Fiscal Incidence of the Property Tax

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Abstract

Extensive research focuses on the distributional burden of taxation, yet less is known about net fiscal incidence, or the difference between benefits received and taxes paid. We use data from Florida spanning a decade (2010-2019) to empirically revisit the topic of fiscal incidence as it applies to property taxation. We first estimate demand equations in order to calculate the Lindahl tax share, or price the median voter would be willing to pay for public goods. Our measure of fiscal incidence is the difference between the Lindahl tax share and the actual tax share. With the exception of police expenditures, fiscal incidence tends to increase with income, a pattern we attribute to public goods being valued more by high-income residents who pay a modestly progressive property tax. Areas with more Black and Hispanic residents have higher levels of fiscal incidence.

Keywords: Property tax, tax incidence, public goods

JEL Codes: H2, H22, H4, H7

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1. Introduction

Numerous studies have investigated the income class incidence of the property tax[1]; that is, is the property tax regressive or progressive? However, the more compelling question from a policy perspective is how the benefits of the services financed by the tax are distributed in comparison to the taxes paid. For example, compared to higher income households, do lower income households pay more or less in property taxes for the services they receive? Such questions come under the heading of net fiscal incidence (hereafter, simply fiscal incidence), which has been sparsely studied over the past 40 years due to the general absence of reliable data on the incidence of both taxes and expenditures.

Our contributions to the literature are twofold. First, we provide new evidence on the fiscal incidence of the property tax, paying particular attention to whether the tax is progressive (pro-poor) or regressive (pro-rich) in its incidence. We have assembled a unique data set for Florida to study this issue. We provide fiscal incidence estimates for total current general expenditures and for each of a number of specific budget categories (e.g., police, parks). In addition to looking at the distribution of fiscal incidence among different income groups alone, we also study the distribution of fiscal incidence in terms of specific population groupings.

Our second contribution is to simulate how fiscal incidence would change if various tax administration policies are changed.[2] Florida has a wide range of policies that may matter to fiscal incidence. There are exemptions that lower a homeowner's assessed value and provide property tax relief, a cap on annual growth in assessed values, and regressive assessments (Ihlanfeldt & Rodgers, 2022). We study the role played by each of these factors in affecting the progressivity of fiscal incidence. Because these characteristics of the administration of the tax in Florida are shared by many other states, our results provide important new information on strategies that other states, in addition to Florida, might follow to improve the property tax as a source of revenue to finance local public goods.

Our empirical methodology closely follows the model developed by Martinez-Vazquez (1982), which relies on the Lindahl market analogue pricing rule to define a household's benefits from the public goods provided by Florida's cities. In this context, net fiscal incidence is approximated

[1] For a review of the literature on property tax incidence and recent results see Ihlanfeldt and Rodgers (2021).
[2] These results are preliminary and not included in this draft (April 2022).

as the difference between the homeowner's tax share of total property tax revenue and his Lindahl tax share, which captures his willingness to pay for the public good. To obtain the needed elasticities to estimate the Lindahl tax shares, we first estimate constant elasticity city expenditure equations, under the assumption that the actual quantity of the public good supplied is decided by the median voter. With the elasticities in hand, we then estimate the fiscal incidence for the median voter within each census block group by subtracting his tax share from his Lindahl tax share. In order to study the progressivity of the tax, we estimate models relating the fiscal incidence of the block group to the median income of the block group. Conditional on income, we also explore if fiscal incidence varies with block group demographic characteristics.

Our results reveal multiple patterns that we hope will motivate future research on this subject. When considering total expenditures, we find that the fiscal incidence of the property tax tends to rise with income. We interpret this result as being due to higher-income households having higher average demand for public goods while only paying modestly more in property taxes. Separate analysis by spending category paints a more nuanced picture. The fiscal incidence of park expenditure also rises with income, but the fiscal incidence of police and fire services tend to fall with income. Our results also show the tax is generally pro-minority, which may allay some of the negative criticism frequently directed at the tax.[3]

2. Theory

The concept of net fiscal incidence is relatively straightforward, yet calculating the difference between tax burden and benefits is more complicated, primarily due to the challenge of quantifying benefits. We follow the theoretical framework outlined in Martinez-Vasquez (1982), which operationalizes the approach of Aaron & McGuire (1970). We start by assuming that a government provides one public good, the quantity of which is determined by the median voter.[4] There are an odd number of taxpayers (*N*) in a jurisdiction and there are only two goods: after-tax income *x* and a public good *z*, the latter of which is produced with a constant marginal cost *c*. Taxpayer i's utility is defined to be concave and monotonically increasing in both x_i and z^*,

[3] Cabral and Hoxby (2015) reviewed the survey evidence from 1972 to 2005 and concluded the following: "The property tax starts out unpopular in 1972 and ends up still unpopular in 2005: in both years, about 38 percent of adults stated that it was the worst tax."

[4] Despite the obvious limitations of both of these simplifying assumptions, Martinez-Velasquez (1982) argues that they are necessary to make the empirical estimation tractable. In effect, we assume that there is no strategic voting behavior and that a multidimensional budget is adequately represented by a budget with only one public good.

$U_i(x_i, z^*)$, where z^* represents how much of the public good the individual consumes. We follow the established notation that distinguishes the individual's consumption (z^*) from the total quantity supplied (z). Following precedent once again, the two variables are related through $z^* = z/N^{\varepsilon}$, where ϵ is a crowding parameter greater than zero but no greater than one. Each taxpayer faces a budget constraint $y_i \geq x_i + \tau_i cz$, where y_i is before-tax income and τ_i is the tax-share of the cost of providing one unit of the public good. These tax-shares sum to one: $\sum_{i=1}^{N} \tau_i = 1$.[5]

Quantifying the value of public good provision requires an accounting of both the benefits and costs to the taxpayer. The median voter-determined quantity is z_m and we define $t_i = \tau_i c$ as the tax price per unit of the public good. A taxpayer must therefore pay $t_i z_m$ as their contribution to the public good. We define the taxpayer's value of the marginal unit of the good as t_i^L, or the Lindahl tax price. Thus, the fiscal incidence for this taxpayer can be written as $V_i = (t_i^L - t_i)z_m$. If taxpayer *i* prefers $z_i < z_m$, then $t_i^L(z_m) < t_i$ and $V_i < 0$. In other words, this taxpayer pays more for the public good than the personal benefits the good provides. Contrastingly, a taxpayer who prefers $z_i > z_m$ will enjoy personal benefits that outweigh the personal costs. And, to be complete, the median voter will face marginal costs equal to the tax price and experience $V_i = 0$.

In order to consider the distributional effects of this program, we assume that taxpayers are ordered based on their incomes so that if $j < k$ then $y_j < y_k$. We also assume that taxpayers have identical preferences. If $V_j < V_k$, then the difference between benefits and taxes paid decreases (and could become negative) as taxpayer income increases. We classify such a budget as progressive or "pro-poor." The opposite situation, where $V_k < V_j$, is regressive or "pro-rich." A neutral or proportional budget generates $V_i = 0$ for every taxpayer.[6] Although related to income group comparisons, age and racial/ethnic group comparisons may shed additional light on fiscal incidence patterns. It is possible that members of group A receive higher V_i than members of group B, on average, possibly due to concentrating benefits in areas where members

[5] In our setting, the tax share is the taxpayer's property tax, which is calculated by multiplying the millage rate multiplied by the taxable value of a property, divided by total property tax revenue. Even if we assume flat millage rates and taxable values that are a linear function of household income, assessment error and tax relief programs can produce tax shares that do not necessarily increase linearly with income (see Ihlanfeldt and Rodgers, 2022). Below we discuss how such policies may affect our estimates.

[6] Proportionality could be due to identical tax shares and benefits for every taxpayer ($t_j^L = t_k^L$ and $t_j = t_k$ for all *j* and *k*) or taxes and benefits that vary by income in precisely the same way (i.e., benefit taxation in the strictest sense of the term).

of a particular group tend to sort (e.g., more parks in areas with younger households) or specific tax relief programs for certain groups (e.g., senior-resident tax exemptions).

Linking this theoretical framework to the data requires additional explanation. We assume that demand for the public good for every taxpayer matches that of the median voter with form $z^* = a(\tau_m c N^{\epsilon})^{\alpha} y_m^{\beta}$, where α is the tax price elasticity of demand and β is the income elasticity. Knowing how individual demand relates to total demand, $z^* = z/N^{\epsilon}$, and multiplying by the constant cost of provision allows us to write total expenditure: $E = b\tau_m^{\alpha} y_m^{\beta} N^{\gamma}$, where $b = ac^{1+\alpha}$ and $\gamma = \epsilon(1+\alpha)$.[7] By regressing public good expenditure on the tax share, income, and other local characteristics, we produce estimates of the elasticities (α, β) necessary to calculate the Lindahl tax share, or what the taxpayer would be willing to pay for a given level of public good expenditure:

$$\tau_i^L = \left[E\hat{b}^{-1} y_i^{-\hat{\beta}} N^{-\hat{\gamma}}\right]^{-1/\hat{\alpha}} \quad (1)$$

Subtracting the actual tax share from the Lindahl tax share and multiplying the expenditure amount produces our measure of fiscal incidence (V_i).[8]

3. Literature Review

As noted above, the literature on the fiscal incidence of the property tax is extremely thin, consisting of the pioneering study by Martinez-Vazquez (1982) and more recently a study by Chaudry-Shah (1989). Using 1972 data from cities in Missouri, Martinez-Vazquez first estimates demand equations across the state. He then predicts the Lindahl tax shares for the median homeowner for 442 voting precincts within St. Louis. The author calculates the fiscal incidence of a precinct by subtracting their actual tax share from their estimated Lindahl tax share. Finally, Martinez-Vazquez regresses this measure of fiscal incidence on a precinct's income and demographic characteristics as a way to understand how fiscal incidence may vary across the city. By using separate models for various expenditure categories, Martinez-Vazquez found that fiscal incidence is pro-poor for general, fire, and library expenditures while it is pro-rich for police and park expenditures. Among the population groups, elderly and black residents

[7] The scaling factor *b* is simply the exponential of the estimated constant from the log-linear demand equations.
[8] Multiplying by expenditure amount aids interpretation as the gap is denominated in dollars.

tend to be net losers in terms of fiscal incidence, while renters are net beneficiaries regardless of the expenditure category.

Chaudry-Shah (1989) takes a capitalization approach to studying the fiscal incidence of the property tax. Using 1977 transactions data on homes in Edmonton, Canada, the author estimates hedonic price equations, which include, in addition to a standard set of house characteristics, variables measuring the property tax burden and spending and output of local public services. Chaudry-Shah then uses differences in the estimated coefficients on public services and taxes to estimate fiscal incidence for 27 neighborhoods. Plots of fiscal incidence against neighborhood income reveal a u-shaped relationship, with fiscal incidence pro-poor up to $43,000 (2021 dollars) and pro-rich thereafter.

Besides using data that are now over four decades old, the above studies are limited by small numbers of observations that are specific to a single city.[9] Our fiscal incidence estimates are based on data between 2010-2019 on thousands of block groups found within over 300 Florida cities. In addition to providing recent evidence on fiscal incidence based on large samples, our work extends these previous studies by considering the sensitivity of fiscal incidence to various tax administration policies that could be altered to improve the distributional consequences of the property tax.

The limited empirical research on net fiscal incidence does not mean to imply there hasn't been extensive work that separately focuses on either side of the ledger. Measuring the distributional incidence of taxation is an evergreen topic that covers income taxation (e.g., Piketty, Saez & Zucman, 2018; Auten & Splinter, 2019), consumption taxation (e.g., Besley & Rosen, 1999), corporate taxation (e.g., Gravelle, 2013; Suárez Serrato & Zidar, 2016). One might assume that estimating the incidence of property taxation is simple given the prevalence of flat millage rates, yet property valuation methods and tax exemption policies complicate what would otherwise be an accounting exercise to establish verify the proportional burden of the tax.[10] The aforementioned particularities of the tax may contribute to the dearth of fiscal incidence studies

[9] See Borcherding & Deacon (1972), Bergstrom & Goodman (1973), and Maital (1973) for earlier examples using data aggregated to the municipality or state level.

[10] Zodrow (2001) discusses competing theories of the incidence of property taxation. Additional questions emerge when one considers other aspects of property taxation, such as residential versus commercial properties, renters versus owners, and mortgage interest deductibility.

and partially explain why empirical evidence on property taxation has often focused on assessment ratios or quantifying the progressivity or regressivity of the tax (e.g., McMillan & Singh, 2020; Ihlanfeldt & Rodgers, 2022).

Successfully quantifying the distributional incidence of various government programs and services depends largely on whether or not the expenditures are targeted and the recipients are identifiable. A tax credit that phases out as income increases is one example where assessing the distribution of benefits is relatively straightforward. A more complicated challenge that directly relates to our study is how to quantify the benefits of public goods. Even if police expenditures are equally distributed across a jurisdiction, for example, it is does not necessarily follow that everyone receives the same benefits of police protection.

Theoretical work related to fiscal incidence per se is more common. For example, the optimal taxation literature considers the welfare and redistributive implications under different tax systems, occasionally with direct focus on the interaction of public good provision with Lindahl or benefit-based taxation (e.g., Hines, 2000; Kaplow, 2006). Weinzierl (2018) discusses how tax theorists in the 20th century shifted their focus away from benefit-based taxation to a more utilitarian-centric model of welfare maximization; this change may partially explain why empirical efforts regarding fiscal incidence have stagnated in recent decades despite substantial advances in data availability and computational power necessary for such estimation. In spite of this theoretical trend, we view fiscal incidence as an important concept for evaluating tax policy. Indeed, Weinzierl states in the same paper "The long-standing role for classical benefit-based logic in public reasoning over taxes stands in stark contrast to this momentum away from it in modern theory." Taken from both empirical and theoretical perspectives, our survey of the literature motivates our efforts to provide updated evidence on fiscal incidence.

4. Data and Empirical Methodology

We estimate two types of models. First, we estimate demand equations for public goods at the city level. This step allows us to obtain Lindahl tax shares for the median homeowner within census block groups. Next, we subtract the median homeowner's actual tax share from the Lindahl tax share to generate our measure of fiscal incidence. We then estimate regressions at the block group level to investigate whether the property tax concentrates net benefits in certain

income or demographic groups. We present these specifications in sections 4.B and 4.C after describing our data in section 4.A.

4.A Data

Our analysis is based on three sets of data, which we combine to create a panel spanning 2010-2019. City and block group demographics are from the American Community Survey (ACS), city expenditure data are from the Florida Department of Financial Services (FDFS), and the Florida Department of Revenue (FDOR) is the source of property tax data.

For each city in Florida the FDFS report general current expenditures, hereafter referred to as total expenditures. The latter is the sum of operating and personnel services, excluding welfare and education. In Florida, school districts are at the county level and have their own separate budgets. The FDFS data are broken down into numerous service categories. In addition to total expenditures, we chose to separately analyze four public goods: police, fire protection, roads, and park expenditures. These are selected because they are the four largest city spending categories and represent the services that most frequently are provided by Florida's cities.

The FDOR requires that all 67 Florida counties submit their property tax roll to the state each year. These tax rolls allow us to calculate a central variable of interest in our analysis: the tax share of the median owner, which is equal to the product of taxable value and the city millage rate divided by the total property tax revenue of the city. Total property tax revenue includes property taxes collected from all sources, not just residential properties, resulting in lower tax shares for homeowners in areas where the commercial tax base is larger. Using GIS maps, we place each single-family home and each condominium within a city. The rolls already include the block group location of each parcel. This detailed location information permits us to calculate the tax share of the median owner at the city and block group levels.

4.B Estimated City Demand Models

Following the theory outlined in Section 2, we obtain the elasticities required to estimate the Lindahl tax shares by first estimating demand equations of the following form

$$\log E_{k,t} = a + \alpha \log \tau_{k,t} + \beta \log y_{k,t} + \gamma \log N_{k,t} + \boldsymbol{X}_{k,t} + \boldsymbol{\omega}_t + \epsilon_{k,t} \quad (2)$$

We regress the log of expenditures (E) on the log of the median tax share (τ), the log of median income (y), and the log of population (N) for city k and year t. As control variables ($\boldsymbol{X}_{i,t}$) that may ostensibly affect the demand for public goods, we include the percentages of Blacks, Hispanics, owner-occupants, residents aged 65 or older, condominiums, mobile homes, and multi-family units. We include year fixed effects (ω) to account for other factors that could affect tax revenue and expenditures throughout the state during the period of analysis. We estimate separate equations for total expenditures and the four spending subcategories listed above (police, fire, roads, and parks).

The coefficients estimated using equation (2) map directly to the elasticities in the Lindahl tax share formula from equation (1). Equation (2) exploits variation between cities because the expenditure data is only available at city level, however variation within cities across multiple dimensions, reflected in variables measured at the block group level, makes it possible to predict the Lindahl tax share at the block group level. In particular, the block group is the most granular level of observation for homeowner income.

4.C Estimated Fiscal Incidence Models

We could estimate the fiscal incidence for an individual homeowner by subtracting the homeowner's tax share from the homeowner's estimated Lindahl tax share were we to possess income data at the household level. Instead, we again turn to the median income of homeowners within a Census block group to calculate fiscal incidence at this more aggregated level of analysis. While this is a second-best approach to actually using data on individual homeowners, it has the advantage of providing a proxy for permanent income, which is superior to using current income in analyzing fiscal incidence. We assume that the transitory components of current incomes cancel out from aggregation, resulting in a correlation with only the permanent and not the transitory component of current income. Our measure of fiscal incidence is therefore the block group difference between the estimated Lindahl tax share and the actual tax share.

With these estimates of fiscal incidence in hand, we turn to an analysis of how they correlate with observable block group characteristics. The specification for our fiscal incidence regressions are:

$$FI_{j,k,t} = \sigma + \delta y_{j,k,t} + \boldsymbol{X}_{j,k,t} + \boldsymbol{\omega}_t + \boldsymbol{\phi}_k + \epsilon_{j,k,t} \qquad (3)$$

where, fiscal incidence (*FI)* is measured in block group *j*, city *k*, and year *t*. The control variables (X) and year fixed effects (ω) mirror those from equation (2). Because fiscal incidence varies within as well as between cities we can include city fixed effects (ϕ) in equation (3). Equation (3) represents our most general specification where δ captures how fiscal incidence changes as income increases. We consider alternate functional forms and specifications in order to explore the possibility of non-linearities between income and fiscal incidence as well as how fiscal incidence varies across different population groups.

5. Results

In the following subsections, we present the results of our demand estimation as well as the fiscal incidence models described above.

5.A Results from Demand Models

We include the results of our demand equation estimation in Appendix Table 1. The total number of cities varies by expenditure category because not all cities offered every public good in our analysis. For example, total expenditures are common in all 381 cities but only 280 cities provide fire protection.[11] The R-squared is 0.74 or higher in each model, indicating that the demand models reasonably fit the underlying data. The explanatory power of the control variables vary between regressions. As expected, the tax share elasticities are negative and the population elasticities are positive. The income elasticities are positive, with the exception of the coefficient from the regression using road expenditures.[12] It is worth noting that the road results serve as a type of falsification check compared to the other spending categories. This is due to the fact that roads in Florida are overwhelmingly county roads. Homeowners associations (HOAs) are responsible for many of the smaller roads in the state, with residents in higher income areas paying for private roads that do not show up in our data. Thus, we would not expect a strong correlation between road expenditure and income. This may also partially explain the smaller relationship between tax share and road expenditure. In any case, it is with these models that we

[11] Some services are provided by county, homeowners association, etc., or may not be provided at all. Due to the sensitivity of OLS to outliers, we drop the bottom and top 1 percent of expenditures conditional on positive expenditures.

[12] Our elasticities are generally similar to those found in Martinez-Vasquez (1982) as measured by overlapping confidence intervals; we are unable to compare the estimated constants because they were not reported in the earlier paper.

predict the Lindahl tax share for a given block group, after which we subtract the actual tax share and multiply the expenditure amount to produce our measure of fiscal incidence, as described in Section 2.

5.B Results from Fiscal Incidence Models

We report the results of our regressions of fiscal incidence on income in Table 1. When we only include year and city fixed effects, we find that the relationship between income and fiscal incidence depends on the expenditure category under consideration. Column (1) shows that the fiscal incidence of total expenditures increases by $51 for each $1,000 increase in income while police expenditures (Column 2) decreases by $8 for a $1,000 increase in income. Similarly, the fiscal incidence of park expenditures increases by $28 per $1,000 of income and the fiscal incidence of fire expenditures falls by $3 per $1,000 of income. As noted above, the connection between income and road expenditures in our data is limited due to alternative funding methods, which explains the noisy zero estimate in Column (4). We hesitate to emphasize the exact magnitudes of coefficients because they are partially a function of the size of the spending category.

Table 1 – Fiscal incidence and income: linear models

	Total Expenditures (1)	Police (2)	Fire (3)	Roads (4)	Parks (5)
Income	50.79***	-7.973***	-3.158***	-2,721	27.95**
	(13.19)	(0.910)	(0.938)	(2,751)	(11.31)
Observations	53,122	52,593	44,886	51,593	51,363
R^2	0.783	0.436	0.445	0.188	0.555
Cities	304	280	230	305	274

Notes: The outcome is the predicted demand for the particular expenditure (Lindahl tax share) minus the actual tax share of the block group. Each regression includes year and city fixed effects. Block group median income is measured in $1000s. Standard errors clustered at the city level in parentheses: *, **, *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

Table 2 changes the functional form from linear to quadratic in order to explore the possibility of a non-linear relationship between fiscal incidence and income. The LR tests we report at the bottom of the table indicate that the quadratic model improved upon the fit provided by the linear model for each expenditure categories. To visualize the relationships, we use binned scatterplots shown in Figure 1 and Appendix Figure 1. With a large number of observations, scatterplots

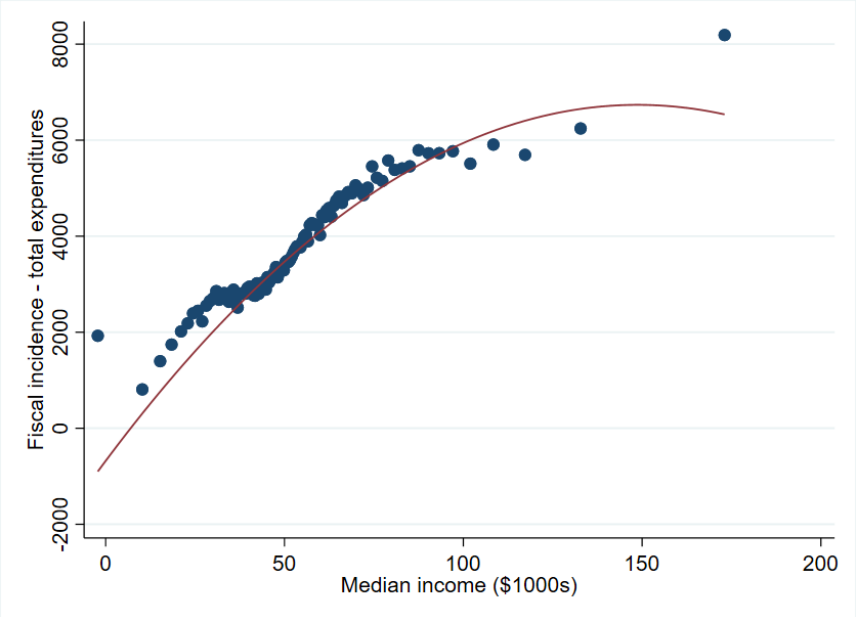
provide a non-parametric way of visualizing the relationship between two variables. The figures show that the deviations from non-linearity are trivial in magnitude. We therefore proceed with the assumption of linearity for the remainder of the paper.

Table 2 – Fiscal incidence and income: quadratic models

	Total Expenditures (1)	Police (2)	Fire (3)	Roads (4)	Parks (5)
Income	81.39***	-3.956*	-1.014	3,239	38.09*
	(24.86)	(2.178)	(2.237)	(2,809)	(21.22)
Income squared	-0.174	-0.0228*	-0.0123	-34.69	-0.0576
	(0.153)	(0.0136)	(0.0146)	(32.13)	(0.0619)
LR test p-value	0.00	0.00	0.00	0.04	1.00
Observations	53,122	52,593	44,886	51,593	51,363
R^2	0.785	0.445	0.450	0.188	0.558
Cities	304	280	230	305	274

Notes: The outcome is the predicted demand for the particular expenditure (Lindahl tax share) minus the actual tax share of the block group. Block group median income is measured in $1000s. Each regression includes year and city fixed effects. Standard errors clustered at the city level in parentheses: *, **, *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

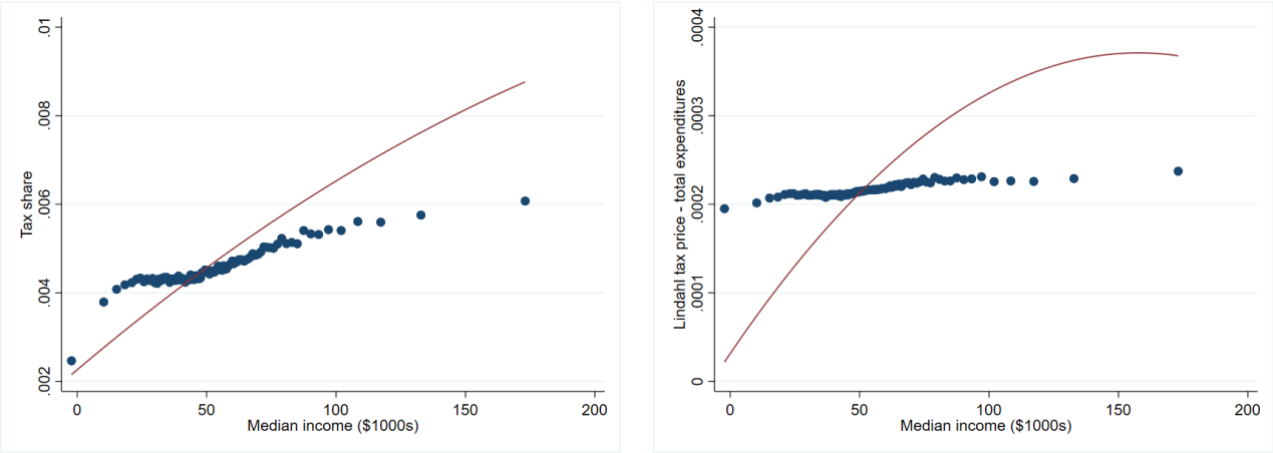
Figure 1 – Fiscal incidence by income (total expenditures)



Notes: Estimated measure of fiscal incidence for all expenditure categories by block group median income. Fiscal incidence is the difference between the Lindahl tax share and the actual property tax share. See Appendix Figure 1 for other spending categories.

It may be helpful to deconstruct Figure 1 into two additional plots showing the underlying the interplay between taxes, benefits, and income. Fiscal incidence can fall with income if the effective property tax burden is progressive, if benefits tend to be concentrated in lower-income areas, or both. Figure 2 show positive relationships for both the actual tax share and the Lindahl tax share, indicating that even though demand for public goods increases with income, higher-income areas tend to pay in excess of what a benefits-based tax would recommend.

Figure 2 – Tax share and Lindahl tax share by income



(a) (b)

Notes: Share of property taxes (a) and Lindahl tax shares (b) by block group median income. Counties set flat millage rates while additional local property taxes (e.g., set by municipalities) are typically small by comparison. Tax exemptions such as the homestead are a flat amount and expected to benefit homeowners with lower-value homes. The tax share increases with income but not in a linear fashion. Lindahl tax shares for total expenditures predicted by the model show a slightly positive linear relationship between income and benefits.

5.C Results for Population Groups

In Table 3 we expand our analysis to explore how fiscal incidence varies among different population groups, while still controlling for income. These results are relevant because public policy may be oriented to specific groups (e.g., minorities or the elderly). In addition to income, our models now include the block group percentages of blacks, Hispanics, renters, residents over the age of 64. Because one may be concerned that they are correlated with the group variables of interest, we also control for the percentage of owner-occupied households, condominiums, multi-family homes, and mobile homes.

Table 3 – Fiscal incidence and population groups

	Total expenditures	Police	Fire	Roads	Parks
	(1)	(2)	(3)	(4)	(5)
Income	54.67***	-7.999***	-3.233***	-4,507	26.37***
	(15.57)	(1.097)	(1.143)	(4,322)	(9.524)
Percent Black	34.50***	3.436***	1.709***	340.3	-2.857
	(6.577)	(0.528)	(0.563)	(654.5)	(4.361)
Percent Hispanic	25.45***	4.281***	2.578***	8,618	1.520
	(5.091)	(0.379)	(0.317)	(6,723)	(1.669)
Percent Aged>64	-25.16***	-2.815***	-1.428**	3,283	-0.823
	(9.412)	(0.815)	(0.709)	(2,542)	(1.586)
Percent owner	14.09**	2.827***	2.001***	5,239	2.916
	(6.085)	(0.717)	(0.603)	(4,793)	(2.974)
Observations	53,122	52,593	44,886	51,593	51,363
R^2	0.792	0.472	0.464	0.188	0.557
Cities	304	280	230	305	274

Notes: The outcome is the predicted demand for the particular expenditure (Lindahl tax share) minus the actual tax share of the block group. Each regression includes year and city fixed effects as well as controls for block group characteristics (percentages for Black, Hispanic, aged 65 and over, owner-occupied, condo, multi-family, and mobile homes). Block group median income is measured in $1000s. Standard errors clustered at the city level in parentheses: *, **, *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

Fiscal incidence with respect to total expenditures shows that incidence is pro-minority. The estimated coefficients on percent Black and percent Hispanic are positive and statistically significant for total, police, and fire expenditures. It is possible lower tax burdens for those groups lead to higher fiscal incidence, but recent work on racial gaps in property taxation indicate this is unlikely (Avenancio-León & Howard, 2020; Berry, 2021; Ihlanfeldt & Rodgers, 2021). Instead, the pro-minority aspects of fiscal incidence could be due to higher Lindahl tax shares, essentially higher demand for those public goods. Fiscal incidence disfavors the senior residents and renters for the same categories.[13] These patterns could be due to different preferences that affect the Lindahl tax share calculation. They may also be related to group specific tax breaks such as the homestead exemption. Once again, it is not surprising that the control variables are insignificant in Column (4) given the way roads are funded and built in

[13] We are assuming that renters fully bear the burden of the property tax. For evidence in support of this assumption see Tsoodle and Turner (2008).

Florida. The fiscal incidence of park expenditures does not appear to be significantly related to any other variable besides income.

It is worth comparing our results to those of Martinez-Vazquez (1982). Martinez-Vazquez finds that Black residents as a group are net fiscal losers, which he assesses as unexpected given the general progressivity of the tax with respect to income. Our findings for both Blacks and Hispanics showing they are net beneficiaries are in line with income progressivity of fiscal incidence. These opposing results may be due to the change in setting and increased data size. One common finding shared between our research and that of Martinez-Vazquez's (1982) is that the elderly (over 60 in his case) tend to be net losers in terms of fiscal incidence. For total, police, and fire expenditures, we estimate negative and statistically significant coefficients on the percentage of residents over the age of 64. As suggested by Martinez-Vazquez, these results may be due partly to the fact that a large number of the elderly still own a house after retirement and continue paying property taxes despite lower total benefits from local public services given their smaller family size.[14]

All in all, our evidence on the fiscal incidence of the property tax suggests that the tax is generally favorable to minorities and sometimes favorable to the poor, two groups whose welfare is commonly at the center of public policy discussions. While the property tax has been characterized as a "bad tax" (Ihlanfeldt, 2013; Cabral & Hoxby, 2015) on either the ability to pay or benefits principle of just taxation, the fiscal incidence perspective provides a bit more nuance to this perennial discussion.

6. Discussion and Conclusion

Despite substantial progress in many areas of economics in part due to the research benefits of technological progress (e.g., data, computational power), empirical efforts to measure fiscal incidence have stagnated in recent decades. In this paper, we used a framework that calculates the net benefits of property taxation with recent data from Florida. After estimating demand equations using city-level data, we predicted the Lindahl tax shares for public services at the block group level throughout state. We then subtracted the actual property tax shares in order to generate our measure of net fiscal incidence. This approach yields a simple-to-understand metric

[14] Senior property tax exemptions offered at the local level typically have strict low-income requirements and therefore affect a relatively small number of elderly homeowners.

of comparative benefits and costs of various publicly provided services. Our analysis shows that the fiscal incidence of the property tax generally increases with income, meaning that property taxes and the services they fund are pro-rich. Contrary to what this first result may suggest, neighborhoods with more black and Hispanic residents have higher measures of fiscal incidence even after accounting for income. Areas with more elderly residents and more renters, on the other hand, are associated with lower fiscal incidence. Our exploration of how various tax relief policies

While this study is a significant improvement over prior work in this area, there are a few key limitations worth mentioning. First, the analysis is based upon a specific model with multiple stages of estimation, each of which requires various assumptions. Future work that relaxes those assumptions or modifies the model to be more flexible would be extremely useful to researchers in this area. Second, we have made the case that Florida is an appealing setting in which to study this question, but questions of external validity nevertheless remain. Lastly, property taxation is but one component of the overall question of fiscal incidence of taxation. A promising avenue for future research is the calculation of the net benefits of public goods funded by other methods of taxation, both across the income distribution and for various population subgroups.

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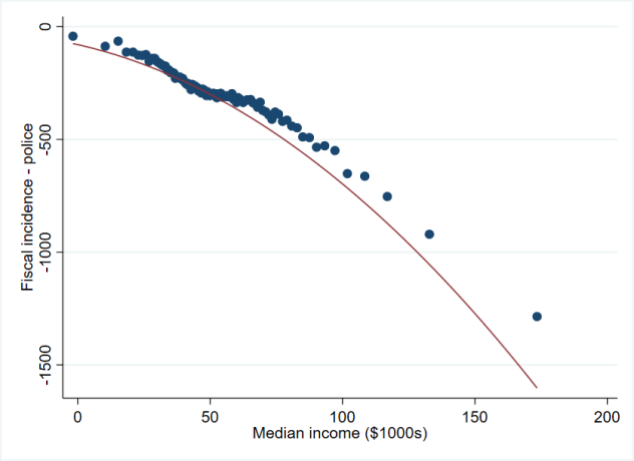
Appendix Material

Appendix Table 1 – Demand estimation for public goods

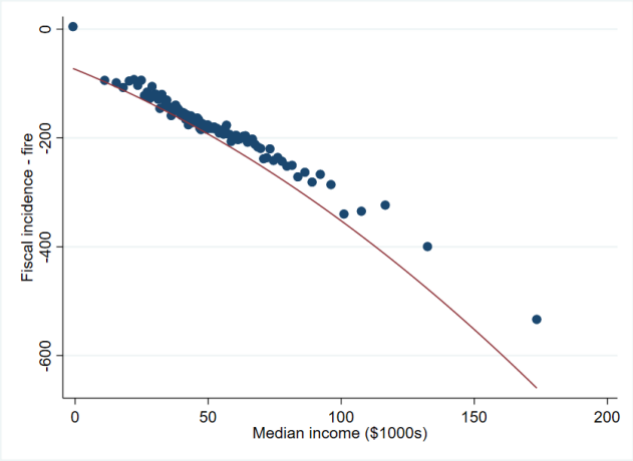
	Total expenditures	Police	Fire	Roads	Parks	Combo – main	Combo – all	Other
Log of Tax Share	-0.478***	-0.609***	-0.379**	-0.268***	-0.451**	-0.521***	-0.520***	-0.470**
	(0.168)	(0.199)	(0.162)	(0.0708)	(0.209)	(0.161)	(0.161)	(0.182)
Log of Median Income	0.529***	0.727***	0.763***	-0.178	0.779***	0.581***	0.565***	0.445**
	(0.152)	(0.150)	(0.216)	(0.154)	(0.246)	(0.158)	(0.157)	(0.181)
Log of Population	0.578***	0.374**	0.784***	0.599***	0.724***	0.557***	0.560***	0.585***
	(0.159)	(0.188)	(0.161)	(0.0834)	(0.198)	(0.153)	(0.153)	(0.174)
Percent Black	0.00292	0.00522**	0.00267	-0.00481*	-0.00233	0.00216	0.00159	0.00298
	(0.00211)	(0.00209)	(0.00359)	(0.00269)	(0.00316)	(0.00219)	(0.00217)	(0.00269)
Percent Hispanic	-0.000821	0.00601***	0.00445	-0.00347	-0.000700	0.000689	0.000396	-0.00249
	(0.00201)	(0.00221)	(0.00332)	(0.00248)	(0.00338)	(0.00209)	(0.00208)	(0.00239)
Percent Aged>64	1.638***	1.026**	2.324***	0.224	0.751	0.979*	0.951*	1.884***
	(0.455)	(0.486)	(0.668)	(0.600)	(0.629)	(0.572)	(0.569)	(0.542)
Percent Owner Occupied	-0.0129***	-0.000389	-0.00162	-0.00124	-0.0121**	-0.00319	-0.00295	-0.0177***
	(0.00376)	(0.00435)	(0.00640)	(0.00423)	(0.00546)	(0.00314)	(0.00311)	(0.00457)
Percent condominium	-0.00231	0.00288	0.00478*	-0.00245	0.00280	0.00226	0.00220	-0.00431
	(0.00280)	(0.00290)	(0.00277)	(0.00268)	(0.00404)	(0.00260)	(0.00258)	(0.00322)
Percent multi-family	0.00110	0.0101**	0.0109**	-0.00403	0.00203	0.00696**	0.00730***	-0.00141
	(0.00333)	(0.00411)	(0.00511)	(0.00451)	(0.00463)	(0.00277)	(0.00275)	(0.00416)
Percent mobile home	0.00105	-0.0108**	-0.0153	-0.00586*	0.000183	-0.00367	-0.00392	0.00326
	(0.00519)	(0.00528)	(0.0114)	(0.00346)	(0.00633)	(0.00330)	(0.00326)	(0.00618)
Constant	1.701	-2.523*	-5.504**	7.707***	-5.239**	-0.807	-0.641	2.476
	(1.566)	(1.525)	(2.261)	(1.543)	(2.530)	(1.668)	(1.653)	(1.862)
R^2	3,336	3,022	2,391	3,145	2,932	3,316	3,316	3,336
Observations	0.900	0.872	0.848	0.744	0.814	0.911	0.912	0.848
Cities	367	330	273	354	334	366	367	366

Notes: Data for cities in Florida from 2010-2019. The main combo category is the summation of police, fire, road, and park expenditure. The combo all category is the main combo category plus library and culture expenditures. The other category subtracts combo all from total expenditures. Standard errors clustered at the city level in parentheses: *, **, *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

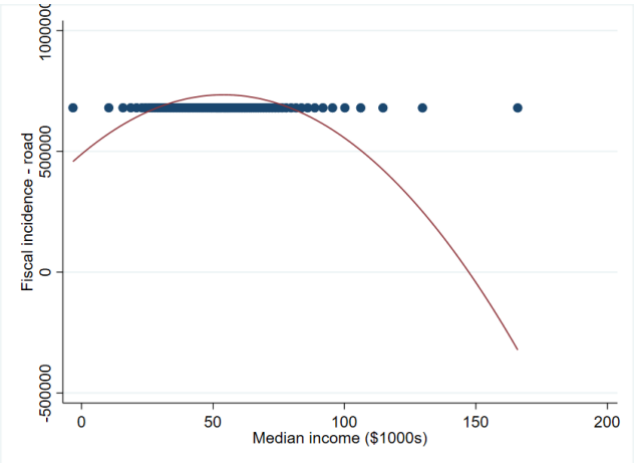
Appendix Figure 1 – Fiscal incidence by income (main spending categories)



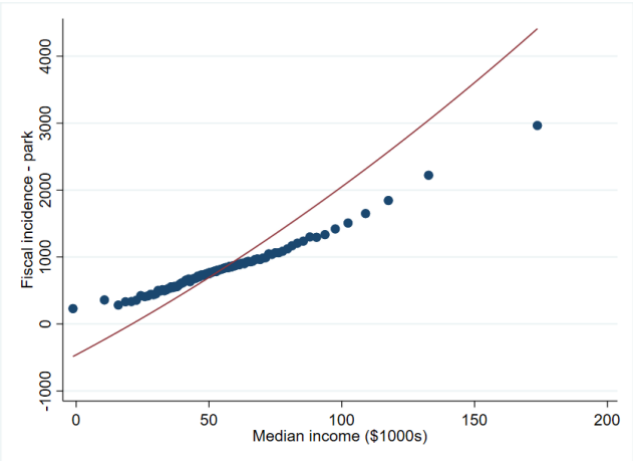
(a) Police



(b) Fire



(c) Roads



(d) Parks

Notes: Estimated measure of fiscal incidence for various expenditure categories by block group median income. Fiscal incidence is the difference between the Lindahl tax share and the actual property tax share. Each circle represents a percentile of income while the red line is the quadratic fit of the data.