The Impact of Population Growth on Residential Property Taxes

Bruce A. Weber and Shepard C. Buchanan

A multivariate model of the effect of population on local fiscal behavior, assessed value of property and average single family home values is estimated using cross-sectional data from Oregon.

Regression results suggest that property tax levies are unit elastic with respect to population, that the total assessed value of property increases less than proportionally with population, and that the average value of a single family home increases with population. These results imply a positive relationship between population and both property tax rates and the tax bill of the average single family homeowner. Ceteris paribus, increases in average residential property taxes are associated with increases in population.

The past decade has seen a great increase in attempts by local communities to manage population growth. A significant impetus for local growth management efforts is a belief that continued population growth leads to higher taxes and problems in public service provision [Dowell]. The main concern of communities that have implemented some sort of growth management, cited by 84 percent of these communities, is the provision of public services and facilities, such as sewer, water, and streets [Burrows]. Concern that such facilities lead to higher taxes for current residents is reinforced by many of the studies of the fiscal impacts of residential and nonresidential developments. (See Burchell and Listokin and Summers *et. al.*, for a review of these studies). Rapid growth in communities in the Western United States has led to a demand for better information about the fiscal impacts of growth and to increased involvement of the land grant universities in using fiscal impact models to provide this information [Meyer; Toman *et. al.*].

Fiscal impact models, however, have been criticized [Dowell; Nelson] for disregarding distributional considerations, i.e., the differential effects of growth on various groups in the community (longtime residents, commercial establishments, etc.). Indeed, Burchell and Listokin's *Fiscal Impact Handbook*, perhaps the most comprehensive and thorough treatment to date of the methods of fiscal impact analysis, does not even mention distributional considerations. The fiscal impact methods reviewed in the *Handbook* project the aggregate current costs and revenues of local governments associated with residential or nonresidential growth; the methods seek to determine whether growth alternatives yield a net fiscal surplus or a net fiscal deficit.

Some take the analysis one step further and seek to estimate the effect of growth

Bruce A. Weber is Associate Professor and Shepard C. Buchanan is Research Assistant in the Department of Agricultural and Resource Economics at Oregon State University.

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alternatives on the local tax rate [Clayton and Whittington].

This paper is an attempt to analyze the effect of population growth in one western state on property taxes paid by the class of property owners about which local officials most often express concern: residential property owners. As such, it is a start in the direction of introducing distributional considerations into fiscal impact models.

It is argued in this paper that, because growth may differentially affect the assessed values of residential and nonresidential property, studies that fail to recognize these differential effects (i.e., studies that look only at fiscal surpluses and deficits or tax rates) may attempt to reach conclusions about the effects of growth on homeowners which are erroneous. Specifically, the implicit assumption common to all previous fiscal impact studies that the average residential property value is unaffected by population growth is shown to be erroneous. At least for Oregon, the average value of a single family home increases as population increases, ceteris paribus. Because property tax levies are found to be unit elastic with respect to population, and because the value of all property increases less rapidly than population, there is a reason to believe that the average homeowner's property taxes increase with population.

Residential Property Taxes in Oregon

Property tax bills in Oregon are determined by the outcomes of two independent processes: the local government budgeting process and the assessment process.[1]

The budgeting process yields a property tax levy (L). In the budgeting process, local governments simultaneously determine planned expenditures, nonproperty-tax revenues and the property tax levy. The property tax levy equals planned expenditures minus non property-tax revenues (fees, service charges, grants and taxes other than the property tax).

The assessment process yields an assessed value for each single family residential property (S_i) and each nonresidential property (0_j). The assessor sums these values for all properties in a local government to obtain an estimate of total assessed value: $A = S^* + 0^*$ where

$$S^* = \sum_{i=1}^{n} S_i \quad \text{and } 0^* = \sum_{j=1}^{m} 0_j \ .$$

The tax bill of the average single-family homeowner ($\bar{T}$) is equal to the tax rate (R) times the assessed value of the average single family home ($\bar{S}$). Since the tax rate $R = \frac{L}{A}$,

$$\bar{T} = \frac{L}{A} \cdot \bar{S} \ .$$

Clearly, the tax bill $\bar{T}$ of the average single family homeowner is determined by the interaction of three variables: L, A, and $\bar{S}$. The current "state of the art" in fiscal impact models is to estimate an equivalent to L ("costs" minus nonproperty tax revenues) or R. If, however, it is not the aggregate tax impact but the distribution of the tax impact which is of concern to policymakers, then a more complete model which identifies impacts on different classes of property owners is desirable. Nelson has suggested, among other things, constructing model households and attempting to identify distributional impacts through an assessment of impacts on the model households.[2] While Nelson's framework is much more ambitious than the model developed in this paper, the notion of a "model household" has been incorporated. The attempt is made to estimate the impact of population growth on the property tax bills of a model household: the average single family homeowner. This notion could be

[1]Assume for simplicity of exposition that there is only one unit of government in each county. That each taxpayer pays taxes to support a variety of taxing districts does not materially affect the analysis.

[2]Nelson's concern is inter-income-class distribution. His concept is equally applicable to inter-property-owner-class distributions.

expanded in future studies to identify impacts on "model renters," "model businesses," "model farms," and even "model industries."

A Model of Residential Property Tax Response to Population Growth

There is good reason to expect that population affects each of the variables (L, A, $\bar{S}$) that determines the tax bill $\bar{T}$ of the average homeowner. Increases in population (P) shift out the demand for public expenditures (E). Such increases also should lead to higher nonproperty-tax revenues (N) since many fees and charges, and intergovernmental grants are either legally or conceptually tied to population. The property tax levy (L) (the difference between E and N) is also therefore a function of population. Whether it is a positive or negative function depends on how population affects expenditures and nonproperty-tax revenues.

Both the total assessed valuation of the county (A), and the average value of a single family residence ($\bar{S}$) are expected to be greater, the higher the population level. Population increases shift out the demand for local commercial and residential property, and so, other things being equal, would be expected to lead to increases in the prices (hence assessed value) of housing and commercial property.

Population, however, is only one of several determinants of these variables. Property tax levies (L) are affected by the size of local government expenditures. Local government expenditures, in turn, have been found to be affected by the age structure of the local population, local income, and the availability of (and conditions attached to) grants-in-aid as well as by population size [Fox and Sullivan]. A properly specified model of the response of local government property tax levies to population growth should account for the effect of these variables as well.

An attempt is made in this paper to properly specify a model of the effect of population on each of the variables that determines $\bar{T}$. A careful review of previous literature guided the selection of variables to include in each of the three independent equations in the model. Economists have not devoted much attention to the determinants of the assessment variables (A and S). Economists have, however, expended considerable effort in specifying models of the determinants of the variables determined in the budgeting process. Deacon and Hirsch have provided excellent reviews of this literature.

The Property Tax Levy

Although it is common practice in the fiscal impact literature to treat expenditures and revenues as independent, they are in fact simultaneously determined in the budgeting process. In a properly specified model of the budgeting process, expenditures, nonproperty tax revenues and the property tax levy are simultaneously determined.

A recent attempt to specify a theoretically sound local government expenditure determinant model is that of Fox and Sullivan. Following Borcherding and Deacon, they specify a demand function for local government services based on the preferences of the median voter, and a supply function based on a Cobb-Douglas constant-returns production function for local services. The reduced form of this system estimated by Fox-Sullivan specifies relative changes in local government expenditures as a function of relative changes in median voter income, tastes (as determined by the age structure of the population), population, wages, grants-in-aid, and a dummy variable for a metropolitan-nonmetropolitan status. Following Fox and Sullivan[3] and making adjustments for the simultaneous nature of the expenditure-levy decision in the budgeting process, local government expenditures can be specified as a function of population (P), income (I), tastes (K), the price of public expenditures (B), grants (C), and the property tax levy (L):

[3]Because the wage and metropolitan status variables were not significant in the estimated Fox-Sullivan model, they are not included in our model.

(1) $E = f(P,I,K,B,C,L)$.

All variables except B are expected to be positively related to E.

Nonproperty tax revenues (N) consist primarily of local fees and charges and intergovernmental revenues. Higher levels of fees and charges (therefore higher N) are expected in areas with higher incomes and populations. Higher N are also obviously expected in areas with more grants. The higher the property tax levy, however, the lower the N needed to make any given level of expenditure. Non-property tax revenues (N) can therefore be specified as a function of population (P), Income (I), Grants (C), and the property tax levy (L).

(2) $N = f(P,I,C,L)$.

The property tax levy (L), as indicated earlier, is merely the difference between E and N.

(3) $L \equiv E - N$

In the reduced form of this system of equations (1) – (3), the property tax levy L is specified as a function of the exogenous variables in the E and N equations.

(4) $L = \beta_{10}P^{\beta_{11}}I^{\beta_{12}}K^{\beta_{13}}B^{\beta_{14}}C^{\beta_{15}}$

where

P = population

I = income per capita

K = percent of population in elementary and secondary school

B = percent of total assessed value in residential property

C = dummy variable indicating whether county receives federal O&C payments.[4] O&C payments (made to counties containing revested Oregon and California Railroad land) are a major source of revenue to some Oregon counties.

K is an age structure variable used to indicate demand for education, a major local public expenditure; it is expectd to be positively related to L. B is a commonly used surrogate for the price of public expenditures to residential property owners [Deacon] and is expected to be negatively related to L. C is a variable which is designed to capture the effect of a major grant (nonproperty-tax revenue) on local expenditures. Because P, I and C are hypothesized to affect both expenditures and nonproperty-tax revenues, the direction of the expected relationship for these variables is indeterminate.

Assessed Value of All Property

Through the assessment process an attempt is made to keep all property assessed at market value.[5] Factors which may be expected to affect the demand for, and thus the market value of, property in an area include population, income, and population density. All are expected to be positively related to market value. The assessed value of all property within the local government boundaries (A) is specified as a function of these three variables.

(5) $A = \beta_{20}P^{\beta_{21}}I^{\beta_{22}}D^{\beta_{23}}$
where D = population density.

Assessed Value of the Average Single Family Home

The value of a single family residence has been found to be affected by factors such as I

[4]Because the equation is estimated in logarithms, and because ln e = 1 and ln 1 = 0, C = e if county receives 0 and C payments; C = 1 if county does not receive 0 and C payments.

[5]During the period covered in this study, Oregon's assessment system required all properties to be assessed at 100 percent of market value. The Advisory Commission on Intergovernmental Relations has attempted to determine how close assessments are to market value in each state. Oregon's assessments were estimated at 87 percent of market value, placing it first in the nation in terms of closeness to market value [ACIR, 1977].

and D which describe the neighborhood environment and by factors which describe the characteristics of the housing itself such as age [Ball]. Variables describing the number of baths and the age of housing in the neighborhood are expected to explain much of the variation in housing price. The average value of a single family residence $\bar{S}$ is specified as a function of both neighborhood and housing characteristic variables:

$$(6) \quad \bar{S} = \beta_{30}P^{\beta_{31}}I^{\beta_{32}}D^{\beta_{33}}H^{\beta_{34}}G^{\beta_{35}}$$

where H = percent of homes with two or more baths
G = percent of 1977 housing built prior to 1939.

Increases in the percentage of homes with two or more baths and decreases in the percent of older homes are expected to be associated with higher average single family house values.

The model specified in Equations 4-6 is estimated empirically using ordinary least squares (OLS) estimation procedures. Cross-sectional data for 34 of 36 Oregon counties are used to estimate the parameters of the model. Unpublished data for the fiscal variables (L,A,$\bar{S}$,B,C) were obtained from the Oregon Department of Revenue for fiscal year 1977. For each county, property tax levies (L) are summed for the major local government units (cities, school districts, and the county). It is recognized that this formulation represents a simplification of reality in that different units of government might be expected to respond differently to population growth. However, this formulation also reduces the potential for distortion of the results due to differences among counties in the assignment of functional responsibilities to different governments. Furthermore, for an understanding of the overall responsiveness of property taxes to population growth, disaggregation is unnecessary.

The demographic data (P,I,K,D) and estimates of the age of housing variables (G) for 1977 were obtained from information published by the Oregon Department of Human Resources and the Oregon Department of Education. The 1970 Census of Housing provided data on (H) the percent of homes with two or more baths.

In order to use OLS on the specified models, the data are entered as logarithms. The estimated regression coefficients $\hat{\beta}_{ij}$ represent estimates of the constant elasticities of the dependent variables with respect to the independent variables. Since the principal purpose of this study is to estimate the effect of population on the dependent variables, discussion of results will focus on the $\hat{\beta}_{i1}$ coefficients. If population has no effect on the dependent variables, the estimated elasticities will equal zero.

Results

Regression results are reported in Table 1. These results contain insights about the effect of population on the three variables (L,A,$\bar{S}$) that determine the property tax bill of the average single family homeowner.

The property tax levy L is approximately unit elastic with respect to population. The estimate $\hat{\beta}_{11}$ of the elasticity of the levy with respect to population (η_{LP}) suggests that per capita property taxes are constant as localities grow.[6]

The total assessed value of A of Oregon counties, however, is inelastic with respect to population. The point estimate $\hat{\beta}_{21}$ of the elasticity of A with respect to P (η_{AP}) suggests that each one percent increase in population is associated with a .77 percent increase in assessed value. The assessed value of a county does not increase proportionally with population.

What does this imply about the effect of population growth on local property tax

[6]Both local incomes and the proportion of local assessed value in residences significantly affect the size of the levy as hypothesized. One may infer from this result that the demand for taxes is in fact somewhat income elastic and voters do apparently demand less taxes as their perceived tax price increases.

TABLE 1. Regression Results: Elasticities of Determinants of Average Residential Tax Bill: Oregon, 1977.

Dependent Variable	Constant	Population P	Income I	Density D	Percent Students K	Residential Base B	O&C Grant C	Percent Old Houses G	Percent 2+ Baths H	$\bar{R}^2$
		Independent Variables								
L	3.155 (2.465)	.998* (.068)	.931* (.421)		.125 (.366)	−.453* (.133)	.178 (.139)			.957
A	5.346 (2.282)	.769* (.073)	.069 (.401)	.081 (.057)						.950
S	2.961 (1.292)	.107* (.040)	.193 (.209)	.033 (.031)				−.173* (.059)	.117 (.070)	.817

*Significantly different from zero at five percent level.
Standard Error of Regression Coefficient in parentheses.
N = 34

rates? Since the tax rate R is equal to L divided by A, the elasticity of R with respect to population P (η_{RP}) can be estimated by subtracting $\hat{\beta}^{21}$ from $\hat{\beta}_{11}$ [7]. Such a manipulation yields an estimate of η_{RP} of .229. Apparently, ceteris paribus, a one percent increase in population is associated with a .2 percent increase in the local property tax rate. There is also evidence in the results in Table 1 of a positive relationship between population P and the average value of a single family residence $\bar{S}$. Average housing values do in fact appear to increase with population increases.

Taken together these results suggest a fairly substantial positive relationship between population and $\bar{T}$, the tax bill of the average homeowner. Since $\bar{T} = R\bar{S}$, the elasticity of $\bar{T}$ with respect to population P can be estimated from the results in Table 1.[8]

[7]Since $R = \frac{L}{A}$, the elasticity of R with respect to P (η_{RP}) equals

$\eta_{LP} - \eta_{AP}$:

$$R = \frac{L}{A},$$

$$\frac{\partial R}{\partial P} = \frac{\partial L}{\partial P} \cdot \frac{1}{A} - \frac{\partial A}{\partial P} \cdot \frac{L}{A^2}$$

$$\eta_{RP} = \frac{\partial L}{\partial P} \frac{PA}{L} \cdot \frac{1}{A} - \frac{\partial A}{\partial P} \cdot \frac{PA}{L} \cdot \frac{L}{A^2}$$

$$\eta_{RP} = \eta_{LP} - \eta_{AP}$$

Since $\hat{\beta}_{11}$ and $\hat{\beta}_{21}$ are the estimates of η_{LP} and η_{AP} respectively, the estimate of η_{RP} is $\hat{\beta}_{11} - \hat{\beta}_{21}$.

[8]Since $\bar{T} = R\bar{S}$ the elasticity of $\bar{T}$ with respect to P ($\eta_{\bar{T}P}$) equals

$\eta_{RP} + \eta_{\bar{S}P}$:

$$\bar{T} = R\bar{S}$$

$$\frac{\partial \bar{T}}{\partial P} = \frac{\partial R}{\partial P}\bar{S} + \frac{\partial \bar{S}}{\partial P}R$$

$$\eta_{\bar{T}P} = \frac{\partial R}{\partial P}\frac{P}{R\bar{S}}\bar{S} + \frac{\partial \bar{S}}{\partial P}\frac{P}{R\bar{S}}R$$

$$\eta_{\bar{T}P} = \eta_{RP} + \eta_{\bar{S}P}$$

Since the estimate of η_{RP} is $\hat{\beta}_{11} - \hat{\beta}_{21}$ (from footnote 7) and the estimate of $\eta_{\bar{S}P}$ is $\hat{\beta}_{31}$, $\eta_{\bar{T}P}$ may be estimated as $\hat{\beta}_{11} - \hat{\beta}_{21} + \hat{\beta}_{31}$.

$$\begin{aligned} \eta_{\bar{T}P} &= \hat{\beta}_{11} - \hat{\beta}_{21} + \hat{\beta}_{31} \\ &= .998 - .769 + .107 \\ &= .336 \end{aligned}$$

Ceteris paribus, a one percent increase in population implies a .3 percent increase in the property tax bill of the average single family homeowner.

Conclusions

The results suggest that citizen/taxpayer concern about the effect of growth on taxes is well-founded. They support the widely-held perception that in the long run population increases are accompanied by increases in property taxes of the average homeowner.

Fiscal impact models that examine only the variables determined in the budgeting process are not able to address the concern of local policymakers about the effects of growth on the property tax bills of various constituencies. The implicit assumption in such models is that the distribution of impacts is proportional to the current tax burden. Under this assumption the evidence reported here about the unitary elasticity of the property tax levy with respect to population would imply no adverse effect of population growth on the tax bills of any group. A more complete model of the tax impact such as the one estimated in this paper allows the identification of impacts on different constituencies. The evidence from the model estimated here suggests that population growth may have an adverse impact on homeowners in the long run, both because of its impact on the tax rate (which affects all property taxpayers) and its effect on the average value of the single family home.

The model developed here is one method of incorporating distributional impact information into fiscal impact studies. While the model examines the impact of growth only on residential property owners, elasticities of average assessed value with respect to population could be developed for other classes of property owners (commercial, industrial, farm, multi-family housing, etc.) to help understand the distributional implications of population changes.

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