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INFRASTRUCTURE CHARGES AND RESIDENTIAL LAND PRICES IN BRISBANE, AUSTRALIA

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ABSTRACT

This paper examines the question of whether the imposition of developer infrastructure charges on housing developers affects the price of residential land. Developer paid fees or charges are a commonly used mechanism for local governments to fund new infrastructure as a "user pays" method of funding new urban infrastructure. Some argue these costs are passed back to the original land owner by way of lower land prices. However, property developers claim these charges are added on to new land prices, with flow on negative impact to housing affordability.

This paper presents the findings of a hedonic land price model that provides the first empirical evidence that infrastructure charges do increase residential land prices in Brisbane, Australia. This research is consistent with international findings and supports the proposition that developer paid infrastructure charges are over-passed to home buyers and are a significant contributor to reduced housing affordability.

Keywords: Housing Affordability, infrastructure charges, impact fees, house prices, land prices, residential land

INTRODUCTION

Housing affordability is an agenda item at all levels of government in Australia and many other countries around the world. This paper examines the question of whether the imposition of infrastructure charges on housing developers affects the price of subdivided vacant residential land. Developer paid fees or charges are a commonly used mechanism for local governments to fund new infrastructure as a "user pays" method of funding new urban infrastructure. Some argue these costs are passed back to the original land owner by way of lower land prices (AEC Group, 2010). However, property developers claim these charges are added on to new house prices, with flow on negative impact to housing affordability (UDIA, 2007).

This study utilises hedonic modelling to empirically examine the effect of infrastructure charges on 13,739 new vacant residential lot prices in Brisbane, Queensland, Australia in the years 2005 - 2011. Brisbane is the State capital of Queensland and is the major metropolitan centre of South-East Queensland which is Australia's third largest metropolitan region.

The term "Infrastructure Charges" is a term that is used to encompass the estimated proportionate cost of providing trunk and other off-site urban infrastructure such as local roads, stormwater and community facilities and parks to new developments. It is a one off charge levied on the developer, generally at the time of rezoning/planning approval (Bryant & Eves, 2014) (Been, 2005, Burge, 2008, Campbell, 2004, Mathur et al., 2004, Ihlanfeldt and Shaughnessy, 2004, Evans-Cowley and Lawhon, 2003).

The purpose of this research is to provide evidence that the imposition of developer infrastructure charges increases the price of subdivided and serviced residential lots. This is important due to the "house and

land" package market that prevails in many Australian cities. With a "house and land" package, greenfield land developers sell the vacant serviced lots to new home buyers, who then enter into a construction contract with a house builder. This two-step method of providing housing has evolved as it: ensures a variety in housing product is supplied in new estates, maximises internal rates of return for land developers, supports a cottage builder industry and the consumer benefits from significant transfer duty savings possible by the separate contract approach.

The remainder of this paper is structured as follows. Further to the introduction, the next section outlines the key literature on this topic. Sections three and four detail the methodology adopted and data requirements respectively. The fifth section presents the research findings and the final section concludes.

LITERATURE

In the US, there is a well-established body of empirical research that has evolved around the cost impact of infrastructure charges on new housing. Infrastructure charges were originally intended to transfer the burden of infrastructure provision in high growth areas from the public purse on to developers (Evans-Cowley and Lawhon, 2003). However, in a competitive market, and subject to the various prevailing market elasticities, the literature is consistent in its conclusions that despite market conditions (i.e. relative market elasticities) infrastructure charges are passed onto home buyers in the long run and will thus lead to increased housing prices (Been, 2005, Evans-Cowley and Lawhon, 2003, Ihlanfeldt and Shaughnessy, 2004, Burge and Ihlanfeldt, 2006).

In excess of a dozen separate US studies on the price impacts of infrastructure charges on new housing, existing housing and vacant residential lots have been published since 1989. However, review of the existing empirical works reveal it is a danger to assume that passing or shifting of infrastructure charges are at parity (that is $1.00 extra for infrastructure charges equals $1.00 passed on or back). Consistent with theory, the empirical research to date is consistent in providing evidence of on-passing and indeed "over passing" or "over shifting" of infrastructure charges to new (and existing) house buyers (Bryant & Eves, 2014) (Been, 2005, Burge, 2008, Campbell, 2004, Mathur et al., 2004, Ihlanfeldt and Shaughnessy, 2004, Evans-Cowley and Lawhon, 2003). In studies of the new housing market as a whole, a $1.00 infrastructure charge is attributed to a price increase of as little as a $0.25 increase in new house price (Dresch and Sheffrin, 1997) and up to $3.21 increase in new house price (Singell and Lillydahl, 1990). With the evolution of better specified models, the research in the last decade from the US indicates that for every $1.00 increase in infrastructure charges, new housing costs increase $1.50 to $1.70 (Nelson et.al., 2008). This concept of "over shifting" for housing is consistent across all of the empirical research dating back to the 1980's.

However the majority of these studies have focused on the effect on new houses, with evidence on price impacts for vacant residential lots being thin. Skaburskis and Qadeer (1992) suggested evidence of on-passing of 120% of the impact fee to serviced residential lot prices, whilst Evans-Cowley et al., (2005) provided weak evidence that a $1.00 infrastructure charge is attributed to a price increase of as little as a $0.13 for a serviced residential lot (Evans-Cowley et al., 2005).

The absence of empirical data on the effect infrastructure charges have on residential land prices is fuelling the debate in Australia as to whether infrastructure charges do get passed on to residential land buyers

or not. This is a significant gap in the Australian research, and this paper seeks to provide the first empirical study of its kind in Australia to address this gap.

METHOD

The use of an ordinary least squares ("OLS") hedonic regression model is appropriate for this study. The hedonic approach is a relatively straightforward method once the requisite data is acquired and transformed into the appropriate scale and format. The relative simplicity of the hedonic approach is one of its strengths and hence why it has been in use since Rosen's (1974) seminary work and forms the core of studies identified in the literature above. The adopted form for this study is:

$$P_{i,t} = \beta_o + \beta_1 S_i + \beta_2 L_i + \beta_3 J_i + \beta_4 G_i + u_{i,t} \qquad \text{Equ.1}$$

Where

$P_{i,t}$ = sale price of house i in time period t

S_i = *S*tructural attributes of the lot: lot area

L_i = *L*ocational features: region, socio-economic suburb rankings

J_i = *J*urisdictional factors: changes to household income levels, population growth, new housing supply, unemployment rate, construction cost index, mortgage interest rates; consumer confidence

G_i = *G*overnment policy: infrastructure charges

$u_{i,t}$ = error term or noise in the model for the i^{th} observation at time t.

DATA

This study examines the effect of infrastructure charges on new residential lot prices in Brisbane, Queensland, Australia. Brisbane is the State capital of Queensland and is the major metropolitan centre of South-East Queensland which is Australia's third largest metropolitan region, with a population of over 2.1 million people (ABS, 2012). The data used for this study includes a sample of suburbs in Brisbane's northern growth corridor as well as the same in Brisbane's southern growth corridor. The study period for this research is from 2005 to 2011.

Full sales record data for all vacant residential lots for the period 2005 to 2011 in the local government areas in this study was provided by Price Finder, a commercial re-seller of the state and local government sales records. This provided the structural data including: address, real property description, lot size, sale price, sale date (contract date), settlement date, zoning, sale type, land use, buyer and seller details. Sales data was cleansed to remove: non arm's length transactions, part sales, multiple transaction sales, and court order transactions.

Next locational data was considered. In order to take factors such as some suburbs in the study areas being more or less desirable than others into consideration, the Australian Bureau of Statistics' ("ABS") "Index of Relative Socio-economic Advantage and Disadvantage" (IRSAD) was utilised. This index provides a 1 – 10 rating at a suburb level as a relative measure of socio-economic advantage and disadvantage.

Jurisdictional data was sourced from the ABS web site, with the exception of data on the 30 year home mortgage rates, consumer sentiment and inflation, which was sourced from the Reserve Bank of Australia ("RBA") web site. Where monthly or quarterly data existed, annual averages were derived (by calendar year). Data on common supply and demand house price drivers were sought at a local government level (rather than State level) to ensure regional sub-market effects were suitably accommodated. The local government area of "Brisbane" was used for the southside data set, and "Moreton Bay" used for the northside data set, with both being part of the Greater Brisbane metropolitan area.

Infrastructure charge data is not readily available in Queensland and has been a limiting factor in the progression of this type of research. In order to access such data, large private land developers were approached to supply infrastructure charge data for their projects. The developers that were approached supplied data on the infrastructure charges levied on their projects in the study area. The total infrastructure charges applicable to a stage were divided by the number of lots in that stage to determine the charge per lot. The applicable rate per annum was derived from the year the stage was released and sold and adopted as the average infrastructure charge applicable in the study area. A one year lag was applied to account for the time between development approval and completion of the project.

The final data set for this study comprised a total of 13,739 vacant residential land sales. Table1 describes the independent variables utilised in the model estimation.

Table 1 Variable Legend

Variable	Definition
Structural	
SQM	Lot size in square metres
Locational	
REGION	Dummy variable indicating whether the house is Brisbane Northside (0) or Southside (1)
IRSAD	1-10 ranking of suburb as indicated by the Index of Relative Socio-economic Advantage and
Jurisdictional	
YEAR	Time variable for year of sale
POPRATE	Percentage rate of change in population (LGA*)
INCOME	Percentage increase in median household income (LGA*)
BDLG	Percentage change in building approvals (LGA*)
UNEMP	Unemployment rate (LGA*)
CONSTN	Percentage change in construction cost index for Brisbane (capital city)
MTGE	Average 30 year mortgage rate (Australia)
CONSS	Consumer sentiment index (Australia)
Policy	
IC	Annual infrastructure charge adopted on a per lot basis, based on year of sale of lot.
FHOG	Dummy variable indicating whether the sale occurred in a year with a high FHOG (1 in 2009 for new and existing, 1 in 2011 for new only) or normal FHOG (0)

*LGA = data obtained at a local government area level

FINDINGS

A step-wise approach was adopted to test the additional predictive value of the model upon the inclusion of more independent variables. The structural elements were regressed initially, with locational elements added in a second step, then the jurisdictional and government (policy) elements added in the final step. The results of the process using 13,739 Brisbane Lot data are indicated in Table 2 below.

Table 2 Step Wise Process Model Summary- Lots [d]

					Change Statistic				
Model	**R**	**R Square**	**Adjusted Square**	**Std Error of Estimates**	**R^2 Change**	**F Change**	**df1**	**df2**	**Sig. F change**
1	.571	.326	.326	83251.851	.326	6649.	1	1373	.000
2	.631	.399	.398	78655.266	.072	551.8	3	1373	.000
3	.641	.411	.411	77847.298	.013	36.82	8	1372	.000

a. Predictors: (Constant), Area, (Structural)
b. Predictors: (Constant), Area, Region, SEIFA, Year (Structural + Locational)
c. Predictors: (Constant), Area, Region, SEIFA, Year, A_Cci, A_Css, AC_Inc, AC_Bul, IA_Ifc_1L, AC_Pop, A_Mgr, A_Upr (Structural + Locational+ Jurisdictional + Policy)
d. Dependent Variable: IA_Price

These findings indicate that the predictive qualities of the lot price model improve as the additional independent variables are added, as would be expected, albeit with a low initial adjusted R^2 and low incremental effect thereafter. This is not unexpected as vacant lots are more homogenous in nature than the housing subsequently built upon them.

The regression results for the Lot data set for Brisbane are provided in Table 3. All outputs are of the expected sign and significance at five percent probability with the exception of income, building approvals and unemployment (all sign and significance); and the construction cost index (sign and significance at ten percent).

Given the linear nature of our model, the interpretation of the infrastructure charge coefficient (IA_Ifc_1L) output of 1.693 and significance of .008, is that this result provides strong evidence that a $1.00 increase in infrastructure charges increases new Lot prices in Brisbane by $1.69.

Table 3 Regression Results- Lots

Model		Beta	t	Sig.	Lower Bound*	Upper Bound*
1	(Constant)	164571.585	119.155	.000	161864.335	167278.835
	Area	152.427	81.545	.000	148.763	156.091
2	(Constant)	-21503629.850	-26.810	.000	-23075791.649	-19931468.051
	Area	158.724	89.100	.000	155.232	162.216
	SEIFA	3635.625	9.534	.000	2888.191	4383.058
	Year	10767.793	26.963	.000	9984.996	11550.590
	Region	55220.188	36.313	.000	52239.423	58200.954
3	(Constant)	-16734106.193	-4.422	.000	-24151369.149	-9316843.237
	Area	158.802	89.938	.000	155.341	162.263
	SEIFA	3446.636	9.062	.000	2701.100	4192.173
	Year	8281.758	4.422	.000	4610.608	11952.908
	Region	88386.788	8.313	.000	67545.763	109227.814
	AC_Inc	-295.477	-.114	.910	-5392.846	4801.892
	AC_Pop	43476.047	6.991	.000	31286.186	55665.908
	AC_Bul	186.173	.522	.602	-513.070	885.415
	A_Upr	10457.635	1.113	.266	-7952.611	28867.881
	A_Cci	-4533.609	-1.636	.102	-9966.447	899.228
	A_Mgr	20413.933	2.099	.036	1354.505	39473.361
	A_Css	-971.569	-2.366	.018	-1776.604	-166.534
	IA_Ifc_1L	1.693	2.633	.008	.433	2.954

*95.0% Confidence Interval

As indicated previously, in contrast to house price studies, the evidence on price impacts for vacant residential lots is thin. This is thought to be due to the nature of the US housing market, whereby the land developer also constructs the house thereupon and there is only a limited vacant lot market. This is in contrast to the "house and land" package nature of much of the Australian new home market in greenfield estates. Evans-Cowley et al., (2005) provide the only recent evidence of the impact of infrastructure charges on residential lot prices. They provide weak evidence that a $1.00 infrastructure charge is attributed to a price increase of as little as a $0.13 for the developed lot (Evans-Cowley et al., 2005). This is a significant under-

passing of the charge. This lower on-passing result when read in conjunction with overpassing at the house level, could be interpreted as evidence of profiteering by house builders. This would be a troubling finding as house builders (as opposed to land developers when these are two separate suppliers) are not subject to any infrastructure charges. This study provides evidence to support the hypothesis that infrastructure charges are over passed to vacant residential lots. The findings of 169% on-passing is positive evidence of overpassing and is an important contribution to the international literature on lot price effects. Hence, the findings of this study are an important contribution to the literature where an active "house and land" market exists, with potential profit taking by house builders to be a consideration for further research.

Various reasons for overpassing have been hypothesised in the literature, however no studies have provided evidence in this regard. A common proposition for the over shifting phenomenon is the suggestion that infrastructure charges add additional uncertainties and delay costs in the approval process, resulting in developers recouping more than the cost of the fees alone as developers seek compensation for the additional risk taken and return on costs (Campbell, 2004, Mathur, 2003). This overshifting can also be combined with back passing to land owners (Ihlanfeldt and Shaughnessy, 2004), with developers requiring higher profit margins to compensate them for the additional uncertainty associated with a rapidly changing regulatory environment. Further, any additional development costs are increased by construction period interest and other development costs determined as a percentage of the sale price (Singell and Lillydahl,1990; Crowe 2007). So not only are infrastructure charges passed directly onto new homeowners, there is an overshifting effect to compensate developers firstly for the additional uncertainty (risk) and secondly a return of funds invested component, either for the developer, or its financier over the development period (Elickson and Been, 2005).

CONCLUSION

Housing affordability is at critical levels in Australia and the reasons for this are the subject of much policy debate. Despite a significant body of research on the incidence of infrastructure charges on new house prices in the US, there has been very limited academic progress in Australia on infrastructure charges' contribution to residential land prices. In a climate where housing affordability is a policy objective for many governments, a clear understanding of the impacts these government charges have on the price of new housing is imperative.

Development industry bodies maintain that infrastructure charges are a significant contributor to the supply-side drivers of increasing house prices. Over three decades of theoretical literature from North America is found to be consistent in its findings that infrastructure charges increase the price of housing. However the evidence on lot effects is thin and this study provides an important contribution to the literature indicating overpassing occurs in this market also.

To date the Australian academic community has not responded to this issue in an empirical manner. This research provides the first empirical evidence of the impact of infrastructure charges on residential land prices in Australia where an active "house and land" market exists. This research provides strong evidence in support of the proposition that not only are infrastructure charges passed on to home owners, they are over-passed to vacant residential lots in the amount of 169%. These results are consistent with the international evidence of over passing of infrastructure charges and support the hypothesis of this paper. The Australian evidence in this

instance indicates overpassing to new home owners in the order of $1.69 over passing for every $1.00 of infrastructure charge.

These results will inform governments on the outcomes of their growth management strategies on housing affordability, providing the first evidence of its kind in Australia.

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