18TH ANNUAL PACIFIC-RIM REAL ESTATE SOCIETY CONFERENCE

ADELAIDE, AUSTRALIA, 15-18 JANUARY 2012

INFRASTRUCTURE CHARGES AND INCREASES TO NEW HOUSE PRICES: A PRELIMINARY ANALYSIS OF THE US EMPIRICAL MODELS

L. E. BRYANT[1] and A. C. EVES

Queensland University of Technology, Brisbane, Australia

ABSTRACT

Sourcing appropriate funding for the provision of new urban infrastructure has been a policy dilemma for governments around the world for decades. This is particularly relevant in high growth areas where new services are required to support swelling populations. The Australian infrastructure funding policy dilemmas are reflective of similar matters in many countries, particularly the United States of America, where infrastructure cost recovery policies have been in place since the 1970's.

There is an extensive body of both theoretical and empirical literature from these countries that discusses the passing on (to home buyers) of these infrastructure charges, and the corresponding impact on housing prices. The theoretical evidence is consistent in its findings that infrastructure charges are passed on to home buyers by way of higher house prices. The empirical evidence is also consistent in its findings, with "overshifting" of these charges evident in all models since the 1980's, i.e. $1 infrastructure charge results in greater than $1 increase in house prices. However, 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.

The purpose of this research is to conduct a preliminary analysis of the more recent models used in these US empirical studies in order to identify the key study area selection criteria and success factors.

The paper concludes that many of the study area selection criteria are implicit rather than explicit. By collecting data across the models, some implicit criteria become apparent, whilst others remain elusive. This data will inform future research on whether an existing model can be adopted or adapted for use in Australia.

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

INTRODUCTION

Sourcing appropriate funding for the provision of new urban infrastructure has been a policy dilemma for governments around the world for decades. This is particularly relevant in high growth areas where new services are required to support swelling populations (Been, 2005). The Australian infrastructure funding policy dilemmas are reflective of similar matters in many countries including the United States of America ("US"), where infrastructure cost recovery policies have been in place since the 1970's (Been, 2005).

In Australia, industry advocates claim that the cost of infrastructure charges are passed on to home buyers, contributing to housing becoming unaffordable (Residential Development Council of Australia, 2006, Residential Development Council of Australia, 2007, Urban Development Institute of Australia, 2007). However, in Australia no empirical studies have been carried out to verify or quantify this cost impact (Bryant and Eves, 2011). Whereas, the cost impact of infrastructure charges on the price of new housing has been well documented in the US over the past two decades. The purpose of this research is to conduct a preliminary analysis of these US models to identify and assess the study area key selection criteria. This is the first step in determining whether any of these models may be applicable for use in Australia to quantify if similar house price impacts are observable here.

Infrastructure Charges

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 (Been,

[1] Lyndall Bryant is a Lecturer in Property Economics and a PhD Candidate. Email: Lyndall.bryant@qut.edu.au

2005, Burge, 2008, Campbell, 2004, Mathur et al., 2004, Ihlanfeldt and Shaughnessy, 2004, Evans-Cowley and Lawhon, 2003).

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). These charges are referred to as "Impact Fees" in the US.

International Studies

Internationally, the issue of infrastructure charges and their impact on housing prices is widely documented. Theoretical argument exists in a number of countries; however the only published empirical studies originate from North America, where these charges are known as "Impact Fees" (Bryant and Eves, 2011). In excess of a dozen empirical studies have examined how much impact fees increase new house prices by in North America (United States and Canada). The theoretical argument is well developed and consistent in its findings that impact fees *do* increase the price of new housing in strong markets in the short term, and that prices also increase in the longer term when weaker market conditions prevail (Been, 2005). Whilst the empirical evidence is not as consistent, a pattern has emerged over a number of studies that indicates for every $1 increase in impact fees, new housing prices increase by $1.50 - $1.70 (Burge, 2008). These studies are examined in further detail in the Literature Review.

If, in the absence of any domestic evidence, we use the mid range average findings of the North American studies ($1:$1.60) then the price of a new three bedroom home could be expected to increase by up to $45,000 purely by virtue of the infrastructure charge alone. In the Queensland State capital of Brisbane, where the average house is $460,000 (Australian Bureau of Statistics, 2011) this represents an increase of approximately 10% for new housing by virtue of one government policy change.

Clearly, it is not only possible, but also likely that the North American models are not directly applicable to the Australian situation. However, they do provide some context, and the only empirical evidence available to date. What is required, is the development of a model that can quantify the impact of impact fees on new housing costs in Australia, so that government can develop consistent and evidence based policy to support the provision of infrastructure, whilst retaining a sustainable level of housing affordability. To date, there has been no empirical evidence of the impact of infrastructure charges on new housing costs in Australia.

The purpose of this research is to conduct a preliminary analysis of the various US empirical models that indicate that impact fees increase new housing prices. This research will identify and assess the study area key selection criteria and form the basis for further analysis of whether these models are transposable to the Australian market. This will be achieved through archival analysis of the various existing studies, focusing on the size and nature of those works, the market and impact fee characteristics, and the data utilised. This work is the predecessor for further research into comparatives with the Australian market and the various econometric model methodologies adopted.

Structure

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 results, with the findings to follow, and the last section concludes.

LITERATURE

In the US, the responsibility of funding new growth related infrastructure shifted from the government to the development industry in many parts of the US since the 1970's (Burge, 2008, Evans, 2000, Shaughnessy, 2003, Mathur, 2003). Academics there have been theorising on the impact of impact fees on new housing costs since that time.

Theoretical Research

Impact fees 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 work is consistent in its conclusions that despite market conditions (i.e. relative market elasticities) impact fees in virtually all instances 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 concept is consistently captured by a vast number of academics, particularly in the US and Canada over the past three decades including (but not limited to): Ellickson (1977), Snyder, Stegman and Moreau (1986), Downing and McCaleb (1987), Huffman, Smith, Nelson and Stegman (1988), Delaney and Smith (1989), Singell and Lillydahl (1990), Skaburdis and Qadeer (1992), Altshuler and Gomez-Ibanez (1993), Dresch and Sheffrin (1997), Brueckner (1997), Skidmore and Peddle (1998), Yinger (1998), Baden and Coursey (1999), Mayer and Sommerville (2000), Nelson and Lillydahl (2002), Nelson and Moody (2003), Evans-Cowley and Lawhon (2003), Ihlanfeldt and Shaughnessey (2004), Mathur, Waddell and Blanco (2004), Campbell (2004), Been (2005), Evans-Cowley, Forgey and Rutherford (2005), Burge and Ihlanfeldt (2006) and Burge (2008). With supporting theoretical literature dating back to the 1970's, current international literature now largely assumes it as given that impact fees increase the price of new housing in the long run (Productivity Commission, 2011).

Empirical Research

If the theoretical work is largely consistent in its conclusions that impact fees 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 impact fees on new housing over the past 35+ years. Been (2005) provides a comprehensive and chronological overview of the empirical research from 1989 to 2004. She identifies a dozen separate North American studies on the price impacts of impact fees on new housing costs, a number of which also examine the price impact on existing housing, as well as the impact on different quality and size of housing. Separate studies are found from both Canada and the US. Burge (2008) makes the observation that much of the early work suffers from weaknesses in methodology and lack of appropriate data. In his 2008 work, Burge identifies a further three papers that post date Been's critique. A further 2010 paper by Lawhon is from research carried out in 1996 is not cited by either of these works (Lawhon, 1996).[2]

From Been's (2005) and Burge's (2008) work, it is evident that whilst the findings of the empirical research to date are consistent in quantifying a consistent "overshifting" of impact fees to new (and existing) housing prices, the methodologies used vary greatly, as does the extent of overshifting identified. In these studies, a $1 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)[3].

Review of this literature reveals however, it is a danger to assume that passing, or shifting of costs is at parity (ie. $1 extra for impact fees = $1 passed on or back). Research from the US 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).

If we assume that subsequent works build on prior works as implied by Burge (2008), let us then focus the remainder of this discussion on the several works from the past decade only. Brief details of each of the empirical works post dating 2000 are listed in Table 1 below for the purpose of providing an appreciation of the range of work on this topic, as well as in the variance in approach and findings. Each uses a form of econometric modelling, but with varying methodologies, variables and inputs. In summary, the research in the last decade from the US indicates that for every $1.00 increase in impact fees, new housing costs increase on average by $1.50 to $1.70 (Burge, 2008). This concept of "over shifting" for new housing is consistent across all of the empirical research dating back to the 1980's.

[2] Lawhon's 2004 paper is omitted from the post 2000 discussion as it is based on research from 1996.

[3] Been (2005) provides a detailed critique of earlier models.

Table 1: Empirical Research Models and Findings 2000 – 2011

Year/Author	Methodology	Impact per additional $1 of infrastructure charge	Comments
2004 Mathur, Waddell and Blanco	Hedonic model based on the value of new homes in three price categories across 38 cities and towns 1991-2000 [Washington State]	+$0.60 Low quality +$1.66 Mid quality +$3.58 High quality	First evidence of differential impacts across housing types. Overall effects of impact fees are accumulative (positive) with amount of over shifting dependent upon the end house value (deemed measure of quality).
2004 Ihlanfeldt and Shaughnessey	Hedonic and repeat sales and regression methods (using time series data) for 39,792 new homes and 107,376 existing homes and land [Florida]	+$1.64 New homes +$1.68 Existing homes. -$1.00 Undeveloped land	Evidence supports the new view, that impact fees add value for consumers that lower future property tax rates, with that value capitalised into current house prices. The finding that undeveloped land values fall at the same time is interesting. It is attributed to developer uncertainty regarding future increases in fees.
2004 Campbell	Hedonic modelling for 279,000 new and existing homes and 45,000 vacant land sales 1997 – 2001 [Orlando SMSA, Florida]	+$1.60 New homes +$1.00 Existing homes Undeveloped land results not conclusive	Average price effect coefficient for new homes is generally consistent with Ihlanfeldt and Shaughnessy and Mathur et al for new homes.
2005 Evans-Cowley, Forgey and Rutherford	Pooled cross-sectional OLS + fixed and random effects models. 1999 data. [43 cities in Austin, Fort Worth, Dallas and Houston, Texas]	+ $0.13 Developed lot value - $0.04 Undeveloped land	Research examines the impact on the price of undeveloped and developed land (rather than housing). Research supported an increase in the price of developed land, with minor back passing for undeveloped land.
2006 Burge and Ihlanfeldt	House price indices + regression analysis for new and existing homes in 41 counties for small, medium and large homes (by square footage) 1993-2003 [Florida]	+$0.38 Small home +$0.82 Mid size + $1.27 Large home	Evidence of differential overshifting by home size. Evidence supports the new view, that impact fees add value for consumers that lower future property tax rates, with that value capitalised into current house prices.

Source: Author, Been (2005) and Burge (2008)

In summary, there is a deep and varied body of evidence on the price impacts of impact fees on new housing costs in the US, with no similar studies having been carried out in Australia to assess the associated impacts of infrastructure charges.

METHODOLOGY

The methodology for this preliminary analysis work is based on archival research. This archival research includes the critical analysis of the existing literature identified above, together with any supplementary works. This analysis will inform further research into the suitability of any of these models for use in the Australian context.

Archival research involves "the locating, evaluating, and systematic interpretation and analysis of sources found in archives"(Archival Research). Whilst often related to social research, this technique is appropriate as it includes collecting data from archival records. Its strengths lie is in its unobtrusive nature and that it can be used for historical data, which is readily available from web linked databases (Teddlie and Tashakkori, 2009). However, a potential limitation of this method is that of information gaps due to incomplete or dated studies, or limited access to information.

In collecting material for this research a literature search identified a very large number of academic, government and industry papers on the impact of impact fees on new housing prices and/or land supply. A rich body of academic literature from North America was identified with Been's 2005 literature review referencing over 100 separate works from Canada and the US directly relating to this topic dating from the early 1970's. This extensive body of work is reflective of the maturity of the infrastructure charging regime in North America which has been in existence for over

three decades. Whilst theoretical works are available from other countries such as the United Kingdom and Australia, all of the empirical studies identified are from the US or Canada.

All literature used in this review were sourced via online database key word searches. Other related works were sourced through the citations in primary research papers identified. Published empirical works were identified from the above and any associated unpublished sources such as full theses have been accessed. Of the five post 2000 empirical studies published, four were the result of PhD works. It is these more detailed documents that provide a rich source of data for analysing methodologies, key variables and underlying assumptions. The one outstanding study was post-PhD research and data from the related thesis has also been retrieved for review where relevant (See Evans 2000). Note, Campbell has not published findings from his 2004 thesis.

Table 2: Archival Data Sources

Author	Data Sources
Mathur, Waddell & Blanco	2003 PhD dissertation by Mathur, University of Washington 2004 journal publication on PhD findings
Ihlanfeldt and Shaughnessey	2003 PhD dissertation by Shaughnessey, Florida State University 2004 journal publication on PhD findings
Campbell	2004 PhD dissertation, Georgia State University Note: Campbell's work has not been published to date
Evans-Cowley, Forgey and Rutherford	2005 journal publication is subsequent to dissertation. Data set is sourced from 2000 dissertation 2000 PhD dissertation by Evans on Evaluating the Equity, Efficiency and Effectiveness of Impact Fees
Burge and Ihlanfeldt Burge	2005 PhD dissertation by Burge, Florida State University 2006 journal publication on PhD findings 2008 book chapter

RESULTS

The analysis for this stage of the research focused on study area selection criteria, scale, market characteristics, impact fee regimes and data requirements used in the US models. The outcome of this research will be a preliminary assessment of the associated selection criteria for these studies. This will enable future comparison with the Australian market characteristics and is the first step in assessing the suitability of these models for adoption or adaption to enable the impact of infrastructure charges on new housing costs here to be measured.

Note it is outside the scope of this preliminary work to assess the actual econometric models themselves. This will form the basis of subsequent research.

Preliminary Observation

It is interesting to observe that three of these five studies have been carried out in Florida, with Burge and Shaugnessey sharing the same PhD supervisor at The Florida State University College of Social Sciences (Department of Economics) whilst Campbell attended Georgia State University (Department of Economics). Shaunessy and Campbell studied different counties over different time frames, while Burge examined all of Florida.

Mathur was a student of University of Washington (Interdisciplinary PhD in Urban Design and Planning), whilst Evans (later known as Evans-Cowley) attended Texas A&M University (Major Subject: Urban and Regional Science). These differences (and similarities) may become relevant when considering differences (and similarities) in the models presented.

Study Area Selection Criteria

The first criterion examined focuses on the study area selected, its characteristics over the study duration, as well the rationale for its selection. These elements are demonstrated in Tables 3 and 4 below and will assist in determining what study selection criteria are important in model specification.

Table 3 below captures the study area, the scale of each study, together with its duration and any study area selection criteria explicitly stated by its author. The following observations can be made from this data:

- With the exception of Burge, each of the study areas focuses on major metropolitan areas: King County, Washington; Miami and Orlando, Florida; and Austin, Fort Worth, Dallas and Houston, Texas. Burge's work examines the entire Florida State.
- The study durations vary in time from 5 to 15 years. It is interesting that Evans-Cowley et al, is the only author to link a milestone event to the start of the study (commencement of new legislation). Burge implies his start date is linked to the availability of property tax roll historical data. None of the other studies discuss the selection criteria associated with the chosen study start date.
- The study scales vary significantly from 14,103 to over 200,000. These are a function of the duration and vary accordingly, however not as might be expected. For example, Mathur et al's study extended for 10 years but only examined 14,103 new house sales (this implies 1,410 sales per annum). On the other hand, Campbell's study only spanned 5 years, but examined 103,444 new house sales (implies 20,688 sales per annum).
- The selection criteria stated for each study varies and in a number of cases is poorly defined. Implied criteria include: availability of data over a lengthy period, consistency in the use of impact fees across the study area, and relatively major scale of the study area within its marketplace.

Table 3 Study Area Selection Criteria

Author	Study Area and Selection Criteria
Mathur, Waddell & Blanco	14,103 new houses, across 38 jurisdictions in King County, Washington Study duration 1991 – 2000 (10 years) • King County is of regional scale, being the most urbanised county in the state and accounting for a major share of the state's population and economy. Has a large and diverse housing market. King County has played pioneering role in implementation of impact fees under state Growth Management Act.
Ihlanfeldt and Shaughnessey	39,792 new homes and 107,376 existing homes in Dade County, Miami, Florida Study duration 1985 – 2000 (15 years) • County and metropolitan borders are coterminous (minimal spillover effects of overlapping markets)
Campbell	103,444 new and 175,877 existing homes and 45,000 land sales in 6 counties, Orlando, Florida. Study duration 1997 – 2001 (5 years) • All of the 6 counties and 50 of the 70 cities use impact fees. • Impact fee information from late 1990's to early 2000's is readily available.
Evans-Cowley, Forgey and Rutherford	48,805 vacant lots, across 43 cities in Austin, Fort Worth, Dallas and Houston Study duration 1990 – 1997 (8 years) • A decade had passed from when enabling legislation had passed and no other empirical works had been carried out in that time.
Burge and Ihlanfeldt	Unstated total records across 41 Florida counties: 19 city counties, 15 suburban counties and 7 rural counties Study duration 1993 – 2003 (11 years) • Impact fees are widely used and have a long history. • 41 of 67 Florida counties used had complete data sets (49 use impact fees) • "Concurrency" effects that may render findings unique to Florida are not considered a true limitation • Length of panel data is limited by number of years property tax rolls were available (1995 – 2004 were used) • "In summary, impact fees in Florida are: 1) widespread in use, 2) countywide in their application, 3) well established, having been used in the majority of Florida Counties since the 1980's, 4) significant in magnitude, and 5) often changing in levels and coverage within counties." Burge & Ihlandfeldt (2005), p50

Examination of the characteristics of the local housing market over the study period provides further insight in the fundamentals conducive to study success. Table 4 summarises any information provided about the relative market characteristics over the relative study periods. It is apparent that each of the study areas experienced high levels of population growth over the study periods.

Table 4 Market Characteristics

Author	Market Characteristics
Mathur, Waddell & Blanco	The period of this study was one of rapid economic and population expansion within King County, with tight housing market conditions. Population of 1,707,460 in 2000
Ihlanfeldt and Shaughnessey	Florida's population has grown in excess of national averages for over three decades: • 1970-1980: 43.5% (11.4% nationally) • 1980-1990: 32.7% (9.8%) • 1990-2000: 32.7% (13.1) State expenditure on highways dropped dramatically over the same periods and school funding didn't keep pace with demand. No specific data provided for Dade County, Miami
Campbell	In 1997, the 6 county metropolitan area had a population of just over 2.5 million people No other housing market characteristics are discussed, despite population growth identified as a data item, but not provided.
Evans-Cowley, Forgey and Rutherford	The 43 cities in the study range in size from large cities, to medium size suburbs and newly developing cities at the fringes of the metropolitan areas. Between 1983 and 1992 Texas experienced a severe real estate depression, followed by a growth spurt. Between 1990-1999, one third of impact fee cities grew at 3-5% and 10% grew at greater than 5%.
Burge and Ihlanfeldt	Florida has had extreme population growth over several decades, growing 160% (10m people) since 1970's. 20% of Florida's population is in central cities, 55% in inner suburbs, 17% in outer suburbs, and 7% in rural. Florida has "anti-growth and anti-affordable housing sentiment present within the community" Burge 2005 p 146

Impact Fee Regime

The second criterion examined looked at the nature of the impact fees in the various study areas. This included examination of the types of services fees were levied for, the relative maturity of the fee charging system in relation to the study period, and the relationship between impact fees and the average house price. These findings are summarised in Tables 5 – 7 below.

Table 5 presents data on the scope of services funded by impact fees in each jurisdiction. Not surprisingly the Florida studies are consistent in the services funded by impact fees. Both Campbell and Burge include other up front planning-associated fees in their calculations. Whilst strictly speaking these do not fall within the definition a of an impact fees (and both acknowledge this), the rationale for their inclusion does appear sound and holistic. Burge provides a further delineation of impact fees: those services that are commonly paid for by user charges (sewer and water), and those services that are commonly paid for by property taxes (roads, schools etc).

Table 5 Public Infrastructure Funded by Impact Fee

Author	Public Infrastructure Funded by Impact Fees
Mathur, Waddell & Blanco	Washington: public streets and roads; publicly owned parks, open space; and recreation facilities; school facilities; and, fire protection facilities in jurisdictions that are not part of a fire district.
Ihlanfeldt and Shaughnessey	Florida: Sewer, water, roads, parks, police, fire, schools, libraries and other public goods.
Campbell	Florida: Sewer, water, roads, parks, police, fire, schools, libraries and other public goods. "Impact Fees" include any one off fee intended to access public services, including any connection fees, permit fees, meter fees etc.
Evans-Cowley, Forgey and Rutherford	Texas: Sewer and water primarily, but can also include roads and stormwater drainage.
Burge and Ihlanfeldt	Florida: 44 counties have water/sewer fees and of these, 35 have other non water/sewer fees that include: roads, schools, parks, libraries, police, fire, jails and emergency medical services. (Most common: road, school and park.). "Impact Fees" includes: connection fees, tap fees, capacity fees, system development charges.

Table 6 below collates the data on when fees are charged, when impact fees were introduced in each jurisdiction and any history of impact fee increases over the study period.

All jurisdictions are consistent in charging fees on developers as part of the planning process, when building permits are issued. "Platting" is a term that refers to land subdivision and is relevant to the Texas study, as it assessed the incidence of impact fees on new lots (rather than the new home built thereupon as in each of the other studies. Hence there would be no building permit applicable.)

It is useful to recap the study period information from Table 3 in this table, so that comparison can be made between the start of the study period and the time impact fees were introduced. It is interesting to note that not one of the studies mentioned the introduction of impact fees as a selection criterion for the start of their study period. This becomes more intriguing when analysis indicates that some of these studies had start dates *after* impact fees were introduced (Evans and Burge), whilst other had start dates *before* impact fees were introduced (Mathur and Shaughnessey) and one provides no impact fee start date at all (Campbell). This is a surprising finding and provides no further guidance as to the selection of study durations. Burge does imply the availability of data determined the start of his study period. Data availability is discussed further in connection with Table 9.

All studies are consistent in noting either the growth in impact fee usage and/or rapid increases in infrastructure charges over the study period.

It is worth noting that as all studies were of single family detached dwellings, the impact fees indicated in all instances are for that sector of the market only i.e. these are the charges that apply for a new single family detached dwelling.

Table 6 Impact Fee Characteristics

Author	Impact Fee Characteristics
Mathur, Waddell & Blanco	Washington (King County) Study period 1991 - 2000 Impact fees collected from developers at the time building permits are issued. In 1994, 2 cities charged impact fees, growing to 14 cities in 2000.
Ihlanfeldt and Shaughnessey	Florida (Dade County, Miami) Study period 1985 - 2000 Impact fees collected from developers at the time building permits are issued. Impact fees introduced in 1988 = $879 road fee per single family detached dwelling, several increases through to 1995 = $5239 for an average size home (2072 square feet).
Campbell	Florida (6 counties, Orlando) Study period 1997 - 2001 Impact fees collected from developers at the time building permits are issued. Some jurisdictions had over 30 increases in impact fees over the 5 year study duration, others had none. Separate fixed fees levied for each different public service. Majority of jurisdictions levy fees by dwelling irrespective of dwelling characteristics, however several jurisdictions determine fee by number of bedrooms or other house attribute such as size or number of fixtures (for water/sewer). Outlying counties charge varying transport levy depending on development location. Models run for each jurisdiction.
Evans-Cowley, Forgey and Rutherford	Texas (43 cities Austin, Forth Worth, Dallas and Houston 1990-1997). Study period 1990 - 1997 Note only 40% of the largest 25 cities in Texas have impact fee programs. Impact fees introduced initially in 1987. 17 cities introduced fees due to high growth between 1995-1998. Levied at time of platting or when building permits are issued on a per single family home basis.
Burge and Ihlanfeldt	Florida (41 counties with full data sets) Study period 1993 – 2003 Separate studies carried out for water/sewer fees and non/water sewer fees. Rationale is that water/sewer fees are usually financed by user fees, whilst non water/sewer fees are financed by local property taxes. Fees have grown rapidly from $125 in 1977 Fees in Florida are not near the full marginal cost of infrastructure provision.

Table 7 below provides data on the average (and range) of impact fees charged over the relevant study periods, and indicates this as a percentage of the average house price in those jurisdictions. As would be expected, the Florida fees are consistent around $5,400 per single family home. In Washington the average fees are much lower at only $899, and slightly higher in Texas at $1,540. In Texas this lesser fee may be due to the lesser services funded (refer to Table 6), however this does not explain the low charge in Washington. Whilst the Washington average appears low, its upper end range limit is the highest reported in all studies. Indeed there is a very wide range of fees indicated for all of the studies. Burge provides information only on one standard deviation, hence the numbers provided in the range for that study show less variance than the remainder. This high variance in impact fee levels across any one study is a feature that warrants closer examination in future research.

Burge (2005) acknowledges that the actual cost of providing the additional infrastructure for new development is estimated at $40,000 and that no Florida fees approach this amount. This is somewhat surprising and would seem to imply that property taxes are still used to fund growth in all studied communities, despite community opposition to funding growth related infrastructure is one of the key reasons touted for the introduction of impact fees in these jurisdictions.

The relationship between impact fees and average house prices is important as it provides a reference point as to the size of the impact fee impost and the subsequent dollar or even percentage increase to the cost of housing. Whilst in the absence of any other related information the impact on housing affordability cannot be deducted, however by virtue of understanding this relationship between average impact fee and average house price, a flavour for the scale of the potential issue can be developed. From Burge's work, it can be seen that impact fees form a much greater percentage of the overall house price for smaller (more affordable) homes than larger (less affordable) homes.

It is interesting to note that Campbell was the only author to provide data on this relationship of impact fees to average house prices. This is despite both Mathur et al's and Burge's work separating out either the quality or size of homes respectively. With the exception of Evans-Cowley et al, this factor was able to be derived from available data. It is interesting that even within Florida, the average impact fee as a percentage of average house price ranges from 2.28% to 7.45%.

Table 7 Impact Fee relationship to Average House Price

Author	Impact Fee relationship to Average House Price		
	Average Impact Fee (Range)	**Average House Price (Range)**	**% Average Impact Fee to House Price (Range)**
Mathur, Waddell & Blanco	$899 ($0 - $11,483)	$246,000 ($52,000 – $765,000)	0.37%* (0% - 1.5%)*
Ihlanfeldt and Shaughnessey	$5,239	$230,278 (sourced from Burge data)	2.28%*
Campbell	$5,408 ($201 - $9,933)	$72,571 ($35,115 - $217,634)	7.45% (0.28% – 15.98%)
Evans-Cowley, Forgey and Rutherford	$1,540* ($243 - $4,301)	No data provided	
Burge and Ihlanfeldt	$5,336 ($2,857 - $7,815* sd) $5,497 ($2,937 - $8,057* sd) $5,726 ($2,968 - $8,484* sd)	Small $72,640 ($38,360 – $149,133) Med $ 120,796 ($70,521 – $240,684) Large $229,998 ($123,078 – $582,047)	7.35%* (5.24%-7.45%)* 4.55%* (3.35%-4.16%)* 2.49%* (1.46%-2.41%)*

* Calculated by author
sd = one standard deviation

Data Requirements and Sources

The final criterion analysed was the scope of data required and the various sources for data collection. This is relevant as it starts to shed light on the key variables and assumptions underpinning the econometric models used. In saying that, it is acknowledged assessment of model designs are outside the scope of this preliminary analysis.

It can be seen from the sheer length of Table 8 that each model required a very high number of separate data items for each record. When combined with the hundreds of thousand records some of the models incorporated, the enormous scale of these studies becomes apparent. Data capture, referencing, cleansing and integrity systems would need to be strictly monitored and maintained. Collection and manipulation of this data would be a very time consuming process.

Whilst the sources of data was not always explicitly disclosed, all studies reference multiple data sources. Campbell highlights over 100 data sources were required and acknowledges that this resulted in inconsistencies between sources, which required significant ground truthing to ensure reliable results.

The availability of a very wide range of data is an underpinning fundamental for any future empirical work in this space.

Table 8: Key Data Requirements and Sources

Year/Author	Key Data Items (Source)
Mathur, Waddell and Blanco	Structural Attributes • House size in square feet (WAGDA[4] and county tax assessors office) • Number of bedrooms and bathrooms (WAGDA and county tax assessors office) • Number of fireplaces (WAGDA and county tax assessors office) • Quality of construction (WAGDA and county tax assessors office) • Lot size (WAGDA and county tax assessors office) Locational Attributes • Presence of a view to lake or mountain (WAGDA and county tax assessors office) • Presence of traffic noise • Latitude and longitude of each lot (WAGDA and county tax assessors office) • GIS for spatial analysis of distance highways and urban centres (Franklin and Wadell's 2003 regional transportation model) Jurisdictional/Regional Attributes • Jurisdictional crime rate (Washington Association of Sheriffs and Police Chiefs) • Municipal expenditure (Washington State Auditors Office) • School expenditure per school student (Office of Superintendent of Public Schools) • Population growth rate (US Census) • number of building permits • Long term mortgage rates (30-40 years) • property tax rates (Association of Washington Cities Annual Tax and User Fee Survey data book) • construction cost index (RS Means Building Construction Cost Data Book) Policy Impacts • impact fees (Association of Washington Cities Annual Tax and User Fee Survey data book) • mitigation fees – State Environment Policy Act fees are alternatives/supplements to impact fees(Association of Washington Cities Annual Tax and User Fee Survey data book) • GIS for spatial analysis of distance to growth boundary Other • New single family house sales (WAGDA and county tax assessors office) • Median and personal income (US Census) • Season, time of year of sale • Jurisdictional dummy

[4] Washington State Geospatial Data Archive

Year/Author	Key Data Items (Source)
Ihlanfeldt and Shaughnessey	Stage 1 – Constant Quality price Index • Housing and land sale data: date and price of three most recent sales (GIS-map version of County Property Appraiser 2011 tax roll) • Housing structural characteristics: land use code, year home built, lot size, Property assessment information, zoning, house sixe, number of bedrooms and bathrooms, *xy* coordinates (GIS-map version of County Property Appraiser 2011 tax roll) • Neighbourhood demographic characteristics (Census GIS map) • Distance to employment centres (Census Transportation Planning Package) • Jurisdictional dummy variables Stage 2 – Stock Flow Model • National and city construction cost indices (RS Means) • prime loan rate (Federal Reserve) • Housing stock as a percentage of households (University of Florida) • Rent of primary residence (CPI) • Annual per capita personal income (US Bureau of Economic Analysis) • 30 year average mortgage rate (Federal Home Loan Mortgage Corporation) • population weighted county millage rate (Dade County Property Appraiser) • total impact fees (Dade County Planning and Zoning Dept)
Campbell	No central collection agency for impact fee data. Data collected from over 100 sources including: • housing and land sale data: date and price (excluding non arms length transactions) (Property Assessor's Offices) • Impact fee rates over study period (Planning departments and Engineering Offices) • Property tax millage rates (State Government) Other sources (data not identified): • academics, planning community. Other data (source not identified) • Locational dummy – not defined • GIS data on each house sale - enables spatial autoregression • Median income (market demand variable) • Percentage change in population (market demand variable) • Numerous house feature variables defined in Table A38-43 for which data collection is not explained. Some errors in overlaps acknowledged
Evans-Cowley, Forgey and Rutherford	This empirical research is subsequent 2000 thesis by Evans on equity, efficiency and effectiveness of impact fees. Data set for empirical study is sourced from 2000 works. • Average impact fees (Real Estate Centre, Texas A&M University) • Land Values (CompactData – reseller of appraisal/valuation rolls from 18 counties) • Lot size • Property tax rate (Texas Comptroller of Public Accounts) • Household income (US Census Bureau) • City population growth • Average house construction cost per square foot • Average housing price per square foot • Impact fee (City/County office) • GIS data for latitude and longitude
Burge 2005 Burge and Ihlanfeldt 2006	• Impact fees (water/sewer) (county planning department) • Impact fees (non water/sewer) (county planning department) • Annual house completions (county documents) • House living area (This study separated houses by size: small-2bed, medium-3bed, and large-4bed) • House sale data: date and price for two most recent sales (County tax rolls) • Locational data (city or inner suburban for central counties) • Population growth per annum(county documents) • Per capita income(Florida statistical abstract) • Construction cost index (RS Means) • Land cost (municode.com)

FINDINGS

This preliminary analysis of the existing US empirical models has been carried out to identify relevant study area selection criteria. These are not clearly stated in the majority of the models, and appear to be implicit assumptions. This process will assist in identifying potentially suitable study areas (and durations) for future research in Australia.

Analysis of the various data gives little enlightenment as to the study durations selected. The studies vary in length from 5-15 years, with impact fees being introduced before the start date for some studies and after the start date for others. With the exception of Evans-Cowley et al, no rationale is provided for study durations, apart from the implicit implication that those are the periods that data was available for. This is an unsatisfactory finding and gives little guidance on the selection of study durations for any subsequent works.

The scale of the study is determined somewhat by the duration i.e. more records over a longer time period. These studies showed a variance of near 8 fold from the smallest (Mathur et al: 14, 103) to the largest (Campbell: 103,444). Hence the scale of new house sales in itself does not appear to be a key selection criterion. Further, whilst some studies examined the impacts on existing housing as well, no comparisons were made between the proportions of new to existing homes. One related market feature that was common to all studies was the presence of higher than average population growth in each of the study areas. Therefore, it is this criterion that is deemed to be the overriding factor, over scale, or proportion of new to existing housing.

The services funded by impact fees, the fee calculation methodology and the time they are levied at are relatively consistent in each study. Interestingly, each of the study areas experienced rapid growth in the quantum and number impact fees over the study period. This may indicate an evolving impact fee regime, rather than one of maturity. This finding warrants further examination in subsequent research to assess whether this is a positive, negative or neutral feature in the methodology and study area selection criterion.

The quantum of impact fee and its proportion of average house price varied greatly from study to study. Interestingly, only one author (Campbell) made explicit reference to this feature that could well be argued has a place in the housing affordability debate. This is somewhat surprising given two of the authors (Mathur et al and Evans-Cowley et al) have urban planning backgrounds, rather than that of the economist as with each of the Florida based authors.

A large variance was noted in the dollar range of infrastructure charges across each study area. This is perhaps best demonstrated by Mathur et al's study that had the lowest average charge of $899 per new single family home, but had both the highest and lowest range being $0 and $11,483 per new single family home respectively. Further examination of the use of high and low end data will form part of future research into the specific model methodologies.

Impact fees in the US do not come close to the marginal cost of providing infrastructure. Again, this finding warrants further examination in subsequent research to assess whether this is a positive, negative or neutral feature in the methodology and study area selection criterion.

The last key finding was in relation to the data requirements for these types of econometric modelling. Vast amount of data was necessary for each of the studies, with this data being sourced from multiple parties. In saying this, the majority of the data was sourced from various government or county offices, which implies it may be readily available, just not centrally located. Clearly this issue is amplified with a wide study area across numerous jurisdictions. The availability of a very wide range of data is an underpinning fundamental for any future empirical work in this space.

CONCLUSION

Despite a significant body of research on the incidence of impact fees 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.

This research relied on archival methods to examine the empirical models developed in the US over the past decade. The purpose of this work was to conduct a preliminary analysis of these prior works to identify explicit and implicit key study area selection criterion, as the first step in determining if any of these models are adaptable to the Australian context. Data was collated on three main areas of focus to derive relevant information. These three areas included 1) study area location, duration, scale, and market characteristics; 2) impact fee regimes and characteristics; and 3) data requirements and sources. There was little consistency identified across the models for the majority of these criteria. Whilst this is a somewhat unsatisfactory finding, it does give comfort that appropriate outcomes can be gained from data with widely varying criteria and characteristics. Further research is required to determine if any of these models are able to be adopted or adapted for use in the Australian context. This further research will involve selection of an Australian case study area and the collation of data, as well as analysis of the actual econometric fundamentals adopted.

REFERENCES

ARCHIVAL RESEARCH. *The SAGE Encyclopaedia of Social Science Research Methods* [Online]. Available: http://srmo-dev.ifactory.com/view/the-sage-encyclopedia-of-social-science-research-methods/n20.xml [Accessed September 14, 2011].

AUSTRALIAN BUREAU OF STATISTICS. 2011. *Catalogue No 3101.0 Table 4* [Online]. Available: http://abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3101.0Dec%202010?OpenDocument [Accessed 7 June 2011].

BEEN, V. 2005. Impact Fees and Housing Affordability. *Cityscape: A Journal of Policy Development and Research,* 8**,** 139-185.

BRYANT, L. E. & EVES, A. C. Year. Proceedings of 2011 International Conference on Construction and Real Estate Management. *In:* 2011 International Conference on Construction and Real Estate Management, 19-20 November, 2011 2011 Guangzhou, China. China Architcture and Building Press, 894 - 899.

BURGE, G. S. 2005. *A theoretical and empirical investigation of the effects of impact fees on the affordability of starter homes.* Ph.D. 3216578, The Florida State University.

BURGE, G. S. 2008. Impact Fees in Relation to Housing Prices and Affordable Housing Supply. Available: http://faculty-staff.ou.edu/B/Gregory.S.Burge-1/Publications%20and%20Working%20Papers/Impact%20Fees%20in%20Relation%20to%20Housing%20Prices%20and%20Affordable%20Housing%20Supply.pdf [Accessed 19 May 2010].

BURGE, G. S. & IHLANFELDT, K. 2006. Impact Fees and Single-Family Home Construction. *Journal of Urban Economics,* 60**,** 284-306.

CAMPBELL, D. A. 2004. *The Incidence of Development Impact Fees.* Doctor of Philosophy, Goergia State University.

EVANS-COWLEY, J., S., FORGEY, F. A. & RUTHERFORD, R. C. 2005. The Effect of Development Impact Fees on Land Values. *Growth and Change,* 36**,** 100-112.

EVANS-COWLEY, J. S. & LAWHON, L. L. 2003. The Effects of Impact Fees on the Price of Housing and Land: A Literature Review. *Journal of Planning Literature,* 17**,** 351-359.

EVANS, J. S. 2000. *Evaluating the equity, efficiency and effectiveness of development impact fees.* Ph.D. 9980145, Texas A&M University.

IHLANFELDT, K. R. & SHAUGHNESSY, T., M. 2004. An Empirical Investigation of the Effects of IMpact Fees on Housing and Land Markets.

LAWHON, L. L. 1996. *Equity considerations of development impact fees and the effect of such fees on the price of housing for low- and moderate-income residents.* Ph.D. 9718394, Texas A&M University.

MATHUR, S. 2003. *Effect of impact fees on housing prices: Analysis of quality differentiated single family housing market of King County and Snohomish County, Washington.* Ph.D. 3102679, University of Washington.

MATHUR, S., WADDELL, P. & BLANCO, H. 2004. The Effect of Impact Fees on the Price of New Single-family Housing. *Urban Stud,* 41**,** 1303-1312.

PRODUCTIVITY COMMISSION 2011. Performance Benchmarking of Australian Business Regulation: Planning, Zoning and Development Assessment. Canberra: Research Report.

RESIDENTIAL DEVELOPMENT COUNCIL OF AUSTRALIA 2006. Residential Development Cost Benchmarking Study. Sydney: Residential Development Council of Australia (RDC).

RESIDENTIAL DEVELOPMENT COUNCIL OF AUSTRALIA 2007. Boulevard of Broken Dreams: the Future of Housing Affordability in Australia. Sydney: Residential Development Council of Australia (RDC).

SHAUGHNESSY, T. M. 2003. *Estimation of the effects of development impact fees on housing and land markets.* Ph.D. 3137486, The Florida State University.

TEDDLIE, C. & TASHAKKORI, A. 2009. *Foundations of Mixed Methods Research - Integrating Quantitative and Qualitative Approaches in the Social and Behavioral Sciences. ,* California, SAGE Publications.

URBAN DEVELOPMENT INSTITUTE OF AUSTRALIA 2007. An Industry Report into Affordable Home Ownership in Australia. Sydney: Urban Development Institute of Australia (UDIA).