Looking for Leviathan in the Tax Base: Growth and Local Property Taxes

Spencer T. Brien
Georgia State University
Andrew Young School of Policy Studies

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I. Introduction

Revenue diversification remains a pressing issue for local governments. The economic turmoil of the last decade as the market has seen the rise and collapse of two speculative bubbles continues to drive local policy makers to make adjustments to their tax structures that would increase revenue stability. But to make informed decisions regarding a rebalance among the sources that local governments depend upon would require estimates of how each of those sources responds to changes in income. While the sales and income taxes, sources also widely used at the state level, have repeatedly been the subjects of empirical studies examining the short and long run relationships between changes in income and revenue yield, the local property tax has received significantly less attention. This has been an unfortunate gap in local public finance research because it leaves local financial managers without key information needed to effectively redesign their tax structures to resist the effects of market shocks.

One of the first considerations for an analysis of the impact of income growth on property tax yields is the unique role this source plays in many local revenue structures. In local governments not subject to legal limitations to levy growth or millage rate assignment, the property tax millage rate is annually set by local tax officials according to a budget balancing rule such that the property levy will equal the difference between budgeted expenditures and expected revenues from all other sources. These unrestricted tax systems experience an annual change to the millage rate enacted by local tax officials in order to follow this administrative rule. The result is that changes in the property base will have only a secondary effect on the volatility of the revenue derived. Instead, volatility in the property tax comes as a result of changes in local expenditures and the other revenue sources eliciting a response from local tax officials to change the millage rate.

A focus on property tax revenue volatility as opposed to changes in the tax base is appropriate for two reasons. First, revenue volatility is a relevant policy issue inasmuch as it becomes a source of fiscal stress. Local freedom to change millage rates and long-term average universal assessment practices combine to shield local tax structures from short-term volatility in current market property values. Because the tax is only applied to the assessed value listed in the tax cadastre, the impact of immediate spikes or drops in market property values have only a muted impact on the recognized tax base. Also, if local officials are truly free to set any millage rate in order to meet their budget balancing rule, changes in the base will only impact the nominal value of the rate, but not the ultimate revenue derived from the property tax.

A second reason to focus on the actual revenues is that unpredictability in taxes paid is a source of public opposition to the property tax. In the *Nordlinger vs. Hahn* Supreme Court case in which California's property tax limitations were challenged, one of the primary winning arguments in defense of the limitation was that it provides homeowners with greater predictability in regards to their future property tax liability. The primary contribution of the framework proposed in this paper is to illuminate the impact of revenue diversification on the volatility of property tax revenues. The framework presented will demonstrate that the relative responsiveness of public expenditures and non-property tax revenues to revenue shifts, along with the share of revenue provided by property taxes, will determine the size of the shift in property levies local tax officials will have to impose in order to comply with their budget balancing rule. For a local government on the cusp of rebalancing its revenue portfolio (e.g. replacing some property tax revenue with a local option sales tax) this framework provides insight into how much larger or smaller the proportional change in the property levy will be given an increase in income. Local tax officials and voters will have more information regarding the impact of a revenue diversification policy on the future predictability of the levy.

It should be reiterated that this framework for examining property tax revenue volatility applies only to those governments not subject to restrictions on their millage rates or their overall levies. I test this framework by estimating the determinants of the property tax income-yield elasticity for county governments in the State of Georgia. The results I obtain are consistent with the budget-balancing framework proposed in this paper. For the case of Georgia, I find that future revenue diversification would actually stabilize future property tax levies.

Section II of this paper will review the literature relating to estimates of the income elasticity of the property tax. Section III introduces the administrative framework for describing how this elasticity is determined. Section IV describes the empirical approach taken to test the validity of this framework. The results of this estimation are then presented in Section V. Concluding remarks then follow in Section VI.

II. Direct Estimation of the Income Elasticity

The budget balancing role of the property tax in local fiscal structures has either been ignored by previous research on revenue stability, or it has been recognized and been the justification for focusing on the state level. Among the former, researchers have focused on the growth of assessed property tax values relative to income in order to shed light on how economic growth affects the base. The seminal paper along this line is Groves and Kahn (Groves, Harold M. and C. Harry Kahn 1952) in which the authors estimate the long-run revenue income elasticities of several taxes across six states. These estimates were achieved by employing OLS regression to estimate an equation with the log of revenues as the dependent variable and logged income as the explanatory variable. Using this form, the authors estimate the income elasticity of property tax assessments in Wisconsin from 1929 through 1948 and obtain an estimate of .22, finding that property tax assessments are inelastic over the long run to income growth.

Following Groves and Kahn, there have been many significant contributions to the study of revenue volatility, such as the development of separate measures for short and long run income-revenue elasticities (Dye, Richard F. and Therese J. McGuire 1991;Williams, William V., Robert M. Anderson, David O. Froehle, and Kaye L. Lamb 1973), the refinement of elasticity estimation to account for serial correlation and asymmetric deviations from the long run equilibrium (Bruce, Donald, William F. Fox, and M. H. Tuttle 2006;Sobel, Russell S and Randall G Holcombe 1996), and the development of a portfolio approach to conceptualizing the overall growth/stability tradeoff of a revenue structure (Misiolek, Walter S. and D. Grady Perdue 1987). The empirical content of these more recent analyses focuses almost entirely on state-level revenue sources, particularly in determining the relative stability of state sales and income taxes. The literature has paid relatively little attention to how overall growth and immedieate shocks would influence the yield of the property tax.

Williams et al (Williams, William V., Robert M. Anderson, David O. Froehle, and Kaye L. Lamb 1973) bring up the property tax in their discussion of non-income determinants of tax yield. They note that changing the tax rate is a discretionary policy choice and that it could be argued that the impact of rate changes should be controlled for before any attempt to measure stability and growth. They observe, however, "that rate change may be a frequent, acceptable practicewhich permits yield growth from a lagging base… Hence, a tax which requires frequent rate increase ought not be judged *a priori* stable or slow growing if in practice such rate changes are a regular feature of its history." They then cite the millage rates of local property taxes changing essentially every year. The essential point is that the authors recognize that in the case of the property tax, an analysis which only considers the base misses key policy-related factors which influence the stability of the ultimate yield of the tax.

There are several possible explanations for the lack of attention on the stability of the property tax. One may be that because the base of this tax, assessed local property value, is viewed to be less volatile than personal income or consumption. But the discussion by Williams et. al. argues that only looking at the base to characterize the stability of a source is inadequate. An alternative reason for focusing on state level revenue sources is that the frameworks used to understand revenue volatility for sales, income and other taxes cannot be easily extended to the property tax. In Gentry and Ladd (Gentry, William M. and Helen F. Ladd 1994) the authors seek to apply the portfolio approach to measuring the stability of alternative state and local tax structures. In their discussion of why they exclude North Carolina's property tax from their analysis, they argue that

> "[b]ecause local property tax revenues, especially in North Carolina, are driven almost exclusively by the growth in local spending, our approach to measuring growth and stability is not readily extended to local taxes. In the context of local property taxes, the approach would yield something close to the growth and instability of local spending rather than the growth and instability of the tax. This link between spending growth and tax growth presents less of a problem for state taxes…" ().

From this statement it can be understood that the level of property tax revenues is dependent upon local expenditures and an analysis of instability in this revenue source is incomplete unless it include the impact of these expenditure effects. This characteristic makes the property tax unique among revenue sources because it is influenced by changes in income not only through a capitalization effect in property values as described by the "traditional" view of the property tax, but also through indirect channels through expenditures. In fact, given modern, universal assessment practices conducted using multi-year averages, the impact of a short term income shock on the base would be minimal, but the effect on the millage rate could be dramatic.

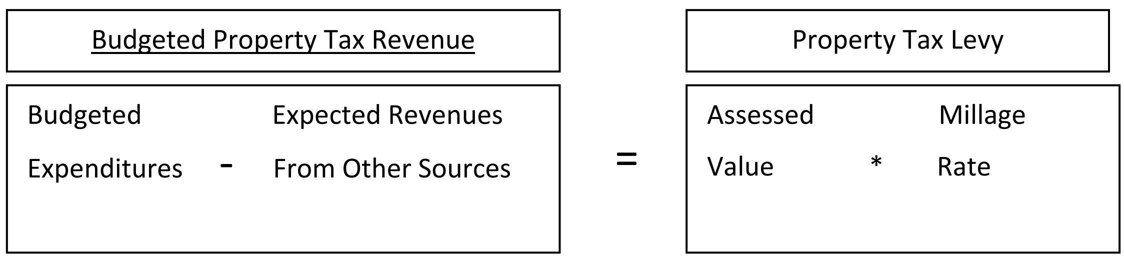
The use of millage rate changes in order to compensate for slow growth in the assessed property base is supported by the Tax and Expenditure Limitation Literature. In Joyce and Mullins (Joyce, Philip G. and Daniel R. Mullins 1991), the authors show that legal limits on property assessment increases are easily circumvented by changing the property tax rate. For this reason, assessment limits without accompanying limits on the millage rate or the overall levy are considered nonbinding constraints. Just as a statutory TEL can be circumvented with a rate limit, an income inelastic property base can also be compensated for with rate changes.

III. The Budgeting Role of the Property Tax

As can be seen from the preceeding discussion, the bulk of past research on revenue-income elasticities has been focused at the state level of government and has centered on comparisons of personal and corporate income taxes with retail sales taxes. These frameworks are inadequate for analyzing the growth and stability of the property tax because they do not account for the unique role that property levies play in local budgets. The key feature to the framework presented in this section is that it explicitly recognizes the budget rule used to determine the property tax millage rate and the overall levy. It should be noted, however, that this framework applies only to those localities that are not constrained by TEL's that bind the rate or the overall property levy.

Unlike other revenue sources, the local property tax is levied in response to the expected receipts of all other local revenue sources. The standard rule governing how local property tax rates are set is to choose the millage rate so that the levy will be equal to the difference between the budgeted local expenditures and the expected receipts from all other sources. This relationship is depicted in Figure 1. This practice makes changes property tax growth relative to income dependent upon how income influences public expenditure growth and the yield of other local revenue sources.

Figure 1.



First, consider the relationship between changes in income and budgeted local expenditures. One way to view the level of services provided is to assume that it reflects local demand for services. Over the long-run, assuming that local services are a normal good, growth in income will lead to higher public expenditures, *ceteris paribus*. It has been suggested that the relationship between expenditures and income would be non-linear, based on income-per capita, with initially increasing demand with diminishing marginal growth in demand as per-capita income rises. Under this view, the degree to which growth in local public expenditures tracks growth in local income will be primarily determined by the income elasticity of for local services.

The second factor in determining the budgeted property tax levy, the expected revenues from all other sources is also influenced by changes in real income. Local governments with their own income and sales taxes are be exposed to the revenue-income elasticities for those sources. Intergovernmental transfers that are based on a shared and fixed proportion of tax receipts will also vary according to these elasticities over both the long and short run. Transfers that are determined as a local aid line item in state budgets may be even more volatile than the overall state tax structure if local aid becomes less of a state spending priority during periods of fiscal stress.

Because the budgeted levy is the difference between budgeted expenditures and expected receipts from other sources, the impact of growth in income on the size of the levy will depend on the respective income elasticities of demand for public expenditures ($\varepsilon_{E,I}$) and income-yield elasticity of non-property tax revenues ($\varepsilon_{NP,I}$). The size of the change in the levy will be equal to the difference in expenditure growth and non-tax revenue growth as depicted in (1). This occurs automatically through the local budgeting process. The proportional change in the levy will depend upon the share of total revenues derived from the property tax.

(1) $$\Delta Property\ Levy = \Delta Budged\ Expenditures - \Delta Other\ Revenues$$

In order to formalize the interaction between income growth, expenditures and revenues, consider (2) which represents the new level of property tax after an increase in income. BE_1 and NP_1 represent budgeted expenditures and non-property tax revenues, respectively, at period 1. The percentage change in income is represented as $\%\Delta I$. PT_1 and PT_2 represent the property tax levy in each period. (2) is a straightforward multiplication of application of the relevant elasticity multiplied by the percent change in income to obtain the second period expenditures and non-property tax revenues.

(2) $$BE_1\left(1 + \left(\mathcal{E}_{E,I} * \%\Delta \mathrm{I}\right)\right) - \mathrm{OT}_1\left(1 + \left(\mathcal{E}_{\mathrm{NP,I}} * \%\Delta \mathrm{I}\right)\right) = \mathrm{PT}_2$$

To obtain the change in the property tax we simply subtract from PT_1 from (2) to obtain:

(3) $$BE_1\left(1 + \left(\mathcal{E}_{E,I} * \%\Delta \mathrm{I}\right)\right) - \mathrm{BE}_1 - \mathrm{NP}_1\left(1 + \left(\mathcal{E}_{\mathrm{NP,I}} * \%\Delta \mathrm{I}\right)\right) - \mathrm{NP}_1 = \mathrm{PT}_2 - \mathrm{PT}_1 = \Delta \mathrm{PT}$$

Which simplifies to (4) which is essentially the idea expressed in (1).

(4) $$(BE_1 * \%\Delta BE) - (NP_1 * \%\Delta NP) = \Delta PT$$

But the change in the property tax is not as useful as the average percentage change which we obtain by dividing (4) by (5) to obtain (6).

(5) $$\frac{PT_1+PT_2}{2} = \frac{PT_1+PT_1+\Delta PT}{2} = \frac{2(BE_1-NP_1)+\big((BE_1*\%\Delta BE)-(NP_1*\%\Delta NP)\big)}{2}$$

(6) $$\frac{2[(BE_1*\%\Delta BE)-(NP_1*\%\Delta NP)]}{2(BE_1-NP_1)+\big((BE_1*\%\Delta BE)-(NP_1*\%\Delta NP)\big)} = \%\Delta \mathrm{PT}$$

Dividing (6) by the percentage change in income allows us to obtain the revenue income elasticity of the property tax, as expressed in (7).

(7) $$\frac{2\big[\big(BE_1*\varepsilon_{E,I}\big)-\big(NP_1*\varepsilon_{\mathrm{NP,I}}\big)\big]}{2(BE_1-NP_1)+\big((BE_1*\%\Delta BE)-(NP_1*\%\Delta NP)\big)} = \varepsilon_{PT,I}$$

Using (7) we can see that in the case where the income elasticities of expenditures and non-property yield are equal, the proportion of revenues derived from the property tax does not impact its income elasticity. Recall that ($BE_1 - NP_1$) is the level of revenues derived from the property tax. We can modify (7) to undo the simplification given in (4) to show that $\varepsilon_{E,I}$ and $\varepsilon_{NP,I}$ appear in both the numerator and the denominator of the expression. It is then straightforward to simplify and obtain (8) which does not contain the property tax share of revenues.

Given $\varepsilon_{E,I} = \varepsilon_{\mathrm{NP,I}} = \varepsilon$

$$\frac{2[(BE_1 * \varepsilon) - (NP_1 * \varepsilon)]}{2(BE_1 - NP_1) + \big((BE_1 * \varepsilon * \%\Delta \mathrm{I}) - (NP_1 * \varepsilon * \%\Delta \mathrm{I})\big)} =$$

$$\frac{2\mathcal{E}(BE_1 - NP_1)}{2(BE_1 - NP_1) + \mathcal{E} * \%\Delta I(BE_1 - NP_1)} =$$

(8) $$\frac{2\mathcal{E}}{2+(\mathcal{E}*\%\Delta I)} = \mathcal{E}_{PT,I}$$

In all other cases in which the income elasticities of public expenditures and the non-property tax revenue yield are not equal, the income elasticity of the property tax yield will depend upon the share of revenues derived from that source. This can be observed more easially by converting the level of property tax revenues into a proportion. I multiply both the top and bottom of (7) by 1/BE. Let S represent the share of revenues derived from the property tax.

$$S = \frac{BE_1 - NP_1}{BE_1}$$

$$\frac{2\left[(\mathcal{E}_{E,I}) - \left((1-S) * \mathcal{E}_{\mathrm{NP,I}}\right)\right]}{2(S) + \left((\%\Delta I\mathcal{E}_{E,I}) - \left((1-S) * \%\Delta I\mathcal{E}_{\mathrm{NP,I}}\right)\right.} = \mathcal{E}_{\mathrm{P,I}}$$

(9) $$\frac{2(\mathcal{E}_{E,I} - \mathcal{E}_{\mathrm{NP,I}}) + S(2\mathcal{E}_{\mathrm{NP,I}})}{\%\Delta I(\mathcal{E}_{E,I} - \mathcal{E}_{\mathrm{NP,I}}) + S(2 + \%\Delta I * \mathcal{E}_{\mathrm{NP,I}})} = \mathcal{E}_{\mathrm{P,I}}$$

In equation (9) we can see that if $\varepsilon_{E,I}$ is equal to $\varepsilon_{NP,I}$ then the terms on the left-hand side of the addition operator in both the numerator and denominator will go to zero, the S term on top and bottom will cancel out and the term reduces to (8). In the case where $\varepsilon_{E,I}$ is not equal to $\varepsilon_{NP,I}$ then the income elasticity of the property tax yield will depend on the difference in the other two elasticities, the magnitude of the revenue-yield elasticity of non-property tax sources and the proportion of revenues derived from the property tax.

Looking more closely at these left-hand side terms on the numerator and the denominator, both contain the difference in the elasticities, but the term on the denominator is multiplied by a percent change, while the numerator term is doubled. Unless income in a single period more than doubles, the term on the numerator will always dominate the impact on the property tax income elasticity. In cases where non-property revenue sources are more income elastic than public service demand, the income elasticity of the property tax will be generally lower. In the case of income growth, the non-property sources are growing faster than budgeted expenditures. The lower the share of revenues derived from the property tax, the larger the portion of the expenditure growth that will be funded through the "automatic" tax increases in the non-property portion of the base. This means that property taxes will not have to grow as much to fund the new budget gap, so a lower share from the property tax will lead to a lower income elasticity of the property tax levy.

In the alternative case in which expenditures are more income sensitive than non-property revenues, the property base will need to provide a larger catch-up revenue hike to compensate for the slow growth in the other sources. This would result in an "automatic" tax decrease in the non-property tax section of the base. The smaller the portion of revenues provided by the property tax, the larger the required percentage change in property tax revenues to fill the gap. In contrast to the previous case, when $\varepsilon_{E,I} > \varepsilon_{NP,I}$, the lower the share of revenues derived from the property tax, the higher the income elasticity of the property tax levy. Table 1 summarizes the relationship between the property tax revenue share and the relative sizes of $\varepsilon_{E,I}$ and $\varepsilon_{NP,I}$.

Table 1.

	$(\varepsilon_{E,I} < \varepsilon_{NP,I})$	$(\varepsilon_{E,I} > \varepsilon_{NP,I})$	$(\varepsilon_{E,I} = \varepsilon_{NP,I})$
High share of revenues from	Higher $\varepsilon_{P,I}$	Lower $\varepsilon_{P,I}$	Share is irrelevant

property tax			
Low share of revenues from property tax	Lower $\varepsilon_{P,I}$	Higher $\varepsilon_{P,I}$	Share is irrelevant

To summarize the potential states of local revenue structures that determine the dynamic of the property tax: 1) the income elasticity of expenditure demand could be equal to the revenue-income elasticity of other sources 2) the income elasticity of expenditure demand could be greater than the revenue-income elasticity and 3) the reverse outcome where the income elasticity of expenditures is less than the revenue-income elasticity. The relative magnitude of these two income elasticities will determine the offsetting change in the property tax levy. It will also determine the impact that the proportion of revenues derived from the property tax has on the responsiveness of that source to changes in income.

In the theoretical case in which $\varepsilon_{E,I}$ is equal to $\varepsilon_{NP,I}$, then public expenditures and non-property tax revenues will have an equal proportional response given a change in income. The proportional increase in the property tax levy will be less than the changes in expenditures and other revenues. Also, for a given value for $\varepsilon_{E,I}$ and $\varepsilon_{NP,I}$, regardless of the proportion of revenues provided by the property tax, the percentage change in the levy relative to the percentage growth in income will be constant.

Under the scenario in which public expenditures are more elastic relative to a change in income compared to non-property tax revenues ($\varepsilon_{E,I} > \varepsilon_{NP,I}$), the larger the share of non-property tax sources in the overall tax structure, the greater the proportionate change in the property tax levy, given a unitary change in income. Table 1 provides a simple illustration of this outcome. Given 2% growth in real income, and values of .9 and .7 for $\varepsilon_{E,I}$ and $\varepsilon_{NP,I}$, respectively, we see that in the low property tax dependence case a balanced budget would require a levy increase of 3.3%, while in the high dependence case only a 1.9% increase would be required.

Table 2. Example of ($\varepsilon_{E,I} > \varepsilon_{NP,I}$)

	Low Dependence on Property Tax			
	$\varepsilon_{E,I}$	**0.9**	**$\varepsilon_{NP,I}$**	**0.7**
	%ΔI	2%		
Period 1	Expenditures	100	Non-Prop Tax Revenue	80
	$\varepsilon_{E,I}$ *%ΔI	0.018	$\varepsilon_{NP,I}$ * %ΔI	0.014
Period 2	Expenditures	101.8	Non-Prop Tax Revenue	81.12
	Original Property Tax Levy		20	
	New Levy		20.68	
	% Change in Levy		3.34%	
	% Change in Levy/% Change in Income		1.672	
	High Dependence on Property Tax			
	$\varepsilon_{E,I}$	**0.9**	**$\varepsilon_{NP,I}$**	**0.7**
	%ΔI	2%		
Period 1	Expenditures	100	Non-Prop Tax Revenue	30
	$\varepsilon_{E,I}$ *%ΔI	0.018	$\varepsilon_{NP,I}$ * %ΔI	0.014
Period 2	Expenditures	101.8	Non-Prop Tax Revenue	30.42
	Original Property Tax Levy		70	
	New Levy		71.38	
	% Change in Levy		1.95%	
	% Change in Levy/% Change in Income		0.976	

For the alternate case in which non-property tax sources are more income elastic than expenditures ($\varepsilon_{E,I} < \varepsilon_{NP,I}$), then the impact of the share of the property tax in the overall revenue structure is reversed. The greater the share of the property tax, there will be a smaller change in the levy proportionate to changes in income. Table 2 illustrates this outcome. In the example shown we observe the case where the other tax sources are sufficiently more elastic to a change in income that they are able to replace some of the property tax revenues. This case supports the trend observed in the revenue diversification literature which shows a declining share of local revenues being derived from the property tax. Even if both expenditures and other non-property tax sources are inelastic, a sufficient difference in their responsiveness will lead to revenue substitution.

Table 3. Example of ($\varepsilon_{E,I} < \varepsilon_{NP,I}$)

	Low Dependence on Property Tax			
	$\varepsilon_{E,I}$	**0.7**	$\varepsilon_{NP,I}$	**0.9**
	%ΔI	2%		
Period 1	Expenditures	100	Non-Prop Tax Revenue	80
	$\varepsilon_{E,I}$ *%ΔI	0.014	$\varepsilon_{NP,I}$ * %ΔI	0.018
Period 2	Expenditures	101.4	Non-Prop Tax Revenue	81.44
	Original Property Tax Levy		20	
	New Levy		19.96	
	% Change in Levy		-0.2%	
	% Change in Levy/% Change in Income		-0.100	
	High Dependence on Property Tax			
	$\varepsilon_{E,I}$	**0.7**	$\varepsilon_{NP,I}$	**0.9**
	%ΔI	2%		
Period 1	Expenditures	100	Non-Prop Tax Revenue	30
	$\varepsilon_{E,I}$ *%ΔI	0.014	$\varepsilon_{NP,I}$ * %ΔI	0.018
Period 2	Expenditures	101.4	Non-Prop Tax Revenue	30.54
	Original Property Tax Levy		70	
	New Levy		70.86	
	% Change in Levy		1.22%	
	% Change in Levy/% Change in Income		0.611	

IV. Empirical Approach

In order to test the validity of this property tax framework, I propose the following comparison. I will first estimate the key parameters of (9) by performing separate estimates of $\varepsilon_{E,I}$ and $\varepsilon_{NP,I}$. I will combine these values with the average annual percent changes in income and the average proportion of revenue derived from the property tax across the time frame and jurisdictions used to estimate $\varepsilon_{E,I}$ and $\varepsilon_{NP,I}$. To estimate the elasticity parameters, I will follow the methodology employed by Sobel and Holcombe (1996) and Bruce et. al (2006), though with some key differences.

In both of these papers, the authors had access to long time series of data of approximately 40 years for their respective tax bases. Bruce et. al were able to estimate their model separately for each state, while Sobel and Holcombe only needed to estimate one model for their national aggregate of state tax bases. The data used in this analysis is only complete over a span of 17 years and it would therefore not be possible to run separate time-series models for each local jurisdiction. As a result, other methods must be adopted to address the bias and inconsistency raised by the non-stationarity of the data.

Instead of calculating elasticity estimates for each local government separately, for this analysis I will employ a panel data approach using an AR1 Prais-Winsten regression model to correct for serial-correlation bias and employ panel corrected standard errors to improve the consistency of the estimates. Because of the large number of counties in the State of Georgia, the cross-sectional breadth of the data makes a panel analysis more feasible. I will also include two degrees of dynamic effects in order to more closely follow the DOLS approach employed by Sobel and Holcombe and Bruce et. al. As an additional addition to prior models, I include a control for county-level population growth which is represented by *X* in the model. The model for the estimation of $\varepsilon_{E,I}$ is as follows:

$$(10) \quad E^{it} = \beta_0 + \beta_1 I^{it} + \beta_2 X^{it} + \sum_{g=-j}^{j} \gamma^{ig} \, \Delta I^{it} + \varphi^{it}$$

Equation (10) is estimated using Prais-Winsten panel approach detailed above. E_{it} is the log of total expenditure for county *i* in year *t*. I is the log of personal income for county *i* in year *t*. For this model j=2, meaning that there are two degrees of leads and lags of the change in the log of personal income for each county in each period. The β_1 term is the estimate of the long-run income elasticity of public expenditures in Georgia counties, $\varepsilon_{E,I}$. This form does vary from the framework by using actual expenditures rather than budgeted expenditures. Because counties have only a limited ability to exceed their budgets, it is anticipated that the error that this introduces to the model will be small.

The income elasticity of the non-property tax revenues will be modeled as an aggregate source, using an equation similar in form to (10). The δ_1 term in this equation is an estimate of the aggregate long-run income elasticity for the sales and excise taxes, license fees, charges, state and federal transfers, and other revenues from fees, rents and interest, $\varepsilon_{NP,I}$. Between 1991 and 2006, these other sources made up an average of 59% of total revenues. Figure 2 depicts the change in revenue sources over that same time period. Although the shares are not constant, the proportions are relatively stable compared to the larger shifts away from the property tax that occurred across local government over the earlier portion of the 20th century[1]. Although a more detailed approach to calculating (9) may be to decompose the non-property revenues into each of their sources and then obtain a weighted average of the income elasticities, doing so should produce essentially the same result as computing the income elasticity of their aggregate. The X

[1] See Bartle, Ebdon and Crane (2005) for a discussion of revenue diversification trends during the 20th century.

vector of controls in this model includes the county population growth rate and the county sales tax rate at time *t*. Equation (11) provides the form for the income-yield elasticity for non-property tax sources:

$$(11) \quad NP^{it} = \delta_0 + \delta_1 I^{it} + \delta_2 X^{it} + \sum_{g=-j}^{j} \gamma^{ig} \, \Delta I^{it} + \phi^{it}$$

NP is the log of all governmental revenues less property tax revenues for government *i* at time *t*. Note that both NP and E both exclude expenditures and revenues relating to public utilities and other enterprise funds.

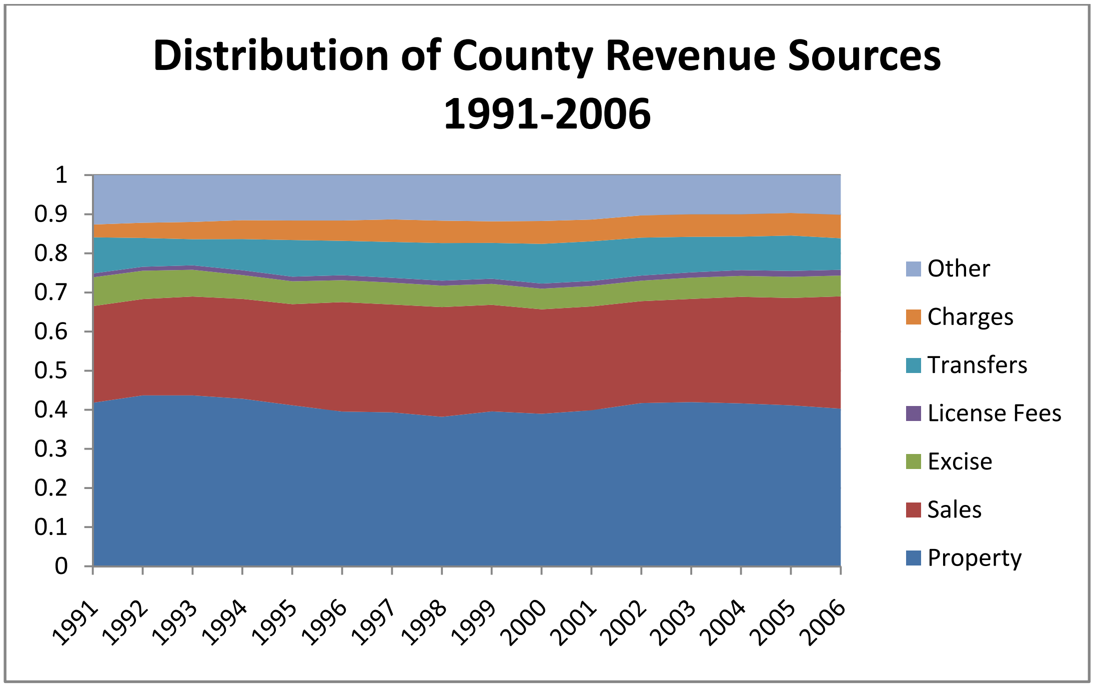
After estimating equations (10) and (11), the β_I and δ_1 estimates of $\varepsilon_{E,I}$ and $\varepsilon_{NP,I}$, respectively, will be combined with the average share of non-property tax revenues and average personal income growth to compute the measure of the long-run revenue income elasticity of the property tax depicted in (9). I define this estimated revenue-yield elasticity from (9) as $\kappa_{I,P}$. Although not yet achieved at this stage of this research, it should be possible, using Monte Carlo simulation, to construct a distribution for $\kappa_{I,P}$ and construct a confidence interval for the parameter.

As an alternative comparison for the value of $\kappa_{I,P}$, it would be interesting to attempt to estimate the income-yield elasticity of the property tax directly, using the same modeling structure presented in equations (10) and (11). This proposed equation follows:

$$(12) \quad P^{it} = \varpi_0 + \varpi_1 I^{it} + \varpi_2 X^{it} + \sum_{g=-j}^{j} \gamma^{ig} \, \Delta I^{it} + \psi^{it}$$

P represents the log of property tax receipts for county *i* in year *t*. In this model, the controls in *X* would consist solely of the county population growth, as in (10). Although this estimator suffers from endogeneity bias, some information about the magnitude of the bias could be gathered by comparing it with $\kappa_{I,P}$. Once a confidence interval has been computed for $\kappa_{I,P}$, it would be possible to conduct a test for whether ω_1 is equal to $\kappa_{I,P}$.

Figure 2.



Description of the Data

The local data employed in this analysis comes from the Report of Local Government Finances (RLGF) maintained by the Georgia Department of Community Affairs (DCA). This dataset contains comprehensive revenue and expenditure data for all counties in the State of Georgia. The data in the RLGF are collected through a survey completed by county officials whose results are subsequently organized by DCA analysts.

Due to the nature of the nature of the dynamic terms included in the regression models, it is necessary to have uninterrupted time series for all county units included in the analysis. Because several counties' participation in the survey has been intermittent, especially during its early years, they were excluded from this analysis. Out of the 159 counties in Georgia, I have complete data for 137 counties over a span of 16 years. This yields a balanced panel of 137 cross-sectional units and 12 time period units. All revenue and expenditure data from the survey were converted to 1982-1984 dollars using the CPI for all urban consumers in the South U.S. Census region, obtained from the Bureau of Labor Statistics.

The personal income data was gathered from the Bureau of Economic Accounts Local Area Personal Income tables. Personal income was converted to real dollars in the same manner as the county finance data from the DCA. The percent change in income was computed by taking the sum of all real income for all the counties in the dataset by year and then computing the average annual growth rate. The $\%\Delta I$ term therefore also reflects real personal income growth. This average growth rate for real personal income was calculated to be 3.4% per year between 1991 and 2006.

The population figures used in this analysis are US Census intercensal estimates of county population.

V. Results

The results of estimating equations (10), (11) and (12) are presented in Table 4. An initial comparison of the income elasticity parameters for expenditures and non-property tax revenues shows that this is a case where the other sources of revenue are more income elastic than public expenditures. For a more rigorous comparison, we can compare the upper limit of the expenditure parameter's 95% confidence interval (.9371) with the lower bound of the non-property tax parameter's interval (.9459) to observe whether the two intervals overlap. The intervals do not overlap, so we can conclude that the higher degree of income elasticity on the part of non-property tax expenditures is statistically significant.

Table 4

Prais-Winsten (AR1) Regression Model Estimating Income Elasticities			
	Dependent Variables		
	E	*NP*	*P*
ln(Income)	*0.921**	0.972*	*0.919**
	(0.008)	(0.013)	(0.009)
Δln(pop)	-0.617**	-0.419	0.080
	(0.298)	(0.411)	(0.504)
Δln(income)-1	-0.319+	-0.028	-0.564**
	(0.190)	(0.237)	(0.223)
Δln(income)-2	-0.307+	0.097	-0.640*
	(0.183)	(0.230)	(0.215)
Δln(income)+1	0.171	0.543**	0.272
	(0.181)	(0.245)	(0.222)
Δln(income)+2	-0.027	0.077	0.026
	(0.184)	(0.241)	(0.238)
sales_rate	---------	0.093*	---------
		(0.019)	
Constant	3.898*	2.363*	3.285*
	(0.108)	(0.226)	(0.126)
Standard errors in parentheses			
+ significant at 10%; ** significant at 5%; * significant at 1%			
R-Square	0.9947	0.9872	0.9841
Wald $\chi 2$ ($p>\chi 2$)	12820.69 (0.0000)	5312.85 (0.0000)	12826.49 (0.0000)
Observations	1644	1644	1644
Number of id	137	137	137
S %ΔI **Value of $\kappa_{I,P}$:**	.41 3.7% **.834**		

Using the β_1 and δ_1 estimates to calculate the $\kappa_{I,P}$ parameter, we obtain a value of .834. Although the Monte Carlo simulation to create a confidence interval for this parameter has not yet been performed, the magnitude of the difference between this value and the directly estimated, but endogenous, estimate of the income-elasticity of the property tax suggests that the two parameters are different. This interpretation leads to the conclusion that the effect of the endogenity bias is positive, leading to the false conclusion that property taxes are more income elastic than an unbiased parameter would suggest.

The value of $\kappa_{I,P}$ obtained here is significantly higher than the initial estimate of the income elasticity of the property tax obtained by Groves and Kahn (Groves, Harold M. and C. Harry Kahn 1952). Given that the elasticity of the property tax depends on its revenue share and the difference between $\varepsilon_{E,I}$ and $\varepsilon_{NP,I}$ it is no surprise that these values should be different given the dramatic changes in the local-level public sector since those figures were computed.

Because the data from Georgia suggest that receipts from the other revenue sources are more income elastic than public expenditure, this framework suggests that further substitution of the property tax with other revenue sources will lower the revenue-yield income elasticity of the property tax. As local governments in Georgia do not currently levy an income tax, increases in either the local sales tax or larger transfers from the state, funded through higher income taxes, are two options for further revenue substitution.

Another aspect of these results that is of significant interest is that estimate of the income elasticity of demand for public expenditures is less than one. Whether this finding should be interpreted to actually represent the characteristics of public demand for services, or it is more descriptive of government automatically scaling to economic growth in the community depends on the framework used to study government responsiveness. Under a traditional model of consumer demand for services, voters would first recognize their growth in income and then rebalance their mix of preferred goods and services, both publically and privately obtained and register their new preferences for public services through voting with their public officials. If, on the other hand, government officials recognize economic growth in the community and automatically scale their services provided through increased tax receipts, then there must be either a) some prior agreement between officials and voters that these services should be scaled at a given rate given expected future economic growth or b) the government is acting independently to grow public expenditures in a Leviathan type fashion. If the former fashion is the case, then this estimated income elasticity of public expenditures could represent this expected rate of government scaling to income growth. In the latter case, income inelastic expenditure growth suggests that the public sector, while growing independently, is going to grow at a slower rate than the private sector.

One other factor that this discussion must also consider is that the growth in expenditures relative to income growth must also account for the impact of higher private salaries leading to higher salaries for the public sector. Using real dollar amounts accounts for inflationary growth, but as the real private wage increases, so will the cost of government.

VI. Conclusions

The framework put forth in this paper to model the impact of income growth on property tax levies is designed to more realistically capture the public budgeting process through which the levies are established. This approach makes explicit the dependence of the property tax on the expected receipts of other revenue sources and budgeted expenditures. It also demonstrates the impact of revenue diversification and the trend to substitute away from the property tax as the primary source of local funds on the income elasticity of this source.

The core use for this framework is to develop a deeper understanding of the drivers of instability in local property tax levies. The focus on the actual levy rather than the base is intentional because changes to taxes paid are highly visible to taxpayers and is at the heart of whether the tax is predictable or not. This framework takes a step towards showing how further revenue diversification will impact future changes in the property tax levy. In the case of Georgia, because other revenues grow faster than expenditures in response to income growth, reducing reliance on the property tax would mean that local officials, through their budget balancing process, would make smaller changes to the levy in the future. This would increase the predictability of the property tax and potentially increase its political sustainability. Reducing local dependence on this source would increase its stability and possibly reduce opposition to it.

The finding that, for the case of counties in Georgia, non-property tax revenues are more income elastic than public expenditures does not generalize to other states with other local financial systems. It would be useful to conduct a multi-state analysis in order to further explore how the mix of non-property tax revenues impacts the responsiveness of property levies to income growth. As Georgia counties receive a relatively small portion of their total funding from transfers, it would be interesting to conduct a similar study on jurisdictions that have a more diverse revenue base.

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