Impact Fees and Single-Family Home Construction

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Abstract

The development community has argued that impact fees that finance public infrastructure are a tax on residential development, which reduces the construction of new homes. Our theoretical model shows that impact fees may expand housing construction within suburban areas by reducing exclusionary regulations and increasing the percentage of proposed projects receiving local government approval. Using panel data estimation techniques that allow us to control for unobservable heterogeneity and potential endogeneities, we find that impact fees earmarked for public services other than water and sewer system improvements increase the construction of small homes within inner suburban areas and of medium and large homes within all suburban areas.

I. Introduction

This paper provides a theoretical and empirical analysis of the effects of impact fees on single-family home construction. Impact fees are one-time levies, predetermined through a formula adopted by a local government unit, that are assessed on property developers during the permit approval process. They are used for the provision of public infrastructure services (such as roads, schools, parks and other recreational areas, libraries, and water and sewer) that are necessary to adequately serve new development.[1]

Roughly a quarter of local governments now use impact fees [19]. The development community has argued that impact fees are a tax on residential development, which reduces housing construction by causing a backward shift in the housing supply curve.[2] Developers also maintain that impact fees discriminate against the construction of smaller homes. Presumably, this is because home builders find the fees, which generally are only slightly higher for larger homes, easier to pass forward to higher income buyers in comparison to lower income buyers. There is therefore real concern that impact fees may reduce the supply of affordable homes. This has led to the worry that impact fees may hinder efforts to integrate communities and may contribute to lower homeownership rates among Hispanic and African Americans [3,5].

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[1] Impact fee ordinances typically must satisfy the "rational nexus" test, which requires (1) a clear connection between new growth and the need for new capital facilities, (2) fees that are proportional to the costs of providing the facility, and (3) that the payer of the fee benefit from the new public facilities. One implication of the nexus test is that communities are prevented from rent-seeking, in that they cannot set the fee at "what the market will bear".

[2] See the internet pages of the Urban Land Institute (www.uli.org), the National Association of Home Builders (www.nahb.org), and the National Association of Realtors (www.realtor.org) for their positions on impact fees.

In this paper we show that the effects of impact fees on housing construction are more complicated than what has been acknowledged by developers. Our theoretical model shows that while impact fees reduce housing supply by directly increasing developers' costs, they may also increase supply by indirectly reducing project approval costs and by relaxing implicit limits on the percentage of permit applications that receive local government approval. Impact fees also increase the demand for housing because they reduce homebuyers' expected future property tax liabilities.[3] A distinction is drawn between impact fees that support public services funded by the property tax and impact fees that help fund services covered by a user fee.

To empirically investigate the net effect on housing construction from the above supply and demand changes resulting from impact fees, we employ a unique panel of impact fees for counties within the state of Florida. Separate housing completions models are estimated for small, medium, and large-sized single-family homes located within central cities, inner suburbs, outer suburbs, and rural areas. The panel nature of the data allow us to exploit a variety of different estimation techniques that control for unobservable factors and possible endogeneities that otherwise may have biased the results. These techniques include fixed effects, random trend, and lagged dependent variable models.

The results indicate that non-water/sewer impact fees (i.e., fees earmarked for services traditionally funded by the property tax) increase the construction of all sized homes within inner suburban areas, and medium and large-sized homes within outer

[3] This idea is proposed by Yinger [29] and empirical support for the proposition is provided by Ihlanfeldt and Shaughnessey [17].

suburban areas. In none of the models are water/sewer impact fees found to affect the number of single-family home completions.

II. Impact Fees and Single-Family Home Construction

Our theory linking impact fees to housing construction represents a simple extension of the standard urban model. In this model all development occurs on the urban fringe, where land is available at the agricultural price. For simplicity we assume that lot size is fixed at one unit. The price per unit of housing stock falls moving away from the city center, due to higher commuting costs. Moving outward, as long as the declining price per unit of stock exceeds the per unit cost of construction, agricultural land is developed into single-family homes. Equilibrium is achieved where demand and supply prices are equal:

$$V = C + P_L + F_T + F_U + A \quad (1)$$

where V is the price per unit of housing stock. The right hand side of (1) includes the costs incurred in building one unit of stock. C is the opportunity cost of construction, allowing for a normal rate of return; P_L is the agricultural price of land; F_T and F_U are impact fees earmarked for public services financed by property taxes and user fees, respectively; and A are project approval costs imposed on the developer by local government (i.e., explicit fees, compliance costs, and time delays), besides impact fees.

In a dynamic context, it is reasonable to assume that the value of V at the urban fringe is increasing over time as the result of steady increases in income or population. Hence, the city edge is continuously expanding outward. What we show below is that an increase in F (either T or U) also increases V and may reduce A. If the increase in V is larger than the net change (ΔF-ΔA) on the right hand side of (1), the growth of the city accelerates. If the reverse is true, then growth decelerates.

First consider F_T.[4] The dependence of V on F_T follows from housing demand theory. This theory posits that the consumption demand for housing is a demand for housing services and not a demand for housing stock. Hence, the relevant price is the rental price per unit of housing services, which can be thought of as the annual rent (R) paid to occupy one unit of housing stock for one year. The user cost of capital (ρ) is the link between rent and housing value:

$$\rho = [\ (i_r + T)\ (1 - t) - \pi * t - g_r + c] \qquad (2)$$

where i_r is the real rate of interest; T is the property tax rate; t is the fraction of the mortgage interest and property taxes paid by the federal government; π is the rate of inflation; g_r is the real rate of capital gains; and operating costs are at the rate c. Operating costs include the costs of maintenance, repair, insurance, and utilities. There are two interpretations of ρ: 1) as the full opportunity cost of annually holding one unit of housing stock, and 2) as a capitalization rate that converts annual rents into housing value. The rates on the right hand side of (2) are current values under the first interpretation. Under the second interpretation, rates are current values only if the rates are not expected to change in the future. If housing investors, however, expect rate changes, then the rates in (2) equal weighted averages of current and expected future values, with weights reflecting normal discounting as well as greater uncertainty over distant in comparison to near term events. The price of a unit of housing stock (in both

[4] We treat impact fees as flat fees, which do not vary with the value of the home. While fees do increase according to interior square footage of the home or the number of bedrooms for some of the jurisdictions in our database, these fee increases are generally small and, on average, dF_T/dV is close to zero.

the long and short-run) must be set such that investors wish to hold the entire stock, and no more, at that price. Housing owners, therefore, must be fully compensated for the cost of capital:

$$V = \frac{R}{\rho} \tag{3}$$

An increase in F_T shifts a portion of the costs of the public infrastructure required by new development away from payers of the property tax to developers, causing T to fall, assuming the local government must balance its budget and does not change the per capita level of public services. A reduction in T lowers ρ and increases V.[5] An alternative to the assumption that increases in F_T will lead to lower future property taxes while holding the per capita level of public services constant is to allow for the reverse – future property taxes are unaffected by impact fees, resulting in increases in the per capita level of public services.[6] V is still a positive function of F_T under this alternative reaction, but for a different reason. Now the higher level of per capita services (holding property taxes constant) causes an increase in R, and therefore an increase in V. Hence, V is a positive function of F_T under all possible balanced budget reactions of the local government.

A functional relationship between A and F_T exists if a community excludes single-family housing developments based upon a fiscal motive. If the perception exists

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[5] In practical terms, one way to think about this effect is that impact fees provide an insurance policy against future property tax rate increases caused by the need to finance additional public infrastructure for new residents.

[6] Note that public service levels rise throughout the community, even though "rational nexus" tests require that impact fee revenues be spent on capital projects that directly affect the new development. An example is the use of school impact fee revenues to pay for a portion of the cost of a new elementary school. This increases consumption of public services for all households if the new school alleviates overcrowding problems at existing elementary schools.

that these developments do not generate enough additional property tax revenue to cover the costs of providing them with public services, the community may adopt exclusionary zoning and other exclusionary regulations.[7] These regulations increase the developer's costs of obtaining project approval.[8] For example, if single-family housing is seen as a free rider, less land may be zoned for single-family homes, increasing the likelihood that the developer must obtain a rezoning in order to build. Rezonings lengthen the project review process and increase the developer's compliance costs.[9] An increase in F_T mitigates the fiscal deficit imposed on the community by the residential development, which may cause the community to zone more land for residential improvements, make variances/rezonings in favor of residential developments easier to obtain, or reduce in other ways the developer's permanent project approval costs.[10] Hence, A is a negative function of F_T.

Differentiating (1) with respect to F_T shows that an increase in F_T may increase or decrease single-family home construction:

$$\frac{dV}{dT}\frac{dT}{dF_T} > 1 + \frac{dA}{dF_T} \Rightarrow \uparrow \text{construction} \qquad (4)$$

$$\frac{dV}{dT}\frac{dT}{dF_T} < 1 + \frac{dA}{dF_T} \Rightarrow \downarrow \text{construction} \qquad (5)$$

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[7] After reviewing the evidence, Burchell et al. [7] conclude that most residential development has a negative fiscal impact on the home community. See Ihlanfeldt [16] for a review of the evidence on various forms of exclusionary land-use regulation.

[8] We assume the residential land developer is also the homebuilder. Separating land development from homebuilding complicates the model without altering its main conclusions.

[9] Compliance costs are payments to engineers, surveyors, and attorneys in order to satisfy specific rules and regulations that govern changes in the local jurisdiction's land use map.

[10] Based on the assumption that the fiscal motivation for exclusion is important, Gyourko [13], Altshuler and Gomez-Ibanez [2], and Ladd [18] have all suggested that impact fees may temper exclusionary zoning and other types of exclusionary regulations.

Construction will increase (decrease) if the increase in the demand price per unit of housing stock caused by a fee-induced reduction in T is greater (smaller) than one plus the fee-induced change (which will be negative) in project approval costs.

The other type of impact fee that we consider are those earmarked for public services that are funded through user fees (F_U) rather than by property taxes. The major services that F_U typically covers are water and sewer. In the absence of water and sewer impact fees, the costs of offsite water/sewer system infrastructure improvements necessitated by new development are borne by residents in the form of higher base rates.[11] Hence, there exists a fiscal incentive for exclusion that may be mitigated by F_U, resulting in lower project approval costs for developers. An increase in F_U also affects the demand price of single-family housing by causing a reduction in the rate of operating costs (c) in the user cost of capital expression (equation 2). Analogous to conditions (4) and (5) showing the construction effects of F_T, for F_U we have:

$$\frac{dV}{dc}\frac{dc}{dr}\frac{dr}{dF_U} > 1 + \frac{dA}{dF_U} \Rightarrow \uparrow \text{construction} \tag{6}$$

$$\frac{dV}{dc}\frac{dc}{dr}\frac{dr}{dF_U} < 1 + \frac{dA}{dF_U} \Rightarrow \downarrow \text{construction} \tag{7}$$

where r equals a weighted average of current and expected future water and sewer base rates.

The magnitudes of the derivatives appearing in equations (4) - (7) may vary by the size and location of homes, resulting in impact fees having varying effects on

[11] The offsite vs. onsite cost distinction is important. Well before impact fees became popular, local water/sewer authorities had charged developers for the actual onsite costs of connecting to the system and even for physical line extension costs in applicable cases. Offsite costs stem from the fact that new development eventually necessitates improvements/additions to the system that allow for more capacity.

housing construction. Because the property tax is an ad valorem tax, dV/dT is greater for more expensive homes. However, because less expensive homes impose a greater fiscal deficit on the community than more expensive homes, dA/dF_T is expected to be greater in absolute value for lower valued homes. The absolute magnitude of dA/dF_T may also vary by location: in comparison to suburban areas, it is expected to be small within both central cities and rural areas. In the latter areas, land use regulations are far less exclusionary in comparison to those that commonly prevail within suburban areas [16]. By the same argument, the absolute magnitude of dA/dF_U may also be greatest within suburban areas. Finally, dT/dF_T and dr/dF_U are expected to be larger in absolute magnitude if homeowners expect greater population growth within their community, because the greater the future population growth rate, the larger the fiscal deficit imposed on existing homeowners if all new capital services are funded from property taxes (or user fees in the case of water and sewer services).

To explore possible locational differences in the housing construction effects of impact fees, we estimate single-family home construction models separately for central cities, inner suburbs, outer suburbs, and rural areas.[12] All of our empirical models are also estimated separately for three size classes of homes (small: 600-1500 square feet of interior living space, medium: 1501-2200 square feet, and large: 2201-5000 square feet). We stratify by home-size class for two reasons: 1) as outlined above, a number of the derivatives determining the effects of impact fees on housing construction vary with home value, which is highly correlated with the size of the home, and 2) we are

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[12] Areas are determined according to U.S. Census MSA definitions. Central city areas are taken directly from Census definitions. Areas of counties containing a central city but located outside of central city areas are defined as inner suburban areas. Outer suburban areas are counties defined as being a part of a MSA but that do not contain any central city. Rural areas are counties that are not part of a MSA.

particularly interested in whether impact fees increase the supply of smaller homes within suburban areas. If exclusion is not fiscally motivated ($dA/dF_T = 0$) or if fee-induced reductions in project approval costs do not decline with value, then an increase in F_T will cause developers to shift up market and build more expensive homes (as noted above, dV/dT is a positive function of V). In this case, an increase in F_T would reduce the construction of smaller homes within suburban areas. However, as noted above, dA/dF_T is expected to be larger in absolute magnitude for lower valued homes. A priori, it is therefore ambiguous whether impact fees create more homeownership opportunities for lower income households in the suburbs. Only empirical investigation can resolve this issue.

Thus far it has been shown that *changes* in impact fees may create a difference between the demand and supply price of housing, resulting in a change in housing construction. However, given a difference between demand and supply prices, the *level* of impact fees may alter the percentage of residential projects annually proposed by developers that receive approval from the local government. Many economic and political factors play a role in the approval process, and it is beyond the scope of this paper to model this complicated process. However, regardless of how the benefits and costs of a yes vote are perceived by the individual government official, impact fees are likely to move the benefit to cost ratio from voting in favor of some projects from below to above one. Impact fees provide a specific monetary benefit to the community from project approval. They may also make it politically less costly for government officials to side with pro-growth groups within the community, to the extent that anti-growth groups believe that impact fees are in fact a tax on development. Finally, there may be less opposition from neighbors in the vicinity of the proposed development if they believe that impact fees will mitigate negative externalities, such as congested roads or schools, imposed on them by the development.

As is true for changes in impact fees, levels of impact fees may also display differential effects across areas. Fiscal exclusion can negatively affect both the housing supply curve (via more stringent land use regulations) and the percentage of projects approved each year. Impact fee levels are therefore expected to increase project approval percentages the most within suburban areas where pre-existing exclusionary regulations are the most prevalent.

III. Literature Review

While roughly a dozen studies have analyzed the effects that impact fees have on housing prices (for a review see [17]), the literature on the relationship between impact fees and housing construction is comparatively thin – consisting of empirical studies by Skidmore and Peddle [25] and Mayer and Somerville [20] and theoretical studies by Brueckner [6] and Turnbull [27].

Skidmore and Peddle's data are a panel of 29 cities lying within Dupage County, a suburb of Chicago, covering the years 1977 to 1992. They regress the number of new single-family homes built in city i in year t on a dummy variable indicating whether the city had an impact fee in year t; year and city dummy variables, resulting in a two-way fixed effects model; and a number of control variables, including per household property tax revenue and average assessed valuation of property in city i in year t. They find that impact fees reduce a city's residential development by 30 percent per year.

Because their impact fee variable simply registers the existence of a fee and not the dollar amount of fees nor the type of services funded by the fee, it is difficult to place much confidence in Skidmore and Peddle's results. Moreover, because new homes are, on average, more expensive than existing homes, their control variables are not exogenous to the number of new homes built.

Mayer and Somerville use quarterly data on 44 metropolitan areas covering the years 1985 to 1996 to regress the log of the number of single-family housing construction permits issued on impact fees, other land use regulatory variables, and a set of control variables. Like Skidmore and Peddle, Mayer and Somerville use a dummy variable as the measure of impact fees. However, Mayer and Somerville's impact fee variable is measured with even greater error than Skidmore and Peddle's. For all quarterly observations coming from a particular MSA the impact fee dummy variable equals one if impact fees were used somewhere within the MSA in 1989. Not surprisingly, this variable is not found to affect the number of single-family construction permits.

Regarding the theoretical literature, Brueckner [6] compares an impact fee scheme for infrastructure financing to two alternative types of cost-sharing schemes. Contrary to conventional wisdom, he concludes that switching from a cost-sharing to an impact fee scheme can stimulate growth under certain conditions. Turnbull [27] compares development patterns that result from impact fees, urban growth boundaries and an unregulated environment. He finds that optimally constructed impact fees induce development rates that are efficient in both the steady state equilibrium and in the transitional path towards equilibrium. In this framework, impact fees are found to lead to slower rates of development than either growth boundaries or the unregulated environment.

IV. The Panel Data Set

A complete history of impact fees was obtained for each of Florida's counties by contacting county planning and building offices.[13] Through these contacts we were able to obtain all current and past impact fee schedules. Based upon our theoretical model, fees are divided into two types: those that pay for part of the infrastructure costs of services funded by user fees and those that partially cover the infrastructure costs for those services funded by property taxes. The first type includes water and sewer impact fees, while the second category includes all other impact fees (henceforth labeled non-water/sewer fees). Non-water/sewer fees are used to help fund a wide variety of local public services, with fees for schools and roads being the largest and most popular. Impact fees in Florida are county-wide, but some cities also impose their own fees on top of those charged by the county. The city fees are in all cases small relative to county totals and are therefore ignored in our analysis.

Of Florida's 67 counties, 41 are found to have used either one or both types of impact fees over the eleven year period (1993 – 2003) covered by our panel (and had

[13] Florida is an ideal state to study, given that impact fees are widely used and have a long history. However, the concern might be raised that Florida's concurrency policy may render our results unique to Florida. Concurrency, which was initiated by the 1985 passage of Florida's Growth Management Act, requires local governments to provide public facilities needed to support development "concurrent" with the impacts of such projects. One view of impact fees is that they provide the funding necessary to satisfy concurrency regulations, thereby allowing residential projects to be approved by local government that otherwise would be denied. However, due to a myriad of problems surrounding its implementation, concurrency has been ineffectual and has not been a binding constraint on development within Florida's Counties [4,23,26]. Hence, there is little reason to believe that concurrency has affected our results or their applicability to other areas.

complete data for the other variables defined below).[14] These are the counties included in our panel data set.[15] They are found throughout the state, with 19 being central counties (i.e., counties containing a central city), 15 being suburban counties, and 7 being rural counties.

Within some counties, impact fees increase with the square feet of living area and/or the number of bedrooms. Our impact fee variables – one for water/sewer and one for non-water/sewer services – are standardized across counties for single-family homes of three sizes: a 1200 square foot, 2 bedroom home; an 1800 square foot, 3 bedroom home; and a 2900 square foot, 4 bedroom home (see Table 1).[16] These homes represent the average home within the three size classes of homes we analyze: 600 – 1500 square feet, 1501 – 2200 square feet, and 2201 – 5000 square feet. The average price of a new home falling within each of these size classes was $106,185, $139,384, and $228,189 in 2002. Hence, homes falling into these respective categories can be considered very affordable, affordable, and unaffordable to moderate income households.

While a number of counties adopted either water/sewer fees or non-water/sewer fees for the first time during the years covered by our panel, most of the variation in impact fees within counties comes from two other sources. First, there are increases in non-water/sewer fees as the number of services funded by impact fees grows over time. Second, fees earmarked for individual services have increased to cover a larger portion

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[14] Of the 49 counties that have used impact fees, eight counties are dropped because of missing data. The data items most frequently missing are the constant-quality price indexes (described below), due to an insufficient number of repeat sales.

[15] We exclude counties that have never used impact fees from our panel because we identify the effects of impact fees on housing construction by relying solely upon within-area fee variation.

[16] The variable means and standard deviations reported in Table 1 are based on the metropolitan counties. As noted below, housing construction models were estimated for the rural counties but results are insignificant for all size classes of homes and are therefore not reported.

of the costs of new public infrastructure. As impact fees have gained acceptance, they have been adjusted to more fully reflect marginal costs, but the common perception is that most individual fees remain well below the infrastructure costs of the services that they help fund.[17] Impact fees have therefore reduced, but not eliminated, the dependence on the property tax as a source of funding for public infrastructure needed for new development.[18]

Although some Florida counties first adopted impact fees as early as the late 1970's, the length of our panel data base is limited by the number of years for which we were able to obtain the property tax rolls for the individual counties from the Florida Department of Revenue. Rolls for the years 1995 to 2004 were provided. Each roll provides a complete list of homes on the property tax roll as of January 1 of the tax roll year. Single-family home completions for the year 2003 were obtained by counting the number of homes on the 2004 tax roll whose year built was listed as 2003. Completions for the years 1994 to 2002 were obtained by using the 1995 to 2003 tax rolls in the same fashion. We also obtained completions for 1991 to 1993 from the 1995 tax roll by adding up homes based on the year they were built. While this procedure extends the panel, some of the homes built over the 1991 to 1993 time period may not appear on the 1995 tax roll if they were lost from the housing inventory. Given the short amount of

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[17] The Florida Legislative Committee on Intergovernmental Relations (LCIR) addressed this issue in their 1986 report, Impact Fees in Florida. The report cites two estimates of the average marginal cost of infrastructure necessitated by a new single-family home in Florida; $10,865 from a 1973 study and $22,000 from a 1985 study. They conclude that impact fee levels do not come close to reaching this level in any location in Florida. Bringing these figures forward to current dollars and comparing them to more recent overall impact fee levels reveals this is still true today.

[18] A 1989 survey conducted by the Government Finance Officers Association (GFOA) indicates that Florida is not unique in having impact fees set at less than marginal cost. The survey found the percentage of jurisdictions' capital budgets paid for by impact fees varied from an average of two percent in Texas to an average of 60 percent in California.

time that had expired between when the home was built and January 1995, we believe the undercount in the number of completions is likely to be small. We therefore added these additional years to our panel.

Completions are divided into our three size classes based upon the total living area of the home reported on the tax roll.[19] Completions are also broken down by area. Completions for central counties were divided into those located within central cities and those located within the rest of the county (henceforth labeled the inner suburbs). Outer suburbs are defined as all metropolitan counties other than the central county.

The tax roll data also include the two most recent sales prices for each property and the year of each sale. From these data individual county constant-quality price indexes were estimated for our three size classes of single-family homes, for the all homes category, and for vacant residential land. The construction of these indexes first involved estimating the standard repeat-sales model:

$$Ln\left(\frac{P_{i,t}}{P_{i,t-n}}\right) = \sum_{k-1}^{T} \beta_k D_{i,k} + \varepsilon_{i,t,t-n} \qquad (8)$$

where $P_{i,t}$ is the most recent selling price of property i at time t; $P_{i,t-n}$ is the previous selling price of property i at time t-n; β_k is the logarithm of the cumulative price index in period t; $D_{i,k}$ is a dummy variable which equals -1 at the time of the initial sale, +1 at the time of the second sale, and 0 otherwise; and $\varepsilon_{i,t,t-n}$ is the regression error term. The estimated coefficients of (8) were then used to calculate annual nominal appreciation rates following the standard methodology developed by Halverson and Palmquist [14].

[19] Because we are using new homes, the square footages on the tax roll should be highly accurate. However, square footages for existing homes are frequently misreported on the tax rolls because room additions are unknown to the property appraiser. The unreliability of square footages for existing homes also rules out the estimation of stock-adjustment models.

Finally, after obtaining the average price of homes falling into each size class and for vacant land parcels in 2003 (calculated from the tax rolls), we construct a benchmarked annual real constant-quality price index for the years 1993 to 2003.[20]

The final data items used to complete our panel are annual values of county population, per capita income, and the Means Construction Cost Indexes (see Table 1).[21] The latter indexes are available annually for 16 Florida counties. For each year of the panel each county is assigned the annual index value of the closest city.

V. Estimated Models

While our theoretical model suggests that impact fees may affect housing construction, communities may also respond to greater housing construction by adopting or raising impact fees. Moreover, there may be unobservables that affect both impact fees and housing construction. To deal with these potential sources of endogeneity bias, we exploit the panel nature of our data by estimating a series of models that allow impact fees to be correlated with unobservables affecting housing construction. These models include two-way (area and time) fixed effects models (FE), random trend models (RT), and lagged dependent variable models (LD).

The FE model is given by equation (9):

$$C_{i,t} = \alpha_i + \gamma_t + \beta_0 WSIF_{i,t-1} + \beta_1 NWSIF_{i,t-1} + \beta_2 \Delta WSIF_{i,t-1} + \beta_3 \Delta NWSIF_{i,t-1} + \varepsilon_{it} \quad (9)$$

[20] We accomplish this by using the 2003 average value as the base and then constructing a series of nominal average values for the years 1993 to 2002 that follows our calculated annual appreciation rates. Finally, these nominal values are turned into a series of real prices using the CPI for the southeast region.
[21] Means includes the cost of materials, labor, and equipment rental costs.

where $C_{i,t}$ equals the number of houses completed in area i during year t; $WSIF_{i,t-1}$ and $NWSIF_{i,t-1}$ are levels of real water/sewer impact fees and real non-water sewer impact fees that prevailed at the end of the previous year, respectively; $\Delta WSIF_{i,t-1}$ and $\Delta NWSIF_{i,t-1}$ are changes in impact fees measured as $IF_{t-1} - IF_{t-2}$; α_i and γ_t are fixed effects for area and time, respectively; and ε_{it} is the idiosyncratic error term.[22] Equation (9) includes both levels and changes in impact fees because we have argued in Section II that both may affect housing construction. Time effects control for factors (e.g., interest rates) that uniformly affect all areas over time. Area fixed effects control for area-specific time-invariant unobservables that may affect the level of construction as well as the level of impact fees or changes in impact fees. Equation (9) is estimated by OLS, after first differencing the variables in order to eliminate the area fixed effect (α_i).[23]

The RT model adds an area-specific time trend (g_i) to equation (9):

$$C_{i,t} = \alpha_i + \gamma_t + g_i t + \beta_0 WSIF_{i,t-1} + \beta_1 NWSIF_{i,t-1} + \beta_2 \Delta WSIF_{i,t-1} + \beta_3 \Delta NWSIF_{i,t-1} + \varepsilon_{it} \quad (10)$$

This model allows each area to have its own time trend in housing construction. The area-specific trend is an additional source of heterogeneity. The RT model controls for area-specific time-invariant unobservables that may affect both the level and the trend in housing construction as well as impact fee levels or changes. We again estimate the model after first differencing. This eliminates α_i and turns $g_i t$ into an area-specific dummy variable. Hence, unobserved variables that affect the level of housing

[22] All dollar figures are expressed in real 2003 dollars according to the CPI for the southeast region.

[23] Both linear and log-linear versions of all of the models were estimated. The results with the log-linear model are somewhat weaker than those obtained with the linear model, but both sets of estimates yield the same conclusions.

construction across areas are controlled for by first differencing and the n-1 dummy variables included in the estimation control for unobserved factors that influence the trend in housing construction over time within each area.

The LD model can be expressed as follows:

$$C_{i,t} = \alpha_i + \gamma_t + \rho C_{i,t-1} + \beta_0 WSIF_{i,t-1} + \beta_1 NWSIF_{i,t-1} + \beta_2 \Delta WSIF_{i,t-1} + \beta_3 \Delta NWSIF_{i,t-1} + \varepsilon_{it} \quad (11)$$

This model, which also controls for area and time fixed effects, mitigates potential omitted variable bias that may arise from within-area movements over time in unobservables, to the extent that these movements are captured by the lagged level of housing construction. To estimate (11), the equation is again first-differenced. After differencing, $\Delta C_{i,t-1}$ and $\Delta\varepsilon_{it}$ are correlated. $\Delta C_{i,t-1}$ is therefore instrumented, using $\Delta C_{i,t-2}$ as an instrument.[24]

A possible criticism of the above models is that there may be other variables, in addition to impact fees, that vary within areas over time that affect housing construction. If movements in these variables are correlated with changes in impact fees, the estimated effects of impact fees on housing construction may be biased. However, omitted variable bias is likely unimportant given our data and approach. Bias will only result if the excluded variable commonly varies within areas, this variation is commonly correlated with the variation in impact fees within areas, and the variable has a common important effect on housing construction across areas, after controlling for

[24] As noted below, separate models are estimated for small, medium, and large-sized homes. To better identify the models, three instruments are used: $\Delta C_{i,t-2}$ for the size category of homes defining the dependent variable and $\Delta C_{i,t-2}$ for the other two size categories of homes. Models are also estimated for all homes regardless of size category. These same three instruments are used to estimate these models. As noted below, regardless of the model estimated, these instruments are jointly significant in a reduced form model of $\Delta C_{i,t-1}$ on all of the exogenous variables.

fixed effects, random growth trends, aggregate time effects, and lagged construction levels. While unlikely, omitted variable bias is still possible. We therefore estimated all models including variables that may shift either the housing demand or housing supply curves within counties. These included the change in county population, the change in county real per capita income, the change in real construction costs, and the change in real land cost. All of these variables are measured as $X_{i,t-1} – X_{i,t-2,}$ given that construction is measured by the number of completions (and not the number of starts). Generally, these variables added almost nothing to the explanatory power of the models. In the interest of efficiency, final estimation included only those variables that had t-statistics larger than one in preliminary estimation.[25]

All of the housing construction models are estimated for the years 1993 – 2003, which after first differencing results in 10 observations per county.[26] Separate models are estimated for all homes, small homes, medium-sized homes, and large homes.[27] The

[25] As noted by a referee, it is curious that the change in county population generally has a negative and statistically significant effect on single-family home construction within inner suburban areas. A possible explanation for this result comes from the effect that population growth has on the supply curve for new residential units. Because the supply of construction labor and materials is less than perfectly elastic in the short-run, population growth causes an increase in construction costs and a corresponding backward shift in the supply curve for new residential units. The short-run equilibrium construction level only rises if the increase in demand associated with population growth is large enough to overcome this supply effect. Hence, if population growth causes a significantly greater increase in the demand for multifamily housing than for single-family housing, it is possible for population growth to have a negative effect on the construction of single-family homes. This will occur if the increase in demand for single-family homes is not large enough to overcome the higher costs that affect both types of construction. A simple exercise shows this is likely the case within Florida's inner suburban areas over the time period in question. Aggregating census data over our 19 central counties, the stock of single-family homes increased by roughly 563,000 units between 1990 and 2000. However, the increase in the number of multifamily units over the same period was approximately 7,878,000- an additional 14 multifamily units for each additional single-family home.

[26] Data from 1991 and 1992 are used in estimating the lagged dependent variable housing construction models.

[27] Seemingly unrelated regression models that allowed the error terms of the three equations estimated by size category to be correlated were also estimated. The results are highly similar to those obtained from estimating the models separately. The advantage of estimating each equation separately is that heteroskedasticity-robust standard errors can be obtained. Stata, which is the statistical package used to

models are further broken down by type of area – central cities, inner suburban areas, outer suburban areas, and rural areas.[28]

VI. Results from Estimating the Home Completion Models

Tables 2, 3, 4, and 5 report the results from estimating the home completion models for all homes, small homes, medium-sized homes, and large homes, respectively. Only the results for the inner and outer suburbs are reported.[29] In the models estimated for central cities and rural areas, neither of the impact fee variables is ever statistically significant.[30] The weak results obtained for the latter areas are not surprising. An exclusionary motive does not generally affect land use regulations or project approval decisions within these areas; hence, impact fees are not expected to strongly affect the developer's project approval costs nor the probability that his project will get approval. In addition, price model results that we report later in this paper suggest that developers are partially or completely compensated for the non-water/sewer fees that they pay in the form of higher demand prices for homes. Hence, in

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estimate the models, reports either a standard error robust to heteroskedasticity (option robust) or a standard error robust to both heteroskedasticity and serial correlation (option cluster). To determine the appropriate standard error to report, all estimated models were checked for heteroskedasticity and serial correlation. The heteroskedasticity tests involved regressing the squared residuals on the predicted value of the dependent variable, the latter variable squared, and the time dummies. The overall F-statistic is significant in all of the regressions, indicating heteroskedasticity. Because all estimated models are first-differenced equations, it is easy to test for serial correlation [28, page 176]. The model is estimated and the residuals are obtained. Then the model is reestimated with the lagged value of the residual included as an additional explanatory variable. Serial correlation is indicated if the estimated coefficient on the lagged residual is statistically significant based on its heteroskedasticity-robust standard error. Across all models the lagged residual is not significant at even the 10 percent level and heteroskedasticity-robust standard errors are therefore reported.

[28] According to the 2000 Census of Population and Housing, 20% of Florida's population live in central cities, 55.3% in inner suburbs, 17.6% in outer suburbs, and 7.2% in rural counties.

[29] Note that missing data reduced the inner suburbs sample from 190 to 185 observations and the outer suburbs sample from 150 to 148 observations.

[30] These results are available upon request.

these areas impact fees may result in offsetting shifts in housing demand and supply curves, resulting in insignificant effects on home construction.[31]

Both differenced and double differenced impact fee variables enter all of the models. The estimated coefficients on these variables register the home completion effects of fee levels and fee changes, respectively (see equation 9). Because there is collinearity between the differenced and double differenced variables, the tables report a number of additional estimates. First, we report the partial derivative of home completions with respect to impact fees, along with its estimated robust standard error.[32] This estimate shows the full effect of a change in impact fees (i.e., it registers both the effect of the change and the effect of the change in the level that results from the change). Second, for the models estimated for all homes, medium-sized homes, and large homes the differenced non-water/sewer variable clearly dominates the double differenced version of this variable. We therefore report at the bottom of Tables 2, 4, and 5 the estimated coefficient on the differenced variable when the double differenced variable is dropped from the model. In the models estimated for small homes neither the differenced nor the double differenced non-water/sewer impact fee variable is dominant; hence, estimates of the effects of each variable with the other excluded are provided at the bottom of Table 3.

A comparison of the partial derivatives obtained with the two types of impact fees shows that water/sewer fees are statistically insignificant in 23 of the 24 models

[31] Because water/sewer fees are not found to affect housing prices or home completions (as noted below), the implication is that they are borne by developers in the short-run and by landowners in the long-run.
[32] The partial derivative equals the sum of the coefficients β_1 and β_3 for non-water/sewer impact fees and the sum of the coefficients β_0 and β_2 for water/sewer fees. Standard errors are computed using the statistical formula for the variance of a sum of random variables [21, page 178]. This formula accounts for the covariance between the betas retrieved from the variance-covariance matrix of the estimators.

estimated, while non-water/sewer fees are significant in 21 of the models. The difference in the results between the two types of impact fees may reflect a difference in the nature of the external cost imposed on the community by each fee. Assume the total external cost imposed on the community from an additional single-family home is the same for F_T and F_U services.[33] The external cost of F_U services is borne by all customers of these services in the base rates they pay. The cost is therefore uniformly distributed across users and is analogous to a head tax. In contrast, the external cost of F_T services is borne by property owners in proportion to the values of their properties, given that the property tax is an ad valorem tax. Property owners, and especially more affluent owners, have more political power within local communities than the average water/sewer customer.[34] Hence, the exclusion of single-family housing (notably affordable homes) from suburban communities is likely to be driven more by the desire of local government officials to lower property tax rates than to lower water/sewer user charges.[35] So while the imposition of either F_T or F_U may lessen fiscal exclusion, the reduction in A is expected to be greater for the F_T case. Impact fees used to fund services otherwise covered by property taxes are therefore more likely to generate

[33] This assumption is supported by similarities in the magnitudes of non-water/sewer and water/sewer impact fees provided in Table 1.

[34] See Peterson [24] for support of the idea that affluent property owners play a major role in the determination of local public policies. As he notes "It is the contribution to the fiscal base of local government that is crucial, not the number of votes the entity casts in local elections. A city concerned about its economic interests does not consider each taxpayer's benefit/tax ratio equally but in proportion to his contribution to the local coffer" (page 36).

[35] Two additional arguments support this conclusion. First, homeowners can shield themselves from higher sewer charges by installing septic tanks. In contrast, homeowners can not protect themselves against rising property tax rates. Second, the connection between water/sewer rates and new development may be less apparent to the average homeowner than that between property taxes and new development because the free-rider issue has been highlighted by local media as it applies to services financed by property taxes and not water/sewer services financed by user charges. One way in which the free rider issue gets highlighted is that it comes to the forefront in public debates over whether a school bond referendum should be supported. No similar event highlights increases in user fees resulting from expansions of water/sewer systems.

savings in project approval costs that are large enough to exceed the direct costs of the fees themselves, resulting in increased single-family home construction.[36]

Given the statistical insignificance of the water/sewer impact fees, we focus the remainder of our discussion on the results obtained for the non-water/sewer impact fees. These results are highly robust across the three different estimators. The estimated coefficient on the lagged value of the dependent variable in the LD model is statistically insignificant in all cases but one; the more general version of the other two estimators, the RT model, is preferred. We therefore further limit our discussion to these results.

The RT models estimated for all homes, medium-sized homes, and large homes yield similar results: the differenced non-water/sewer impact fee variable is statistically significant for both the inner and outer suburbs, while the estimated coefficients on the doubled differenced variable are small and never significant. Also, when the double differenced variable is dropped from the models, there is little change in the estimated coefficient on the differenced variable. Recall that the differenced variable measures the effect of levels of impact fees, while the double differenced variable measures the effect of changes in impact fees. As we argued in Section II, changes in fees affect housing construction by altering the equilibrium level of housing construction, while impact fee levels are more likely to affect construction by altering the percentage of residential

[36] Because water/sewer fees yield less political benefit to local government officials than non-water/sewer impact fees, we might expect non-water/sewer fees to be more prevalent than water/sewer fees. However, in Florida roughly equal numbers of counties have adopted each type of impact fee. Besides the political benefit of water/sewer fees, albeit smaller than that of non-water/sewer fees, there are two additional factors that help explain the popularity of water/sewer fees. First, they decrease how frequently local governments must obtain rate increase approval from the Florida Public Service Commission. Rate cases are both time-consuming and expensive for local governments. Second, water/sewer fees programs are comparatively inexpensive to implement. Developers have long been expected to cover the costs of on-site water/sewer infrastructure. Extending their financial responsibility to cover off-site infrastructure improvements imposes minimal additional administrative costs on the local government.

projects annually proposed by developers that receive approval from the local government. Because we find a stronger effect on housing construction from fee levels than from fee changes for medium-sized and large home completions, the results suggest that impact fees increase the construction of these house types primarily by increasing project approval rates.

The results for small homes differ from those for medium-sized and large homes in two respects. First, for small homes no effects are found for the outer suburbs. Both the differenced and double differenced variables, as well as the partial derivative, yield small coefficients that are less than their standard errors. Second, within the inner suburbs, the double differenced variable is statistically significant, while the differenced variable is insignificant. (The partial derivative is highly significant). However, the double differenced variable does not dominate the differenced variable – their estimated coefficients are similar (.055 versus .062) and each is statistically significant (at the highest indicated level) when the other variable is dropped from the model. While collinearity makes it difficult to precisely estimate their separate effects, these results suggest that both fee levels and fee changes affect small home completions. The implication is that impact fees on small homes have two significant effects -- they increase the equilibrium level of small home construction and increase the percentage of projects that annually receive approval from the local government.

An explanation for the difference in the results for small homes between the inner and outer suburbs is that exclusion from the outer suburbs is more than just fiscally motivated. In comparison to inner suburbs, outer suburbs are more homogeneous with respect to both income and race. Evidence suggests that prejudicial attitudes play a role in explaining the homogeneity of these areas [15]. Hence, regardless of whether or not impact fees are being used, the residents (and government officials) of outer suburban areas may seek to exclude lower income households.

To gauge the economic importance of our results, we used the RT estimates to compute the change that would occur in the number of home completions if the average inner suburb or outer suburb adopted the average level of non-water/sewer impact fees for each size category of homes. Percentage increases in completions for each category of homes were then computed using average levels of completions for each area over the years covered by our panel as the base. Table 6 reveals that these percentage changes are far from trivial in magnitude. Within the average inner suburb, they range from a 24% increase in large home completions to an 82% increase in small home completions. In the average outer suburb, there would be 26% more large home completions and 36% more medium-size home completions.

Our three alternative housing completion models (FE, RT, and LD) attempt in various ways to control for the possible endogeneity of impact fees. Because all three models include fixed effects, the consistency of our estimates requires the assumption of strict exogeneity [28, page 258]. This assumption implies that explanatory variables in each time period (X_{it}) are uncorrelated with the idiosyncratic error (ε_{it}) in each time period: $E(X'_{is}\ \varepsilon_{it}) = 0$, s,t = 1,…,T. This assumption is stronger than assuming zero contemporaneous correlation: $E(X'_{it}\ \varepsilon_{it}) = 0$, t = 1,…,T. While it is reasonable to assume that ε_{it} is uncorrelated with past values of X_i, ε_{it} may be correlated with future values of X_i if there exists reverse causality running from housing construction to impact fees.

A simple test for strict exogeneity involves including leading values of impact fee levels in our first differenced housing construction models [28, page 285]. We therefore reestimated all of our models adding the variables $WSIF_t$, $WSIF_{t+1}$, $NWSIF_t$, and $NWSIF_{t+1}$. The test of strict exogeneity is a test of the joint statistical significance of the leading variables, which is conducted using the usual F statistic but made robust to heteroskedasticity. For the eight groups (all, large, medium, and small home completions estimated separately for inner and outer suburban areas), the leading values of impact fees are jointly statistically insignificant at the five percent level in the RT and LD models for all but one group (medium-sized homes in the inner suburbs). The FE models performed less well, with strict exogeneity rejected for four of the eight groups. Because we use the RT results in constructing Table 6, we further analyzed the one case (medium-sized homes, inner suburbs) where strict exogeneity is rejected for this model. Our experimentation revealed that the endogeneity of water/sewer impact fees accounted for the results. When only non-water/sewer impact fees are included in the RT model, the assumption of strict exogeneity cannot be rejected. Our strict exogeneity test results suggest that our RT model estimates do not suffer from endogeneity bias, and further substantiates our preference for this model over the FE and LD alternatives.

VII. Results from Estimating Some Simple Price Models

While we are primarily interested in estimating the effects of impact fees on housing construction, we also estimated some simple models relating impact fees to housing prices. These models allowed us to further explore the hypothesis that homebuyers find communities more attractive after they adopt or increase impact fees, because this will result in greater expected future levels of public services per tax dollar paid. First we estimated a two-way fixed effect model analogous to equation (9):

$$\ln P_{i,t} = \alpha_i + \gamma_t + \beta_0 WSIF_{i,t-1} + \beta_1 NWSIF_{i,t-1} + \varepsilon_{it} \qquad (12)$$

where $P_{i,t}$ is the constant-quality real price of housing for county i in year t. We also estimated a random trend price model analogous to equation (10):[37]

$$\ln P_{i,t} = \alpha_i + \gamma_t + g_i t + \beta_0 WSIF_{i,t-1} + \beta_1 NWSIF_{i,t-1} + \varepsilon_{it} \qquad (13)$$

These models, like the housing construction models, are estimated for the years 1993 – 2003, which after first differencing results in 10 observations per county.

Table 7 reports the results obtained from estimating the constant-quality housing price models using all 41 counties that are included in our panel data set.[38] Separate sets of results are again reported for all homes, small homes, medium-sized homes, and large size homes.[39] Non-water/sewer impact fees are shown to have a positive and statistically significant effect on constant-quality housing prices in 6 of the 8 estimated models. The two exceptions are still positive and marginally insignificant. The magnitudes of the estimated effects are highly similar between the fixed effects and random trend models. Moreover, estimated coefficients are not significantly different

[37] For both of the price models, population and real per capita income measured for year t entered preliminary estimations as covariates. Where the variable's t-statistic exceeded one, it was retained in the final estimation. Since evidence for both serial correlation and heteroskedasticity was found for the price models, all reported standard errors are robust to both of these problems.

[38] Note that of the total 410 observations, 9 are dropped from the all homes, small homes, and medium-sized homes models. Six of the dropped observations are outliers, which we suspect may be the result of data entry errors on the tax rolls or inaccurately reported data regarding water/sewer impact fees. If these observations are retained the estimated coefficients on water/sewer impact fees for medium-sized homes change from insignificant to positive and significant. The remaining three observations that are dropped have missing values on the constant-quality price index due to an insufficient number of sales in those years. For the large home models, 19 additional observations are dropped, again because of missing values on the price index.

[39] The price models were also estimated using only the 34 metropolitan counties (i.e., the 7 rural counties were dropped). Results are highly similar to those reported in Table 2.

between any two of the market segments, which implies that a given change in impact fees results in similar percentage increases in housing price for small, medium, and large homes. This finding is consistent with the idea that the demand for housing increases in response to the adoption of or increase in non-water/sewer impact fees because homebuyers expect future property tax savings. The capitalization of these savings would cause the same percentage increase in home value, regardless of the size (value) of the home, given that the effective rate of property taxation is the same for all homeowners living within the same jurisdiction.[40]

At the point of means, the estimated coefficients imply that a $1.00 increase in non-water/sewer impact fees will increase the price of small, medium, and large homes by $0.39, $0.82, and $1.27, respectively. Only the first estimate is significantly different from one.[41] The results obtained for water/sewer impact fees also do not vary between estimators or home size categories. However, here the uniformity lies in the fact that all estimated coefficients are statistically insignificant. The finding that changes in water/sewer fees have weaker effects on housing price than changes in non-water/sewer fees is consistent with the results we obtain from estimating our housing construction models.

We are interpreting the non-water/sewer impact fee results as evidence that these fees increase a county's attractiveness to homebuyers. Another interpretation, however, is that the increase in developers' costs caused by an increase in impact fees is

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[40] In Florida, county tax rolls are audited each year by the Florida Property Tax Administration Program to ensure vertical and horizontal equity in property tax assessments.

[41] Marginal effects are calculated by taking the estimated coefficient and multiplying by the average real constant quality value over all included counties and years. For the all homes, medium homes and large home categories, marginal effects are averaged across fixed effects and random trend models. For small homes, the marginal effect was taken from the fixed effects model.

shifted forward to new homebuyers, which causes a shift outward in the demand for existing homes, given that new and existing homes are close substitutes. There are, however, a number of reasons for rejecting this alternative interpretation of our price model results. First, in Florida, new homes only constitute about 2 to 3% of an average county's housing stock (calculated from the tax rolls). Hence, homebuyers should be able to find close substitutes to new homes within the much larger existing home market, implying a high elasticity of demand for new homes. Developers, therefore, will find it difficult to pass the costs of impact fees forward to buyers of new homes, if impact fees cause only a reduction in new housing supply. Second, for existing medium and large-sized homes we cannot reject the hypothesis that an additional dollar of impact fees increase price by one dollar. The magnitude of these effects is too large to be the result of a shift in demand away from the new to existing home market. Third, if our non-water/sewer impact fee results are due to forward shifting, we would expect to find similar effects resulting from changes in water/sewer and non-water/sewer impact fees. Finally, we computed averages of the real impact fees in neighboring counties and added these variables (one for water/sewer fees and one for non-water/sewer fees) to our models.[42] If impact fees are passed along to new homes buyers we would expect that higher fees in bordering counties would also shift the demand curve for housing outward in the county. The results from estimations including these variables provide no support for this expectation.

[42] Averages are weighted according to U.S. Census reported County-to-County live/work flow data. Normalized weights are constructed for a particular county based upon worker inflows from all surrounding counties contributing at least 1% of the counties workforce. For example, if a county has 10%. 6%, and 4% of it's workforce commuting from three surrounding counties (with no other counties above the 1% threshold), then the neighboring impact fee variable would take the values for the three surrounding counties and multiply them by .5, .3, and .2, respectively, then add them to construct the neighbors water/sewer and non-water/sewer impact fee variables for the home county.

VIII. Conclusion

In this paper we have investigated the effects of impact fees on single-family home construction and housing prices. Impact fees are growing in popularity despite the fact that we have poor knowledge of their effects. A major criticism of impact fees is that by acting as a development tax they reduce home construction, especially within the small home market.

Our results strongly contradict conventional wisdom, as well as prior empirical evidence, regarding the effects of impact fees on housing construction. Using a unique panel of impact fees and home completions for Florida counties, we estimate a variety of models that control for potential omitted variable and endogeneity biases. The results show that non-water/sewer fees increase the number of completions of all sizes of homes within inner suburban areas and medium-sized and large homes within outer suburban areas. Our explanation for these findings is that impact fees, in addition to increasing the total fees that the developer must pay, also increase the demand for housing, reduce project approval costs, and increase the percentage of projects that annually receive approval from local government.

From a social welfare perspective, our most important finding is that non-water/sewer impact fees increase the number of small homes within inner suburban areas, where a majority of the population living within Florida is located. These are also the areas that offer the greatest job opportunities for lower-skilled workers. Dating back to the Los Angeles Watts riots in the 1960s, advocates for the inner city poor have emphasized the need to open up more housing opportunities for lower income households within suburban areas. Suburban communities, however, have offered stiff resistance, and have generally succeeded in excluding low income housing from being built within their borders. This has banned not only the poor but also public servants who cannot afford to live in the same suburban communities where they work.

Our results suggest that, at least in part, the desire to exclude low income housing from the suburbs is fiscal in nature. Impact fees decrease the fiscal deficit imposed on existing residents by new development, allowing more affordable homes to be built within suburban areas.

Because our research is limited to an examination of the effects of impact fees on single-family housing construction, there is clearly more work that needs to be done. Most importantly, research is warranted on other types of residential developments, such as apartment buildings, condominiums, and mobile homes.[43] It would also be of interest to investigate the effects that impact fees have on non-residential development.

[43] For some evidence on the effects that impact fees have on multifamily housing construction see Burge and Ihlanfeldt [8].

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Table 1
Variable Means and Sources[a]

Variable	Mean (S.D.)	Source
Annual Completions		County tax rolls
All Houses	2186 (1910)	
Small Houses	274 (307)	
Medium Houses	825 (749)	
Large Houses	1086 (1102)	
House Price Index[b]		County tax rolls
All Houses	134053 (41831)	
Small Houses	72640 (19700)	
Medium Houses	120796 (30527)	
Large Houses	229998 (81099)	
Impact Fees, non water/sewer		County documents
Small Houses	2465 (1352)	
Medium Houses	2622 (1439)	
Large Houses	2833 (1624)	
Impact Fees, water/sewer		County documents
Small Houses	2871(1127)	
Medium Houses	2875 (1121)	
Large Houses	2893 (1134)	
County Population (1,000)	383 (465)	Fl Statistical Abstract
County Per Capita Income	27424 (6454)	Fl Statistical Abstract
Construction Cost Index	107 (5)	R. S. Means
Land Cost Per Acre	33060 (21652)	County tax rolls

[a]Means and standard deviations are computed for metropolitan counties.
[b]The house price index, impact fees, per capita income, construction cost, and land cost are expressed in 2003 dollars.

Table 2
Completions Model Results for All Houses

	Inner Suburbs			Outer Suburbs		
	FE[a]	RT[b]	LD[c]	FE	RT	LD
ΔNWSIF	.465**	.485**	.441**	.344***	.270***	.169
	(.220)[d]	(.256)	(.199)	(.109)	(.104)	(.143)
ΔΔNWSIF	.022	.004	.073	-.069	-.050	.029
	(.143)	(.143)	(.169)	(.049)	(.054)	(.082)
ΔWSIF	-.240	.043	-.175	-.013	.194*	.022
	(.195)	(.187)	(.227)	(.111)	(.114)	(.142)
ΔΔWSIF	.084	-.186	.076	.057	-.081	.011
	(.165)	(.171)	(.160)	(.076)	(.073)	(.100)
ΔCompletions	--	--	.150	--	--	.663**
	--	--	(.433)	--	--	(.325)
ΔΔPopulation	-55.715**	-45.919***	-69.438	22.363	--	--
	(24.692)	(17.663)	(48.333)	(16.683)	--	--
ΔΔIncome	--	-.088	--	-.037	-.032	--
	--	(.075)	--	(.032)	(.028)	--
ΔΔConst. Cost	23.590	--	24.783	--	--	--
	(19.986)	--	(18.927)	--	--	--
ΔΔLand Cost	--	--	--	.024*	.020	.025
	--	--	--	(.014)	(.014)	(.016)
$\partial C/\partial NWSIF$	.487***	.489***	.514***	.275***	.220**	.198**
	(.170)	(.177)	(.188)	(.107)	(.092)	(.100)
$\partial C/\partial WSIF$	-.156	-.144	-.099	.044	.113	.033
	(.159)	(.150)	(.206)	(.096)	(.089)	(.110)
ΔNWSIF#[e]	.486***	.489***	.500***	.281***	.222**	.204**
	(.170)	(.176)	(.183)	(.105)	(.091)	(.101)
R^2	.340	.487	.345	.417	.555	.369
Observations	185	185	185	148	148	148
F-tests on IVs			4.11			6.62
			[.008][f]			[.000]

[a]FE = Fixed Effects Model
[b]RT = Random Trend Model
[c]LD = Lagged Dependent Variable Model
[d]Robust standard errors in parentheses
[e]This row reports the estimated coefficient on ΔNWSIF when ΔΔNWSIF is excluded from the model
[f]Probability values in brackets
*, **, *** indicate significance at the 10%, 5%, and 1% level by a two-tailed test, respectively

Table 3
Completions Model Results for Small Sized Houses

	Inner Suburbs			Outer Suburbs		
	FE[a]	RT[b]	LD[c]	FE	RT	LD
ΔNWSIF	.040	.055	.030	.020	.007	.019
	(.046)[d]	(.049)	(.062)	(.029)	(.034)	(.026)
ΔΔNWSIF	.070**	.062**	.134**	-.012	-.007	-.014
	(.034)	(.030)	(.069)	(.021)	(.023)	(.019)
ΔWSIF	-.064	-.010	.037	.028	.043	.029
	(.055)	(.042)	(.091)	(.027)	(.033)	(.027)
ΔΔWSIF	.062	.008	.045	.008	-.001	.009
	(.047)	(.041)	(.060)	(.032)	(.036)	(.032)
ΔCompletions	--	--	.842	--	--	-.215
	--	--	(.581)	--	--	(.328)
ΔΔPopulation	-14.509*	-13.176**	-34.008*	11.452	10.814	14.030
	(7.591)	--	(18.435)	(11.720)	(11.161)	(13.252)
ΔΔIncome	-.040	-.042*	-.092**	-.005	-.006	-.005
	(.026)	(.023)	(.047)	(.004)	(.004)	(.003)
ΔΔConst. Cost	4.910	--	6.062	--	--	--
	(4.592)	--	(6.482)	--	--	--
ΔΔLand Cost	--	--	--	.005	.005	.005
	--	--	--	(.005)	(.005)	(.004)
∂C/∂NWSIF	.110***	.117***	.164**	.008	.000	.005
	(.039)	(.043)	(.075)	(.017)	(.000)	(.019)
∂C/∂WSIF	-.002	-.002	-.082	.036	.043	.038
	(.020)	(.020)	(.070)	(.026)	(.029)	(.025)
ΔNWSIF#[e]	.106***	.118***	.154*	--	--	--
	(.042)	(.047)	(.082)	--	--	--
ΔΔNWSIF#[f]	.086***	.085***	.151**	--	--	--
	(.029)	(.029)	(.072)	--	--	--
R^2	.391	.488	.082	.202	.242	.257
Observations	185	185	185	148	148	148
F-tests on IVs			2.99			3.96
			[.032][g]			[.010]

[a]FE = Fixed Effects Model
[b]RT = Random Trend Model
[c]LD = Lagged Dependent Variable Model
[d]Robust standard errors in parentheses
[e]This row reports the estimated coefficient on ΔNWSIF when ΔΔNWSIF is excluded from the model
[f]This row reports the estimated coefficient on ΔΔNWSIF when ΔNWSIF is excluded from the model
[g]Probability values in brackets
*, **, *** indicate significance at the 10%, 5%, and 1% level by a two-tailed test, respectively

Table 4
Completions Model Results for Medium Sized Homes

	Inner Suburbs			Outer Suburbs		
	FE[a]	RT[b]	LD[c]	FE	RT	LD
ΔNWSIF	.142*	.177**	.145*	.205***	.158***	.118
	(.081)	(.087)	(.082)	(.066)	(.062)	(.107)
ΔΔNWSIF	.046	.028	.040	-.054*	-.040	.008
	(.045)	(.044)	(.074)	(.029)	(.029)	(.060)
ΔWSIF	-.035	.0865	-.040	.001	.127	.016
	(.078)	(.075)	(.074)	(.060)	(.067)	(.077)
ΔΔWSIF	.009	-.108	.008	.007	-.058	-.019
	(.076)	(.081)	(.077)	(.040)	(.042)	(.055)
ΔCompletions	--	--	-.044	--	--	.680
	--	--	(.491)	--	--	(.604)
ΔΔPopulation	-22.300**	-18.548*	-20.619	--	--	-22.913
	(9.050)	(6.244)	(21.026)	--	--	(21.405)
ΔΔIncome	--	-.035	--	--	--	--
	--	(.030)	--	--	--	--
ΔΔConst. Cost	11.043	--	10.905	4.561	--	--
	(9.277)	--	(9.855)	(4.690)	--	--
ΔΔLand Cost	--	--	--	.013*	.012*	.012
	--	--	--	(.008)	(.007)	(.009)
∂C/∂NWSIF	.188**	.205***	.185**	.150**	.118**	.125**
	(.075)	(.080)	(.089)	(.063)	(.055)	(.064)
∂C/∂WSIF	-.026	-.022	-.032	.008	.069	-.003
	(.067)	(.026)	(.037)	(.056)	(.048)	(.030)
ΔNWSIF#[e]	.186**	.206***	.180**	.155**	.119**	.128**
	(.077)	(.081)	(.088)	(.062)	(.054)	(.058)
R^2	.295	.472	.288	.327	.475	.235
Observations	185	185	185	148	148	148
F-tests on IVs			4.21			4.55
			[.007]			[.002][f]

[a]FE = Fixed Effects Model
[b]RT = Random Trend Model
[c]LD = Lagged Dependent Variable Model
[d]Robust standard errors in parentheses
[e]This row reports the estimated coefficient on ΔNWSIF when ΔΔNWSIF is excluded from the model
[f]This row reports the estimated coefficient on ΔΔNWSIF when ΔNWSIF is excluded from the model
[g]Probability values in brackets
*, **, *** indicate significance at the 10%, 5%, and 1% level by a two-tailed test, respectively

Table 5
Completions Model Results for Large Sized Homes

	Inner Suburbs			Outer Suburbs		
	FE[a]	RT[b]	LD[c]	FE	RT	LD
ΔNWSIF	.228**	.197*	.197*	.102*	.087*	.105
	(.112)	(.122)	(.104)	(.053)	(.048)	(.084)
ΔΔNWSIF	-.078	-.066	-.038	-.006	-.003	-.007
	(.081)	(.086)	(.080)	(.027)	(.027)	(.042)
ΔWSIF	-.130	-.032	-.065	-.057	.018	-.057
	(.100)	(.112)	(.133)	(.055)	(.058)	(.056)
ΔΔWSIF	-.020	-.097	-.042	.023	-.013	.024
	(.083)	(.097)	(.090)	(.034)	(.033)	(.035)
ΔCompletions	--	--	.321	--	--	-.022
	--	--	(.559)	--	--	(.528)
ΔΔPopulation	-15.821**	-14.665**	-24.389	--	--	--
	(7.453)	(5.839)	(16.942)	--	--	--
ΔΔIncome	--	--	--	-.025	-.020	-.026
	--	--	--	(.022)	(.019)	(.024)
ΔΔConst. Cost	--	--	--	7.277	5.119	7.442
	--	--	--	(5.092)	(4.570)	(6.270)
ΔΔLand Cost	-.022	-.002	-.003	--	--	--
	(.002)	(.002)	(.002)	--	--	--
∂C/∂NWSIF	.150**	.131*	.160**	.096**	.085**	.098*
	(.067)	(.074)	(.065)	(.046)	(.040)	(.057)
∂C/∂WSIF	-.150*	-.128	-.107	-.034	.005	-.034
	(.078)	(.083)	(.102)	(.040)	(.035)	(.041)
ΔIFNWS#[e]	.152**	.128*	.161**	.087**	.085**	.099*
	(.066)	(.071)	(.065)	(.146)	(.039)	(.055)
R^2	.224	.344	.191	.350	.479	.345
Observations	185	185	185	148	148	148
F-tests on IVs			4.22			4.55
			[.007][f]			[.002]

[a]FE = Fixed Effects Model
[b]RT = Random Trend Model
[c]LD = Lagged Dependent Variable Model
[d]Robust standard errors in parentheses
[e]This row reports the estimated coefficient on ΔNWSIF when ΔΔNWSIF is excluded from the model
[f]This row reports the estimated coefficient on ΔΔNWSIF when ΔNWSIF is excluded from the model
[g]Probability values in brackets
*, **, *** indicate significance at the 10%, 5%, and 1% level by a two-tailed test, respectively

Table 6
Change in Completions From Adopting Average
Non-Water/Sewer Impact Fee

	Inner Suburbs	Outer Suburbs
Small Size Houses		
Average fee	2649	2027
Additional units from adopting average fee[a]	312	0
Percentage increase[b]	82	0
Medium Size Houses		
Average fee	2849	2116
Additional units from adopting average fee	339	250
Percentage increase	30	36
Large Size Houses		
Average fee	3157	2203
Additional units from adopting average fee	404	187
Percentage increase	24	26
All Houses		
Average fee	2849	2116
Additional units from adopting average fee	1393	470
Percentage increase	44	29

[a]Based on random trend model results with the double difference in non-water/sewer fees excluded.
[b]Percentage increase is calculated using the average level of completions as the base.

Table 7
Price Equation Results

	All Homes		Small Homes		Medium Homes		Large Homes	
	FE[a]	RT[b]	FE	RT	FE	RT	FE	RT
ΔNWSIF[c]	5.40**	4.90*	5.76**	4.36	7.53***	6.69**	5.81**	5.71
	(2.26)[d]	(2.65)	(2.62)	(2.71)	(2.46)	(2.60)	(2.90)	(3.64)
ΔWSIF	0.96	3.21	-2.01	0.96	-2.06	0.14	3.27	2.34
	(4.25)	(3.57)	(5.42)	(5.10)	(4.17)	(4.65)	(3.86)	(4.33)
ΔPopulation	0.16*	0.29**	0.33**	0.46**	--	--	0.12	0.28*
	(0.08)	(0.12)	(0.14)	(0.19)	--	--	(0.09)	(0.15)
ΔIncome	--	--	--	--	2.07	1.41	--	--
	--	--	--	--	(1.56)	(1.67)	--	--
R-square	0.63	0.71	0.44	0.54	0.59	0.66	0.53	0.59
Observations	401	401	401	401	401	401	382	382

[a]FE = Fixed Effects Model
[b]RT = Random Trend Model
[c]Estimated coefficients and standard errors for impact fees and income have been divided by .000001
[d.]Robust standard errors in parentheses
*, **, *** indicate significance at the 10%, 5%, and 1% level by a two-tailed test, respectively