Developers pay developer charges

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Abstract

Existing empirical studies of the price and quantity effects on new dwellings from developer charges (DCs), or impact fees, are limited by a lack of naturally occurring variation in the DC size. It is therefore difficult to isolate any behavioural effect from the mechanical relationship of DC and price arising from larger dwellings being levied with higher DCs. To overcome this problem we use data over a period incorporating a surprise policy change in Queensland, Australia, that introduced a cap on DCs which required them to be later changed, both upwards and downwards, for different dwelling types in different local council areas. Our model estimation shows that there are no measurable effects on price or quantity of new dwellings from DCs, supporting the practitioner's view of the charge being economically benign and fully incident on the landowner, even when the landowner is a property developer. When we instead include the baseline DC for each sale prior to the policy change, the problem of capturing only the mechanical effect arises once again, and model estimates using this baseline DC are similar to others studies that have instead claimed large behavioural price effects from DCs. The results are consistent with a real options view of the developer's economic situation.

Keywords: Impact fees, developer charges, natural experiment

1 Introduction

Charges on landowners who convert land to more intensive uses are known as impact fees, or developer charges (DCs), and are a common revenue source for sub-national governments across the world. While practitioners in town planning see these charges as economically benign, there remains an academic debate about their potential to increase prices and depress sales volumes of new dwellings (Hsieh *et al.* , 2012; Nelson *et al.* , 2012; Ruming *et al.* , 2011; Burge & Ihlanfeldt, 2006; Ihlanfeldt & Shaughnessy, 2004)

Previous studies examining price and quantity effects of DCs typically do not utilise natural experiments, which means that the variation in the DC is mechanically correlated with the value of dwellings by its construction, and the true behavioural price-effect is difficult to untangle (Mathur, 2013; Billings & Thibodeau, 2013; Evans-Cowley *et al.* , 2009; Burge & Ihlanfeldt, 2006; Mathur *et al.* , 2004). We add value to this debate by using a natural experiment in Queensland, Australia, which capitalises on surprise policy variation of DCs to cleanly identify their behavioural effect on price and new housing quantity.

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The surprise political decision by the Queensland government to cap DCs occurred on 12 April 2011 as a response to the property development lobby which had argued that high DCs led to high prices. The cap for dwellings with two bedrooms or fewer was $20,000, and for dwelling with three bedrooms or more was $28,000. This meant that some local councils were forced to lower their DCs for some dwelling types to remain under the cap, but it also allowed them to increase their DCs for other dwelling types. In the two largest cities in the State, Brisbane and Gold Coast, the four year transition period that followed involved multiple different upwards and downwards revisions to DCs for different dwelling types, providing the natural variation that can be exploited to isolate the behavioural effect of DCs on prices and new dwelling supply.

Our results support the view of practitioners that DCs have benign economic effects in terms of price and new dwelling sales volumes. Our model estimates of the behavioural effect of DCs on prices at zero, and their effect on new sales volumes slightly positive, with a dollar increase in DC associated with an extra new dwelling of that type every 9 months. We show the importance of our identification strategy by looking at the results of the same models in the absence of the surprise policy variation, showing that indeed, this reverses the sign of the estimated coefficient, as it now captures predominantly the mechanical covariation with dwelling value that DCs have by their construction (i.e. dwellings with more bedrooms have higher DCs).

2 Background

Consider the economic problem of a property developer. Prior to owning developable land, their first problem is to determine a bid price for the site. This involves subtracting estimated costs from revenue once developed to the highest and best use. All costs are subtracted from expected revenue, including government charges, construction costs, and selling costs, along with a risk adjusted profit margin, to determine the site value. At this point the economic incidence of DCs is on the landowner, whose value is diminished by the charge, which all potential bidders will account for in their assessment of its value. It should have no effect on the assessment of the sales prices or volumes made by developers, which are all based on market assessments.

For a developer who owns land, the land is now a sunk cost, and additional charges cannot be 'passed back', as they are in the position of the landowner in the previous case. Their problem of profit maximisation simply changes to account for the additional DC costs as a function of quantity of dwelling built, which may lower the optimal development density. Equation 1 shows how the $-DC.q$ term enters the standard profit maximisation problem, reducing the optimal density due to convexity of $C(q)$ and the resulting $-DC$ term in the optimality condition in Equation 2 (which holds under convexity assumptions on $C(q)$).

$$\max_{\{q\}} \pi(p_0) = p_0 q - C(q) - DC.q \tag{1}$$

$$\frac{\partial C}{\partial q} = p_0 - DC \tag{2}$$

In the absence of regulatory restrictions on density, which may negate this effect entirely[1], higher DCs reduce optimal building density on each site. However, this effect is not the same as reducing the rate of new housing supply on a per period of time basis. Intuitively, larger new buildings

[1]In such cases the density limit q^* is less than the optimal q of Equation 1, satisfying Equation 2.

take longer to sell to the market than smaller ones. Reducing the total size of a building on any given site may not change the rate of new dwellings that meet the market in a given time period across the market as a whole.

The dynamic problem of determining the rate of sale of new dwellings for any development, either pre-construction sales or post-construction sales, is a real options one. Because development sites contain the option to delay both construction and sales, the developer is faced with an optimal timing problem. We show the most simplified version of this problem for a developer who has already committed to a particular size of building in Equation 3, where ϕ is the growth rate of p_0 and ρ is the discount rate, or the cost of waiting had each dwelling q been sold and the revenue gained at an earlier point in time. It is a present-value-of-revenue maximisation problem, with a control variable of the rate of flow of new sales, q_t.

$$\max_{q_t} V_0(p_0) = \int_{t=0}^{\infty} (p_0 e^{\phi t} q_t) e^{-\rho t} \tag{3}$$

We can solve this problem by looking at the optimal strike time for a single sale of a new dwelling, q, which is the instantaneous rate q_t. For each q, whether this single sale occurs, or is delayed, depends on whether the cost of waiting ρ, exceeds the benefit of waiting, ϕ, with the following the expected outcomes.

$$\begin{aligned} &\text{If } \phi > \rho \Rightarrow \text{Delay} \\ &\text{If } \phi < \rho \Rightarrow \text{Sell now} \\ &\text{If } \phi = \rho \Rightarrow \text{Indifferent} \end{aligned} \tag{4}$$

In the equilibrium the third condition in Equation 4 will hold, and the rate of supply of q will be adjusted by each participant in the market to ensure this is the case. Notice also that this result is true regardless of the size of a development, i.e. the total q of any given developer does not affect the rate at which they supply the market, even though the total quantity of new dwellings on any given site may vary according to the size of DC as per the optimal size decision from Equation 1. A developer selling 100 dwellings will find it optimal to sell at the same rate as a developer with 10 dwellings, given market conditions. Neither has an incentive to bring forward sales and depress local prices, and both have an incentive to delay each sale if it increases the expected present value of their next sale. This is true regardless of any changes to costs, such a through increases or decreased DCs, or unforeseen changes to construction costs, as there is no costs in this maximisation problem. This real options element of the developer's problem supports the practitioner's view that DCs have economically benign effects in terms of overall rate of supply of new dwellings, though it may effect the distribution of dwellings on different sites where density restrictions are not binding. Ignoring the dynamic problem of a developer can lead to erroneous expectations of negative effects on total new dwelling quantity, and via this quantity effect, a potential effect of increasing prices.

Reality, however, is often much messier than theory, and it remains of crucial practical interest to explore whether in fact DCs lead to price and quantity effects due to other market characteristics or failures, including in credit markets for developers, that are not captured in this very simple theoretical picture. The main recent empirical research attempting to tease out whether any price and quantity effects occur in practice use a variety of controls and instruments to overcome their identification problems. But because the mechanical relationship of DC size and dwelling price, whereby larger homes are levied with higher DCs, is hard to statistically isolate behavioural effects in the absence of natural variation in the DC.

For example, Billings & Thibodeau (2013) use data on new home sales in Denver from 2002-2004 and instrument the development district tax rate (a type of amortised DC) on sales rate, age of district, and area of district to try and remove covariation with prices, finding that most of the tax obligation is capitalised into lower prices, but with substantial variation depending on their model specification. Mathur (2013) uses 1991-2000 data on detached home sales in King County, Washington, to look at jurisdictional level price effects from impact fees designated for different uses, finding few significant results, but highlighting the potential for fees to have different price effects. It is not clear however, whether these results are a product of the mechanical relationship between home value and DCs, because of the underlying method used to determine DCs applicable to different size homes. Evans-Cowley *et al.* (2009) also encounter this problem in their model fitted to a cross-section of property sales data in 63 Texas cities from 1999. They look to control for the choice of a city to impose a DC, but overlook the relationship between the size of the DC and home price in the cities that do. Despite the challenges of identification, on their face their lack of clean results of the effect of DCs on prices in either direction seems to support the view of benign effects.

In terms of effect on quantity of new homes constructed, Burge & Ihlanfeldt (2006) use county-level data from Florida between 1993 and 2003, using size-standardised DCs to test the quantity effect of DCs. They seperate DCs into two types - water and sewage, and other - and estimate a variety of models that include lags of DCs for a number different standardised dwelling types. Their results are mixed both of the coefficient size and significance of DCs and their lags across dwelling types and DC types, indicating just how difficult it is to tease out true net behavioural effects of DCs on new dwelling volumes in the absence of natural experimental conditions. In more recent work, divergent results for the impact of DCs on residential and commercial land values was found (Burge, 2014).

3 Data and methods

3.1 Data

New home sales data from Brisbane and Gold Coast, Australia, from 2011 to 2016 are used. There are 65,883 sales altogether, of which 32,052 have the specific information on the number of bedrooms in the dwelling, which is the criteria for determining the size of the relevant DC. The choice of this area over this timeframe arises because of the policy variation in the DCs that occurred following a surprise State government decision to change the rules for local councils. The overall housing cycle during this period was one of involving a sharp recovery in both new sales volumes and prices following multi-year downturn after the financial crisis of 2007-08.

Table 1 provides an overview of the policy changes to DCs during the time period, and details of the sales data used. The sales data includes only dwellings with their first recorded sale after 1 July 2011, indicating that they were recently constructed. We use the contract date, which typically occurs prior to, or during, construction to match with the applicable DC at the time. Sales data that does not contain information on the number of bedrooms, which is required to determine the applicable DC, are excluded.

Table 1: Summary of DC policies and sales data

		DC policy environment			DC	Number of sales		Av. price ($'000)	
		Date	Beds	DC	Change	Before	After	Before	After
Gold Coast	House	July 2013	1	20,000	-7,000	1	16	213	792
			2	20,000	-7,000	41	168	506	654
			3	28,000	1,000	277	1,426	505	587
			4+	28,000	1,000	292	1,488	674	744
	Apart.	July 2013	1	20,000	6,500	56	224	379	500
			2	20,000	3,000	216	1,148	394	530
			3	28,000	6,000	242	1,084	550	555
			4+	28,000	4,500	68	324	554	795
Brisbane	House	July 2015	2 -	20,000	2,000	*937*	335	617	669
			3 +	28,000	2,000	*8,060*	3,500	679	729
	Apart.	July 2015	2 -	20,000	2,000	*1,804*	824	542	528
			3 +	28,000	2,000	*1,354*	508	604	594
	House	July 2013	2 -	19,000	1,000	641		511	
			3 +	27,000	1,000	4,651		575	
	Apart.	July 2013	2 -	19,000	1,000	1,240		461	
			3 +	27,000	1,000	1,097		594	
			Av.	23,750	Total	20,977	11,045		

Italicised sales numbers are for the period between July 2013 and July 2015. DC change is the difference between this DC and the DC prior to any policy changes.

3.2 Methods

To examine the relationship of DCs to price the following model is estimated

$$ln(p_{i,t}) = X_i\beta + Y_t\alpha + DC_{i,t}\gamma + \varepsilon_{i,t} \tag{5}$$

where $ln(p_{i,t})$ is the log of sales price for property i at time t, X_i is a set of property specific characteristics including location (Brisbane or Gold Coast), type (house or apartment), and size (number of bedrooms), Y_t is a set of yearly time dummy variables which capture overall variation at each time period, $DC_{i,t}$ is the DC applicable to the sale of property i at time t, and $\varepsilon_{i,t}$ is the error term.

A number of variations of this core model are estimated, including using a log transformation of $DC_{i,t}$, and also using raw price level rather than a log transformation.

To highlight the effect of the natural experimental condition on the estimation, we also use the baseline DC from prior to the first policy change matched to each sale, to show how this results in the estimation fitting the mechanical relationship between DC and price, rather than any behavioural effect of DC on price.

To examine the relationship between DCs and new housing, we also partition the data into quarterly time periods starting 1 July 2011, and look at the frequency of quarterly sales of each

Table 2: Summary of price model results

	$ln(Pi,t)$				$P_{i,t}$	
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	13.4***	10.9***	12.8***	12.7***	755***	402***
Gold Coast	0.10***	-0.10***	-0.10***	-0.10***	-26***	-27***
Apartment	-0.07***	-0.05***	-0.07***	-0.06***	-19*	-5
2 bed	0.21***	0.20***	0.21***	0.21***	25	14
3 bed	0.31***	0.21***	0.30***	0.24***	164***	8
4 bed	0.50***	0.40***	0.49***	0.43***	305***	149***
5 bed	0.77***	0.68***	0.77***	0.71***	562***	406***
6 bed	0.82***	0.72***	0.81***	0.75***	649***	491***
2013	0.05***	0.05***	0.05***	0.05***	16	9
2014	0.15***	0.15***	0.15***	0.15***	97***	82***
2015	0.18***	0.18***	0.18***	0.18***	119***	95***
2016	0.20***	0.20***	0.20***	0.20***	119***	90***
$ln(DC_{i,t})$	-0.06					
$DC_{i,t}$			0.00		-0.015***	
Base: $ln(DC_{i,t})$		0.20***				
Base: $DC_{i,t}$				0.00006**		0.004
R^2	0.16	0.16	0.16	0.16	0.04	0.04
N	32,052	32,052	32,052	32,052	32,052	32,052

Coefficients in Models 4 and 5, using the price level only, are in thousands.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

dwelling type, either a house or apartment, and number of bedrooms of each[2], as a function of the applicable DC, as per the following model.

$$q_{d,t} = H_d\beta + Y_t\alpha + DC_{d,t}\gamma + \varepsilon_{d,t}. \tag{6}$$

Here, $q_{d,t}$ is the quantity of sales in quarter t of each dwelling type, d, H_d is a dummy variable for houses, Y_t is a set of yearly time dummy variables which capture overall variation at each time period, $DC_{d,t}$ is the applicable DC for dwelling type d, and $\varepsilon_{d,t}$ is the error term.

Like with the price model, we also demonstrate the effect of the natural experimental condition by estimating this quantity model using the baseline DC from the starting period applied to all sales, rather than the actual DC.

4 Results

Table 2 summarises the main price regression results (Equation 5 and its variations), clearly showing the difference between using the DCs that vary over this natural experiment, and the

[2]Giving 24 categories of dwelling type overall; 12 for each city comprising house and apartment types each with six types that match the number of bedrooms.

baseline DCs that applied at the beginning of the data period. The fit is much improved using the log transformed price level in Models 1 to 4, all with an R^2 of 0.16, compared to 0.04 in the untransformed Models 4 and 5. In these first four models all of the property-specific explanatory variables are significant.

In Model 1, the -0.06 estimated coefficient for $ln(p_{i,t})$ is relatively small and insignificant, as expected by the practitioner view of DCs being economically benign. What is more interesting is that Model 2, which replaces the applicable DC on the new dwelling with the baseline DC applicable before any policy changes, the sign of the log-transformed DC coefficient estimate has a positive sign, is large, at 0.20, and significant. This results reveals that absolute importance of having natural experimental conditions identify the true price effect of DCs, rather than rely on cross-sectional data, where the mechanical covariation between DC and price is difficult to statistically remove. Models 3 and 4, which use the untransformed DC, show a similar pattern in support of this view.

The last two columns report models without the log-transformation of price, which both have a much lower fit to the data, but show a similar pattern in terms of the importance of our identification strategy on isolating the true price effect of DCs. The Model 6 DC coefficient estimate is similar in magnitude to previous studies that interpret their results as a behavioural effect which allows each dollar of DC to be passed through to four dollars in the price (Bryant & Eves, 2014).

In terms of the effect of DCs on turnover, we report the results of the estimation of two variations of Equation 6 in Table 3. In Model 1 the DC coefficient is positive and significant, at 0.002, indicating that in the period of study that the frequency on sales of each dwelling type in each quarter co-moved with the unexpected changes to DCs that occurred. On average there were 66 sales of new dwellings of a particular type each quarter, suggesting that each extra dollar of DC is associated with an extra sale of that type every 1.9 years. When the baseline DC is used, there is no statistically significant effect, as per Model 2. Because of size of the coefficient in Model 1, and the p value of the DC coefficient estimate of 0.09, we hesitate to generalise about potential positive quantity effects from DCs from this result.

5 Discussion and conclusions

To improve on previous empirical approaches to understanding potential price and quantity effects of DCs we have capitalised on natural experimental conditions which generated unforeseen changes in DCs in Brisbane and Gold Coast, Australia, between 2011 and 2016. Using new residential sales data matched with the applicable DC at the time of the contract, we show how the practitioner view of DCs as economically benign is strongly supported, both in terms of price and quantity effects. We have also highlighted the difficulties in untangling any behavioural effects of DCs from their mechanical relationship with price where there is no naturally occurring variation, and where the researcher relies only on hedonic controls. Our results are similar to the study of Davidoff & Leigh (2013), who use instrumental variables methods to untangle the economic incidence of property transaction taxes (stamp duties). They found that the full tax was capitalised into lower prices, being incident on the seller and having no price effect, as per our result with DCs. They did find that higher transaction taxes did slightly reduce overall turnover in the market, which may come from the ability of investors to time their entry and exit from the market, and the frequency of their transactions, to minimise the cost of this tax.

Table 3: Quantity model results

	$q_{d,t}$	
	(1)	(2)
Constant	48.5	101.2
Gold Coast	-74.6***	-73.8***
Apartment	-44.8***	48.5***
2012	8.5	8.7
2013	24.2	24.7
2014	43.4**	45.5 **
2015	66.2***	68.8***
2016	2.9	5.5
DC	0.002*	
Base: *DC*		-0.000
R^2	0.20	0.20
N	480	480

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Much of the confusion over the expected economic effects of DCs comes from relying on the static theory of optimal size of building investment on any particular site. Only once dynamic considerations are considered does the theory conform to the practitioner's view of DCs being economically benign. This dynamic view also shows how future increases in DCs can lead to new dwelling sales and construction being brought forward, increasing the rate of supply. This occurs through their effect of decreasing the growth rate of the net price received by the developer. As per Equation 4, the conditions now rely on $\phi - \delta \frac{DC}{P_0}$, which subtracts the rate of growth in the DC share of price to get the rate of growth of net prices, which would be ϕ alone if the DC was fixed. This effect could go some way to explaining the positive relationship between DC and quantity of new dwellings sold of a particular type reported in Model 1 of Table 3. That the dynamic view overturns the logic of the static view should not be surprising, as it has been long known that the same applies to the effect of density controls on land, where the dynamic view shows that development of land with density limits will be brought forwarding time compared to development of land without such limits, by removing the gains from additional density from waiting for higher prices (Titman, 1985).

Overall, the results from our improved empirical identification method support the more complete dynamic theory of the economic effects of DCs, and pinpoint some of the reasons that such academic debates continue.

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