.16)
Cultural Heritage	0.0729	0.0696	0.462***	-0.123
	(0.70)	(0.67)	(3.55)	(-0.79)
Complex Assessment	0.185**	0.188**	0.405***	-0.105
	(2.48)	(2.52)	(3.90)	(-0.92)
Time to Dec. (Wks)	0.00622***	0.00619***	0.00584***	0.00729***
	(10.21)	(10.23)	(7.78)	(7.29)
Vacant	-0.469***	-0.467***	-0.402***	-0.376***
	(-5.66)	(-5.67)	(-4.46)	(-3.63)
Objected	0.216***	0.217***	0.198***	0.342***
	(5.00)	(5.05)	(3.54)	(4.49)
Ap3: Extension	-0.172*	-0.173*	-0.498***	0.0242
	(-1.69)	(-1.69)	(-3.79)	(0.19)
Ap25: Multi-dwelling	0.420***	0.413***	0.259**	0.449***
	(4.00)	(3.94)	(1.98)	(2.66)
Ap26: Subdiv of Land	-0.571***	-0.577***	-0.207*	-0.677***
	(-5.46)	(-5.50)	(-1.68)	(-5.50)
WARD CHARACTERISTICS				
Log Median Income	0.731***	0.651**	0.842***	-0.0959
	(2.93)	(2.42)	(2.94)	(-0.17)
Unemployment Rate	1.264	1.612	-1.510	4.316*
	(1.02)	(1.26)	(-1.01)	(1.96)
Dwellings per cap.	0.257**	0.292***		
	(2.47)	(2.59)		
Age Under 20	-1.751**	-1.355	-0.569	-1.030
	(-2.14)	(-1.60)	(-0.59)	(-0.35)
VS per Councillor$_{t-1}$	-0.255*		-0.103	-0.392*
	(-1.74)		(-0.54)	(-1.67)
VS per Cr$_{t-1}$x Crs(S)$_{t-1}$		0.202		
		(1.30)		
VS per Cr$_{t-1}$x Crs(M)$_{t-1}$		-0.846***		
		(-4.23)		
VS per Cr$_{t-1}$x Crs(L)$_{t-1}$		-2.405		
		(-1.06)		
Crs(M)$_{t-1}$		0.444***		
		(4.02)		
Crs(L)$_{t-1}$		0.556*		
		(1.73)		
Constant	-10.50***	-9.700***	-11.33***	-0.0862
	(-3.74)	(-3.20)	(-3.43)	(-0.01)
Observations	29051	29051	17806	11233
Clusters	129.00	129.00	67.00	62.00
Pseudo R-squared	0.18	0.18	0.20	0.17
Overall Correctly Classified	86.54	86.58	87.55	85.69
Area under ROC	0.79	0.79	0.80	0.79

t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

(t-1) previous election; Crs = Councillors; S=1, M=2,3, L=>3; average marginal effects reported

Selected variables presented. Full results available upon request.

4.2 House Price Modelling

Hilber and Vermeulen (2014)-HV used a local area specific price index to estimate their model (see equation (1)). In this study we estimate a similar model at the Ward level for the Greater Melbourne area. We construct a quality-adjusted house price index at the Ward level for this purpose. The index was created using the hedonic regression time dummy method, constructed over two stages Melser (2005). Stage one of this method involves the estimation of a hedonic house price model using the unit level records of the detached dwelling sales, from which the coefficients of the time dummy variables are retained. The dependent variable is the log sale price of property i sold in year t. The model is estimated separately for each ward, w under the assumption that shadow prices for each hedonic characteristic vary across wards. The hedonic characteristics included in the model (from CoreLogic settled sales data) for detached dwellings are land area, floor size, categorical groupings of number of bedrooms, bathrooms, car spaces, year built and distance from the CBD.

The results for the HV house price-income elasticity model presented in Table 7. The two endogenous variables in the model are refusal rate and share of developed land. The results demonstrates that this model, originally specified for an entire country, fits the data and applies to the case of Greater Melbourne surprisingly well. All of the estimates have the expected positive signs, and are significant for the most part, with the exception of income, which will be discussed below. The estimates for the impact of the supply constraints are lower for the base model. This is a standard fixed effects panel model that does not account for endogeneity. It also indicates a higher level of regulatory restrictiveness is observed in wards displaying lower housing supply elasticities due to other factors. Here, the coefficient on income suggests that a permanent 10% increase in median income raises (quality adjusted) house prices by 3.35%, given mean levels of the two supply constraints. A standard deviation increase in the local refusal rate on major residential projects or the share of developed land is predicted to raise this house price-income elasticity by 0.06 and 0.004, respectively. Models (2) to (5) now instrument the endogenous supply constraints with the instruments given in the last rows of the results table, in the preferred model (5) with vote share per councillor, number of local election candidates and turnout for the refusal rate, and the 90s population density variable for the share of developed land.

A 10% increase in median income is estimated to increase house prices by around 27% for a ward displaying average levels of the other supply constraints. For a one standard deviation increase in the level of regulatory restrictiveness, the preferred model predicts the house price-income elasticity is then increased by 0.25. These estimates are comparable to those found by Hilber and Vermeulen (2014) wherein the same standard deviation increase in restrictiveness was found to increase house price-earnings elasticity by 0.29. Though significant, the share of developed land constraint is predicted to have a lesser effect on the elasticity where a standard deviation increase in this second constraint is estimated to increase the elasticity by leas than 0.01. The quality adjusted house price index is already adjusted for distance to CBD, so this could explain the slightly diminished role of share of developed land in this model, which is strongly correlated with distance to CBD and markedly higher in the inner regions of Greater Melbourne, decreasing with distance from the city.

Table 7: HV House Price-Income Elasticity Model

Dependent Variable:	Log House Price Index				
	(1)	(2)	(3)	(4)	(5)
Model:	FE Panel	FE Panel IV	FE Panel IV	FE Panel IV	FE Panel IV
Log Med. Income	0.335**	0.300	0.240	0.243	0.269
	(2.06)	(1.26)	(0.84)	(0.89)	(1.28)
Avg. Refusal Rate on	0.112***	**0.483****	**0.130**	**0.156**	**0.253*****
Mejor Residential Projects	(5.66)	(2.37)	(1.15)	(1.41)	(2.94)
x Log Med. Income					
Share of Developed Land	0.00223***	**0.000665**	**0.0145***	**0.0136***	**0.00808***
x Log Med. Income	(4.78)	(0.10)	(1.86)	(1.83)	(1.90)
Observations	1161	1160	1161	1161	1161
Clusters	129.00	129.00	129.00	129.00	129.00
R-squared	0.91	0.85	0.78	0.80	0.87
Hansen J p-value		0.03	0.61	0.93	0.17
LM stat p-value		0.06	0.20	0.10	0.06
F	506.17	288.75	443.03	438.08	401.04
AR F-stat p-value		0.00	0.00	0.00	0.00
Weak ID (C-D F stat)		2.17	1.27	1.68	2.36
Instruments		Fed. Labor	Fed. Labor	VS per Cr	VS per Cr
		Time to Dec (Wks)	VS oer Cr	Candidates	Candidates
		Pop.Dens.90s	Candidates	Pop.Dens.90s	Turnout
			Pop. Dens.90s		Pop.Dens.90s

t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. VS per Cr = Vote Share by Councillor.
Supply constraints are standardised; all instruments interacted with income;
instrumented variables in bold; local election variable instruments are lagged; year dummies included.

The first stage of these 2SLS panel fixed effects regressions (available upon request) indicated poor overall first stage results through weak significance of the instruments in explaining the interaction of income and the supply constraints, low F statistics and R-squares. Although these diagnostics were relatively weak as well in the case of (Hilber and Vermeulen, 2014), the results found here confirm that while the model appears to translate well in the second stage in that we observe the positive effect that physical land availability constraints and restrictiveness of local planning authorities have on the house price-earnings elasticity, this model only weakly captures the same mechanism. The first stage results are comparatively weaker for the interaction of income and the refusal rate, with the second endogenous interaction (income and share of developed land) yielding a much higher F statistic. This could indicate that the use of the average refusal rate on major residential projects is another reason the model does not perform so well, that the interaction term possesses a joint lack of sufficient variation from both of it's components.

The cause of the weakness is suspected to be the measure of median income used to model shifts in demand. This measure across a single GCCSA lacks comparable variation to the measure observed over an entire country, as was exploited by Hilber and Vermeulen (2014) in the English application. As this measure of income interacts with all variables, it has a significant impact on the joint significance of the model and its lower observed variation contributes to weaker performance of the model, especially in the first stage. Here the minimum median income was 40.8% of the maximum observed, and minimum average earnings was 41.2% of its maximum, whereas the minimum average earnings was 16% of the maximum in the UK case to which Hilber and Vermeulen applied this model originally. The difference in ranges is partly due to the differences in panel length, but mainly a result of the higher range of income levels across a country. It was also found earlier that income was not always significant in explaining the probability of permit refusal, so it could be that it plays less of an important role in this case and is more weakly correlated with refusal than in the British case.

As a robustness check in response to the conclusion that income lacked sufficient variation, mean income and average earnings for Greater Melbourne were used instead. These models did not represent an improvement and yielded very similar results, so were not presented here. A further attempt to improve the model was made through the use of various alternative demand shifter in place of median income. These included the ABS SEIFA index of socio-economic advantage and disadvantage, the share of population above the Melbourne median income and a measure of employment using the labour force statistics collected from the ABS. Again, median income still presented the best results and these robustness checks failed to identify a better demand shifter than income to address the weak identification problem. Principal component analysis of all of the instruments in the study was also used to create new instruments as a solution to weak instruments. However, again, no significant improvement in the post-estimation diagnostics was found.

What constitutes a major residential project in Greater Melbourne can be regarded quite differently to that of in England, so the above model was run using alternate measures of the refusal rate. This motivates an extension of the Hilber and Vermeulen house price-income elasticity model above to cases of residential projects where 5, 3 or even just one new dwelling is created to assess the impact on supply and house prices. This is performed as a robustness to differing measures of regulatory restrictiveness, given population and dwelling density is much lower in Melbourne than in parts of England.

In Table 8 we observe the correct positive signs on the estimates and significance for all except income, which is unsurprising as discussed above. The estimate of the regulatory restrictiveness supply constraint impact on the house price-income elasticity is highest when the refusal rate relating to all permits is used in model (1), reflecting the overall restrictiveness of the ward. Starting with the same refusal rate as in the original model in the previous section (relating to major projects of more than 10 dwellings), the coefficients of the impact on house price-income elasticity decrease as the scale of the projects considered in the refusal rate decrease. This is to be expected; the refusal rates on projects in which more dwellings are proposed, the greater the impact to supply and thus the larger the consequent impact on the house price-income elasticity. To demonstrate, a 10% increase in the refusal rate of permits to create more than 5 new dwellings raises the house price-income elasticity by 0.26, representing a premium of 0.055 on the corresponding impact of a 10% increase in the refusal rate on permits to create at least one new dwelling. This differential is significant and several times the size of the share of developed land.

Table 8: House Price - Income Elasticity Model Under Varying Refusal Rates

	(1)	(2)	(3)	(4)	(5)
DEPENDENT VARIABLE:			Log House Price Index		
Log Med. Income	0.0353	0.269	0.328	0.343	0.269
	(0.12)	(1.28)	(1.54)	(1.49)	(1.28)
Avg. Refusal Rate x Log Med. Income	**0.418****				
	(2.32)				
Avg. Refusal Rate on Major Res. Projects x Log Med. Income		**0.259*****			
		(2.90)			
Avg. Refusal Rate (5+) x Log Med. Income			**0.257*****		
			(3.10)		
Avg. Refual Rate (3+) x Log Med. Income				**0.257*****	
				(2.92)	
Avg. Refusal Rate (+1) x Log Med. Income					**0.255*****
					(3.06)
Share of Developed Land x Log Med. Income	**0.00457**	**0.00794***	**0.00848****	**0.00979****	**0.00732***
	(0.71)	(1.86)	(2.06)	(2.23)	(1.72)
Observations	1161	1161	1161	1161	1161
Clusters	129.00	129.00	129.00	129.00	129.00
R-squared	0.84	0.87	0.87	0.85	0.88
Hansen J p-value	0.47	0.07	0.06	0.09	0.08
LM stat p-value	0.07	0.03	0.03	0.03	0.03
F	343.67	398.83	412.92	381.89	380.15
AR F-stat p-value	0.00	0.00	0.00	0.00	0.00
Weak ID (C-D F stat)	2.17	3.02	2.98	3.19	3.01
Instruments	VS per Cr Turnout Pop.Dens.90s	VS per Cr Turnout Pop.Dens.90s	VS per Cr Turnout Pop.Dens.90s	VS per Cr Turnout Pop.Dens.90s	VS per Cr Turnout Pop.Dens.90s

t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. VS per Cr = Vote Share by Councillor.
Supply constraints are standardised; all instruments interacted with income;
instrumented variables in bold; local election variable instruments are lagged; year dummies included.

5 Discussion and Conclusions

This study draws attention to an alarming finding of very low rates of turnout to local council elections with a mean of 72.1% for the whole of Greater Melbourne and 54.2% specifically for the inner region, observed in some wards as low as 44%. Contributing factors include the lower share of homeowners and younger demographic of this region.

The strong, positive and significant coefficients on homeownership in the voter turnout model confirm the applicability of Fischel's Homevoter Hypothesis (2001), despite compulsory voting in Greater Melbourne local council elections, with region-specific results indicating an effect almost twice the size for the outer region, and lower than average for the metro region. We hypothesise that the motivation for attendance varies between regions: given the scarcity of undeveloped land, high median income and a high share of Labor voters (implying taste for growth) observed in the inner region, it could be the case that homeowners in this region have an interest in attending elections to ensure parties with strong policies for growth are elected in order to profit from sales of their dwelling to developers looking to replace existing property with higher density dwellings. This is as opposed to in the outer region – characterised by a more conservative population – where motivation of homeowners is more likely to include protection of property values and to fight densification. This is supported by the finding that residents in the metro and outer regions are much more sensitive to multiple-dwelling developments than the construction of a single dwelling, given the opposition to densification where marginal developments could significantly change the community landscape, evidenced by the variation in objection rates and the lack of such variation observed for the inner region. Perhaps in the model specifically applied to the metro region, on the boundary separating these two very different regions, the effects are somewhat conflicting and do not produce significant estimates for homeownership due the lack of a single clear effect.

Public notice, larger-scaled developments, election turnout, lower prevalence of Labor voters and demographics including income, education and age were all shown to significantly increase the probability of a permit receiving objections; a direct expression of voice. Wards in which residents display a higher propensity to object to development permits in turn – along with similar features of project scale, heritage, highly educated and conservative voters with a greater degree of engagement in local politics – experience a heightened probability of permit refusal, on average. Other characteristics correlated with homeownership including the share of residents in the 20-55 year age group and those who have lived at the same address for more than five years were also found to raise the probability of refusal. The ability of residents with these characteristics being able to use their political influence to shape planning outcomes in order to protect property values may have important distributional consequences. Shifting the distribution of development and densification in their favour can support income divergence, gentrification and associated productivity costs if restrictive land use constraints and increasing house prices act as barriers to entry for diverse and lower income residents.

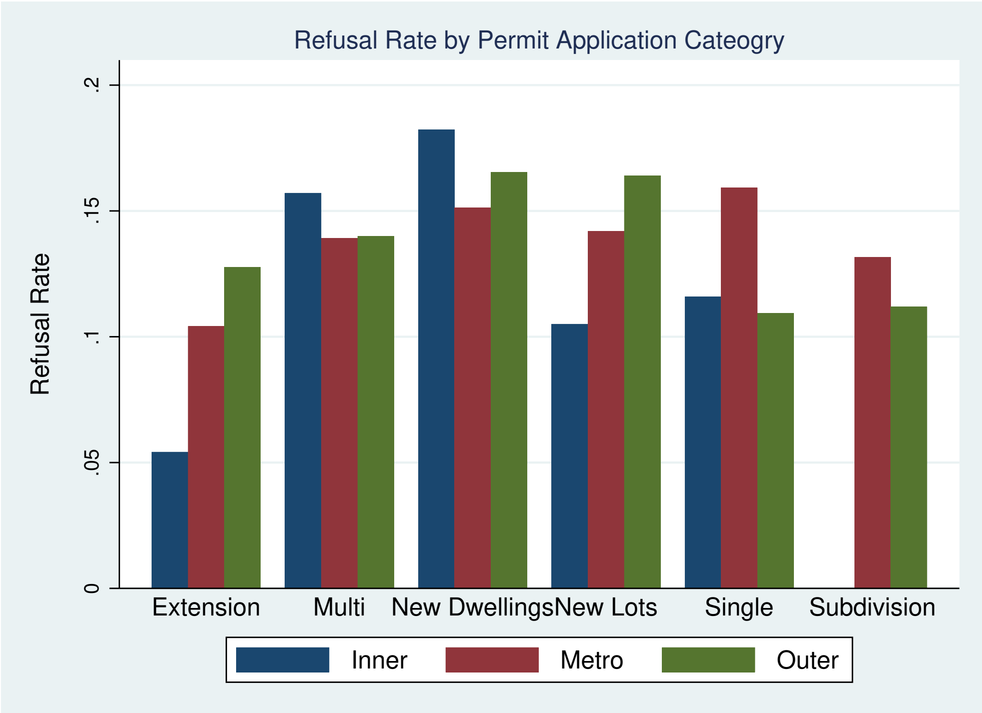
The positive effect of regulatory restrictiveness on house price growth in the outer region and parts of the metro region beyond the 17km turning point supports the mechanism we expect; an increase in the refusal rate constrains housing supply and increases the price of detached dwellings. Inside the 17km radius - capturing the inner and the majority of the metro region – distance to CBD is low thus the negative coefficient on the refusal rate dominates and increases in restrictiveness dampen price growth of detached dwellings. Given the PPARS data includes permits relating to both detached dwellings and multi-dwelling developments, Lejcak (2020) hypothesised that the elasticity is lower closer to the CBD due to a shift in the composition of housing. If development closer to the city comprises a higher share of new multi-dwelling projects – that is, applications aren't to increase the supply of detached dwellings, rather to develop them into multi-dwellings – then higher approval rates may increase detached dwelling sale prices as a result of higher demand for their purchase and development into more profitable, higher density dwellings. The inner and metro regions are characterised by a much lower detached share of total dwellings than in the outer region, thus this effect also increases the relative scarcity of detached dwellings. The negative elasticity estimates extend this theory and demonstrates the effect isn't just stronger in the outer region, it actually changes sign for wards in the inner and most of the metro region, suggesting the above mechanism must dominate. To support this, Table 9 shows that over the 2008 to 2016 study period, most of the permits lodged to create new dwellings were for multi-dwellings in the inner and metro regions, contrasted against the outer region where a much larger relative share were for the addition of a single dwelling. Further, Figure 4 shows the refusal rate calculated for specific application categories, by region, over nine year period. This indicates the refusal rate for single dwellings is slightly higher than for multi-dwellings in the inner region, whereas in the outer region the refusal rate on multi-dwellings is higher than both for single dwellings and the inner counterpart, amplifying the compositional differences. However, further targeted analysis would be required to confirm the above hypotheses.

Table 9: Share of Dwelling Permits for Single and Multi-Dwellings by Region: 2008 to 2016 Average

	Permit Applications for New Dwellings	
	Single Dwelling[a]	Multi-Dwelling[b]
Inner	33%	67%
Metro	16%	84%
Outer	65%	52%

[a]Application category 6; [b]Application categories 7, 8 & 25

Figure 4: Permit Refusal Rate by Major Application Category and Region: 2008 to 2016 Average



A major contribution of this work is the application of the Homevoter Hypothesis in a compulsory national politics from this case study of Greater Melbourne. Despite far higher penalties for failure to vote, turnout to local elections is significantly lower than that observed at the federal equivalent. It is shown that despite the compulsory nature of local elections, there exists high variation in attendance, a significant amount of which can be explained by the relative prevalence of homeowners in a ward - those with most at stake in the scope of local politics. The low election turnout observed, especially in the inner region, has potential implications for the level of media coverage and community awareness of local elections, and calls for consideration on the effectiveness of postal elections in ensuring an acceptable level of community engagement. Although apparently disregarded by many, this study outlines the impacts of local politics and election outcomes on planning permits and development, which in turn has serious impacts on the broadly applicable issue of housing affordability.

From the probability models we conclude expression of community voice in the form of turnout, formal votes and concentration of vote share in local elections appear to signal to councillors the level of active interest a community has in local matters, which in turn affects the probability with which permits are refused. Lower effort to attend elections and prevalence of informal votes – in some wards observed up to 17% of the total cast – may be interpreted as tacit approval, alongside higher vote share, as a measure of a councillor's support or freedom to engage in deals with developers within a ward. This is mitigated by the fact that councils with fewer members or a greater share of votes appear to be more likely to accept development proposals. These results may also have implications for future ward restructuring, in line with recently observed mergers, given the estimated impact the number of councillors may have on planning outcomes. Observed increases in probability of permit refusal in multi-councillor wards could be explained through the many competing interests and reduced accessibility by developers.

In addition to low turnout and informal voting, recent examples of corruption investigations within local councils indicate a lack of oversight and attention to government at the local level. Interstate reports suggest this case study of Greater Melbourne is not an outlier and that there are councillor corruption concerns across Australia. It seems the impact of these issues at the local level are underestimated and disregarded, leaving councils vulnerable to bribery and corruption without the appropriate level of supervision. More needs to be done to safeguard council procedure, transparency and the contract allocation and application approval process, as well as to boost community awareness surrounding local elections, given the significant flow on effects these appear to have to regulatory restrictiveness and housing prices.

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A Descriptive Statistics

Table 10: Ward Level Local & Federal Election Summary Statistics by Region 2016

	Count	p25	Median	p75	Mean	Std.Dev.
Greater Melbourne						
Informal Share	129	3.5%	5.1%	7.4%	5.7%	2.9%
Turnout	129	69.6%	73.5%	76.9%	72.1%	7.3%
Councillors	129	1	2	3	2.2	1.2
Candidates per Vac.	129	3	4	6	5	2
Vote Share per Clr.	129	15.2%	19.1%	36.6%	26.8%	17.2%
Fed. Labour Share	129	44.1%	50.7%	63.6%	53.4%	12.2%
Inner						
Informal Share	10	4.9%	6.4%	7.5%	5.9%	2.0%
Turnout	10	49.4%	51.8%	57.4%	54.2%	6.9%
Councillors	10	3	3	3	3.6	1.9
Candidates per Vac.	10	3	3	4	3	1
Vote Share per Clr.	10	16.5%	18.0%	19.1%	17.1%	4.0%
Fed. Labour Share	10	38.9%	55.7%	62.3%	55.0%	14.8%
Metro						
Informal Share	57	3.5%	4.8%	7.8%	5.7%	2.8%
Turnout	57	69.8%	74.2%	77.1%	73.2%	5.2%
Councillors	57	1	2	3	2.21	0.92
Candidates per Vac.	57	3.33	4.33	5.33	4.48	1.64
Vote Share per Clr.	57	14.2%	18.5%	29.9%	25.4%	16.1%
Fed. Labour Share	57	44.1%	49.5%	65.0%	53.5%	13.3%
Outer						
Informal Share	62	3.4%	5.3%	7.1%	5.7%	3.1%
Turnout	62	71.7%	73.9%	77.1%	73.9%	4.6%
Councillors	62	1	2	3	2.05	1.12
Candidates per Vac.	62	3	4.17	6	5.05	2.72
Vote Share per Clr.	62	15.2%	20.7%	44.3%	29.6%	18.8%
Fed. Labour Share	62	44.2%	51.1%	63.2%	53.1%	10.7%

Table 11: Summary Statistics of Ward Level ABS Data: 2008 to 2016 Average

	N	p25	Median	p75	Mean	Std.Dev.
Inner						
Homeownership (%)	10	41.7	44.4	46.2	44.8	8
Median Income	10	$49,215	$52,873	$56,015	$52,806	$4,037
Median Age	10	34	35.7	36.9	35.5	2.5
Age Under 20 (%)	10	14	14	15	15	3
Age 55+ (%)	10	18.3	20.5	24	20.7	4.3
Diff. Language (%)	10	19	21.8	25.3	23.2	7
Married (%)	10	24.9	26.7	33.5	28.9	5.2
Bachelor Degree + (%)	10	36.4	37.8	39.6	38.5	3.1
Same Ad. 5y (%)	10	35.2	38.3	38.8	37.3	7.2
Blue Collar (%)	10	5.7	5.8	7	6.2	1.1
Unemployment (%)	10	4.6	4.9	5.6	5.6	1.7
Share Developed Land (%)	10	65.1	83.9	92.9	74.3	23.1
Pop.Dens.90s (ppl/km2)	10	2,595	2,990	3,765	2,980	755
Health Workers (%)	10	5.6	6.4	6.6	6.1	0.9
Metro						
Homeownership (%)	57	62.6	69.9	76	69	9.4
Median Income	57	$41,700	$44,233	$47,014	$44,738	$3,955
Median Age	57	36.9	38.7	40.9	38.7	2.9
Age Under 20 (%)	57	22.1	23.5	24.8	23.4	2.5
Age 55+ (%)	57	23.6	26.9	29.4	26.6	4.3
Diff. Language (%)	57	20.8	29.4	39.2	31.6	13.1
Married (%)	57	38.5	41.2	44.4	41.1	4.9
Bachelor Degree + (%)	57	19.6	24.7	31.7	25.4	8.1
Same Ad. 5y (%)	57	51.9	55.8	58.8	55.4	6.4
Blue Collar (%)	57	6	9	12	9.5	3.5
Unemployment (%)	57	4.4	5.2	6.5	5.8	1.8
Share Developed Land (%)	57	87	93.5	96.7	88.3	13.1
Pop.Dens.90s (ppl/km2)	57	1,493	2,015	2,407	1,879	752
Health Workers (%)	57	5.1	5.6	6.6	5.7	1.1
Outer						
Homeownership (%)	62	71.8	77.4	82.9	77	7.9
Median Income	62	$40,179	$41,727	$42,879	$41,375	$2,496
Median Age	62	35.6	38.2	39.3	38	3.7
Age Under 20 (%)	62	25.3	27.4	29.3	27.4	3.2
Age 55+ (%)	62	20.8	24	27.7	24.3	6.4
Diff. Language (%)	62	6.3	11.5	31.6	20.4	17.8
Married (%)	62	39.8	41.4	43.7	41.4	3.2
Bachelor Degree + (%)	62	10.2	12	16.2	13.1	4.5
Same Ad. 5y (%)	62	51	56.4	62.7	55.7	8.3
Blue Collar (%)	62	14	16	17.2	15.5	2.5
Unemployment (%)	62	4.1	4.9	6.2	5.5	1.9
Share Developed Land (%)	62	59	75.2	87.9	72.6	19.7
Pop.Dens.90s (ppl/km2)	62	93	304	804	521	535
Health Workers (%)	62	4.6	5.3	5.9	5.2	0.9

Table 12: Ward Level PPARS Summary Statistics by Region: 2008 to 2016

	Count	Mean	SD	p25	Median	p75
Greater Melbourne						
Applications	129	126	86	64	108	158
Refusal Rate (RR) (%)	129	15.92	5.98	11.5	15.47	19.99
Annual RR Growth (%)	129	-0.29	1.55	-0.98	0	0.54
Annual New Dwell.	129	188.3	407.2	47	97.7	199.6
Public Notice (%)	129	47.8	11	42.4	48.2	53.3
Complex (%)	129	12.7	14.7	3.7	7.3	15.9
Time to Dec. (Wks)	129	25	7	21	24	28
Greenfield (%)	129	13.7	16.1	2.4	7.3	19
Est. Cost ($)	129	$778,333.00	$2,571,954.00	$27,743.00	$423,169.00	$59,288.00
Objected (%)	129	25	15	12	23	32
Inner						
Applications	10	132	117	45	72	274
Refusal Rate (RR) (%)	10	18.79	10.15	10.73	15.76	25.22
Annual RR Growth (%)	10	-1.15	2.18	-1.44	-0.33	0.18
Annual New Dwell.	10	688.8	1293.3	165.1	242.4	538.9
Public Notice (%)	10	59.2	14	43.3	61.4	73.7
Complex (%)	10	12.8	8.5	7	11.4	15.9
Time to Dec. (Wks)	10	36	12	26	34	42
Greenfield (%)	10	4.7	5	1.2	2.7	6.9
Est. Cost ($)	10	$4,302,230.00	$8,720,214.00	$1,182,273.00	$1,598,526.00	$2,597,553.00
Objected (%)	10	46	13	38	42	58
Metro						
Applications	57	142.18	92.27	75.22	124.67	176.78
Refusal Rate (RR) (%)	57	15.4	6.2	11.2	14.9	20
Annual RR Growth (%)	57	-0.5	1.7	-1.5	-0.1	0.3
Annual New Dwell.	57	217.8	216.8	59	125.8	287.3
Public Notice (%)	57	49.6	6.7	45.8	49.3	52.9
Complex (%)	57	11.9	10.7	4.2	8.2	16.9
Time to Dec. (Wks)	57	25.8	4.5	22.5	25.9	28.2
Greenfield (%)	57	5.4	7.6	1.3	3	5.7
Est. Cost ($)	57	$619,308.80	$624,329.10	$376,014.50	$483,340.70	$647,124.00
Objected (%)	57	22.2	9.1	12.7	23.9	28.9
Outer						
Applications	62	110.5	72.8	53.1	104.8	140.3
Refusal Rate (RR) (%)	62	15.9	4.8	12.5	15.5	19.2
Annual RR Growth (%)	62	0.1	1.2	-0.7	0.2	0.7
Annual New Dwell.	62	80.4	64.7	32	63.9	114.1
Public Notice (%)	62	44.3	12.2	38.6	46.4	53.2
Complex (%)	62	13.5	18.4	2	5.8	11.8
Time to Dec. (Wks)	62	22.8	5	19.5	21.8	25.2
Greenfield (%)	62	22.7	18.1	9.5	18.3	30.7
Est. Cost ($)	62	$356,163.00	$250,766.70	$191,889.40	$292,239.80	$435,231.40
Objected (%)	62	24.5	17.7	10	19.1	31.7

Table 13: Summary Statistics for Greater Melbourne Housing Sales Data: 2008 to 2016

	Count	p25	Median	p75	Mean	SD
2008	21419	309950	400000	580000	499756	310551
2009	26595	337000	430000	613000	533847	325434
2010	25992	385350	510000	723750	623828	371087
2011	27330	385000	500000	700000	611890	363494
2012	30135	375000	485000	681000	593898	351882
2013	36688	389950	520000	740000	638797	394843
2014	42262	407000	552000	810002	691421	442535
2015	49197	430000	595000	910000	769102	522132
2016	48412	467500	635000	950000	814127	539288
Observations	308030					