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Technical Papers In Economics

The Revenue Sharing Formulas: An Assessment And Framework For Further Research

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General Accounting Office
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PAD-81-57

FOREWORD

This document is intended to serve two purposes: first, to disseminate to other researchers in the field of intergovernmental financial relationships and grant formulas new information concerning the performance of the revenue sharing formula and second, to serve as a basis for further evaluation of the formula both by GAO and other interested research organizations.

To prepare for the 1980 renewal of the revenue sharing program, GAO undertook a review of the formula used to allocate general revenue sharing funds to State and local governments. Many of GAO's findings and recommendations on the formula are contained in three GAO reports to the Congress: How Revenue Sharing Formulas Distribute Aid: Rural Implications (PAD-80-23, April 22, 1980); The Impact of Tiering and Constraints on the Targeting of Revenue Sharing Aid (PAD-80-09, June 11, 1980); and Changes in Revenue Sharing Formula Would Eliminate Payment Inequities; Improve Targeting Among Local Governments (PAD-80-69, June, 10, 1980). However, due to the nature of the subject, many insights were deemed too technical to be included in the above reports. In addition, many insights were not developed in time to be included in the above reports.

This report should provide useful information to persons working with revenue sharing formulas, and stimulate additional work by other interested researchers. Any comments or observations should be directed to Jerry C. Fastrup, Room 3350, U.S. General Accounting Office, Washington, D.C. 20548. The analysis and conclusions expressed are strictly those of the author and do not necessarily represent any official position of the Program Analysis Division or the U.S. General Accounting Office.

S/W Morton A. Myers

Morton A. Myers
Director
Program Analysis Division

April 1981

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CHAPTER 1

REVENUE SHARING FORMULA ISSUES 1/

Since its inception in 1972, the revenue sharing program has distributed general-purpose aid to nearly 39,000 State and local governments by use of a complex formula. The formula has been subjected to considerable evaluation and debate prior to and during its 1976 and 1980 renewals.

One of the major concerns about the program has been distributional equity. This concern has not been translated into legislative changes in the formula because the alternatives considered produced too much information, coupled with the lack of an analytical framework. This has not enabled the Congress to systematically address myriad formula issues. It is the intent of this paper to provide such a framework and present research results concerning the equity grant allocations produced by the current revenue sharing formula.

CLASSIFICATION OF FORMULA ISSUES

Revenue sharing formula issues can be classified into three groups:

1. Conceptual - According to what criteria should revenue sharing funds be allocated?

2. Empirical - How should the distribution criteria be measured?

3. Structural - What procedures should be used to allocate revenue sharing funds?

Conceptual issues

At a fundamental level, agreement on the basic objectives of the program must be reached before the developing an allocation formula can begin. At a general level, revenue sharing is intended to represent general fiscal assistance to State and local governments to aid them in providing public services to their citizens. On what basis should this general assistance be distributed? There are

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1/I would like to express my gratitude to my colleagues, Charles Vehorn and Gerald Godshaw, for reviewing an earlier draft of this paper. Full responsibility for views and errors remain with the author.

several possible answers to this question. For example, funds could be distributed in a way which would tend to equalize the revenue raising "capacity" of local governments. An alternative would be to allocate a larger share of funds to those jurisdictions that exhibit the greatest "sacrifice" or "effort" in that their residents would have to give up a larger proportion of their economic resources (income or wealth, for instance) in order to provide some specified level of public services.

Yet another alternative would be to distribute revenue sharing aid on the basis of "need." Actually this represents several alternatives since there are many dimensions of need. For example, need could be defined in terms of social needs (a concentration of people that have a disproportionate need for public services such as the young, the elderly, and the poor) or fiscal need (governments under financial strain due to an eroding tax base, for example). The possibilities are endless, yet some agreement must be made on what criteria are to be used for distributing the aid.

Empirical issues

Once the distribution criterion (or criteria if more than one objective is adopted) is selected, the question of how each criterion is to be measured must be answered. For example, suppose it were decided to distribute revenue sharing aid with the objective of equalizing the revenue raising capacity of State and local governments. How would their respective revenue capacities be measured? State and local governments collect revenues from a variety of sources (personal and corporate income, retail sales, property and estate taxes) as well as a variety of license and user fees. How would each of these revenue bases be defined and combined into an overall measure of revenue capacity? Obviously, similar problems are encountered in trying to quantify various measures of need and effort.

Structural issues

The last set of issues has to do with the structural aspects of the formula. Once the criteria have been selected and issues of empirical measurement resolved, procedures must be developed to distribute the funds to recipient governments. Questions to be addressed would include: What mathematical formulation should be used to combine the various criteria chosen (if there is more than one)? What constraints, if any, should be placed on the formula? What kind of tiering process, if any, should be utilized? The program currently utilizes primarily a geographic tiering process whereby funds

are allocated to successively smaller geographic areas before allocations to actual governments are made. Alternatively, funds could be allocated to all governments simultaneously or to State areas first and to all governments within a State.

SCOPE

In this paper the interstate allocation of revenue sharing aid is not considered, but rather is assumed as given. The intrastate formula is generally considered to take three criteria into account: (1) revenue capacity, (2) revenue effort, and (3) a crude measure of need as measured by population. Chapter two is concerned with the conceptual issues surrounding the formula, while chapters three, four and five adress the structural issues. In chapter two, two separate formulas are derived. The first equalizes revenue raising capacity; the second rewards the effort made in providing local public services. Both formulas are based on the normative principle that equal effective tax rates ought to allow communities to provide equal levels of public services. The distributive implications of each of these formulas are discussed. Chapter two concludes with a digression showing how the capacity and effort formulas are conceptually related to exiting and proposed formulas in education and public assistance.

The third chapter describes the current intrastate revenue sharing formula and demonstrates that it is identical to the effort rewarding formula derived in chapter two. From this it is concluded that the revenue sharing formula embodies only one objective (rewarding high effort). Consequently, the objective of equalizing fiscal capacities will only be achieved to the extent that capacity and effort are colinear. Data are presented to indicate that the relationship between these criteria is very weak; consequently, if capacity equalization is an equally important objective, the current formula should be altered.

Assuming that effort is the appropriate criterion for distributing revenue sharing aid, chapter four examines the impact the tiering process has on the allocation of aid to local governments within a State. That is, the entire tiering process is not brought into question. Instead, the amount of aid to be distributed to local governments within a State is taken as given and the tiering process from this point on is examined.

The first half of chapter five analyzes the impact the maximum and minimum per capita grant constraints have on equity. It is shown that these constraints and the tiering

process described in chapter four are interdependent. Consequently, changes in the constraint will alter the inequities created by tiering and visa versa. Chapter five concludes with a description of the budget constraint which limits the size of grant allocations to a maximum percentage of expenditures. It is shown how this constraint can be altered so that it is consistent with the effort criterion embodied in the formula rather than superseding it, as is the case currently.

The empirical issues surrounding the measurement of the effort criterion contained in the current formula are not addressed. Current methods for measuring effort have been adopted, in part because there is general agreement that the current data being used represent a reasonable proxy for the theoretical concept being measured in light of currently available data. The empirical issues have also been set aside because they represent a major research effort in their own right.

CHAPTER 2

DISTRIBUTION CRITERIA: FISCAL CAPACITY OR FISCAL EFFORT

In this chapter, two alternative formulas for distributing intergovernmental aid are derived from the normative principle that communities with equal tax rates ought to provide comparable levels of public services to their citizens. The objective of the first formula is to equalize the revenue raising capacities of recipient jurisdictions; the second formula is primarily designed to reward those jurisdictions which would have to make a greater effort to supply its citizens with public services given its tax base. Because both formulas are derived from the same principle they contain the same elements of population, income, and tax revenue. They only differ in their mathematical structure. Because of the different mathematical structures, the two formulas will exhibit different income (tax base) elasticities. The implications of these differing elasticities will be explored.

Before considering the revenue sharing formula, the chapter concludes by showing that the capacity and effort formulas are related to grant formulas in the educational finance literature, with special reference to the wealth neutrality concept introduced by Professor Martin Feldstein. It is also shown that the current Medicaid formula is closely related to the effort formula when appropriately modified for use in a categorical program.

A CAPACITY EQUALIZING FORMULA

The public discussion of a Federal revenue sharing program in the mid-1960s led to some research on how general purpose aid ought to be distributed from national to sub-national units of government. The underlying equity criterion contained in many of these studies has been that jurisdictions which tax themselves at the same rate ought to be able to purchase the same amount of public services for its citizens. If expenditures are taken as a measure of public services then this principle implies that the ratio of per capita expenditures to the local tax rate ought to be equal for all eligible jurisdictions, mathematically:

(2-1) $e_i/t_i = \tilde{y}$

where e_i = Per capita expenditures on public services made by jurisdiction i. 1/

t_i = Effective tax rate of jurisdiction i which is identical to the ratio of locally raised per capita revenues (r_i) to per capita tax base (y_i) (i.e., $t_i = r_i/y_i$).

$\tilde{y}$ = constant.

Lester Thurow [19] defined the expression in 2-1 as a "benefit-effort" ratio. In the absence of any intergovernmental transfers the benefit-effort ratio is nothing more than the tax base of the local government (i.e., $e_i/t_i = t_i y_i/t_i = y_i$). Thus equalizing benefit-effort ratios (i.e., $y_i = \tilde{y}$ = constant for all i) is tantamount to equalizing tax bases or revenue capacity. LeGrand and Reschovsky [13] derived a formula which would equalize the revenue capacities of recipients by substituting the budget identity $e_i = r_i + g_i$ (where g_i is the tax base equalizing per capita grant) into equation 2-1 and solving for g_i.

The benefit-effort ratio $\tilde{y}$ is a policy determined parameter and could be set equal to the per capita tax base of the wealthiest jurisdiction or some multiple thereof. (Implications concerning the choice of this parameter will be discussed below.) Substituting the budget identity into equation 2-1 results in the following capacity equalizing formula:

$$(2\text{-}2) \qquad g = t(\tilde{y} - y) = \left(\frac{\tilde{y} - y}{y}\right) r$$

where the subscripts have been dropped for convenience.

In the area of school finance a percentage equalizing formula has been proposed as a means of offsetting the revenue raising advantage enjoyed by school districts with large tax bases. Under this formula the State government would finance a fixed percentage of school expenditures. The share of the local budget financed by the State would vary in such a way that school districts with equal tax rates would be able to finance equal levels of expenditures. (See for example Benson

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1/Throughout this report lower case letters will represent variables expressed in per capita terms and upper case letters will denote total dollar amounts.

[6] and Coons, Clune, and Sugarman [7].) In its simplest form the percentage equalizing formula can be expressed as:

$$(2\text{-}3) \qquad g = (1 - y/\tilde{y})e$$

LeGrand and Reschovsky showed that this power equalizing formula is equivalent to the capacity equalizing formulation of equation 2-2. Equation 2-3 makes clear that a capacity equalizing formula is a matching grant formula where the matching rate (m) is the coefficient for e. The locally financed share of expenditures is simply 1 - m and is generally interpreted as the price of public services to the local jurisdiction (i.e., p = 1 - m).

AN EFFORT REWARDING FORMULA

A measure of effort can also be derived from the benefit-effort ratio of equation 2-1. If the local tax rate is taken as an exogenous parameter along with a specified benefit-effort ratio we can determine the level of local revenues (r*) necessary to achieve the benefit-effort ratio $\tilde{y}$ by solving the following expression:

$$(2\text{-}4) \qquad r^*/t = \tilde{y}$$

Given the local community's tax base (y) this level of revenues would require an adjusted tax rate (t*) given by:

$$(2\text{-}5) \qquad r^* = t^*\tilde{y}$$

t* can be interpreted as an index of the "effort" the local government would have to incur if it were to achieve the policy determined benefit-effort ratio given its effective tax rate t. Substituting equation 2-5 into 2-4 and solving for t* we obtain the following effort index:

$$(2\text{-}6) \qquad t^* = \left(\frac{\tilde{y}}{y}\right)\left(\frac{r}{y}\right) = \left(\frac{\tilde{y}}{y^2}\right)r$$

The implication contained in 2-6 is that effective tax rates have to be adjusted by the relative size of the per capita tax base ($\tilde{y}/y$) in order to offset the revenue raising advantage of high tax base jurisdictions. t* will be referred to as fiscal effort to distinguish it from the effective tax rate t.

An effort rewarding formula can be constructed by multiplying each recipient's fiscal effort (t*) by a policy determined tax base y_t. For convenience if we set y_t equal to the benefit-effort ratio $\tilde{y}$ then the per capita grant can be expressed analogous to equation 2-2 as:

$$(2\text{-}7) \qquad g = \tilde{y}t^* = \tilde{y}(\tilde{y}/y)t = (\tilde{y}^2/y^2)r$$

Substituting the budget identity $r = e - g$ into equation 2-7 the effort formula can be expressed as a function of expenditures analogous to the capacity formula in equation 2-3.

$$(2\text{-}8) \qquad g = [\tilde{y}^2/(y^2 + \tilde{y}^2)]e$$

In this formulation the matching rate is given by the coefficient of e while the price of public goods to the local government is $y^2/(y^2 + \tilde{y}^2)$.

TAX BASE, PRICE EFFECTS AND THE CHOICE OF A CAPACITY OR EFFORT FORMULA

Inspection of equations 2-2 and 2-7 will reveal that the capacity formula and the effort formula depend on the same factors, the local tax base and effective tax rate, but differ in their functional form. This difference in functional form produces differences in their redistributional implications and matching rates or prices.

Differences in tax base elasticities of the grant

Equations 2-2 and 2-7 can be differentiated with respect to the local tax base (y) and elasticities computed assuming that local revenues are functionally related to y. The result of these calculations are:

$$(2\text{-}2a) \qquad E_{g\cdot y} = E_{r\cdot y} - [\tilde{y}/(\tilde{y} - y)] \quad \text{(capacity formula)}$$

$$(2\text{-}7a) \qquad E_{g\cdot y} = E_{r\cdot y} - 2 \quad \text{(effort formula)}$$

where $E_{g\cdot y}$ = tax base elasticity of the grant
$E_{r\cdot y}$ = tax base elasticity of local taxes.

Differences in tax base elasticities of price

Equations 2-4 and 2-8 express the capacity and effort formulas as a linear function of expenditures. The coefficients in each equation represent the share of expenditures financed by the donor government or the matching rate (m). If price (p) is defined as the share of expenditures financed by the recipient government we have $p = 1 - m$. The price implied by the capacity and effort formulas can be expressed as:

(2-3a) $p = y/\tilde{y}$ (capacity formula)

(2-8a) $p = y^2/(y^2 + \tilde{y}^2)$ (effort formula)

the implied tax base elasticities are:

(2-3b) $E_{p \cdot y} = 1$ (capacity formula)

(2-8b) $E_{p \cdot y} = 2\tilde{y}^2/(y^2 + \tilde{y}^2) = 2m$ (effort formula)

Comparison of the various tax base elasticities are shown in table 1 and reveals a symmetry between the two types of formulas. For the effort formula, the policy parameter $\tilde{y}$ determines the price elasticity while the price elasticity of the capacity formula is independent of this parameter. By contrast, the grant elasticity of the capacity formula is determined by the parameter $\tilde{y}$ while this elasticity is independent of $\tilde{y}$ in the effort formula.

Table 1

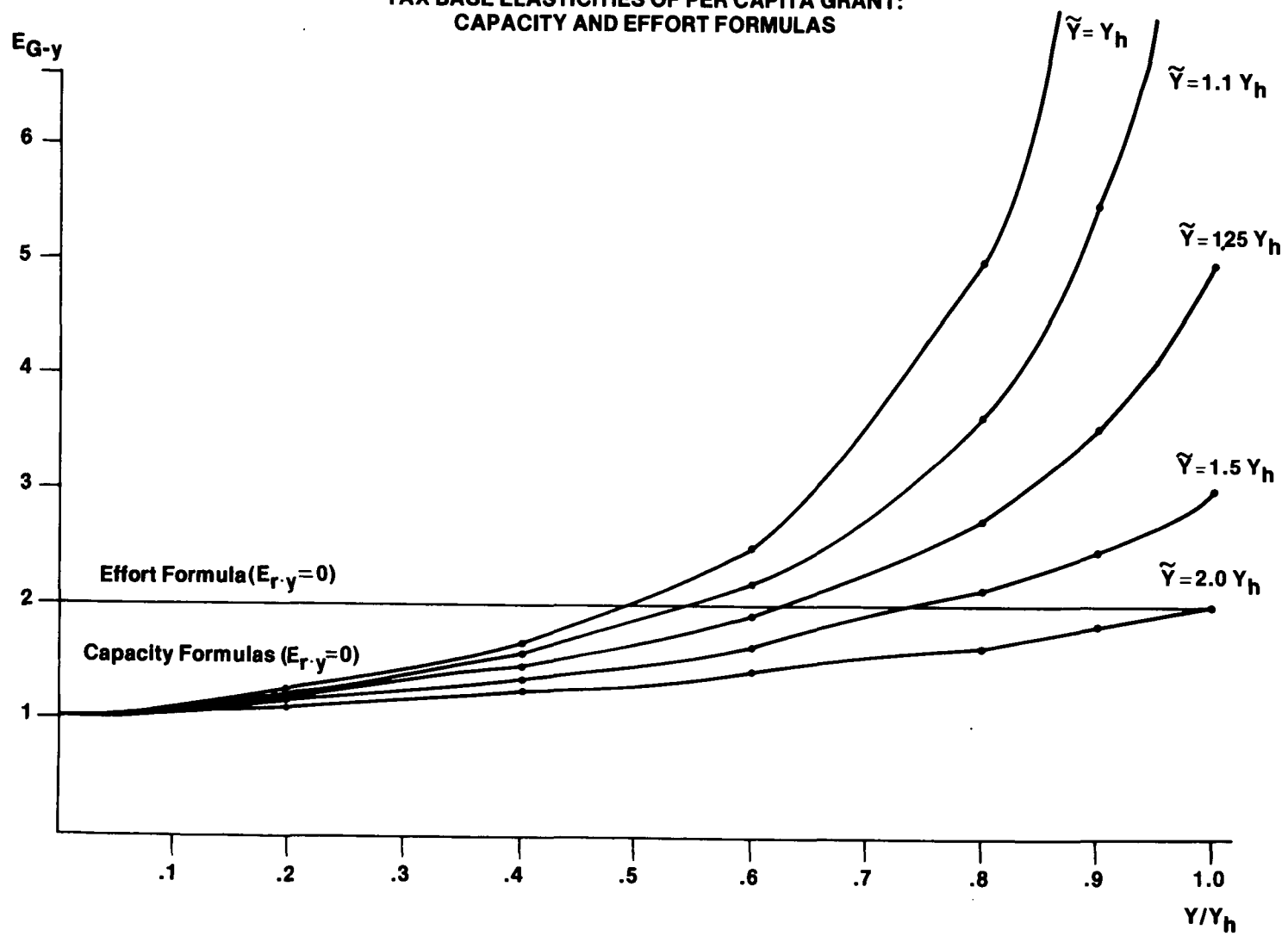
Comparison of Tax Base Elasticities of the Grant and its Price

Formula Type	Tax Base Elasticity	
	Grant	Price
Capacity formula	$E_{r \cdot y} - \left(\frac{\tilde{y}}{\tilde{y} - y}\right)$	1
Fiscal effort formula	$E_{r \cdot y} - 2$	$\left(\frac{2\tilde{y}^2}{y^2 + \tilde{y}^2}\right) = 2m$

An important policy implication is that the redistributive impact of the effort formula (as measured by tax base elasticity of the grant) is not subject to control by policymakers whereas the tax base elasticity of the capacity formula is determined by the choice of the parameter $\tilde{y}$. The larger the value of $\tilde{y}$ the lower the tax base elasticity of the grant.

The impact of the choice for $\tilde{y}$ is shown graphically in figure 1 where the grant elasticity of the capacity formula is measured along the vertical axis and the recipients tax base (expressed as a percent of the highest tax base y_h) is measured along the horizontal axis. Figure 1 demonstrates that the elasticity increases with the size of the recipients tax base. For a given tax base (y) the schedule of tax base elasticities is shown for alternative values of $\tilde{y}$ (also

Figure 1
TAX BASE ELASTICITIES OF PER CAPITA GRANT:
CAPACITY AND EFFORT FORMULAS



expressed as a percent of the highest tax base Y_h). 1/ For $y = \infty$ the tax base elasticity reaches a lower limit of -1 and increases as $\tilde{y}$ is lowered. Figure 1 also shows that if y is set at twice the per capita tax base of the best-off recipient, the capacity formula will exhibit weaker redistributive properties than will the effort formula, which has an elasticity of -2. 2/ Alternatively, if $\tilde{y}$ is set equal the per capita tax base of the best-off community y_h, the elasticity of the capacity formula will exceed that of the effort formula (i.e., $E_{g \cdot y} > 2$) for all recipients whose tax base exceeds half that of the best-off jurisdiction (i.e., $y/y_h = .5$). 3/

Another implication of the grant elasticity of the two formulas, shown in table 1, is that neither formula will necessarily display an inverse relationship between the size of the grant and the tax base due to the tax base elasticity of local taxes. This elasticity can be thought of as the result of a reduced form equation reflecting the demand and supply for local public services. If preferences and various demographic characteristics of communities which influence demand and supply are positively correlated with the tax base it would be reflected in the tax revenue elasticity ($E_{r \cdot y}$). If this elasticity is sufficiently large the grant elasticity theoretically could become positive. In any event, if either formula were applied to different sets of communities (in different States for example) they would show differing degrees of-tax base equalization.

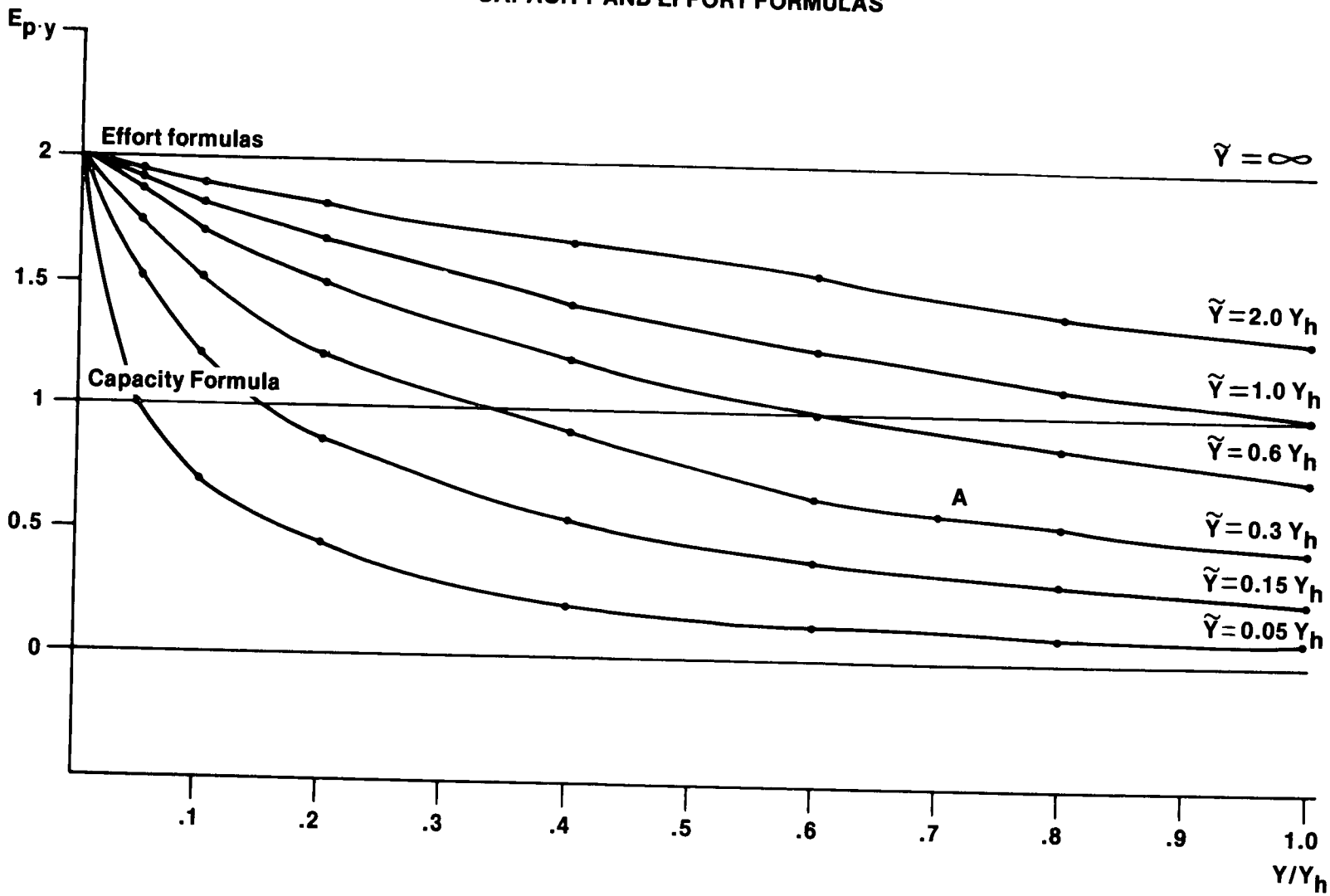
The impact of y on the effort formula's price elasticity is shown in figure 2. The vertical axis measures the price elasticity and the recipient's per capita tax base (again expressed as a percent of the largest per capita tax base y_h) is measured along the horizontal axis. Inspection of figure 2 indicates that the price elasticity declines with the per capita tax base. Figure 2 also indicates that the effort formula's price elasticity increases with y. Further implications of this relationship will be discussed in connection with wealth neutrality in the next section.

1/For illustrative purposes $E_{r \cdot y}$ has been set equal to zero.

2/Again, assuming $E_{r \cdot y} = 0$.

3/No State has a per capita income less than 50 percent of the highest per capita income State.

Figure 2
TAX BASE ELASTICITIES OF PRICE IN CAPACITY AND EFFORT FORMULAS



CAPACITY AND EFFORT FORMULAS IN REFERENCE TO LOCAL SCHOOL FINANCE AND FEDERAL MEDICAID PAYMENTS

Before analyzing the Federal revenue sharing program application of the capacity and effort concepts to two program areas which also rely heavily on formulas will be discussed in order to demonstrate their relationship to formulas in current use. The first formula has long been debated in the context of equalizing fiscal capacities among school districts. The second formula is concerned with Federal policy on sharing welfare costs with States based on the "Medicaid formula."

School finance reform and tax base (wealth) neutrality

The capacity equalizing formula has been discussed most frequently in the context of local school finance reform. Some State Supreme Courts 1/ have ruled that the level of resources devoted to a child's education cannot depend on the tax base (property wealth) of the local school district but can be a function of the State's tax base only. The capacity formula has been advocated as a means of satisfying the mandate of these rulings without sacrificing local control. Under such a formula equal tax rates would produce equal revenues (benefits) and each jurisdiction would be free to choose which tax rate they preferred. In effect the capacity equalizing formula provides the same size tax base, on a per capita basis, to all recipients.

Martin Feldstein [9] argues that such a formula may or may not satisfy the conditions contained in the court rulings depending on local demand conditions. He interprets the court mandate as meaning the total elasticity of expenditures (per student) with respect to tax base should be zero. Analytically:

$$(2\text{-}9) \qquad \ln e = \alpha_o + \alpha_1 \ln y$$

where tax base neutrality is achieved if $\alpha_1 = 0$. A demand function of the following form is posited:

$$(2\text{-}10) \qquad \ln e = B_o + B_1 \ln y + B_2 \ln P + B_3 \ln x$$

1/Most notably California in the famous Serrano vs. Priest decision.

where e and y are expenditures and tax base per student, p is price as defined earlier and x represents a vector of other factors which determine demand. Differentiating equations 2-9 and 2-10 with respect to ln y and equating the results, the relationship between demand and wealth neutrality emerge. 1/

$$(2\text{-}11) \qquad \alpha_1 = B_y + B_2 E_{p \cdot y}$$

$\alpha_1 = o$ implies that

$$(2\text{-}12) \qquad E_{p \cdot y} = -B_y / B_2$$

This demonstrates that tax base (wealth) neutrality requires a formula where the tax base-price elasticity is equal to the ratio of the tax base elasticity of demand to the price elasticity of demand. Table 1 shows that for the capacity formula this elasticity is unity and therefore will achieve tax base neutrality only in the special case where the tax base and price elasticities of demand are of equal magnitude. In contrast the tax base-price elasticity of the effort formula depends on the parameter y and varies from zero to two. Consequently, an effort formula could achieve tax base neutrality provided the tax base elasticity of demand did not exceed twice the price elasticity. For example, if the required value of $E_{p \cdot y}$ was 0.60 and the average per capita tax base was 70 percent of the highest tax base then point A in figure 2 indicates that $y = 0.3y_h$ would achieve tax base neutrality among recipients.

The Medicaid formula is closely related to fiscal effort

The Federal Government shares the cost of financing Medicaid and Aid to Families With Dependent Children with State governments. The formulas used to determine the Federal grant is shown in equation 2-13;

$$(2\text{-}13) \qquad G_i = \left[1 - .45\left(\frac{y_i}{y_{us}}\right)^2\right] E_i$$

where G_i = the Federal grant to State i

1/Equating $\partial \ln e / \partial \ln y$ from equation 2-9 and 2-10 yields the relation $\alpha_1 = B_1 + B_2 E_{p \cdot y} + B_3 E_{x \cdot y}$. By defining an adjusted tax base elasticity as $B_y \equiv B_1 + B_3 E_{x \cdot y}$, the relation in equation 2-11 results.

y_i = per capita income of State i (a measure of the State's tax base)

y_{us} = per capita income of the U.S.

E_i = program expenditures of State i computable for Federal funding.

This formula closely resembles the capacity equalizing formula shown in equation 2-3 with two differences. The .45 coefficient of the relative tax base term represents a generalization of the formula which has the effect of proportionately scaling the price variable thereby proportionately raising or lowering each State's share of total program expenditures. The second difference is that the relative tax base variable is squared. This squaring of the tax base variable has been criticized [5, 17] for the lack of an explicitly stated rationale. In terms of the capacity equalizing criterion this squaring works to the detriment of high income States by reducing the Federal share of program costs by an amount in excess of what is necessary to equalize each State's "ability" to finance the program.

The important question to ask is whether the capacity equalizing criterion is the appropriate criterion for evaluating a cost sharing formula used in income transfer programs. Economists have long argued that efficiency considerations lead to the conclusion that income redistribution programs should be a Federal responsibility. This would suggest that the capacity equalizing criterion is the wrong one. If the costs of income transfer programs are to be in part financed by States then the criterion would more appropriately be one of equalizing fiscal effort required to finance a given level of program benefits.

Equalizing the fiscal effort each State must make to finance Medicaid costs can be interpreted as requiring expression in equation 2-6 to be identical for all States. That is:

$$(2\text{-}10) \qquad t^* = \left(\frac{\tilde{y}}{y^2}\right) r_w = \text{constant}$$

where r_w represents the per capita own source revenues which must raised to finance eligible welfare expenditures.

Locally financed per capita welfare expenditures (r_w) can be determined by expressing the product of the number of recipients (P_w) times the per recipient benefit payments (b) times the local share of eligible welfare expenditures

(p) in per capita terms [i.e., $r_w = (P_w \cdot b \cdot p)/P$]. Making this substitution into equation 2-10 will result in:

$$(2\text{-}11) \qquad \bar{t}^* = \frac{\tilde{y} p b (P_w/P)}{y^2} = \text{constant}$$

Solving for the local share we obtain the formula:

$$(2\text{-}12) \qquad p = \left(\frac{\bar{t}^*}{\tilde{y}}\right)\left(\frac{1}{b}\right)\left(\frac{y^2}{P_w/P}\right)$$

The first term in parenthesis is a constant arbitrarily chosen by policymakers. If we set the arbitrary constant $\tilde{y}$ equal to the square of U.S. per capita income (y_{us}^2) then the grant formula which would equalize fiscal effort can be expressed as:

$$(2\text{-}13) \qquad G_i = \left[1 - \left(\frac{\bar{t}^*}{b}\right)\frac{(y_i/y_{us})^2}{(P_w/P_i)}\right]E_i$$

A comparison with the Medicaid formula in equation 2-9 shows that it is identical to a matching formula that would equalize fiscal effort among States with two exceptions. First, it does not take the concentration of recipients (P_w/P) into account. Second, the Medicaid formula does not allow the local share (p) to vary with per recipient benefit levels (b). Equation 2-13 also demonstrates a theoretical justification for the squaring of the relative tax base exists based on an equal fiscal effort criterion.

CHAPTER 3

THE INTRASTATE REVENUE SHARING FORMULA

Revenue sharing funds are distributed to local governments using a series of formulas. In this chapter we will describe each step in the distribution process (referred to as tiering) and the formulas which operate at each stage. The formulas will be interpreted in light of the theoretical discussion of chapter two. The structural issues of tiering and formula constraints will be considered in chapters four and five.

NOTATION

The following notation will be used in describing the revenue sharing formula:

k = 1,...K = county area identifier (K = number of counties).

i = 0, 1, ...N_k = local government identifier (N_k = number of jurisdictions in county k; i = o denotes the county government).

P_{ik} = Population of jurisdiction i in county k (P_{ok} represents the population of both the county area and county government).

T_{ik} = Tax collections of jurisdiction i in county k (T_{ok} = tax collections of the county government).

Y_{ik} = Aggregate personal income of residents of jurisdiction i in county k (Y_{ok} = aggregate income of both county area and county government k).

y_{ik} = Y_{ik}/P_{ik} = Per capita income of residents in jurisdiction i in county k.

y_s = Per capita income of residents in State s.

G_s = Revenue sharing allocation to be distributed to local governments in State s.

G_k = Revenue sharing allocation to county area k.

G_{mk} = Revenue sharing allocation to be distributed among municipalities in county k.

G_{ik} = Revenue sharing allocation to jurisdiction i in county k.

$g_{ik} = G_{ik}/P_{ik}$ = Per capita revenue sharing allocations to jurisdiction i in county k.

THE INTRASTATE FORMULA

Currently, revenue sharing aid is distributed in a series of steps referred to as tiering. First, the Federal allocation is apportioned to State areas. Each State's allocation is apportioned one-third to the State government and two-thirds to all general purpose local governments. The share destined for local governments is then apportioned among each of the State's county areas. Next, each county area allocation is subdivided into separate allocations for each type of government (the county, municipalities, and townships). Finally, money is distributed to jurisdictions. These successive steps are referred to as "tiering." The impact of adopting these tiering procedures will be discussed in the next chapter.

The allocations to county areas, and municipalities and townships within each county area are determined on the basis of three factors: population, income, and tax collections. The formula for county areas and municipalities is shown in equations 3-1 and 3-2. 1/

$$(3\text{-}1) \qquad G_k = G_s \left[\frac{P_{ok}\left(\frac{Y_s}{Y_{ok}}\right)\left(\frac{\sum_{i=o}^{N_k} T_{ik}}{Y_{ok}}\right)}{\sum_{k=1}^{K} P_{ok}\left(\frac{Y_s}{Y_{ok}}\right)\left(\frac{\sum_{i=o}^{N_k} T_{ik}}{Y_{ok}}\right)} \right]$$

$$(3\text{-}2) \qquad G_{ik} = G_{mk} \left[\frac{P_{ik}\left(\frac{Y_{ok}}{Y_{ik}}\right)\left(\frac{T_{ik}}{Y_{ik}}\right)}{\sum_{i=1}^{N_k} P_{ik}\left(\frac{Y_{ok}}{Y_{ik}}\right)\left(\frac{T_{ik}}{Y_{ik}}\right)} \right]$$

1/For States with townships the formulas are analogous. Henceforth the discussion will assume there are only two types of governments: counties and municipalities. The inclusion of township is straightforward.

The county area allocation is determined by the product of the county population, the per capita income of county residents relative to the State per capita income and the tax collections of all governments within the county relative to the total personal income of county residents. The allocation to individual municipalities is similar except the municipalities per capita income is measured relative to county per capita income. 1/

The allocation destined for municipalities (G_{mk}) and the county government (G_{ok}) is determined by multiplying the county area allocation, (eq. 3-1), by percentage share of taxes collected by municipalities and the county government respectively (i.e. $\sum_{i=1}^{N_k} T_{ik} / \sum_{i=o}^{N_k} T_{ik}$ and $T_{ok} / \sum_{i=o}^{N_k} T_{ik}$). Multiplying equation 3-1 by each of these factors is shown in equations 3-3 and 3-4.

$$(3\text{-}3) \qquad G_{mk} = G_s \left[\frac{P_{ok} \left(\frac{y_s}{y_{ok}}\right) \left(\frac{\sum_{i=1}^{N_k} T_{ik}}{Y_{ok}} \right)}{\sum_{k=1}^{K} P_{ok} \left(\frac{y_s}{y_{ok}}\right) \left(\frac{\sum_{i=o}^{N_k} T_{ik}}{Y_{ok}} \right)} \right]$$

$$(3\text{-}4) \qquad G_{ok} = \left[G_s \frac{P_{ik} \left(\frac{y_s}{y_{ok}}\right) \left(\frac{T_{ok}}{Y_{ok}}\right)}{\sum_{k=1}^{K} P_{ok} \left(\frac{y_s}{y_{ok}}\right) \left(\frac{\sum_{i=o}^{N_k} T_{ik}}{Y_{ok}} \right)} \right]$$

The expression in 3-4 indicates that in effect the allocations to county governments is based on the same three factor formula that applies to municipalities (population, per capita income, and tax collection). That is, the tiering process (county area allocations followed by allocation based on jurisdictional type) results in a three factor formula for county government.

1/ y_{ok} is a constant which can be factored outside the summation sign in the denominator and therefore cancels with Y_{ok} in the numerator. Therefore, the choice of the constant in the relative income term is arbitrary and does not affect the relative size of allocations to individual recipients.

THE TRADITIONAL INTERPRETATION OF THE THREE FACTOR FORMULA

The traditional interpretation of this formula has been that it distributes aid on the basis of three factors: need, capacity, and effort. The first term, population, has been interpreted as an indicator of need representing the number of people served by the recipient government. The second term, the relative income factor, represents the ability of the recipient government to meet its need, income is taken to represent the revenue or fiscal capacity of the municipality. The third term, the general tax effort factor, serves to indicate the "effort" the local government is putting forth to meet its need given its fiscal capacity.

Due to the ad hoc interpretation of this formula, interpretation of the program's objectives has been somewhat schizophrenic. Past research has called for alternative formulas which represent a more sophisticated measure of need while others have criticized the formula because it performs poorly based on a fiscal capacity equalizing criterion [1, 2, 4, 20]. The objective of rewarding high effort has gone unscrutinized except to point out that it interferes with the equalization goal. The remainder of this chapter will demonstrate that the three factor formula can be interpreted as embodying an effort criterion exclusively, as defined in equation 2-6 in chapter two.

THE FISCAL EFFORT INTERPRETATION OF THE THREE FACTOR FORMULA

The fiscal effort interpretation of the revenue sharing formula can be seen by expressing equations 3-2 and 3-4 in the notation of the fiscal effort formula in equation 2-7 of the previous chapter. The fiscal effort concept was defined in equation 2-6 is reproduced here as equation 3-5:

$$(3\text{-}5) \qquad t^* = \left(\frac{\tilde{y}}{y}\right)\left(\frac{r}{y}\right)$$

where $\tilde{y}$ is an arbitrary constant, y represents the recipient's per capita tax base and r is per capita revenues. The first term is the relative tax base and the second is an effective tax rate. Inspection of equation 3-2 reveals a relative tax base term, where county per capita income (y_{ok}) is used in place of the arbitrary constant $\tilde{y}$, and an effective tax rate term (T_{ik}/Y_{ik}), 1/ where tax revenues

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1/Actually, both numerator and denominator must be divided by population to be consistent with equation 3-5 but this does not alter the value of the expression.

is used to measure local revenues in the revenue sharing formula. Thus equation 3-2 can be expressed in per capita term as:

$$(3\text{-}6) \qquad g_{ik} = \frac{G_{ik}}{P_{ik}} = \left[\frac{G_{mk}}{\sum_{i=1}^{N_k} P_{ik}\ t^*_{ik}} \right] t^*_{ik} = \tilde{y}_k\ t^*_{ik}$$

the term in brackets is a constant for a given k and can be thought of as a policy determined tax base ($\tilde{y}_k$) which is multiplied by each jurisdiction's fiscal effort to determine its per capita grant. Thus, the revenue sharing formula for municipalities (equation 3-2) and with similar changes for counties (equation 3-4) is identical to the fiscal effort criterion developed in equation 2-7.

Open and closed ended formulas

The actual revenue sharing formula represents a closed ended grant in contrast to the open ended formulation in chapter two. This difference has an important implication. Under the open ended specification (equation 2-7) each jurisdiction's per capita grant is a function of its own revenues and tax base and does not depend on the behavior of other recipients. That is, $\tilde{y}$ is a policy determined constant. Under the closed ended formulation (equation 3-6) $\tilde{y}_k$ is not determined by policymakers exclusively but also depends on the fiscal effort (t^*_{ik}) of other recipients. This dependency alters the responsiveness of the grant to increases in local revenues.

The responsiveness of the revenue sharing grant can be measured by the elasticity of the grant to changes in local revenues ($E_{g \cdot r}$). Under the open ended formula shown in equation 2-7 this elasticity is unity. When the formula is expressed in its closed ended form, equation 3-2, the elasticity falls below unity by an amount equal to the recipient's share of the allocation to all municipalities located in the same county. 1/ From this we conclude that distributing revenue sharing funds by use of a closed ended formula reduces the incentive of recipients to increase the allocations by raising local taxes for two reasons. First, closing

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1/From equation 3-2 compute $E_{g \cdot r} = [\partial G_{ik} / \partial T_{ik}] \cdot T_{ik}/G_{ik}$

the algebra results in the following expression:

$$E_{g \cdot r} = 1 - \frac{P_{ik}\ t^*_{ik}}{\sum_{i=1} P_{ik}\ t^*_{ik}}$$

the grant reduces the elasticity of the grant with respect to increases in local taxes. Because of the county area allocation, this elasticity depends on the fiscal effort and population of other municipalities located in the same county. In many instances, especially in more rural States and in urban counties with one large dominant city that receives a large share of the county allocation, this elasticity will fall considerably below unity, thereby reducing the incentive to raise local taxes in order to capture a larger share of the revenue sharing allocation.

Second, using a closed ended formula produces a game-theoretic situation. An attempt by one recipient to increase its share of the grant by raising its taxes necessarily reduces allocations to other recipients. The actual change in a recipient's grant depends on the reaction of the other recipients. For example, if all other recipients increased their taxes proportionately this would thwart the initial attempt to capture a larger share of the grant. The possibility of such responses introduces an element of uncertainty and also serves to greatly reduce the elasticity of the grant with respect to local revenue increases.

NEEDS, CAPACITY, AND EFFORT - AGAIN

Based on this reinterpretation of the formula, it is clear that the current revenue sharing formula is neither a needs based formula nor a formula which attempts to correct for disparities in the fiscal capacities of recipient jurisdictions. The relationship between a jurisdiction's per capita grant (g_{ik}) and its per capita tax base (y_{ik}) is determined solely by the relationship between its per capita tax revenues and its tax base. This can be seen more clearly by thinking of per capita revenues (r in equation 3-5) as the result of reduced form a demand supply equation for local public services. Such an equation would express per capita revenues as a function of the per capita tax base and non-tax base factors which determine both demand and supply. 1/ Analytically we could express per capita revenues as:

$$(3\text{-}7) \qquad r = \alpha y^{\beta} \varepsilon$$

where β is a parameter which allows for non-linear effects of y on r and α is an arbitrary constant. Here ε represents an error term reflecting the non-tax base related variables which influence demand and supply conditions which has been

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1/We are abstracting from a Tiebout process where revenues and tax base are interdependent.

expressed multiplicatively for convenience. Substituting 3-7 into 3-5 and that result into 3-6 results in the following expression for the revenue sharing grant in per capita terms within a county area:

$$(3\text{-}8) \qquad g_{ik} = \frac{G_{ik}}{P_{ik}} = \alpha^* y^{\beta - 2\varepsilon}$$

where all variables are as previously defined and $\alpha^* = \alpha(G_{mk}/\Sigma P_{ik}\, t^*_{ik})$. The poor capacity equalizing performance of the formula as reported in [1, 20], for example, is a result of the fact that the revenue sharing formula is <u>not</u> a capacity equalizing formula per se but rather seeks to achieve an alternative objective of rewarding high fiscal effort which is related to a multitude of factors in addition to the jurisdiction's tax base. (i.e. the variance of ε may be quite large due to variables which determine effort but are unrelated to the tax base.)

CHAPTER 4

TIERING AND HORIZONTAL EQUITY

The previous chapter showed that the revenue sharing formula distributes aid on the basis of the fiscal effort concept introduced in equation 2-6 of chapter two. Specifically, each municipality's per capita grant was shown to be proportional to its fiscal effort. However, it was also shown that the proportionality factor ($\tilde{y}_k$) varied from county to county. 1/ As a result, two jurisdictions with identical levels of fiscal effort located in different county areas may receive different per capita allocations, introducing horizontal inequity into the distribution of revenue sharing funds.

In this chapter the impact of the tiering procedures, described in the previous chapter will be investigated.

HORIZONTAL EQUITY

The criterion that equal fiscal efforts ought to be associated with equal per capita grants can be expressed as:

$$(4\text{-}1) \qquad g_{ik} = \frac{G_{ik}}{P_{ik}} = \alpha t^*_{ik}$$

where α is a constant of proportionality. Multiplying equation 4-1 by P_{ik} and summing over all jurisdictions in all counties represents the total revenue sharing allocation distributed to eligible local governments. That is,

$$(4\text{-}2) \qquad G_s = \sum_{k=1}^{K} \sum_{i=o}^{N_k} G_{ik} = \alpha \sum_{k=1}^{K} \sum_{i=o}^{N_k} P_{ik}\, t^*_{ik}$$

If the total amount to be allocated is fixed, the proportionality constant α must be set equal to $G_s / \sum_k \sum_i P_{ik}\, t^*_{ik}$.

Substituting this into equation 4-1 results in the following "untiered" formula:

$$(4\text{-}3) \qquad g^u_{ik} = \left[\frac{G_s}{\sum_{k=1}^{K} \sum_{i=o}^{N_k} P_{ik}\, t^*_{ik}} \right] t^*_{ik} = \tilde{y}\, t^*_{ik}$$

1/ Equation 3-6 of the previous chapter showed that $g_{ik} = \tilde{y}_k\, t^*_{ik}$ where $\tilde{y}_k$ varied from county to county.

where the superscript u indicates untiered. Inspection of equation 4-3 implies that horizontal equity requires that all recipient jurisdictions compete from a single pot (G_s) directly instead of separate pots for each type of government within each county.

TIERING AND HORIZONTAL EQUITY

In the previous chapter it was noted that revenue sharing aid is distributed in a series of steps which we referred to as tiering. Taking the amount of aid to be distributed to local governments within a State as given we will analyze the impact tiering, after the local allocation (G_s) has been determined, has on horizontal equity.

The allocation formula for county areas was shown in equation 3-1. This formula can be interpreted as making allocations on the basis of county area fiscal effort in that $\sum_{i=o} T_{ik}/Y_{ok}$ represents an aggregate effective tax rate and is adjusted by the relative tax base of the county area y_s/y_{ok}.

LOCAL GOVERNMENT ALLOCATIONS

County governments receive a fraction of the county area allocation (G_k) based on their relative share of tax collections within their county area. Multiplying the county area allocation, equation 3-1, by $T_{ok}/\sum_{i=o}^{N_k} T_{ik}$ results in a county government per capita allocation given by:

$$(4\text{-}5) \qquad g_{ok} = \frac{G_{ok}}{P_{ok}} = \left[\frac{G_s}{\sum_{k=1}\sum_{i=o} P_{ok}\frac{y_s}{y_{ok}}\frac{T_{ik}}{Y_{ok}}}\right] t^*_{ok}$$

Some algebra will show that this is equivalent to 1/.

1/ $$\sum_k \sum_i P_{ok}\left(\frac{y_s}{y_{ok}}\right)\left(\frac{T_{ik}}{Y_{ok}}\right) = \sum_k \sum_i \left(\frac{P_{ok}}{Y_{ok}}\right)\left(\frac{y_s}{y_{ik}}\right)\left(\frac{y_{ik}}{y_{ok}}\right)\left(\frac{T_{ik}}{Y_{ik}}\right)\left(\frac{Y_{ik}}{P_{ik}}\right) P_{ik}$$

$$= \sum_k \sum_i P_{ik}\left(\frac{y_s}{y_{ik}}\right)\left(\frac{T_{ik}}{Y_{ik}}\right)\left(\frac{1}{y_{ok}}\right)\left(\frac{y_{ik}}{y_{ok}}\right) y_{ik}$$

$$= \sum_k \sum_i P_{ik}\, t^*_{ik}\left(\frac{y_{ik}}{y_{ok}}\right)^2$$

$$(4\text{-}6) \qquad g_{ok} = \left[\frac{G_s}{\sum_{k=1}^{\Sigma} \sum_{i=o}^{\Sigma} P_{ik} \, t^*_{ik} \left(\frac{Y_{ik}}{Y_{ok}} \right)^2} \right] t^*_{ok}$$

Similarly, a pot for municipalities is created by multiplying the county area allocation, equation 3-1 by their relative share of tax collections $\sum_{i=1}^{\Sigma} T_{ik} / \sum_{i=o}^{\Sigma} T_{ik}$.

The pot for municipalities in county k can be expressed as:

$$(4\text{-}7) \qquad G_{mk} = \left[\frac{P_{ok} \left(\frac{Y_s}{Y_{ok}} \right) \left(\frac{\sum_{i=1}^{\Sigma} T_{ik}}{Y_{ok}} \right)}{\sum_{k=1}^{\Sigma} \sum_{i=o}^{\Sigma} P_{ok} \left(\frac{Y_s}{Y_{ok}} \right) \left(\frac{T_{ik}}{Y_{ok}} \right)} \right] G_s$$

Substituting this result into the formula for municipalities (equation 3-2) produces:

(4-8)

$$g_{ik} = \left[\frac{G_s}{\sum_{k=1}^{\Sigma} \sum_{i=o}^{\Sigma} P_{ok} \left(\frac{Y_s}{Y_{ok}} \right) \left(\frac{T_{ik}}{Y_{ok}} \right)} \right] \left[\frac{\sum_{i=1}^{\Sigma} P_{ok} \left(\frac{Y_s}{Y_{ok}} \right) \left(\frac{T_{ik}}{Y_{ok}} \right)}{\sum_{i=1}^{\Sigma} P_{ik} \left(\frac{Y_{ok}}{Y_{ik}} \right) \left(\frac{T_{ik}}{Y_{ik}} \right)} \right] \left(\frac{Y_{ok}}{Y_{ik}} \right) \left(\frac{T_{ik}}{Y_{ok}} \right)$$

Some algebra will show that this is equivalent to:

(4-9)

$$g_{ik} = \left[\frac{G_s}{\sum_{k=1} \sum_{i=o} P_{ik}\, t^*_{ik}\left(\frac{Y_{ik}}{Y_{ok}}\right)^2}\right]\left[\frac{\sum_{i=1} P_{ik}\, t^*_{ik}\left(\frac{Y_{ik}}{Y_{ok}}\right)^2}{\sum_{i=1} P_{ik}\, t^*_{ik}}\right] t^*_{ik} \quad 1/$$

INTRACLASS EQUITY

Inspection of equation 4-6 will show that counties with identical fiscal efforts will receive equal per capita allocations since the coefficient of t^*_{ok} is a constant. Thus, we can conclude that the county area step and the division of that pot into separate sub-allocations for each type of government (tiering) does not introduce any horizontal inequities among county governments within a State. 2/

With respect to municipalities, equation 4-9 reveals that the coefficient of t^*_{ik} is composed of two terms, the first term is identical to the coefficient in the county government equation which is constant across all counties. However, the second term varies from county to county and will result in two municipalities with the same fiscal effort receiving different per capita allocations if they are located in different counties.

1/The first term in brackets in equation 4-8 is identical to the corresponding term in equation 4-5 and can therefore be written as in equation 4-6. The numerator of the second term can also be written according to the algebra in the previous footnote on page 25. The denominator of the second term and the last term each contain the following expression which can be written as:

$$\left(\frac{Y_{ok}}{Y_{ik}}\right)\left(\frac{T_{ik}}{Y_{ik}}\right) = \left(\frac{Y_s}{Y_{ik}}\right)\left(\frac{T_{ik}}{Y_{ik}}\right)\left(\frac{Y_{ok}}{Y_s}\right) = t^*_{ik}\left(\frac{Y_{ok}}{Y_s}\right)$$

Y_{ok}/Y_s is a constant which factors out of the summation in the denominator and cancels with the same factor in the last term, equation 4-9 results.

2/Chapter five will show that allocations to Indian tribes and maximum and minimum constraints applied to county areas do introduce horizontal inequities among county governments.

To determine which municipalities benefit and which lose as a result of the tiering can best be seen by comparing the allocation received by a municipality under the current tiered formula, equation 4-9 and the untiered formula, equation 4-3. Dividing equation 4-9 by equation 4-3 represents the relative difference in a tiered and an untiered allocation and is shown in equation 4-10.

(4-10)

$$\frac{G_{ik}}{G^{u}_{ik}} = \left[\frac{\sum_{i=1} P_{ik}\ t^{*}_{ik}\left(\frac{y_{ik}}{y_{ok}}\right)^{2}}{\sum_{i=1} P_{ik}\ t^{*}_{ik}}\right] \div \left[\frac{\sum_{k=1}\ \sum_{i=o} P_{ik}\ t^{*}_{ik}\left(\frac{y_{ik}}{y_{ok}}\right)^{2}}{\sum_{k=1}\ \sum_{i=o} P_{ik}\ t^{*}_{ik}}\right]$$

The numerator reflects the relative differences in the per capita tax base of municipalities versus that of the overlying county government, weighted by each jurisdiction's population and fiscal effort. The denominator represents the reciprocal of the city-county tax base disparity throughout the State. Representing these city-county tax base differentials by D_k and D_s respectively equation 4-10 can be written as:

$$(4\text{-}11) \qquad \frac{G_{ik}}{G^{u}_{ik}} = \frac{D_k}{D_s}$$

D_k will exceed unity if the per capita tax base of municipalities on balance, exceeds that of the underlying county government and will be less than unity if the county government has the larger per capita tax base. Similarly, D_s will be greater/less than unity, on balance, if the municipalities within the State have the greater/smaller per capita tax base compared to county governments.

These results can be shown graphically. In figure 3 the per capita revenue sharing grant is measured along the vertical axis and fiscal effort (t*) along the horizontal axis. The graph of the untiered formula, equation 4-3, is given by the ray OB. Thus, a city with a fiscal effort t^{*}_{1}, would receive a per capita grant $(G/P)_1$. Under the current tiered formula a city with fiscal effort t^{*}_{1} would only receive a per capita grant $(G/P)_1$ in the special case where $D_k = D_s$.

The formula for cities located in a county where the differential exceeded the statewide differential is shown by the ray OA while a smaller differential would be given by OC. The difference between OA and OC shows the potential range of horizontal inequity, which grows as t* increases. For

Figure 3
REVENUE SHARING FORMULA UNDER ALTERNATIVE CITY — COUNTY TAX BASE DISPARITIES

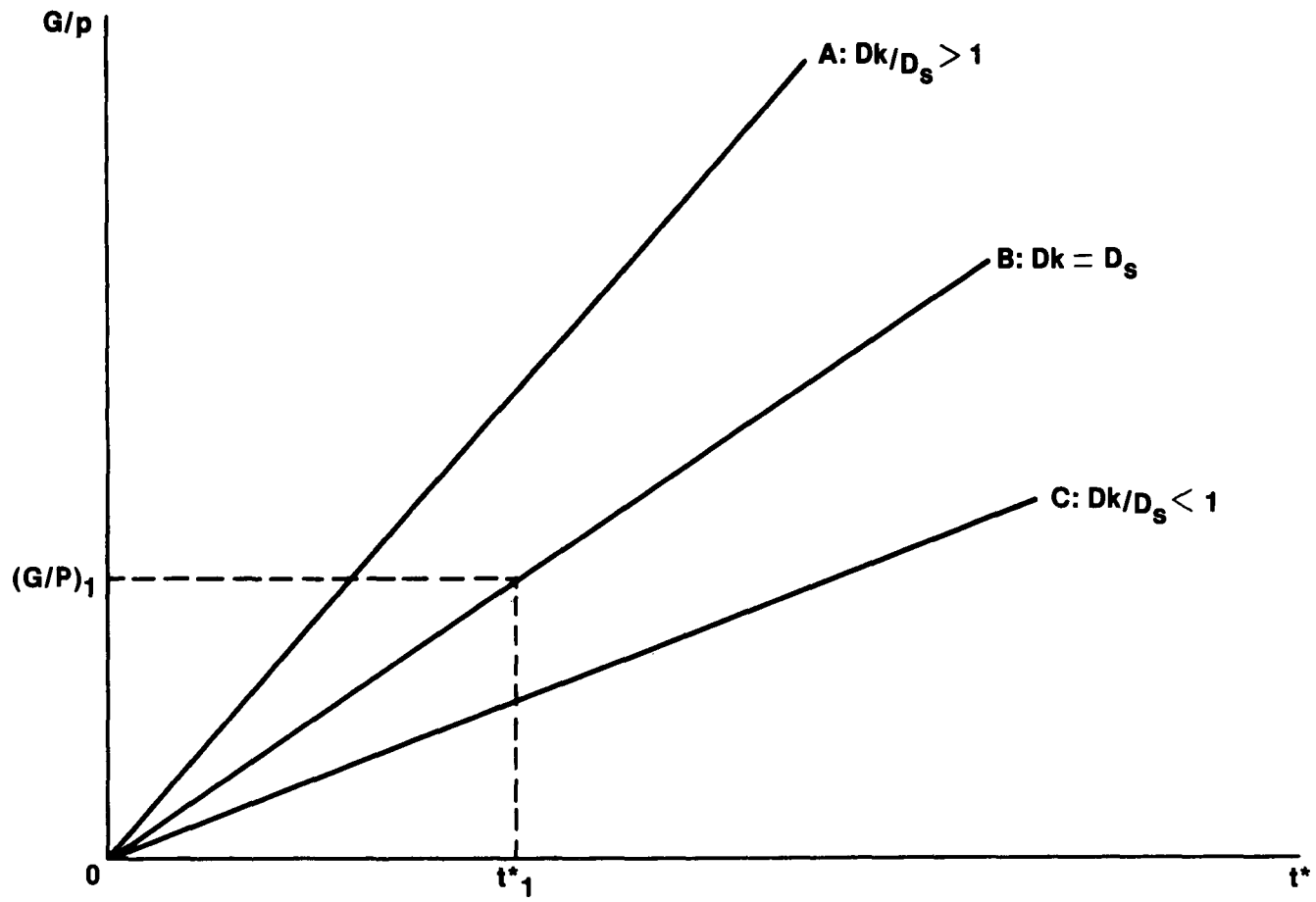
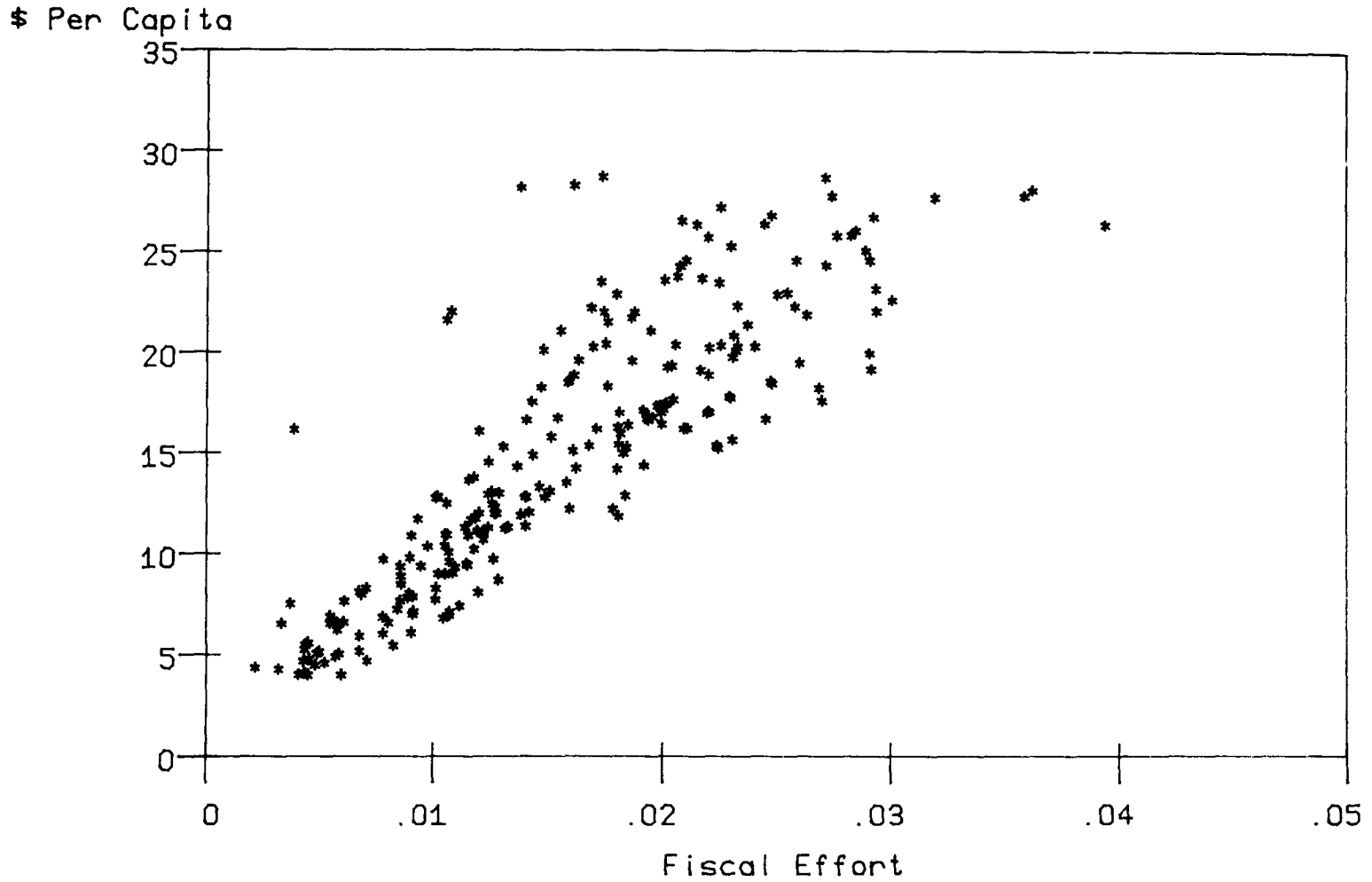


Figure 4
UNCONSTRAINED TENNESSEE CITIES' PER CAPITA REVENUE SHARING PAYMENTS FOR ENTITLEMENT PERIOD 10 (CURRENT FORMULA)



illustrative purposes a scatter diagram of Tennessee municipalities is shown in figure 4 based on data for entitlement period 10.

Several conclusions can be drawn from the expressions in (4-10) and (4-11). First, tiering will only avoid creating horizontal inequities in the unlikely event that the tax base disparities between municipalities and their overlaying county governments are identical to that which exists throughout the State (i.e., $D_k = D_s$). Second, municipalities will benefit/lose as a result of tiering if they are located in a county where the city-county per capita tax base disparity is greater/less than the disparity within the State (i.e., $D_k \gtrless D_s$). Third, tiering produces the same percentage gain/loss for all municipalities within a county since the ratio in equation 4-10 is equal for all municipalities within a given county.

The percentage gain/loss resulting from a tiered versus an untiered formula depends on the extent to which D_k exceeds/falls-short of D_s. This in turn depends on the correlation of $(y_{ik}/y_{ok})^2$ with population and fiscal effort. The greater the correlation the greater will be $\sum_k \sum_i P_{ik}\, t^*_{ik}\, (y_{ik}/y_{ok})^2$. Consequently, if these correlations happen to be particularly high in some counties then all municipalities within that county will receive larger allocations while municipalities in counties where this correlation happens to be low will receive correspondingly smaller allocations.

An extreme example would be Eagle County, Colorado, where the resort community of Vail is located. Vail is the largest city in the county, has a per capita income of $12,626 compared to a county per capita income of $5,420. Because of its tourist industry, Vail raises a large amount of tax revenue ($1,624 per capita in entitlement period 10); consequently its fiscal effort measures among the highest in the State. Computer simulations of the formula indicate that municipalities in Eagle County receive allocations 68 percent larger under a tiered formula relative to an untiered formula.

Another implication based on the expression in equation 4-10 is that the distortion introduced by tiering depends only on the relative disparity in the per capita tax base of the county government and its underlying cities $(y_{ik}/y_{ok})^2$. Consequently, a city may be well-off in terms of the size of its tax base but penalized by tiering because the disparity in the city-county tax base is small compared to the disparity which exists in other counties of the State.

Based on this analysis the use of tiering in the revenue sharing formula would require a rationale for distributing more aid to municipalities (regardless of their fiscal effort) simply because their per capita tax base exceeds that of the overlying county government by a wider margin than that which prevails throughout the State. In addition, a rationale would have to exist for distributing more aid to municipalities in those counties which exibited a high correlation between their per capita tax base and their fiscal effort. Such a rationale is particularly hard to imagine when one considers that high correlations between (y_{ik}/y_{ok}) and t^*_{ik} are most likely to exist in counties able to export most of their taxes. Resort communities with high incomes and fiscal effort such as Vail fall into this category.

INTERCLASS EQUITY

In the previous section we concluded that tiering does not produce any horizontal inequities among county governments (ignoring the distortion created by allocating funds to Indians at the county level rather than the State level) while it does introduce inequities among municipalities. What of the equity between cities and counties? This question can best be analyzed by comparing a county government's allocation with and without tiering. This can be done by dividing equation 4-6 by 4-3; the result is shown in equation 4-12.

$$(4\text{-}12) \qquad \frac{G_{ok}}{G^u_{ok}} = \left[\frac{\sum_{k=1} \sum_{i=o} P_{ik}\ t^*_{ik}}{\sum_{k=1} \sum_{i=o} P_{ik}\ t^*_{ik} \left(\frac{y_{ik}}{y_{ok}}\right)^2} \right] = D_s^{-1}$$

The expression indicates that horizontal inequities between cities and counties as a group do exist if $D_s \neq 1$. If the per capita tax base of cities on balance exceeds that of counties $(y_{ik}/y_{ok} > 1)$ than $D_s^{-1} < 1$ and tiering shifts funds from counties to cities. Thus, if a city and a county government are making identical fiscal efforts the city will receive a larger allocation on a per capita basis. 1/ Conversely, tiering will benefit county governments if the municipalities in the State, on balance, have lower per capita tax bases than county governments. Thus, it appears that if counties have the relatively higher tax bases on a

1/This is true in general, however, if the city is located in a county where tiering penalizes the county area the city may actually receive less.

per capita basis tiering rewards them with a larger allocation. On the other hand, if they have small tax bases relative to municipalities then tiering has the effect of penalizing them.

The revenue sharing formula uses per capita income as a measure of a jurisdiction's per capita tax base. This will produce some interesting geographic patterns if tiering is eliminated. Low income households tend to be located in more rural unincorporated areas in Southern States whereas they are predominantly located in the larger central cities in the more urban industrial States. Consequently, untiering the formula would shift aid from cities to counties in the Southern States, while the reverse pattern occurs in the Northeast. Table 2 presents allocations to counties, cities and townships for entitlement period 10 under the current formula and under an untiered version of the formula. 1/

1/The current formula operates under a series of constraints which will be discussed in the next chapter. The untiered simulation contains the same constraints.

Table 2

Changes in Revenue Sharing Allocations
Among Counties, Cities and Townships
Resulting from Detiering the Intrastate
Revenue Sharing Formula

State a/ and jurisdiction	E.P. #10	Untier only	Increase (decrease)
ALABAMA			
Cities	46,946,900	44,975,952	(1,970,948)
Counties	25,630,341	27,601,284	1,970,943
ARIZONA			
Cities	26,044,447	26,125,392	80,945
Counties	24,023,313	24,023,831	518
ARKANSAS			
Cities	20,936,315	19,075,296	(1,861,019)
Counties	24,396,681	26,257,705	1,861,024
CALIFORNIA			
Cities	226,910,331	229,746,238	2,835,907
Counties	290,946,518	288,132,386	(2,814,132)
COLORADO			
Cities	32,086,122	31,954,503	(131,619)
Counties	18,718,202	18,859,234	141,032
CONNECTICUT			
Cities	27,601,533	31,317,527	3,715,994
Townships	29,713,951	25,997,720	(3,716,231)
DELAWARE			
Cities	5,343,127	5,502,105	158,978
Counties	8,796,695	8,637,716	(158,979)
FLORIDA			
Cities	63,004,509	62,437,940	(566,569)
Counties	72,985,287	73,554,029	568,742
GEORGIA			
Cities	41,805,759	41,957,823	152,064
Counties	59,095,453	58,943,387	(152,066)
IDAHO			
Cities	7,587,945	7,399,747	(188,198)
Counties	9,705,622	9,902,957	197,335

Table 2 -- Cont'd.

State a/ and jurisdiction	E.P. #10	Untier only	Increase (decrease)
ILLINOIS			
Cities	148,964,432	146,568,030	(2,396,402)
Counties	46,352,394	49,025,006	2,672,612
Townships	31,941,490	31,665,276	(276,214)
INDIANA			
Cities	45,254,402	45,781,152	526,750
Counties	34,600,251	33,908,983	(691,268)
Townships	12,223,087	12,387,765	164,678
IOWA			
Cities	25,102,427	24,589,321	(513,106)
Counties	31,854,523	32,368,870	514,347
KANSAS			
Cities	19,093,054	19,008,413	(84,641)
Counties	18,949,004	18,828,937	(120,067)
Townships	2,177,353	2,386,656	209,303
KENTUCKY			
Cities	38,865,695	37,310,288	(1,555,407)
Counties	36,334,964	38,172,049	1,837,085
LOUISIANA			
Cities	58,679,614	57,379,949	(1,299,655)
Counties	36,689,109	38,224,750	1,535,641
MAINE			
Cities	12,208,417	10,558,728	(1,649,689)
Counties	2,646,167	5,693,536	3,047,369
Townships	15,660,427	14,268,429	(1,391,998)
MARYLAND			
Cities	83,286,400	33,256,924	(29,476)
Counties	57,583,802	57,613,274	29,472
MASSACHUSETTS			
Cities	77,771,557	74,056,340	(3,715,217)
Counties	9,238,057	25,449,927	16,211,870
Townships	57,941,436	45,444,783	(12,496,653)
MICHIGAN			
Cities	111,866,637	112,091,451	224,814
Counties	60,127,281	59,816,562	(310,719)
Townships	19,441,636	19,527,004	85,368

Table 2 -- Cont'd.

State a/ and jurisdiction	E.P. #10	Untier only	Increase (decrease)
MINNESOTA			
Cities	36,672,524	35,931,037	(741,487)
Counties	49,167,909	48,910,371	(257,538)
Townships	5,143,097	6,194,837	1,051,740
MISSISSIPPI			
Cities	23,762,454	20,532,985	(3,229,469)
Counties	42,804,717	46,014,243	3,209,526
MISSOURI			
Cities	54,539,582	53,713,804	(825,778)
Counties	28,122,470	28,804,265	681,795
Townships	1,604,722	1,748,706	143,984
MONTANA			
Cities	6,099,542	5,726,312	(373,230)
Counties	10,568,796	11,174,911	546,115
NEBRASKA			
Cities	13,653,522	13,417,298	(236,224)
Counties	13,997,221	14,101,183	103,962
Townships	835,130	977,609	142,479
NEVADA			
Cities	4,017,956	4,239,957	222,001
Counties	7,246,334	7,023,219	(223,115)
NEW HAMPSHIRE			
Cities	6,749,219	6,186,226	(562,993)
Counties	2,227,140	3,157,068	929,928
Townships	6,596,611	6,229,674	(366,937)
NEW JERSEY			
Cities	63,682,664	69,804,959	6,122,295
Counties	50,175,600	48,064,381	(2,111,219)
Townships	36,539,047	32,527,964	(4,011,083)
NEW MEXICO			
Cities	14,694,631	13,154,158	(1,540,473)
Counties	12,062,433	13,476,314	1,413,881
NEW YORK			
Cities	350,552,071	351,144,101	592,030
Counties	106,018,542	105,303,112	(715,430)
Townships	53,334,034	53,411,741	77,707

Table 2 -- Cont'd.

State a/ and jurisdiction	E.P. #10	Untier only	Increase (decrease)
NORTH CAROLINA			
Cities	46,836,675	43,281,521	(3,555,154)
Counties	65,675,745	69,277,347	3,601,602
NORTH DAKOTA			
Cities	4,347,904	3,927,813	(420,091)
Counties	6,813,357	6,993,933	180,576
Townships	1,192,264	1,473,769	281,505
OHIO			
Cities	106,350,463	108,482,768	2,132,305
Counties	60,350,732	58,268,504	(2,082,228)
Townships	18,300,567	18,250,478	(50,089)
OKLAHOMA			
Cities	35,787,878	35,256,795	(531,083)
Counties	13,315,598	13,783,548	467,950
OREGON			
Cities	31,588,709	31,081,466	(507,243)
Counties	18,983,498	19,512,255	528,757
PENNSYLVANIA			
Cities	117,183,192	119,266,136	2,082,944
Counties	61,147,152	59,668,944	(1,478,208)
Townships	43,913,030	43,308,285	(604,745)
RHODE ISLAND			
Cities	13,515,490	13,661,483	145,993
Townships	6,080,996	5,935,004	(145,992)
SOUTH CAROLINA			
Cities	27,763,620	25,758,613	(2,005,007)
Counties	33,648,254	35,653,269	2,005,015
SOUTH DAKOTA			
Cities	5,700,934	4,956,547	(744,387)
Counties	7,861,601	8,106,791	245,190
Townships	1,057,146	1,416,627	359,481
TENNESSEE			
Cities	48,725,263	47,872,956	(852,307)
Counties	35,604,123	36,456,432	852,309

Table 2 -- Cont'd.

State a/ and jurisdiction	E.P. #10	Untier only	Increase (decrease)
TEXAS			
Cities	143,356,795	141,797,225	(1,559,570)
Counties	81,674,834	83,241,410	1,566,576
UTAH			
Cities	14,809,047	14,327,718	(481,329)
Counties	13,101,170	13,650,563	549,393
VERMONT			
Cities	4,412,049	3,953,680	(458,369)
Counties	220,828	398,519	177,691
Townships	9,319,583	9,600,388	280,805
VIRGINIA			
Cities	57,432,825	56,628,790	(804,035)
Counties	37,523,376	38,327,286	803,910
WASHINGTON			
Cities	34,435,795	33,848,476	(587,319)
Counties	26,768,111	27,388,994	620,883
WEST VIRGINIA			
Cities	21,241,067	20,558,345	(682,722)
Counties	20,252,229	22,081,823	1,829,594
WISCONSIN			
Cities	54,674,804	53,296,336	(1,378,468)
Counties	43,212,669	43,283,087	70,418
Townships	9,207,118	10,536,492	1,329,374
WYOMING			
Cities	2,771,336	2,687,678	(83,658)
Counties	5,983,644	6,063,555	79,911

a/Data for Alaska and Hawaii were omitted because the noncontiguous State adjustment factor was not handled consistently in the computer runs. The District of Columbia was omitted because it is treated as a State in the allocation process; therefore, its interstate and intrastate allocations would remain the same.

CHAPTER 5

THE IMPACT OF CONSTRAINTS AND ADJUSTMENTS ON EQUITY

The distribution of revenue sharing aid is subject to four constraints: (1) a maximum per capita grant, (2) a minimum per capita grant, (3) a budget constraint, and (4) a de minis constraint. The de minis constraint waives a unit of local government's entitlement if its allocation is less than $200. Few governments are affected by this constraint and it will not be considered further.

Imposition of constraints on the basic fiscal effort formula implies that, for subsets of eligible governments, an alternative to the fiscal effort criterion is to be applied. In the case of the maximum and minimum constraints the Congress intended ".... to prevent local governments from receiving extremely large or small entitlement amounts." 1/ However, application of these constraints necessitates a series of adjustments which influences the equity of allocations to unconstrained recipients. Imposition of the budget constraint was designed to supercede the fiscal effort criterion by placing a limit on the size of a jurisdiction's allocation relative to its expenditures. This constraint also requires adjustments which affect allocations to unconstrained governments.

The next two sections describe the maximum and minimum constraints, the required adjustments and their impact on the distributional equity of the resulting allocations to unconstrained recipients, and concludes with suggestions and comments concerning changes in these constraints. This is followed by a description of the budget constraint, the impact of its related adjustments on unconstrained governments and suggested changes in this constraint.

MAXIMUM AND MINIMUM CONSTRAINTS AND ADJUSTMENTS

The maximum per capita grant is set at 145 percent of the per capita allocation to be distributed to eligible units of local government. Similarly, the minimum per capita grant is set at 20 percent of the State per capita amount. The tiering process initially allocates funds to county areas

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1/State and Local Fiscal Assistance Act Amendments of 1980; 96th Congress, 2nd Session, report no. 96-1277, p. 5.

based on the aggregate fiscal effort of all eligible governments within the county, as described in the previous chapter. 1/ The maximum constraint generates a surplus of funds while the minimum constraint will produce a deficit. The net surplus/deficit is eliminated by proportionately increasing/decreasing allocations to unconstrained county areas.

The tiering process then continues to make allocations to units of local government within each county. The maximum and minimum constraints are then applied to municipalities and townships. 2/ The resulting net surplus/deficit necessitates a proportionate change in the allocations of unconstrained governments. However, this adjustment is not confined to other governments within the same county but rather applies to unconstrained governments located in other unconstrained county areas as well. Adjustments are not made to unconstrained governments in constrained county areas for this would cause the area constraints to again be violated.

CONSTRAINT ADJUSTMENTS AND HORIZONTAL EQUITY AMONG MUNICIPALITIES

The adjustments required by application of these constraints will influence the degree of horizontal inequity produced by the tiering process and will be described with the aid of figure 5. Allocations to cities located in two county areas designated A and B are given by the rays OA and OB respectively. Cities whose fiscal efforts would place them in the dashed portions of the two rays are affected by either the 145 percent or the 20 percent constraint. The resulting adjustments needed to comply with the maximum and minimum constraints depends on two factors: whether either of the county areas are affected by the constraints and whether the surplus funds produced by governments affected by the 145 percent constraint are sufficient to bring those governments affected by the minimum constraint up to the 20 percent floor.

For purposes of illustration assume that neither county area is affected by the constraints and a net surplus results from application of the constraints. The adjustment is made by rotating the rays OA and OB upward proportionately

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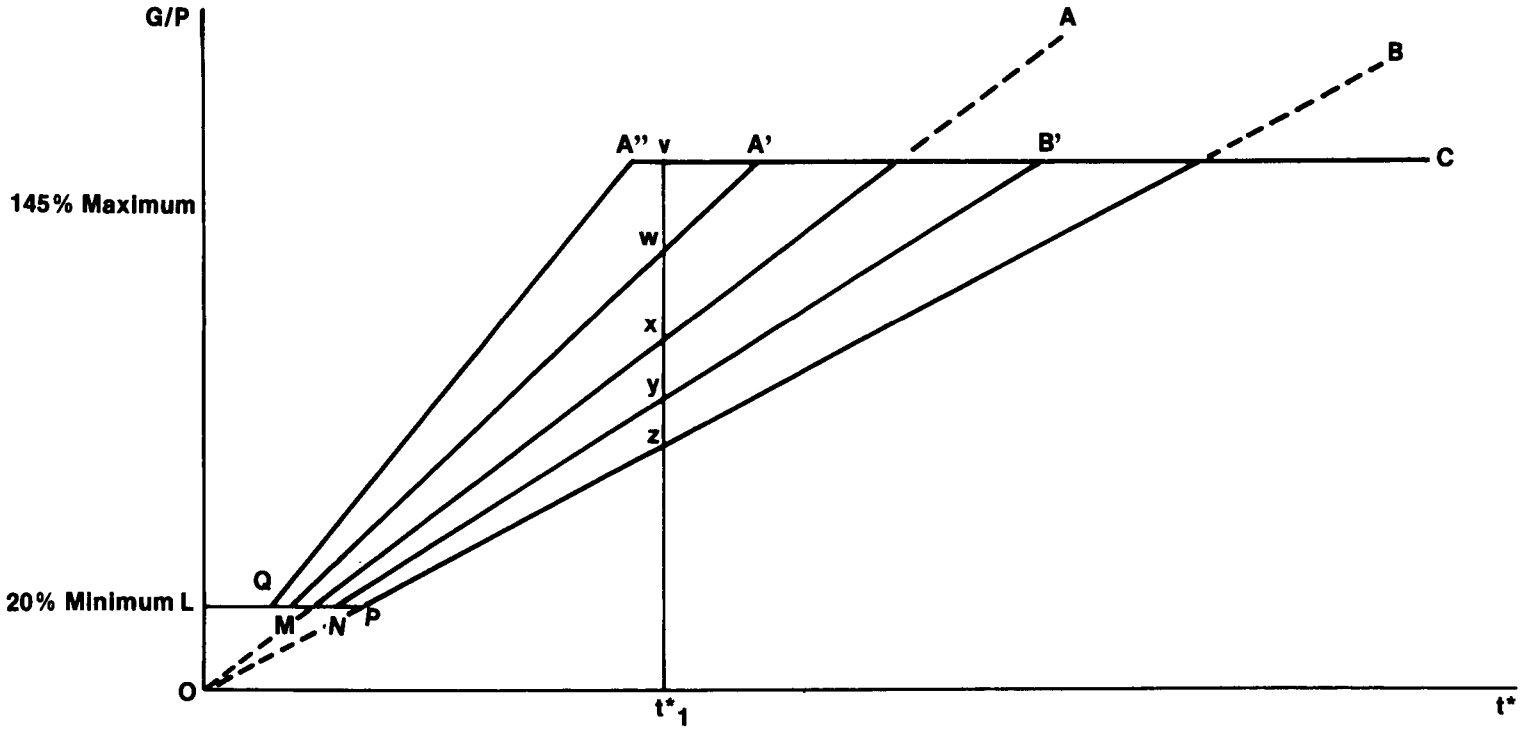
1/See equation 3-1 on page 18.

2/These constraints do not apply directly to county governments but only indirectly through the constraints on county areas.

Figure 5
IMPACT OF CONSTRAINT ADJUSTMENTS
ON HORIZONTAL EQUITY



resulting in the rays OA' and OB'. Under the constraints per capita allocations in county A are given along LMA'C and in county B along LNB'C.

If the degree of horizontal inequity is measured by the relative difference in the per capita grant of governments with identical fiscal effort (the ratio of the per capita grants x and z for example) then the adjustment does not affect the degree of horizontal inequity in that the ratio of per capita grants at w and y are equal to the ratio at x and z. However, suppose that county area B is affected by the maximum constraint. In this case the net surplus can only be distributed to unconstrained governments in county area A causing the ray OA to rotate to OA". In this case, per capita grants to cities in county A are given by LQA"C and by LPRC in county B. In this case, the adjustments required by the constraints have increased the horizontal inequity in that the difference in per capita grants for jurisdiction with a fiscal effort to t_1* has increased from xz to vz.

Alternatively, if the constraints had produced a net deficit with county area B being constrained at the 145 percent maximum the ray OA would have been rotated downward toward ray OB. In this case the degree of horizontal inequity created by the tiering would have been reduced as long as the adjustment was not so large as to cause OA to be rotated beyond OB enough to cause the ratio of OB to OA" to rise above the ratio of OA to OB.

The above examples demonstrate that the upper and lower constraints interact with the tiering and may either increase the horizontal inequity introduced by tiering or dampen them. An important corollary is that if the upper and lower constraints are relaxed to improve the vertical equity 1/ of the formula it may be done at the expense of aggravating existing horizontal inequities unless the tiering is also removed. Empirical data on the interaction between tiering and constraint adjustments is presented in table 3. Within each State a simple linear regression equation was estimated for municipalities based on data from simulations of the formula for entitlement period 10. The dependent variable is the per capita revenue sharing grant and the independent variable was fiscal effort. Three simulations of the formula were run under the following specifications:

1/The issue of vertical equity will be discussed in the next section.

-Current Formula 1/	145% maximum constraint 20% minimum constraint 50% budget constraint
-Simulation 1	175% maximum constraint 10% minimum constraint 25% budget constraint
-Simulation 2	no maximum constraint no minimum constraint 25% budget constraint

All governments affected by any one of the three constraints were deleted before estimation. For illustrative purposes the results of the estimation for Tennessee municipalities under the current formula 1/ were:

$$(5\text{-}1) \quad (G/_P) = \underset{(5.26)}{2.75} + \underset{(26.14)}{783.61}\, t^* \qquad \bar{R}^2 = .74$$

standard error = 3.415
elasticity at means = .81
number of observation = 239

The standard error of the regression represents the average difference in per capita grants at a given fiscal effort. An interval of two standard errors represents the more extreme differences in per capita grants which can exist for jurisdictions with identical fiscal effort. These extreme differences are shown in table 3 for the three simulations.

Table 3

Extreme Differences in Per Capita Revenue Sharing Grants to Unconstrained Municipalities with Equal Fiscal Efforts

State a/	Current formula	Simulation 1	Simulation 2
Alabama	11.88	11.46	13.52
Arizona	13.21	16.21	20.50
Arkansas	6.43	4.37	4.09
California	5.75	5.62	5.65

1/A scatter diagram for this data set was shown in figure 4 for Tennessee municipalities unaffected by constraints.

Table 3--Cont.

State a/	Current formula	Simulation 1	Simulation 2
Colorado	8.78	6.57	12.81
Connecticut	4.81	6.64	4.57
Delaware	21.05	21.05	45.27
Florida	7.32	7.04	8.79
Georgia	12.32	10.97	11.84
Idaho	7.42	6.55	6.33
Illinois	4.99	4.74	5.93
Indiana	4.57	4.01	4.92
Iowa	4.30	4.43	4.46
Kansas	9.06	7.75	7.80
Kentucky	14.84	13.22	14.05
Louisiana	12.86	11.20	10.29
Maine	5.07	5.04	6.39
Maryland	10.75	6.77	9.42
Massachusetts	7.25	5.43	5.53
Michigan	8.90	7.51	8.57
Minnesota	5.51	5.58	6.30
Mississippi	17.79	17.53	17.25
Missouri	8.17	7.19	6.10
Montana	8.40	10.33	7.29
Nebraska	6.23	5.77	6.07
Nevada	8.56	8.54	8.51
New Hampshire	9.37	9.52	9.45

Table 3--Cont.

State a/	Current formula	Simulation 1	Simulation 2
New Jersey	8.72	8.47	10.48
New Mexico	9.56	10.23	11.35
New York	7.61	6.54	10.31
North Carolina	13.77	13.02	18.54
North Dakota	6.40	4.99	5.89
Ohio	5.50	5.03	6.54
Oklahoma	7.24	6.23	5.93
Oregon	8.36	7.15	6.96
Pennsylvania	8.46	7.24	5.98
Rhode Island	2.52	2.38	2.38
South Carolina	13.86	16.01	19.01
South Dakota	7.01	6.70	11.28
Tennessee	13.66	12.12	17.06
Texas	8.85	7.26	6.20
Utah	6.76	5.08	3.52
Vermont	8.86	8.13	11.25
Virginia	14.29	13.27	15.46
Washington	3.86	3.84	4.41
West Virginia	12.99	20.73	18.28
Wisconsin	6.83	6.73	6.73
Wyoming	6.70	3.73	2.37

a/Alaska is not shown because of the special treatment of Alaska native villages, and Hawaii was deleted because it has are only three cities.

Inspection of table 3 reveals several interesting results. First, the horizontal inequities due to tiering are considerable. Even in simulation 2 with no upper or lower constraint, per capita grants differed by as much as $20.50 in Arizona, $17.25 in Mississippi, $18.54 in North Carolina, and $19.01 in South Carolina. For a city of 100,000 population this means a difference in their allocation of nearly $2,000,000. In some States, relaxing the constraints increased the inequities (for example, Arizona, Minnesota, New Mexico, and South Carolina), while in others they decreased (Arkansas, Idaho, Louisiana, and Missouri). Table 3 also indicates that in many States a partial relaxation of the constraints may reduce the inequity but that further relaxation will increase it (see New Jersey for example).

MAXIMUM AND MINIMUM CONSTRAINTS AND VERTICAL EQUITY

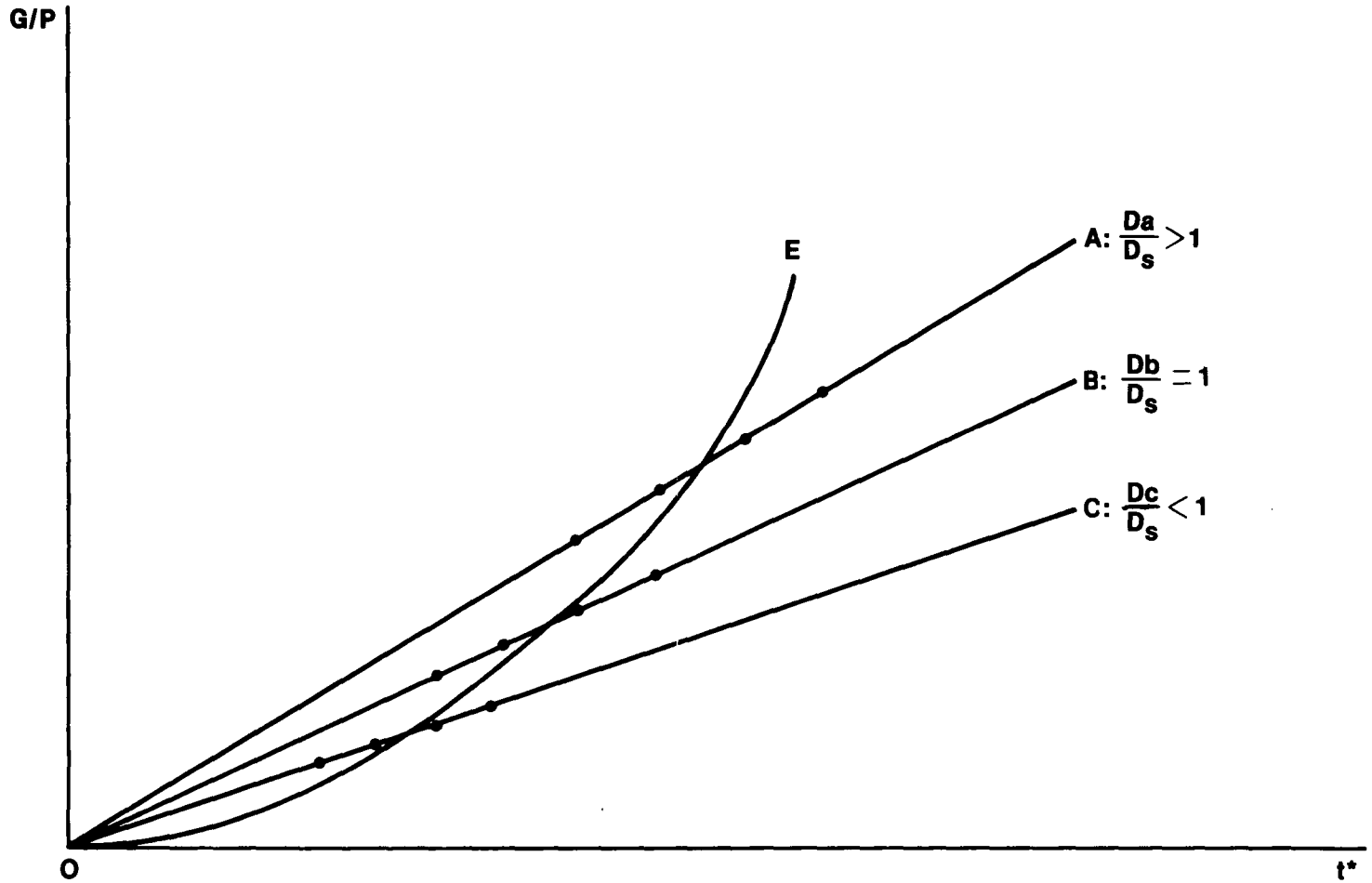
Vertical equity refers to treatment of unequals. The basic revenue sharing formula implies a fiscal effort elasticity of unity. That is, a jurisdiction with a one percent higher fiscal effort received a per capita grant which is one percent greater. This was represented in figure 5 (p. 41) by rays from the origin for jurisdictions within each county. The question can be raised as to whether this unitary elasticity is preserved when all jurisdictions within the State are considered. The answer to this question depends on the distribution of fiscal effort within counties. This can be seen more clearly with the aid of figure 6 where a hypothetical State has three counties where it is assumed that the tiering process aids cities in county A ($D_a/D_s > 1$) has no effect in county B ($D_b = D_s$) and adversely affects cities in county C ($D_c/D_s < 1$). 1/ If the distribution of fiscal effort of cities were identically distributed with each county, an estimated regression equation would also be a ray from the origin, producing a unitary elasticity. However, if the fiscal effort of cities in county C were low, average in county B, and high in county A, an estimated constant elasticity regression equation would produce an elasticity above unity, such as that shown by function OE.

1/ It should be recalled that $D_s = \dfrac{\sum_k \sum_i P_{ik}\, t^*_{ik} \left(\dfrac{y_{ik}}{y_{ok}}\right)^2}{\sum_k \sum_i P_{ik}\, t^*_{ik}}$

is the city-county tax base disparity in the State and D_k is the disparity in county k.

Figure 6

IMPACT OF FISCAL EFFORT DISTRIBUTION WITHIN THREE COUNTIES ON THE STATEWIDE FISCAL EFFORT ELASTICITY



Alternative distributions of fiscal effort could produce elasticities below unity and theoretically even negative elasticities.

Introduction of the maximum and minimum constraint introduces nonlinearities into the formula as is evident in figure 5. Estimating a constant elasticity equation based on data which included constrained governments would tend to reduce the estimated elasticity especially if there were a few jurisdictions with an extremely high fiscal effort. Table 4 contains estimates of the fiscal effort elasticity for municipalities in each State based on the current formula and similation 2. In each case all governments affected by a constraint were deleted for purposes of estimation.

Table 4

Fiscal Effort Elasticities of Per Capita Revenue Sharing Grants for Unconstrained Municipalities

State a/	Current formula		Simulation 2	
	Elasticity b/	Number of municipalities	Elasticity b/	Number of municipalities
Alabama	.89*	284	.97	238
Arizona	.91	57	.91	71
Arkansas	.96*	385	.97*	251
California	1.00	360	1.00	408
Colorado	.90*	196	.95	231
Connecticut	.87	24	.89*	32
Delaware	.53*	23	.90	19
Florida	.89*	330	1.00	370
Georgia	.85*	393	.91*	364
Idaho	.94	160	.91*	164
Illinois	.97*	1017	.92*	1229
Indiana	.97	382	.96*	519

Table 4--Cont.

State	Current formula		Simulation 2	
	Elas-ticity	Number of municipalities	Elas-ticity	Number of municipalities
Iowa	.98	825	1.00	921
Kansas	.78*	516	.83*	522
Kentucky	.82*	192	.93	167
Louisiana	.87*	215	.97	197
Maine	.85	19	1.00	23
Maryland	.76*	103	1.00	133
Massachusetts	.69*	37	1.10*	40
Michigan	.95*	464	.98*	520
Minnesota	1.01	705	.99	791
Mississippi	.75*	215	.98	183
Missouri	.85*	625	.99	683
Montana	.93	116	.88*	124
Nebraska	.92*	434	.96*	498
Nevada	.61*	17	.61*	17
New Hampshire	.77	11	.85	13
New Jersey	.83*	297	1.09*	324
New Mexico	.96	60	1.09*	83
New York	.89*	387	1.24*	605
North Carolina	.80*	366	1.00	393
North Dakota	.94*	257	1.03	305
Ohio	.93*	602	.95*	891
Oklahoma	.89*	336	.96*	338
Oregon	.93*	188	.96*	207

Table 4--Cont.

State	Current formula: Elasticity	Current formula: Number of municipalities	Simulation 2: Elasticity	Simulation 2: Number of municipalities
Pennsylvania	.80*	949	1.07*	989
Rhode Island	.90	8	.92	8
South Carolina	.83*	132	.99	93
South Dakota	.97	251	.82*	261
Tennessee	.82*	239	1.07*	275
Texas	.79*	794	.97*	796
Utah	.97	180	1.05*	152
Vermont	.91	32	1.06	22
Virginia	.59*	185	.79*	160
Washington	1.00	229	.98	260
West Virginia	.82*	87	1.03	13
Wisconsin	1.00	483	1.02	568
Wyoming	.94	64	.98	86

a/Alaska was deleted because of the special treatment of Alaskan native villages; Hawaii was deleted because there were insufficient observations to estimate an elasticity.

b/An elasticity significantly different from one at a 95 percent level of confidence is noted by an asterisk.

In simulation 2, with no maximum or minimum constraint, 22 of the 48 States had elasticities significantly different from unity. This number increased to 30 under the current set of constraints. Some of the more extreme cases were Kansas (.78), Maryland (.76), Massachusetts (.69), Mississippi (.75), and Virginia (.59). It is clear that simply removing the constraints does not correct the problem

although it generally is improved. In other words, tiering adversely affects the performance of the formula with respect to vertical equity as well as the horizontal inequities described earlier.

Another issue which can be raised is where should the maximum and minimum constraints be set or if they should exist at all. Although a precise answer to this question does not exist some suggestions for further work can be offered. First, with respect to the minimum constraint, the current program is intended for general purpose local governments. Currently, many small essentially single function governments participate in the program because they technically meet the Census Bureau's definition of a township. Research into a more appropriate definition of a general purpose government is required. This could be utilized to define a minimal fiscal effort necessary to meet the criterion of being a general purpose government and use that level of effort for purposes of eligibility in lieu of a minimum constraint.

The maximum constraint is most often justified to prevent industrial enclaves and resort communities which have unusually large tax collections from reaping a windfall gain. If municipalities within each State are ranked by their fiscal effort these enclaves are generally at the extreme top of the list. Examples for the States of Maryland and North Carolina are shown in table 5. It will be noted that a discreet break in the distribution of fiscal effort occurs. This pattern exists for most States although the break occurs at different levels of effort. 1/ A maximum constraint could be set so that it falls where these discreet breaks occur. What is required is some additional research to determine if such a rule can effectively discriminate between enclaves which export much of their taxes to non-residents and legitimate high effort governments.

1/In fiscally decentralized States, local governments have higher levels of fiscal effort than is true in the more centralized States.

Table 5

Maryland	Fiscal effort	Per capita grant: Current formula	Per capita grant: Simulation #2 untiered
Ocean City	0.281	31.94	177.50
Highland Beach	0.272	31.94	171.50
Luke	0.150	31.94	94.33
Baltimore	0.065	31.94	40.82
North Beach	0.051	19.88	32.00
Snow Hill	0.044	26.79	27.77
Salisbury	0.037	29.76	32.62
North Carolina			
Pine Knoll	0.359	29.91	230.62
Top Sail Beach	0.321	29.91	206.78
Ocean Isle Beach	0.229	29.91	188.78
Emerald Isle	0.202	29.91	166.33
Casewell Beach	0.179	29.91	123.88
Surf City	0.171	29.91	141.12
Holden Beach	0.167	29.91	137.82
Long Beach	0.982	29.91	67.85
White Lake	0.072	29.91	59.06
Kure Beach	0.059	29.91	48.84
Maggie Valley	0.056	29.91	46.10
Highlands	0.047	29.91	38.73
Blowing Rock	0.046	29.91	37.85
Mount Gilead	0.045	29.91	37.36
Robbinsville	0.045	29.91	37.21

THE IMPACT OF MAXIMUM AND MINIMUM CONSTRAINTS ON COUNTY GOVERNMENTS

In chapter four it was shown that, in the absence of allocations to indian tribes, allocations to county governments were proportional to their fiscal effort. That is, making county area allocations and its subsequent division into separate pots for the three possible classes of government in the county did not produce horizontal inequities among county governments. Earlier in this chapter it was pointed out that the maximum and minimum constraints do not apply directly to county governments, but only indirectly through the county area constraints. Consequently, per capita allocations to county governments can fall below the 20 percent floor. This is shown in figure 7 where the formula for county governments is represented by the ray OA.

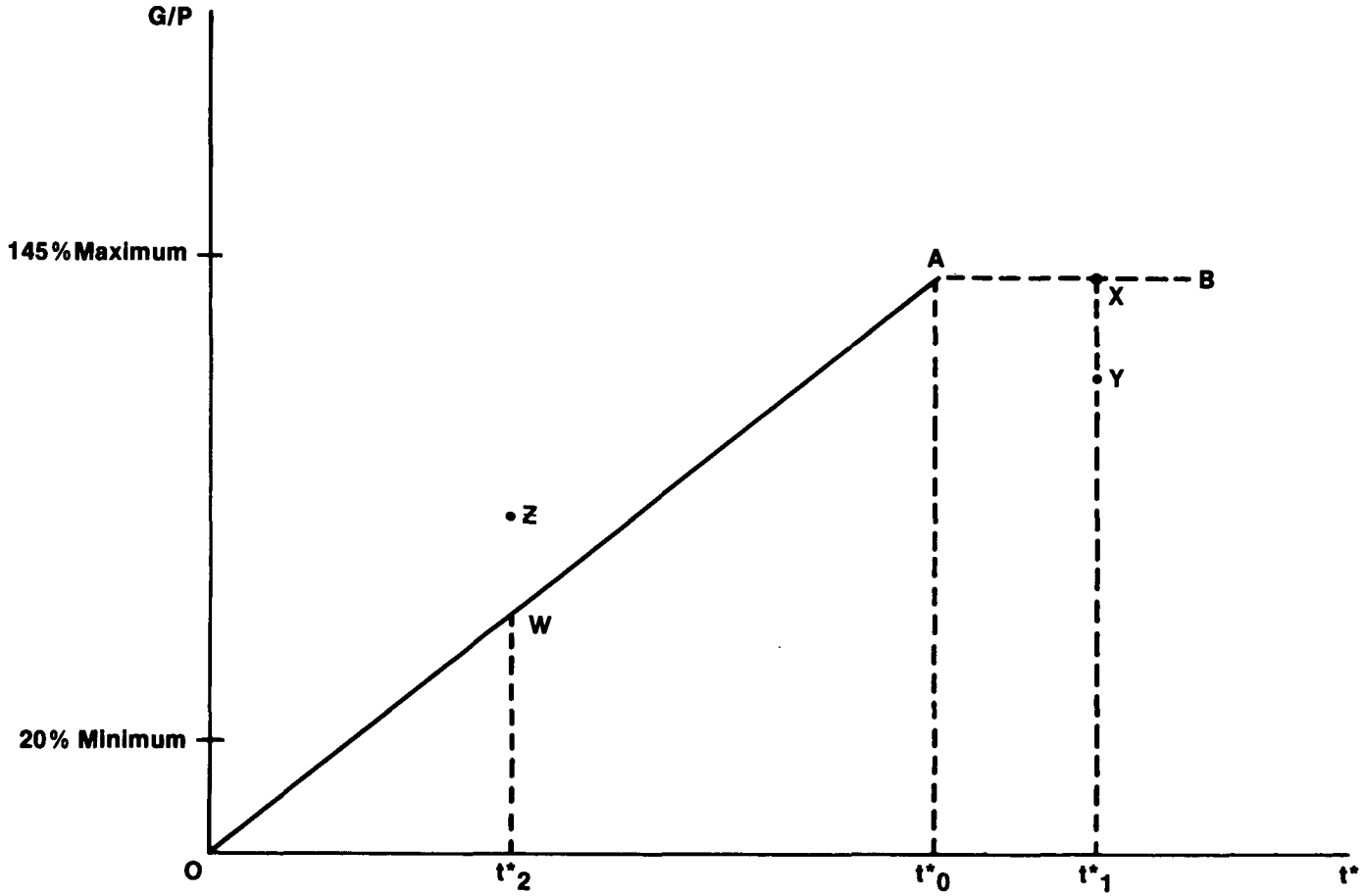
If there are no municipalities or townships in the county then the county government will be constrained by the 145 percent maximum constraint which applies to the county area. This is shown by the dashed segment AB in figure 7. In the more usual case where there are underlying cities and towns the county area maximum constraint introduces an additional inequity between county and city governments. Fiscally active county governments will have high fiscal efforts. If their fiscal effort exceeds t_o^* and their county area is affected by the maximum constraint then their per capita grant will reduced the 145 percent maximum. The result that can occur is that a city with a fiscal effort of t_1^*, for example, will receive the maximum shown at x while the equally situated county government will receive a per capita given by Y for example.

THE BUDGET CONSTRAINT AND ADJUSTMENTS

The budget constraint requires that a jurisdiction's allocation is not to represent more than 50 percent of its adjusted taxes plus intergovernmental transfers from the Federal and State governments. In the event that a municipality or township is affected by both the 20 percent minimum grant and the budget constraint, the budget constraint is taken as the binding one. Thus, it is possible for a government to fall below the 20 percent floor and still receive revenue sharing aid. If a jurisdiction is affected by both the 145 percent maximum and the budget constraint then the more binding of the two constraints is applied.

Application of the budget constraint also produces a surplus of funds which must be reallocated. Unlike the maximum and minimum constraints which proportionately adjust the

Figure 7
THE IMPACT OF MAXIMUM AND MINIMUM
PER CAPITA GRANT CONSTRAINTS ON COUNTY GOVERNMENTS



allocations of unconstrained jurisdictions the excess funds generated by the budget constraint are passed up to the next higher level of government. Thus, county governments receive the funds generated by the municipalities and townships within their borders. If a county government is affected by the constraint the surplus funds are passed on to the State government.

THE BUDGET CONSTRAINT AND HORIZONTAL EQUITY

When additional funds are allocated to those county governments which have municipalities and townships which are affected by the budget constraint, another inequity among county governments is introduced into the allocation process. This is shown in figure 7 where OA gives the per capita allocation to county governments at alternative levels of fiscal effort. For example at fiscal effort t_2^* a per capita allocation given by W would be made. If some underlying cities or towns were affected by the budget constraint the county's allocation would increase to Z introducing the inequity.

AN ALTERNATIVE FORMULATION OF THE BUDGET CONSTRAINT

For local governments affected by the budget constraint the revenue sharing formula is transformed into an open-ended matching grant up to the point where the constraint is no longer binding. Under the budget constraint a jurisdiction's per capita grant increases by $.50 for each $1.00 increase in local per capita revenues or intergovernmental transfers. This can be written mathematically as:

$$(5\text{-}1) \qquad g = .5(r + a)$$

where g = per capita grant
r = per capita revenues
a = per capita intergovernmental transfers

In chapter two an open-ended matching grant which rewarded high fiscal effort based on the criterion of equalizing benefit-effort ratios was derived and is reproduced here:

$$(5\text{-}2) \qquad g = t^*\tilde{y} = \left(\frac{\tilde{y}}{y}\right)^2 r$$

In chapter three it was shown that this was equivalent to the current revenue sharing formula except that the actual

revenue sharing formula is closed ended. 1/ Thus, one interpretation of the budget constraint is as follows: Initially funds are distributed to reward high fiscal effort. However, this may result in excessive grants to some units of local government and therefore a cap given by equation 5-1 is placed on the size of their per capita grant.

Imposing the constraint in the form of 5-1 rewards jurisdictions which raise larger amounts of revenues or are the beneficiaries of larger intergovernmental transfers rather than rewarding high fiscal. The implication is that the fiscal effort criterion must be sacrificed in order to limit the size of the grant. Inspection of the open-ended version of the fiscal effort formula in 5-2 reveals that this is not necessarily the case, for the per capita grant can be limited to any desired level by appropriately selecting a value for the parameter $\tilde{y}$. Using an open-ended formulation of the fiscal effort formula in equation 5-2 as a budget constraint to a closed-ended formula, such as the untiered formula shown in equation 4-3 of chapter four, would allow the twin goals of rewarding high effort and limiting the size of the per capita grant to be achieved simultaneously.

INCORPORATING CATEGORICAL GRANTS

In chapter two, the concept of fiscal effort based on the criterion of equalizing benefit-effort ratios among units of local government was derived. Fiscal effort was composed of two factors: a relative tax base factor ($\tilde{y}/y$) and an effective tax rate (r/y) (see equation 2-6 on page 7). From this, an open-ended matching grant was developed by simply multiplying each recipient's fiscal effort by a target fiscal capacity ($y_t = \tilde{y}$). In chapter three it was shown that, within each county, revenue sharing funds are allocated based on the fiscal effort criterion with county per capita income used for the parameter $\tilde{y}$. The actual revenue sharing formula was converted to a closed-ended grant by defining the target tax base in terms of the fiscal effort of all recipients within the county (see equation 4-6).

1/In chapter two, t^* was defined as $t^* = (\tilde{y}/y)(r/y)$, the open-ended grant was given by $g = t^*\tilde{y}$. In chapter three, the actual revenue sharing formula is closed-ended by appropriately defining the target tax base $\tilde{y}$ (see the discussion on page 21). The constant $\tilde{y}$ which appears in the definition of fiscal effort was set equal to the State per capita tax base y_s. Formula 5-2 and the revenue sharing formula are the same except for their open versus closed ended formulations.

The development of the fiscal effort concept in chapter two abstracted from the existence of intergovernmental transfers from higher level governments. What effect would there be if these categorical grants were incorporated into the fiscal effort measure? In this case the benefit ratio would be redefined as:

$$(5\text{-}3) \qquad (r + a)/t = \tilde{y}$$

where r = per capita revenues
a = per capita categorical grants
y = per capita tax base
$t = r/y$ = effective tax rate
$\tilde{y}$ = benefit-effort ratio (constant across recipients)

Proceeding as in chapter two, an adjusted per capita revenue given by $r^* = t^* y$ is substituted into 5-3 solved to t^*. The result is

$$(5\text{-}4) \qquad t^* = \left(\frac{\tilde{y}}{y}\right)\left(\frac{r}{y}\right) - \left(\frac{a}{y}\right)$$

As before the effective tax rate (r/y) is adjusted for relative differences in per capita tax bases ($\tilde{y}/y$) resulting in our previous measure of fiscal effort. This measure is then scaled down by the tax rate equivalent of their categorical grants (a/y).

The budget constraint consistent with this formulation is obtained by multiplying the revised fiscal effort in 5-3 by a target tax base y_t and again, for convenience, setting the parameter $y_t = \tilde{y}$. The result is:

$$(5\text{-}5) \qquad g = t^* \tilde{y} = \left(\frac{\tilde{y}}{y}\right)^2 r - \left(\frac{\tilde{y}}{y}\right)a$$

The budget constraint in equation 5-5 indicates that intergovernmental transfers should enter as a <u>negative</u> factor if it is to be consistent with the objective of rewarding higher effort. A comparison with the current budget constraint, shown in equation 5-1 reveals that the current budget has precisely the opposite effect.

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