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THE IMPACT OF BLOCK GRANTS ON LOCAL EXPENDITURES AND PROPERTY TAX RATES

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1. Introduction

Unrestricted block grants have been a prominent feature of several Federal systems of government[1] and accordingly attracted numerous theoretical and empirical examinations in the public finance literature.[2] American scholarly interest has increased because of recent Federal legislation to share substantial amounts of Federal taxes with state and local governments. The rationale and impact of alternative inter-state distribution formulas has been examined by several scholars;[3] however, few if any have attempted to analyze and evaluate the intra-state impact of alternative proposals. This gap in our knowledge is no doubt due to the difficulties of predicting the behavioral responses of localities to an entirely new form of inter-governmental transfers and the correlative normative problem of evaluating these predicted effects.

It is the purpose of this paper to examine several intra-state revenue sharing formulas in the context of a behavioral model of the expenditure–tax rate decision process. With a realistic model of local responses to block grants, we may predict and then evaluate the distributional impact of three intra-state revenue sharing formulas and ascertain if any meets the goal of providing fiscal relief to more 'needy' communities. Fortunately, we do have some experience at the state level with block grants; Wisconsin has had substantial experience with revenue sharing to its counties, cities, and townships. Thus, focusing on local responses to block transfers in Wisconsin may provide insights

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[1]See Maxwell (1971) for a recent analysis of the Canadian and Australian experiences with central government block grants to states and their localities.

[2]See, for example, Hirsch (1970) or Burkhead and Miner (1971) for reviews of the U.S. literature.

[3]See Weidenbaum and Joss (1970) for a discussion of alternative bills before the 92nd Congress.

into how localities in other states may behave when block grants are inaugurated by the Federal government.

The plan of the paper is as follows: Section 2 develops the theoretical model of the expenditure–tax rate decision process and applies it to a cross-section of localities in Wisconsin. Section 3 contains a discussion of intra-state distribution formulas and develops several measures to evaluate their distributional impact. The model is then simulated over time with these three formulas and the resulting patterns of transfers, taxes, and expenditures compared. Section 4 concludes.

2. A model of the local expenditure–tax rate process with an empirical application to localities in Wisconsin

To construct a realistic behavioral model of the local expenditure–revenue process, one must account for the fact that most local governments in the U.S. make constrained, simultaneous expenditure–tax rate decisions.[4] City councils are pressured on the one hand by certain demands for local public services, and are constrained on the other by the availability of revenues to finance these services at existing tax rates. Typically, the city council is provided with a revenue estimate based on last year's property tax rate and the most current assessment of property values. Budgetary requests by the various executive agencies are then evaluated against the available revenues to finance some, or all of the proposed programs. Moreover, localities often face a constitutional obligation to balance expenditures over the budgetary period with own-source revenues and transfers. Debt is typically excluded as a permanent means of financing local expenditures, although short-term notes are typically offered to smooth out payment obligations. Thus, a city council, given a tax base of known assessed value, may cut agency-proposed expenditures and/or raise the property tax rate when proposed expenditures exceed revenues.[5] The property tax rate that is chosen equilibrates the demand pressures for additional services with the supply of revenues.

Block grants affect both the demand and supply sides of city council deliberations. On the 'supply' side, the presence of unrestricted aid of a known amount involves a rightward shift in the supply of revenues available to the city council at each property tax rate. On the demand side, the council may view these funds as additions to community income which increase the ability of the community to purchase public services. Implicit in this demand side effect is a type of 'fiscal illusion'. That is, since all or part of the block grants

[4]Two recent papers by Gramlich (1969) and Henderson (1968) note the simultaneous relationship between expenditures and taxes. However, neither paper explicitly deals with the determination of local tax *rates*, nor do they recognize that most localities are usually required to finance current expenditures out of current (non debt related) revenues.

[5]We abstract here from possible increases in fees and charges as an alternative to raising property tax rates.

are ultimately financed by residents of localities, it may be inappropriate to consider the grant as an addition to income. However, since the political liability to finance the transfer program has been incurred at a higher level of government, it appears plausible to assume that such grants are viewed as new funds by the city council.

Additional factors affecting the local expenditure decision include population (P) which is thought to proxy for the public service requirements of a community,[6] community ability to pay, measured by its total money income (Y), and the full value property tax rate (t). The property tax rate represents the political risk of a particular expenditure level, given population, income, and block grants levels. We expect this rate of transformation of private wealth into public expenditures to be inversely related to expenditures because it operates as a political price that the council faces. Of course, expenditures and the property tax rate are determined at once; hence simple joint observations on expenditures and property tax rates among communities may not exhibit the hypothesized inverse relationship. As we shall see, a careful specification of the interaction between expenditure and financing pressures provides a sensible avenue for estimation of this price effect.

The supply of local expenditures will be affected by transfers (Trans), the property tax base (W), the property tax rate (t), and other sources of revenues – primarily charges and fees (CAF).

To examine the effects of an increase in block grants or other exogenous variables on property tax rates and expenditures levels, let us first spell out the model algebraically. The demand equation is specified as:

$$E^{d}_{ij} = \beta_1 + \beta_2 Y_{ij} + \beta_3 P_{ij} + \beta_4 P^2_{ij} + \beta_5 \text{Trans}_{ij} + \beta_6 t_{ij} \qquad (1)$$

(ith locality, jth time period).

Thus we write the demand function as a linear (in parameters) function of income, transfers, and the property tax rate. We enter population quadratically to capture intra-state heterogeneity in expenditure behavior which is known generally to exist between smaller and more populous communities.[7]

It will be useful later because of data limitations to consider E^{s}_{ij} as dependent on total revenues, R_{ij} rather than the property taxes, $t_{ij}W_{ij}$. Since $R_{ij} \equiv t_{ij}W_{ij} + \text{CAF}_{ij}$, we may restate the supply of expenditures relationship as:

$$E^{s}_{ij} \equiv R_{ij} + \text{Trans}_{ij}. \qquad (2)$$

Now eq. (2) is written as an identity because $E^{s}_{ij} = E_{ij}$ by law, i.e., the balanced budget constraint requires the revenue side of the local budget to equal actual expenditures.

[6]Population is, of course, only a rough proxy for the vector of factors which describe 'need' in this sense, independent of ability to pay. It is quite likely, for example, that the age composition of a community affects its utilization of public facilities. We shall assume, however, that population satisfactorily captures the impact of most non-income factors.

[7]See Scanlon and Strauss (1972) on the issue of heterogeneity.

Because CAF_{ij} is not known in our data, but $t_{ij}W_{ij}$ and R_{ij} are, and because we wish to state our model in terms of E and t, we specify an auxiliary equation that relates property taxes to total local revenues:

$$t_{ij}W_{ij} = \beta_7 R_{ij}, \qquad 0<\beta_7\leqslant 1. \tag{3}$$

Setting E^s_{ij} equal to E_{ij} in eq. (2), we may then solve eqs. (2) and (3) for t_{ij}:

$$t_{ij} = \beta_7(E_{ij}-\mathrm{Trans}_{ij})/W_{ij}. \tag{4}$$

Eq. (4) thus expresses the full value property rate as a function of the tax base, expenditure level, and transfers.

From eqs. (1) and (4) we see that E_{ij} and t_{ij} are simultaneously determined. Solving eqs. (1) and (4) yields the reduced form equations:

$$E_{ij} = [W_{ij}/(W_{ij}-\beta_6\beta_7)][\beta_1+\beta_2 Y_{ij}+\beta_3 P_{ij}+\beta_4 P^2_{ij}+\beta_5\mathrm{Trans}_{ij} + \beta_6\beta_7(-\mathrm{Trans}_{ij}/W_{ij})], \tag{5}$$

$$t_{ij} = [\beta_7/(W_{ij}-\beta_6\beta_7)][\beta_1+\beta_2 Y_{ij}+\beta_3 P_{ij}+\beta_4 P^2_{ij} + \beta_5(\mathrm{Trans}_{ij})-\mathrm{Trans}_{ij}]. \tag{6}$$

Under the assumptions that $\beta_7, \beta_1, \ldots, \beta_5 > 0$ and $\beta_6 < 0$, we see that increments in Y and P will have unambiguously stimulative impacts on expenditures and property tax rates. An increase in intergovernmental transfers will also 'stimulate' expenditures; however, whether or not property tax rates increase as well depends on whether or not β_5 is greater than 1.0. Thus whether or not additional block grants will increase property taxes depends on the extent of the income effect that such transfers have on city council decisions.[8] An increase in the tax base, W_{ij}, will have an unambiguously depressing effect on property tax rates.

Statistical estimation of eqs. (5) and (6) might proceed in terms of estimating β from joint observations on the relevant variables over time for one or several communities, or from estimating β from joint observations on several communities at a moment in time. Because of data limitations, we shall consider here the problems of estimating eqs. (5) and (6) at a moment in time. Least squares estimation of eqs. (5) and (6) faces in either case several obstacles: first, the reduced form equations are nonlinear in parameters (and variables). Second, β_6 and β_7 cannot be separately identified in eqs. (5) and (6). Third, separate (but non-simultaneous) reduced form estimation of eqs. (5) and (6) will yield identified, but not necessarily arithmetically consistent estimates of

[8]It should be noted that recent empirical controversies over the stimulative impact of block grants have centered around the size of the regression coefficient of transfers when regressed on expenditures with other socioeconomic characteristics. The more complete specification here indicates that the impact of such transfers on expenditures depends on the tax base, W, and the political-economic price effect, β_6, as well as β_5, and is hence more complex that in the usual naive single equation models.

$\beta_1, \ldots, \beta_5$.[9] We shall meet the first and second difficulty as follows: we shall estimate a variant of eq. (5) by available nonlinear techniques.[10] We choose eq. (5) to estimate because it is thought that the greater variation in E (as opposed to t) provides a better opportunity to obtain estimates of β. To solve the identification problem we first estimate eq. (4) by ordinary least squares. That is, we estimate:

$$t_{ij}W_{ij} = \theta_7 R_{ij} + \mu_{ij}, \qquad i = 1, n, \tag{7}$$

$$E_{ij} = [W_{ij}/(W_{ij}-\theta_1)][\theta_2+\theta_3 Y_{ij}+\theta_4 P_{ij}+\theta_5 P_{ij}^2 + \theta_6 \text{Trans}_{ij}+\theta_1(-\text{Trans}_{ij}/W_{ij})+s_{ij}]. \tag{8}$$

Clearly, $\theta_1 = \beta_6\beta_7$. By assuming that with $\hat{\theta}_7$ from eq. (7) we know β_7 with absolute certainty (i.e., we use non-zero a priori information from eq. (7), we may solve for β_6 and thus identify it).[11]

As indicated earlier, we shall apply eqs. (7) and (8) to cross-sectional data from Wisconsin. We shall estimate eqs. (7) and (8) for the 72 Wisconsin county aggregates reported in the *1967 Census of Governments* and thus aggregate across communities and types of governments within each country and presume that the predominant variations in the variables in the system are between counties rather than within. We use this Census source for direct general expenditures (E), total own source local revenues (R), and inter-governmental transfers (Trans). Data on income, population, and full value property in 1966 are due to the Wisconsin Department of Revenue (1966a, 1970).

Ordinary least squares estimation of eq. (7) yields the following:

$$t_{ij}W_{ij} = \underset{(0.001572)}{0.7700} R_{ij}, \qquad R^2 = 0.9997, \quad \sigma^2 = 0.1748. \tag{9}$$

Not surprising is the extremely close fit between property tax receipts and general purpose own source revenues. Nonlinear estimation of eq. (8), with linearized estimates of standard errors in parentheses, yields:[12]

[9]That is, nonlinear estimation of eqs. (5) and (6) need not yield identical β's.

[10]In particular, we use a nonlinear regression program, Gaushaus, developed at the University of Wisconsin, which combines the Gaus (Taylor series) method and the method of steepest descent. For a useful discussion of nonlinear least squares, see Draper and Smith (1967). We choose reduced form estimation because of our interest in forecasting and simulation as developed in section 3.

[11]We should note that ordinary least squares estimation of eq. (4) probably results in some simultaneous equation bias; however, it is probably quite small.

[12] Analysis of variance information for the nonlinear regression is as follows:

	Sums of squares	d.f.	Mean square
a. Total	$1{,}965.3\times10^6$	71	27.7×10^6
b. Due to regression	$1{,}763.5\times10^6$	5	352.7×10^6
c. Residual	201.8×10^6	66	3.1×10^6
Pseudo R^2 $(b \div a)$: 0.8973			

$$E_{ij} = [W_{ij}/(W_{ij}-351\times10^6)][5.759\times10^6-0.04381\,Y_{ij}+289.0P_{ij}$$

$$(139.5\times10^6) \qquad (3.426\times10^6)\ (0.01807) \qquad (73.35)$$

$$+0.346740^{-4}P_{ij}^2+1.573\ \mathrm{Trans}_{ij}-351\times10^6(-\mathrm{Trans}_{ij}/W_{ij})].$$

$$(0.1892\times10^{-4})\ (0.4800) \qquad (139.5\times10^6) \qquad (10)$$

All parameters are of expected sign except $\hat{\theta}_3$, which suggests a negative effect of income on expenditures. This unexpected sign is due to several factors. First, population as entered in the equation may be picking up the entire effect of ability to pay on expenditures. Second, we find upon investigation of a scattergram of E_{ij}/P_{ij} against P_{ij} and Y_{ij}/P_{ij} that the smaller, rural counties

Table 1

Elasticity matrix for model of expenditure and tax rates for three Wisconsin County aggregates in 1966–67.

Elasticity	Florence County	Mean County	Milwaukee County
	Expenditure equation		
$E\cdot Y$	—0.0056	—0.1460	—0.2913
$E\cdot P$	0.0250	0.4003	0.8109
$E\cdot$Trans	0.8208	0.5380	0.5488
$E\cdot W$	0.1855	0.2588	0.0319
	Tax rate equation		
$t\cdot Y$	—0.0170	—0.2995	—0.4805
$t\cdot P$	0.0775	0.8211	1.0854
$t\cdot$Trans	0.0562	0.2409	0.3191
$t\cdot W$	—0.0236	—0.5048	—1.0104

have higher expenditures and relatively lower income. Disaggregation of the expenditure data by county reveals that the bulk of this unusually high per capita expenditure was for public welfare. Over a range of the observations, then, income is not exogenous. Over the remainder of the range of observations a weak positive relationship obtains between E_{ij}/P_{ij} and Y_{ij}/P_{ij}.

With $\hat{\boldsymbol{\theta}}$ we may calculate $\boldsymbol{\beta}$, the vector of structural parameters: $\hat{\theta}_2,\ldots,\hat{\theta}_6=\beta_1,\ldots,\beta_5$. Since $\hat{\theta}_7=0.77$ and $\hat{\theta}_1=-351\times10^6$, $\beta_6=-457\times10^6$. Of immediate interest is that $\beta_5=1.573$; hence an increase in block grants will lead to an increase in both expenditures and property tax rates. The impact of changes in all exogenous variables is displayed in table 1 which provides elasticities for both reduced from equations at three points in the sample. Milwaukee County area is the most populous observation, and Florence county is the least populous.

The elasticities derived from eqs. (9) and (10) vary dramatically by size of county aggregate, and suggest that the extent of stimulation of expenditures and property tax rates that may occur is relatively slight. Thus, a one per cent increase in Trans will stimulate expenditures in Florence by 0.82%, while only 0.55% in Milwaukee County. The impact of a one percent increase in transfers on property tax rates is much more modest – in Florence they will rise 0.06% and in Milwaukee 0.32%. Population growth, in contrast, elicits a far greater percentage increase in Milwaukee's expenditures than for Florence, though both elasticities are less than 1.0. A one percent increase in Milwaukee's population leads to a 1.09 percent increase in t compared to a 0.08 percent increase in the property tax rate for Florence. Of course, incrementing P but not W or Y is somewhat unrealistic since additional population entails additional community income and wealth. However, to the extent that such immigration is of relatively poor persons, examining $\partial t/\partial P$ alone at various points in the sample may be instructive. Perhaps the most striking elasticity is the property tax rate elasticity with respect to wealth. A one percent increase in Milwaukee's full value property leads to a 1.01 percent decrease in its property tax rate; the analogous figure for Florence is 0.02 percent.

3. Simulation of alternative formulas and the normative interpretation of their impacts

The distinguishing feature of any general revenue sharing plan is that the formula operates on a fixed sum basis each year. Unlike Federal grants which are partially financed by localities via 'matching' agreements and attempt to influence relative expenditure decisions within local budgets, general revenue sharing grants are fixed each time period in dollar amount. Three alternative formulas are considered below. The 'Tarr' formula resulted from a blue-ribbon study in Wisconsin.[13] The 'Nixon' (HR4187) formula was suggested in the February, 1971 proposal to the Congress[14] to share Federal funds with state governments, counties, cities, and townships. The third formula (HR4187′) considered below involves a modification of the Nixon proposal. Each formula contains at least one variable which reflects current or previous fiscal choice by each locality. Hence, behavioral responses to each by a locality will influence in subsequent periods the amount they receive.

The Tarr formula shares on the basis of population and the excess of historical property tax rates over 20.0 mils. With a total amount to be shared of F, set

[13] See Tarr (1969). The Commission also suggested changes in the method of sharing school aids; however, we shall analyze only the recommendations vis-à-vis the general revenue sharing formula.

[14] See U.S. Treasury (1971) for the proposed law, technical description of the formulas, and state by state allocations.

each year by the legislature, we may write the Tarr formula explicitly as:

$$\begin{aligned} \text{Tarr}_{ij} &= \$30P_{ij}+m_j(t^*_{ij}-20.0)W_{ij}, \text{ if } t^*_{ij}>20.0, \\ &= \$30P_{ij}, \qquad\qquad\qquad \text{if } t_{ij}\leqslant 20.0, \end{aligned} \tag{11}$$

$$t^*_{ij} = \tfrac{1}{3}\sum_{j=1}^{3} t_{ij-1} \tag{12}$$

$$m_j = F_i - \sum_{i=1}^{n} 30P_{ij} / \sum_{i=1}^{n} (t^*_{ij}-20.0)W_{ij}. \tag{13}$$

The HR4187 formula has several stages to it since funds must be first allocated among state geographic areas and then divided between state and local level governments. Using the same notation as above, the amount to all localities, F_j, is shared on the basis of their relative revenues raised. HR4187 explicitly is:

$$\text{HR4187}_{ij} = F_j(R_{ij} / \sum_{i=1}^{n} R_{ij}). \tag{14}$$

Since F_j and $\sum_i R_{ij}$ are constants at the time of allocation, this formula essentially pays to each locality a constant fraction $(F_j/\sum_i R_{ij})$ of its locally raised revenue.

The 'modified' Nixon plan, or HR4187′[15] would account not only for revenues raised, but also 'revenue effort', revenues raised divided by total community income, and ability to pay as measured by inverse per capita income:

$$\text{HR4187}'_{ij} = F_j\left\{\left(R_{ij}\frac{R_{ij}}{Y_{ij}}\cdot\frac{P_{ij}}{Y_{ij}}\right) \Big/ \sum_{i=1}^{n}\left(R_{ij}\frac{R_{ij}}{Y_{ij}}\;\frac{P_{ij}}{Y_{ij}}\right)\right\}. \tag{15}$$

Now, the grant as a fraction of revenues raised will vary positively with the pressure such revenues create on the income base, a fiscal plight measure, and inversely with the average income level in the community.

We have, then, three transfer schemes all of which will have initial and dynamic impacts on local expenditures. The initial impact is the same as captured in the empirical investigation in section 2: there will be an income and substitution effect on the local expenditure–property tax rate decision as a result of additional block grants. The dynamic impact results from the dependence in all three formulas on revenues-raised data; expenditures and revenues-raised as a result of transfers now will lead to higher transfers in the next time period.

For forecasting and evaluation purposes, it is of interest to analyze the expenditure and tax rate patterns that would result were each formula to operate over a period of time. As noted earlier, we could perform this analysis best

[15]This modification was aired in a September 12, 1971 speech in Philadelphia by Treasury Undersecretary Charls Walker, *Revenue sharing is not dead*, to the U.S. Public Works Congress and Equipment Show.

if we had time series estimates of the model for each locality. With values for the exogenous variables we could predict expenditures and property tax rates into the future under each formula. Unfortunately, this separate estimation for each locale was not possible because of data limitations. However, we do have time series information on W, Y, P, and Trans. With $\hat{\theta}$ obtained from the cross-sectional estimation reported above and time trends for W, Y, P, and Trans, we can simulate the expenditure–tax rate under each formula. Denoting time trend generated data points for W, Y, P, and Trans as $\overset{*}{W}$, $\overset{*}{Y}$, $\overset{*}{P}$, and $\overset{*}{\text{Trans}}$,[16] we may forecast first expenditures and then property tax rates by:[17]

$$\hat{E}_{ij} = [\overset{*}{W}_{ij}/(\overset{*}{W}_{ij}-\hat{\theta}_1)][\hat{\theta}_2+\hat{\theta}_3\overset{*}{Y}_{ij}+\hat{\theta}_4\overset{*}{P}_{ij}+\hat{\theta}^5\overset{*}{P}_{ij}$$

$$+\ \hat{\theta}_6(\overset{*}{\text{Trans}}_{ij})+\hat{\theta}_1(-\overset{*}{\text{Trans}}_{ij}/W^*_{ij})]\,, \tag{16}$$

$$\hat{t}_{ij} = \hat{\theta}_7(\hat{E}_{ij}-\overset{*}{\text{Trans}}_{ij})/\overset{*}{W}_{ij}. \tag{17}$$

This provides our control simulation to compare our 'formula-shocked' effects with. To shock eqs. (16) and (17) under each formula, we add an amount, Trans'_{ij}, that each *ij*th community deserves from the Tarr formula (11), the original Nixon plan, eq. (14), or the 'modified' Nixon plan, eq. (15).

We turn now to develop measures that will allow us to make normative judgments about the simulated effects of the various formulas. Since all three formulas would be administered identically, they would presumably succeed equally well in achieving the goals of reducing uncertainty, enhancing accountability via decentralization, and eliminating red tape. It is only in terms of the fourth goal of providing aid to the fiscally 'needy' that we may find differences among the formulas in terms of ultimate impact. However, providing 'fiscal relief' to 'needy' communities is far from unambiguous. We must then carefully define these terms, for out subsequent inferences about which formula is superior will depend critically on our operational criterion of 'needy'.

A tempting analogy to pursue in defining 'need' would be that of the poverty gap. Were one to define a 'needy' government in the same way one would define a 'needy' person, one would be forced to inquire into its income, i.e. revenue status in relation to a basic set of expenditure requirements. However, since local governments are required by law to balance expenditures with taxes, transfers, and fees, we cannot sensibly analyze the extent of deficits as a barometer of their plight. Revenue short-falls, due to tax base flight, will be countered on the expenditure side by service cuts. Observed property tax rates tell us

[16]The time trends used were of the general form: $\overset{*}{W}_{ij} = \gamma_1+\gamma_2 t_{ij}$ (t = 1961, . . ., 65; i = 1, . . ., 72).

[17]Likely parametric drift in the intercept and population coefficients was corrected by multiplying them times the state and local GNP deflator (predicted for 1972) from the relevant *Economic Report of the President*.

about the pressures on the tax base; however, as we have seen from the derivation of the behavioral model in section 2, local property tax rates reflect the interaction of supply and demand forces.

While an identification problem certainly exists with regard to using the property tax rate as a measure of fiscal need, we shall use it as one target variable. Thus we would expect a successful formula to channel greater funds to communities with higher property tax rates. Evidence of success would then be a positive correlation between the additional per capita grant and the property tax rate. We shall call this relationship Measure I.

A second way to measure 'need' is to examine the underlying ability to pay of a community – now measured in income terms. Presumably, poorer communities are more deserving of transfers than richer communities. One would expect then that an inverse correlation between the per capita grant and, say, per capita income to be evidence of a successful formula. We shall call this correlation of the per capita grant and per capita income Measure II.

As we saw in section 2, the extent of property tax rate 'stimulation' that occurred in Wisconsin because of block grants was relatively slight, although the elasticities varied substantially among communities. Given that property tax rates will increase, we may ask that a successful formula stimulate property taxes more in those communities more able to pay. Two definitions of 'need' suggest themselves here: the increment in property *tax rates* and the increment in per capita property *taxes* that would occur as a result of additional block grants. A successful formula would then generate positive correlations between community per capita income and the increments in property tax rates and per capita property taxes. These then are respectively Measures III and IV.

Another consideration in evaluating alternative formulas relates to the gross versus net movement towards the goals outlined above. That is, we may wish to examine the pattern of grants among communities in relation to the pattern of implied financing among communities.[18] An appealing measure of net benefit is: $(B_i - C_i)$, where B represents the gross benefit or grant and C the implicit financing costs to the ith community. We may entertain several assumptions about how C could be incurred. Originally, revenue sharing was to be financed by the 'fiscal dividend' [e.g., Heller (1966)] of economic growth. At this point in time, however, either debt finance, reduction of other expenditure items, or a surcharge appear more tenable. For simplicity, we shall assume that a surcharge on the individual income tax is imposed:

$$\delta_j = \sum_{i=1}^{n} \mathrm{Tarr}_{ij} / \sum_{i=1}^{n} \mathrm{Tax}_{ij}, \tag{18}$$

[18]There may appear to be an inconsistency in evaluating gross and net benefits of a grant per community when it is assumed that recipients ignore the financing requirements when spending these funds. However, since the higher level of government is distributing the funds, it seems appropriate for it to consider gross and net patterns of distribution.

where δ_j is the surcharge, Tax_{ij} is the individual income tax liability in the absence of the grant program, and $\sum_{i=1}^{n} \text{Tarr}_{ij}$ is the aggregate amount to be shared. In our simulation studies, we shall equal aggregates under each formula, so that: $\sum_{i=1}^{n} \text{HR4187}_{ij} = \sum_{i=1}^{n} \text{HR4187}'_{ij}$.

Using time trends for the exogenous variables, we first perform a control simulation for the period 1968–72. Table 2 provides the basic results. Were

Table 2
Endogenous variables from control simulation.

Year	Average t	σ	Average E/P	σ
1968	24.19	5.05	374.23	88.61
1969	25.33	5.27	400.29	94.49
1970	26.80	5.56	429.32	100.44
1971	28.19	5.83	458.59	106.47
1972	31.62	6.58	504.52	113.03

transfers to grow as in the past, along with the other exogenous variables, average full value property tax rates would rise from 24.19 mils to 31.62 mils in 1972, a 30.7% increase. Average per capita expenditures would increase from \$374 to \$504, a 34.8% increase. Average per capita transfers grow from \$214 to \$260, a 21.5% increase; average county per capita income grows from \$2189 to \$2723, a 24.4% increase; state population grows from 4.254 million to 4.402 million, a 3.5% increase.

The next to last column of table 3 indicates the additional amount to be shared in the policy simulations.[19] The dollar amounts reflect the local share under

Table 3
Trends for exogenous variables.

Year	State P $\times 10^6$	State Y/P	Average county Y/P	Average county Trans$/P$	δ	F $\times 10^6$
1968	4.254	\$2712	\$2189	\$214	0.0931	\$39.904
1969	4.291	2857	2324	226	0.1025	43.904
1970	4.328*	3000	2458	237	0.0893	49.201
1971	4.365	3139	2591	249	0.0984	54.218
1972	4.402	3277	2723	260	0.0795	56.727

*1970 census of population = 4.418 million.

[19]The fund was set at 0.032 per cent of total taxable individual income (Wisconsin's share of the U.S. total), and grew from \$56.7 million in 1972. The growth path is based on Treasury Department projections of the individual income tax base. The amount shared under the Tarr proposal was initially much larger; to ensure that half the funds shared under the Tarr formula were based on population, and half on property tax relief, the per capita grant was set at \$5.

HR4187; the growth reflects projected growth in the Federal tax base. The final column shows the necessary surcharge, δ, required to finance F_j. In this regard, it should be noted that the surcharge is calculated from a distribution of state individual tax liabilities rather than the desired distribution of Federal liabilities. Data on the latter are currently unavailable; however, since the effective rates in Wisconsin are approximately linearly related to the Federal rates, the calculated δ will be a linear function of the true δ.

Table 4 displays the time paths of the endogenous variables under each policy simulation. The average per capita expenditures and property tax rates displayed are the increments that resulted when the control simulation was shocked by the additional funds under each formula. As expected, property tax rates and per capita expenditures are higher than in the control environment; however, a definite pattern emerges. In both the case of incremental

Table 4
Policy simulation results, county averages (standard deviation in parentheses).

	HR 4187			Tarr			HR 4187′		
Year	$\Delta(E/P)$	Δt	$\frac{\text{HR 4187}}{P}$	$\Delta(E/P)$	Δt	Tarr/P	$\Delta(E/P)$	Δt	$\frac{\text{HR 4187}'}{P}$
1968	9.5080	0.228	7.926	9.4942	0.220	8.013	13.162	0.269	11.366
	(2.9094)	(0.161)	(1.934)	(2.3443)	(0.153)	(1.724)	(7.887)	(0.158)	(7.608)
1969	9.1220	0.227	7.449	9.329	0.227	7.734	10.518	0.240	8.749
	(3.624)	(0.188)	(2.198)	(2.7401)	(0.177)	(1.539)	(5.511)	(0.181)	(4.637)
1970	10.256	0.250	8.350	9.6733	0.242	7.909	11.705	0.262	9.693
	(4.0130)	(0.204)	(2.420)	(3.6481)	(0.205)	(2.125)	(6.144)	(0.198)	(5.091)
1971	11.339	0.270	9.203	10.011	0.253	8.095	12.860	0.282	10.606
	(4.5072)	(0.220)	(2.687)	(4.676)	(0.233)	(2.839)	(6.984)	(0.218)	(5.663)

per capita expenditures and property tax rates, HR4187′ stimulates the most. HR4187 the next most, and the Tarr formula the least.

Using the sign and size of correlation coefficients as the basic normative tool, we find that the Tarr formula, on a gross or net basis, moves per capita grants to higher property tax rate areas. Table 5 displays the correlation results and indicates a final (1972) correlation between per capita grant and property tax rate of 0.9483 on a gross basis and 0.4340 on a net basis. Note the Tarr formula has the desired signs for the Measure I, viewed in gross or net terms.

If we view meeting 'needs' to be measured by the relationship between per capita income and the per capita grant, only HR4187′ succeeds on a gross or net basis in moving relatively more per capita funds to low income areas. The final correlation between the gross grant and per capita income of −0.1349 and a final correlation between net grant and per capita income of −0.0829. Finally, if we consider the relationship between per capita income and changes

Table 5

Correlation results.

	Year	HR 4187	Tarr	HR 4187′
Measure I (Gross) correlation between: $(\text{Trans}'/P)_i \cdot t_i$				
Desired sign: +				
	1968	0.1652	0.0892	−0.2804
	1969	0.4632	0.7839	−0.04495
	1970	0.4334	0.9412	−0.0560
	1971	0.4023	0.9470	−0.0707
	1972	0.3820	0.9483	−0.0865
Measure II (Gross) correlation between: $(\text{Trans}'/P)_i \cdot (Y/P)_i$				
Desired sign: −				
	1968	0.3999	−0.1972	−0.4806
	1969	0.7480	0.3705	−0.1262
	1970	0.7305	0.5636	−0.1218
	1971	0.7133	0.5835	−0.1260
	1972	0.6940	0.5892	−0.1349
Measure III (Gross) correlation between: $(\Delta t)_i \cdot (Y/P)_i$				
Desired sign: +				
	1968	0.7692	0.6449	0.3661
	1969	0.7743	0.6708	0.6077
	1970	0.7640	0.6642	0.5939
	1971	0.7531	0.6451	0.5803
	1972	0.7408	0.6415	0.5643
Measure IV (Gross) correlation between: $(W\Delta t/P)_i \cdot (Y/P)_i$				
Desired sign: +				
	1968	0.8276	0.7487	0.5428
	1969	0.8208	0.7606	0.6405
	1970	0.8111	0.7455	0.6198
	1971	0.8003	0.7202	0.6009
	1972	0.7876	0.7173	0.5798
Measure I (Net) correlation between: $(\text{Trans}'—\text{Tax})_i \cdot (t)_i$				
Desired sign: +				
	1968	0.0689	0.2553	−0.2889
	1969	0.3403	0.3438	0.2268
	1970	0.3666	0.4039	0.2904
	1971	0.3673	0.4359	0.2842
	1972	0.3781	0.4340	0.3148
Measure II (Net) correlation between: $(\text{Trans}'—\text{Tax})_i \cdot (Y/P)_i$				
Desired sign: −				
	1968	−0.2746	−0.1051	−0.5959
	1969	−0.0482	−0.0537	−0.2557
	1970	0.0251	0.0230	−0.1461
	1971	0.0207	0.0448	−0.1551
	1972	0.0635	0.0683	−0.0829

in property tax rates or per capita taxes to be the important indicator of success, then all three formulas are desirable since all three have the desired correlation coefficient signs. However, in both comparisons, the original Administration proposal has the largest correlation coefficients. In the final time period, its correlation coefficients were 0.7408 to 0.6415 and 0.3643 for the $\Delta t \cdot Y/P$ comparison, and 0.7876 to 0.7173 and 0.5798 for the $W\Delta t \cdot Y/P$ comparison. Thus, in terms of Measure I, the Tarr formula is superior; in terms of Measure II, the HR4187′ formula is superior; and in terms of Measures III and IV, HR4187 formula is superior.

What we find then is that two of the three formulas unilaterally succeed in meeting particular definitions of need while using a third definition of need, all three do fairly well. However, the third formula succeeds markedly better in attaining this third definition of the goal. In a sense, this is not surprising since different formulas, containing different combinations of variables are bound to have different distributional impacts. However, from a public policy point of view, the choice among the three formulas to achieve global success is rendered more difficult because none succeeds in moving towards all definitions of need. To solve this dilemma, the policy maker must then weight which kind of need is most pressing. It is at this point that the analysis becomes entirely normative.

4. Conclusion

Given that local government must balance current expenditures with current revenues without debt finance, we have seen that a reasonable model of the expenditure–tax rate decision predicts that property tax rates and expenditures may rise slightly if block grants of this kind being discussed are made to local governments. Whether or not property tax rates are in fact 'stimulated' depends on local tastes. This in and of itself is an unexceptional finding.

By applying the model to local government data in Wisconsin, the only State having historical experience with state block grants to localities, we see that property tax rate stimulation will indeed take place. This result is, of course, based on a cross-sectional regression at a fairly high level of aggregation. With time trends for the exogenous variables, we were able to generate a plausible control simulation of expenditures and property tax rates for the period 1968–72 which suggest upward trends in both endogenous variables.

Three different intra-state revenue sharing formulas were simulated to ascertain how well each fared in meeting local 'needs' and shifting emphasis away from the property tax. We find that whether or not a particular formula achieves the first goal is very sensitive to the operational definition of the goal. The formula based on population and milrate in excess of 20.0 did quite well in alleviating one measure of the fiscal crisis while a formula based on revenues raised, revenue effort, and relative per capita income performed adequately in alleviating a second measure of the fiscal crisis. All three formulas investigated succeeded in stimulating property rates more in higher per capita income areas, though a formula based on revenues raised alone was most successful. Since all three succeeded in achieving the second goal, choice among them probably rests on which measure of the goal, alleviation of the fiscal crisis, one finds most appealing.

In terms of national policy, the choice of the HR4187′ rather than Tarr formula is in some sense easier because a national formula based on full value milrates would in all likelihood prove to be an administrative nightmare since few, if any, States have state-wide property tax assessment.[20]

It should be emphasized that these findings and policy conclusions are based on the experience of one State which has been analyzed from essentially cross-sectional data. It is not clear that one can or should graft these findings onto other States which do not currently have block grant systems. The introduction of a new institution may lead to extra-marginal changes in behavior which cannot be analyzed from historical experience. Fruitful avenues for additional research would involve time series analysis of individual units of government in Winsconsin, the explicit consideration of debt as a financing instrument for capital improvements, and the explicit consideration in the model of interlocal tax competition.

[20]After this research was substantially completed, the Congress enacted the State and Local Fiscal Assistance Act of 1972, HR14370. Of interest is that the intra-state formula is similar to HR4187′ in its distribution of funds among county areas, although total taxes, T, rather than revenues is used. The legislation provides for the ith county area:

$$\mathrm{HR14370}_{i}{}^{j} = F_j \left[P_{ij} \frac{T_{ij}}{Y_{ij}} \frac{P_{ij}}{Y_{ij}} \right] \Big/ \left[\sum_{i=1}^{n} \left(P_i \frac{T_i}{Y_i} \frac{P_{ij}}{Y_{ij}} \right) \right].$$

Subject to two constraints:

(1) $0.2 \left(\sum_{i=1}^{n} \mathrm{HR14370}_{ij} / \sum_{i=1}^{n} P_{ij} \right) \leqslant \mathrm{HR14370}_{ij}/P_{ij} \leqslant \left(\sum_{i=1}^{n} \mathrm{HR14370}_{ij} / \sum_{i=1}^{n} P_{ij} \right) 1.45,$

(2) $\mathrm{HR14370}_{ij}/(R_{ij} + \mathrm{Trans}_{ij}) \leqslant 0.5.$

Thus, HR14370 differs from HR4187′ in that per cent of state population is the initial distribution device with more fiscally pressed county areas getting more and poorer areas getting relatively more. It would appear that analogous simulations would yield the same results vis-à-vis alternative formulas since P_i and T_i (or T_i/P_i) are highly correlated.

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