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THE IMPACT OF INFRASTRUCTURE CHARGES ON HOUSE PRICES IN AUSTRALIA

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ABSTRACT

Developer paid fees or charges are a commonly used mechanism for local governments to pay for new infrastructure. However, property developers claim that these costs are merely passed on to home buyers, with adverse effects to housing affordability. Despite numerous government reports and many years of industry advocacy, there remains no empirical evidence in Australia to confirm or quantify this passing on effect to home buyers. Hence there remains no data from which governments can base policy decision on, and the debate continues.

This paper examines the question of the impact of infrastructure charges on housing affordability in Australia. It presents the findings of a hedonic house price model that provides the first empirical evidence that infrastructure charges do increase house prices in Australia. This research is consistent with international findings, that support the proposition that developer paid infrastructure charges are passed on to home buyers and are a significant contributor to increasing house prices and reduced housing affordability.

Keywords: Housing Affordability, infrastructure charges, impact fees, house prices, growth management

INTRODUCTION

Housing is widely touted as the largest investment most Australians make in their lifetime, however despite all levels of government having housing affordability policies, housing affordability remains at critical levels (Demographia, 2013). At the same time, the provision of new urban infrastructure in growing communities has been a policy dilemma for governments since the 1950s (Neutze, 1995). On one hand, governments may appease existing residents by shifting the responsibility of funding new growth related infrastructure from the government to the development industry (Burge, 2008) ; however on the other hand, the passing-on of these costs to new homeowners is said to directly contribute to reduced housing affordability (Been, 2005).

There is an extensive body of international literature that discusses the passing on (to home buyers) or passing back (to the englobo land seller) of infrastructure charges (Nelson et.al 2008). Regardless of the direction of passing and the various market elasticities, in the long term the outcome appears inevitable that house prices rise as a result of infrastructure charges (Been, 2005)(Been, 2005). The question that remains in debate is: how much do infrastructure charges increase house prices by? In a climate where housing affordability is a policy objective for many governments (Queensland Government, 2007)(Queensland Government, 2007) a clear understanding of the impacts these government charges have on the price and supply of new housing is imperative. Despite over a dozen separate studies over two decades in the US on this topic, no empirical works have been carried out in Australia to test if similar shifting or overshifting occurs here. This research seeks to close that knowledge gap through hedonic modelling of infrastructure charges and house prices using data from Brisbane, Queensland. This issue is important because the Queensland State Government has dual policies of housing affordability and growth management (Queensland Government, 2009), however to date there has been no evidence of the impact of one on the other.

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).

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These costs historically were born by the public purse, however in high growth areas, governments have been increasingly reluctant to fund such infrastructure through general revenue (Evans-Cowley and Lawhon, 2003). Existing home owners resist paying higher rates and taxes to fund new development. Hence infrastructure charges were introduced to shift these costs to the private sector (Burge, 2005). Around the globe, various terminologies are used to describe what are essentially urban infrastructure funding mechanisms. For example, the term "Impact Fees" is used throughout the majority of the US, "Development Charges" is prominent in Canada, "Planning obligation", "planning gain" or "Section 106 agreements" are all terms used today to describe the equivalent to an infrastructure charging system in the UK (Evans, 2004). "Exactions" is a general term used in Indian (3iNetwork) and some American literature, whilst in Australia "Infrastructure Charges", "Developer Contributions" or "Development Levies" are largely interchangeable terms depending on the jurisdiction.

This introductory section sets the background for this topic. The following section details the relevant literature, whilst the third section outlines the methodology used for this research. The forth section presents the data, with the results to follow, and the last section concludes.

LITERATURE

Internationally, the issue of infrastructure charges and the impact on housing prices is widely documented. 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 theoretical 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).

This theoretical concept is consistently captured by a vast number of academics, particularly in the US and Canada over the past three decades. With supporting theoretical literature dating back to the 1970's, current international literature now largely assumes it as a given that infrastructure charges increase the price of new housing in the long run (Productivity Commission, 2011).

If the theoretical work is largely consistent in its conclusions that infrastructure charges lead to increased housing prices, the next question that follows is: how much do house prices increase by? In the US, there is a well established body of empirical research that has evolved from this theoretical evidence on the cost impact of infrastructure charges on new housing over the past 35+ years (Been, 2005, Nelson et.al 2008). Review of this literature reveals however, it is a danger to assume that passing, or shifting of costs is at parity (ie. $1.00 extra for infrastructure charges = $1.00 passed on or back). The US research indicates that it is common for "over shifting" to occur, with home buyers paying a greater incremental increase in the cost of the new home (as compared to the cost of the infrastructure charge) as developers seek compensation for the additional risk taken and return on costs (Campbell, 2004, Mathur et al., 2004, Burge and Ihlanfeldt, 2006, Ihlanfeldt and Shaughnessy, 2004).

It is evident that whilst the findings of the empirical research to date are consistent in quantifying a consistent "overshifting" of infrastructure charges to housing prices, the methodologies used vary greatly, as does the extent of overshifting identified. In these studies, a $1.00 infrastructure charge is attributed to a price increase of as little as a $0.13 for the developed lot only (Evans-Cowley et al., 2005), $0.23 increase in new house price (Dresch and Sheffrin 1997) and up to $3.58 increase in new house price (Singell & 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.

Until now, this debate has gone largely unanswered in Australia by the academic community. Recently Gurran and colleagues considered the issue of planning costs and housing affordability from a broader qualitative perspective using case studies (Gurran et al., 2009, Ruming et al., 2011, Gurran et al., 2010, Gurran et al., 2008). These examine the impact of all government charges and planning regulations on housing costs in each of the three eastern seaboard States. Amongst other findings, this research limits its findings on the impact of infrastructure charges to concluding that all planning charges have increased at a greater and disproportionate rate to median house prices, however no empirical evidence of the direct impact of infrastructure charges on house price increases is provided.

The absence of empirical data on this house price effect is fuelling the debate in Australia as to whether infrastructure charges do get passed on to home 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.

METHODOLOGY

Hedonic price models based on multiple regression theory dates back to Waugh in 1928 with other early contributions by Court in 1939 and Stone in 1954 (Hill et al, 1997). However, it is since the seminal work of Griliches in 1971 and Rosen in 1974 (Meese and Wallace, 2003) that hedonic methods started to receive attention. These models provide for differentiation of individual supply and demand attributes (vectors of characteristics whose prices are not independently observed) whilst controlling for heterogeneous characteristics that are commonly thought to contribute to house price such as location, neighbourhood, age, number of bedrooms and the like (Dougherty, 2011); Hill 2012) .

Review of the empirical models used internationally to estimate the effect of infrastructure charges on house prices suggests that 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. Despite the various functional forms employed in the literature, a simple linear reduced form equation may be equally appropriate Delaney and Smith (1989), and is the adopted form for this study. In building the model, a step-wise approach was adopted to test the theory of additional variables adding greater predictive qualities to the model. 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 final model is indicated below:

$$P_{i,t} = \beta_0 + \beta_1 S_i + \beta_2 L_i + \beta_3 J_i + \beta_4 G_i + u_{i,t} \qquad \text{Equ. 1}$$

Where

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

S_i = *S*tructural attributes of the house: lot area; number of bedrooms, bathrooms and car parking spaces, dummy for new or existing home

L_i = *L*ocational features of the house: region and socio-economic suburb rankings

J_i = *J*urisdictional factors that might affect the price of a house: changes to household income levels; population growth; new housing supply; unemployment rate; construction cost index; mortgage rates; consumer confidence

G_i = *G*overnment policy factors that might affect the price of the house: infrastructure charges, First Home Owners Grant

$u_{i,t}$ = 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 houses and developed residential lots in Brisbane, Queensland, Australia. Brisbane is the State capital of Queensland and is the hub of South-East Queensland which is Australia's third largest metropolitan region, comprising 3.1 million people, of which approximately 70% reside in the Greater Brisbane area, accounting for approximately half of the State's population (ABS, 2012). New development stretches along the major transportation routes to the north and south of the central business district and to a lesser extent the east and west due to geographical constraints. 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 houses and 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, number of bedrooms/bathrooms/carparks, zoning, sale type, land use, buyer and seller details. Sales data was cleansed to remove: non arms length transactions, part sales, multiple transaction sales, and court order transactions. Bedroom, bathroom and carpark data was missing for approximately one third of the data set. The sales with incomplete data were removed. Data on the size of the house and the age of the house were not available.

Next locational data was considered. The data set supplied full address details for each sales record however, no GIS data was available. 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.

The two government policy variables that are relevant to house prices over the study period are infrastructure charges and the First Home Owners Grant. 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 First Home Owners Grant ("FHOG") and other associated government initiatives are an important feature of the Australian housing market due to their stimulatory objectives. The study period of 2005 to 2011 incorporates the strong market in the lead up to the GFC and the post GFC market retraction. For the purposes of this analysis, a FHOG dummy variable has been introduced: 0 if net assistance is in the normal range or 1 if stimulatory policy is in place ie 2009 for both new and existing homes, and 2011 for new homes only.

The final data set for this study comprised of a total of 29,752 house sales in Brisbane from 2005 to 2011.. Table 1 describes the independent variables utilised in the model estimation. Table 2 indicates the summary statistics.

Table 1 Variable Legend

Variable	Definition
Structural Attributes	
SQM	Lot size in square metres
BEDS	Total number of bedrooms
BATHS	Total number of bathrooms
CARS	Total number of car parking spaces
TYPE	Dummy variable indicating whether the house is Existing (0) or New (1)
Locational Attributes	
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 Disadvantage
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 Attributes	
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

Table 2 Summary Statistics –Houses

Variable	Mean	Std Dev
PRICE	471,863.63	148,510.16
SQM	687.58	333.59
BEDS	3.63	0.77
BATHS	1.78	0.65
CARS	1.93	0.74
TYPE	0.16	0.37
REGION	0.47	0.50
IRSAD	7.26	2.48
YEAR	2007.61	1.72
POPRATE	2.77	0.69
INCOME	4.99	1.49
BDLG	- 4.70	16.68
UNEMP	3.59	1.00
CONSTN	4.23	2.66
MTGE	7.56	0.93
CONSS	105.29	8.48
IC	12,080.79	4,536.60
FHOG	0.21	0.41
n	29,752	

Step-Wise Process

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 Brisbane house data are indicated in Table 3 below.

Table 3 Step Wise Process Model Summary[d]

		R	Adjusted R	Std Error of	Change	Statistics			
Model	R	Square	Square	Estimates	R2 Change	F Change	df1	df2	Sig. F change
1	.683[a]	.467	.467	108443.541	.467	5210.088	5	29746	.000
2	.743[b]	.552	.552	99457.403	.085	1873.676	3	29743	.000
3	.756[c]	.572	.572	97182.892	.020	157.503	9	29734	.000

a. Predictors: (Constant), SQM, BEDS, BATHS, CARS, TYPE (Structural)
b. Predictors: (Constant), SQM, BEDS, BATHS, CARS, TYPE, YEAR, REGION, IRSAD (Structural + Locational)
c. Predictors: (Constant), SQM, BEDS, BATHS, CARS, TYPE, YEAR, REGION, IRSAD, YEAR, POPRATE, INCOME, BDLG, UNEMP, CONSTN, MTGE, CONSS, IC FHOG (Structural + Locational+ Jurisdictional + Policy)
d. Dependent Variable: PRICE

These findings indicate that the predictive qualities of the house price model improve as the additional independent variables are added, as would be expected, albeit with diminishing returns.

RESULTS

The regression results for the pooled data set for Brisbane houses are provided in Table 4. All outputs are of the expected sign and significance with the exception of building approvals. These results indicate that a $1.00 increase in infrastructure charges (IC) increases house prices in Brisbane by $3.69 at a 95% confidence interval, or an on-passing ratio of 369%.

Table 4 Regression Results – Brisbane Houses

Model		Beta	t	Sig.	Lower Bound*	Upper Bound*
1	(Constant)	71,170.13	22.12	0.000	64,863.91	77,476.36
	SQM	141.86	71.42	0.000	137.96	145.75
	BEDS	32,808.21	30.77	0.000	30,718.64	34,897.78
	BATHS	89,582.08	70.09	0.000	87,076.92	92,087.24
	CARS	9,939.19	10.96	0.000	8,161.72	11,716.66
	TYPE	34,338.84	19.10	0.000	30,814.85	37,862.83
2	(Constant)	- 31,193,538.82	-44.50	0.000	- 32,567,566.00	- 29,819,511.64
	SQM	148.57	80.74	0.000	144.97	152.18
	BEDS	26,844.01	27.34	0.000	24,919.59	28,768.42
	BATHS	71,547.33	59.31	0.000	69,182.82	73,911.85
	CARS	10,266.89	12.30	0.000	8,630.17	11,903.61
	TYPE	32,969.58	19.74	0.000	29,695.31	36,243.84
	REGION	14,290.00	56.07	0.000	13,790.49	14,789.50
	IRSAD	48,922.20	39.26	0.000	46,479.67	51,364.72
	YEAR	15,534.33	44.49	0.000	14,849.90	16,218.75
3	(Constant)	- 17,258,177.32	-5.19	0.000	- 23,771,671.58	- 10,744,683.06
	SQM	147.23	81.82	0.000	143.70	150.75
	BEDS	26,535.98	27.66	0.000	24,655.23	28,416.74
	BATHS	71,786.83	60.89	0.000	69,475.97	74,097.69
	CARS	10,552.51	12.93	0.000	8,952.63	12,152.39
	TYPE	33,272.01	19.90	0.000	29,994.77	36,549.25
	REGION	14,389.73	57.78	0.000	13,901.55	14,877.90
	IRSAD	61,628.69	7.53	0.000	45,578.94	77,678.44
	YEAR	8,808.39	5.33	0.000	5,570.39	12,046.39
	POPRATE	11,943.88	2.21	0.027	1,327.70	22,560.06
	INCOME	4,361.34	2.24	0.025	552.13	8,170.55
	BDLG	- 410.24	-1.43	0.152	- 971.35	150.86
	UNEMP	- 23,543.13	-3.02	0.003	- 38,841.35	- 8,244.90
	CONSTN	11,472.42	5.55	0.000	7,422.94	15,521.89
	MTGE	- 57,728.68	-6.70	0.000	- 74,626.85	- 40,830.51
	CONSS	- 576.21	-1.67	0.095	- 1,251.75	99.34
	IC	**3.69**	**6.89**	**0.000**	**2.64**	**4.74**
	FHOG	- 30,893.77	-5.03	0.000	- 42,944.69	- 18,842.86

*95.0% Confidence Interval for Beta

FINDINGS

This study provides the first empirical evidence that infrastructure charges, after accounting for macroeconomic conditions and other factors that influence housing price, contribute to increases in the price of houses in Brisbane, Queensland during the period of 2005 to 2011. This evidence supports the theory that despite infrastructure charges being levied on property developers, these supply chain costs are passed onto the end home buyer. Not only are these fees being passed onto consumers, they are being significantly over passed in the order of 369%.

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 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).

Whilst this explanation appears intuitive and in line with common thinking, there are others within who argue the opposite, suggesting that infrastructure charges increase certainty. Nelson et al (1992) supported by Nelson et al. (2008) contend that infrastructure charges reduce uncertainty by virtue of timely provision of public infrastructure, that may expand the supply of buildable land. In their Australian review, Gurran et al (2009) suggest that the negotiated approach in the UK reduces risks for developers. This seems counter intuitive, with any unknown in the costing process adding uncertainty for developers. This is further compounded by the unpredictable delays (and costs) incurred in the negotiation process (Bramley & Leishman, 2005; Chan et al., 2009).

The high on-passing ratio evident in this study could be a function of the uncertainty associated with the fully negotiated and rapidly increasing opaque infrastructure charging regime in Queensland at the time. In the US studies, set fees per lot were scheduled with annual increases announced in advance. Theory suggests that in a fully transparent system, such supply chain costs are able to be passed back to the land owner, and yet overpassing at a consistent level existed in all US studies undertaken. Indeed Shaughnessy's (2003) study on land price impacts suggested that back-passing and over-passing were occurring contemporaneously, albeit with weak evidence.

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 house 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 and supply 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 empirical work is somewhat inconsistent in its conclusions as to how much house prices are increased by. The reasons for these price impacts are also still under debate.

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 house prices in Australia. This research provides strong evidence in support of the proposition that not only are infrastructure charges passed on to home buyers, they are over-passed by 369%. 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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