Formula Allocation as a Policy Tool: Politics and Measurement

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ABSTRACT

In the U.S. today there are over 140 domestic programs which allocate funds to state and localities on the basis of statistical formulas. These programs are for a wide range of purposes, from public works to schools, housing, and social services. The statistics they rely on include a variety of housing and population characteristics, and the formulas differ by program. This paper will provide a brief overview of the types and uses of formulas in the U.S., and them will address the ways in which such formulas are and are not equitable and appropriate as methods of distribution of resources. It will look at how formulas tend to get designed and publicly debated, and will explore the ways in which their use enhances or inhibits informed and democratic choice. It will be argued that formulas need certain characteristics, including comprehensibility, transparency, and predictability, if they are to inform rather than obscure decision criteria. While different principles of allocation may be embodied in formulas, those that are intended to allocate funds where needs are greatest are apt to be more meaningful where programs are the most narrow in aim. In many cases, more research is required to link the incidence of problems in the population to the statistical measures. Formulas are popular and seem likely to continue to be an important method of allocation in the U.S. The focus should be on how to improve their design and use in the future.

FORMULA ALLOCATION AS A POLICY TOOL: POLITICS AND MEASUREMENT

INTRODUCTION

Formula allocation is a major tool for distribution of public funds in the U.S. Over 140 federal grant programs use formulas to provide money to states and localities, for purposes ranging from education and social services to the construction of sewers and highways. These formulas, which rely on local statistics on income, housing quality, or service demand, have a powerful appeal as a solution to distributional problems. Formulas apply a uniform standard to all recipients. They are easy to administer, and they remove allocation decisions from political pressures common to discretionary, case-by-case allocation. Formulas offer a seemingly equitable and objective way to allocate resources.

For formulas to be acceptable tools, however, they must embody the distributional policy intended by the program, and they must do so in a reliable and predictable way. Algebraic formulas can be reasonable approximations of policy intent, if the variables within them measure the conditions that merit funding and if the way of combining them reflects their relative policy importance. A review of formulas currently in use in the U.S. indicates, however, that such principles have not been followed systematically. Indeed, there is little discussion in the policy process or the literature that even tries to apply these to formula design.[1]The consequences of this failure to employ explicit principles in formula design are serious from a policy viewpoint. Ad hoc formulas fall short of basic standards for measurement and thus

[1]Exceptions are the work of the U.S. General Accounting Office (1983), which has collected and assessed information on the formulas and allocation provisions of the major grant programs; and the Treasury Department, which has analyzed different formula types (1985). This paper has drawn in a variety of ways on these reports, and on conversations with Jerry Fastrup, senior analyst in the General Accounting office, and on his report (1985).

do not reflect the conditions they are presumed to. Many of them have little comprehensible connection to the grant objectives. Distributional policy is therefore decided de facto in the process of formula design, often without policymakers' understanding what that policy is. Ultimately, ad hoc formula design has an ambiguous and misleading role in policy debate and an unreliable one in policy implementation.

This chapter will critically explore several prototypical examples of formulas used for allocation of federal funds in U.S. domestic programs, looking at their construction, their meaning, and their consequences. In this process we will begin to develop design principles, arguing that theories of measurement must be their basis. These theories say that the formula must be a valid representation of policy intent. Thus, it is important to keep the notion of policy intent conceptually clear, so that a formula's validity as a reflection of that intent can be tested. The components of the formula, moreover, should be reliable, sensitive, and technically adequate indicators of the conditions the program addresses.

The design of the formula is both a political and a technical task. The political task is to determine what it should try to measure; the technical task, to make it succeed. As a practical matter, these two tasks cannot be neatly separated -- technical choices inevitably reflect some value judgments, and political choices depend in part on what is technically possible.

Formula Design: Objectives and Practices

Several types of distributional goals are embodied in the purposes of U.S. grant programs to states and local jurisdictions. Some programs provide public goods, where benefits accrue nationwide to all citizens and where no one can be excluded. These include airports, interstate highways, and civil defense, which, at least in part, serve the national economy and defence. Funds for such public goods should be distributed according to where they will be effective. A second purpose of

many programs is to assure a minimum level of services to people; these funds logically can be allocated according to the location of those with service needs. Because of the U.S. federal system, in which each level of government collects and allocates its own taxes, interjurisdictional equity is important. Therefore, a third common objective is to compensate local governments for spillovers, usually the costs of activities taking place in other jurisdictions. Into this category fit, for example, grants for wastewater treatment projects. Similarly, a jurisdiction might be compensated for providing benefits that accrue to others, as they are in federal aid to higher education, as where university graduates and research have national benefits. A fourth and related grant objective is to equalize citizen access to public programs by adjusting for the differing taxing capacity of each jurisdiction (Johnson 1947).

Each of these types of objectives, with the possible exception of the first, suggests measurable criteria that can be incorporated into formulas. As most grant programs implicitly include more than one objective, formulas should combine measures in a way that reflects their relative importance. For example, an educated citizenry is a national public good, but education aid is also designed to upgrade opportunities for the disadvantaged. Thus, aid has been given on the basis of numbers of students and the amount of poverty in a school district. Where equalizing fiscal capacity is an issue, the formula may also contain a factor distributing funds in inverse relation to a jurisdiction's wealth. Each factor can in turn be weighted in different ways.[2]

There are currently no standard procedures for designing a formula. Instead, the process seems almost random, and certainly differs for each program. The actors may include congressional representatives and their staff, executive branch technicians and policy staff, private lobbying groups, task forces, and policy researchers in the private and academic sectors. The idea for a formula may be

[2]See Appendix for a summary of principal formula designs.

initiated almost anywhere in the system. It may be created for the purpose or it may be borrowed from another program. Technical advice from statisticians and other analysts may play a large or a small role in the discussion. The formula is likely to undergo design and redesign up until the program is enacted by Congress. These processes tend to subordinate the technical criteria which would indicate the adequacy of a formula as a measurement tool. In the political arena, decisions are often taken in haste and changes made under time pressure, with little opportunity to evaluate them. Thus, in the end, Congress may make formula choices in a way which is arbitrary and not fully informed.

Keeping it Simple: Using Population Shares

One approach to formula design is to aim for simplicity, using a single variable -- usually population. This has the advantage that policymakers can understand the formula quickly and make rapid comparisons of its impact on jurisdictions. The approach may appear equitable, though this distributional principle is often insensitive to program objectives -- particularly where need or spillover justifications are involved.

A case in point is the Social Services Block Grant, which replaced many social welfare programs historically targeted to the needy. It funds services designed for such purposes as helping individuals achieve economic self-sufficiency, preventing child abuse, improving institutional care, and providing other social services and training. Its formula relies solely on a state's share of total U.S. population:

Social Services Block Grant Formula

State share of grant = state population ÷ U.S. population

This formula is a valid reflection of the legislation's implicit distributional policy, insofar as population distribution is proportional to the distribution of need for the services. Population correlates poorly with this need, however. Lightly-populated states in the rural South, for example, have disproportionate shares of poverty. States undergoing economic dislocation may have unusual service needs. Moreover, the formula does not take into account the relative capacity of a state to support its own services. Some states with declining industrial bases or agricultural economies have little capacity to take care of their neediest citizens, though their tax burden is high, while resource-rich states have a high revenue capacity and are in a better position to supply services.

A similar argument can be made for other formulas which rely uniquely on population shares. For example, planning funds for both highways and urban transportation are given out on the basis of population -- in the latter case, shares of urban population. The need for such planning, however, is likely to be contingent on whether an area is growing, on whether it is highly congested, and on the amount and quality of its existing facilities. Simplicity and clarity are desirable qualities in formulas, but few programs have objectives which can be well-translated into a single variable such as population size.

Combining Many Variables: The Problem of Interpreting the Formula

Another ad hoc approach to formula design is at the other extreme. These formulas seem to include variables indiscriminately, with the idea that more variables are better. The problem of combining and weighting increases with the number of variables, as do the problems of understanding what the final formula means and how

it is likely to work when applied. All of these difficulties increase when the rationale for inclusion of variables is not obvious.

This set of problems can be illustrated by the formula used to allocate funds for eliminating the hazards of rail-highway crossings.

Highway Safety Grants Formula

State share = 6/12 (number of state rail-highway crossings ÷ number of U.S. rail-highway crossings)
+ 3/12 (state urban population ÷ U.S. urban population)
+ 1/12 (state land area ÷ U.S. land area)
+ 1/12 (state rural population ÷ U.S.rural population)
+ 1/12 (state mileage of mail delivery routes
÷ U.S. mileage of mail delivery routes)

It is difficult to figure out the rationale for inclusion of most of the factors. The share of crossings probably has some relation to the number of dangerous crossings. The urban population share could have some relation to safety problems, if the railroads run through urban areas with their heavier traffic. On other hand, cities may have long since protected their railroad crossings. As for the other three factors, there seems no rationale for why states with greater proportions of rural population, greater land areas, or longer mail routes merit more safety devices than other states with the same number of crossings. Other factors would have been more meaningful predictors of safety problems, such as the number of automobiles, the amount of gasoline sold, or miles of railway track. Why were they not used? It is even more difficult to guess the reasons for the weights. While it makes sense to weight urban population more heavily than rural, why in the ratio of 3 to 1? And why is the crossings variable weighted 6/12? Why not 7/12 or 8/12?

The answers to such questions depend on accident and the political history of the program, as well as sometimes on an explicit policy decision about the relative importance of factors. Frequently, measurement principles are not considered. The

numbers may simply be those easiest to obtain for jurisdictions. Sometimes a factor may have been added in the hope it would compensate for the limitations of other factors. Sometimes the factor is chosen to make the resulting allocation come out the way the political powers want. Sometimes there is precedent in earlier formulas. Occasionally, however, factors are selected on the measurement principle that they discriminate in a sensitive way between the needy and less needy states.

A long formula with variables that do not have a conceptual relation to the problem the legislation addresses does not serve the purposes of public debate. Policymakers cannot tell what if anything is being measured,[3] or what principles of allocation are at work. It is difficult to understand the consequences of all the factors working together. While it may be feasible for policymakers to agree on weights for two, or even three, variables, it is more and more difficult to have valid reasons for choosing one weight over another as the number of variables grows.

Borrowing for Formula Design: When Form no Longer Serves Its Function

It is not uncommon for new program formulas to borrow from formulas for related programs. In this process, the logic that linked the borrowed terms to the policy purpose may get lost. Many U.S. formulas include one such borrowed term in particular -- an expression used to weight the influence on the formula of measures of state wealth, usually in the form of per capita income. In its original form, this expression was intended to determine what proportion of state payments to individuals would be reimbursed by the federal government. In the formula, for example, for Medicaid, share of medical costs for the poor is as follows:

[3] de Neufville (1975) makes a similar finding with respect to measures of standard of living. She found that efforts to use the standard budget or other poverty measures in Congressional policy debate failed because Congress felt these measures had no clear meaning.

Medicaid Formula

Federal share of state payment = 1 - [0.45 (state per capita income ÷ U.S. per capita income)^2]

The logic of the formula is that states with lower-than-average per capita income would pay a smaller share of these costs than those higher than average. The multiplier, or term weighting the state's relative income or wealth, is set at 0.45 to reflect a policy decision about the average size of the federal share and the degree to which this share should vary with that income or wealth. Thus, if the state's per capita income is exactly the national average, the value of the expression is 55 percent. The value of the federal share varies inversely with the state's comparative income.

The basic expression, 1 - [multiplier] x [income ratio], is found in a number of formulas for other programs, but in some programs it is used to determine the actual level of allocation to a state rather than the proportion of costs to be paid. The multiplier may be 0.45 or some other figure. In the six largest U.S. programs which use state income ratios, there is considerable inconsistency. Three of the formulas use a per capita income term directly to establish state allocation levels (as in General Revenue Sharing, described below, and three, including Medicaid, use it to determine the proportion of costs to be paid federally. Of the three formulas using relative income to establish level of funding, two use one multiplier (0.50), and of the three using it to establish proportion of funding, two use another multiplier (0.45), with no evident rationale.[4]

Given the intent of the income adjustment to equalize the burden on citizens in different states, it is even more striking that many U.S. formulas do not include this term at all. Is it logical that such an adjustment be important for vocational education, but not for general education, or that it be important for revenue sharing,

[4]For an extended analysis of issues in fiscal capacity measurement, see Barro 1984.

but not for education or community development? Should it be a major determinant of funding for job training for the physically handicapped, but not for the economically disadvantaged?

Since few now know what were the origins, meaning, and purpose of this algebraic expression, its value and form can easily be manipulated in the political process of formula design. Changes in the level of the multiplier can dramatically affect a program's distributional consequences. Yet no one can call on a principle to evaluate its appropriateness. This absence of principle also means the whole expression is likely to be considered optional. As a result, programs with comparable objectives distribute funds according to different de facto principles.

Measurement Without Theory: The Problem of Unpredictable Consequences

Formula components are often selected because they intuitively seem to be related to the program's goals and they seem to produce acceptable distributional results. Such components, which at the time may correlate with other perceptions of need, may actually measure that need poorly. If formula factors are chosen for convenience rather than theory relating them to a phenomenon, the formula can have unpredictable consequences if underlying conditions change or if the formula is applied to a new recipient group. If one cannot say why a particular measure works in the first place, nor what its relation is to the phenomenon, one will not predict under what circumstances the measure will no longer work.[5]

Although these consequences are normally invisible, a study on the application of the Community Development Block Grant (CDBG) formula documented what can happen. One of the formulas used in this grant program, which is designed to provide funds to cities primarily for the improvement of infrastructure and housing, combines

[5]The dangers of relying on measurement without theory for making predictions or setting policy were elaborated by Koopmans in his classic critique of business cycle forecasting (1947).

a city's population share in poverty, share of pre-1940 housing units, with a measure of population growth lag:

CDBG Entitlement Grant Formula[6]

Locality share = 0.3 (total population in poverty in locality ÷ total in poverty in all U.S. MSAs)
+ 0.5 (number of pre-1940 housing units in MSA ÷ total pre-1940 housing units in U.S. MSAs)
+ 0.2 (lag in population growth in an MSA 1960-80 ÷ average population growth in all U.S. MSAs 1960-80.)

(Note: MSA = Metropolitan Statistical Area.)

The last two factors were explicitly chosen to target funds to the older and more distressed central cities, which had been the focus of these grants before they were given out by formula. While formula designers did not claim growth lag and housing age were intrinsically related to urban distress, later analysis showed that the formula gave out funds in ways that correlated well to the ranking of cities' needs on a variety of alternative variables (U.S. Department of Housing and Urban Development 1979).

Longer-term experience and systematic analysis, however, has shown that housing age and growth lag are not consistently connected to urban distress, either over time or across categories of jurisdiction. When the formula was applied to a subgroup of recipients, suburban and small cities, the results did not correspond well to other measures of need in those communities (Isserman 1981). Many characteristics of these communities, their physical plant, and population differentiate them from central cities. Undoubtedly, some wealthy jurisdictions have high income populations because of the desirability of their grand-scale, older housing.

[6]There are two formulas for this program, which operates under the "dual formula" model, described later in the chapter.

Population decline may occur in these once family-oriented communities because children leave home, rather than because of urban blight.

When the formula was applied over time to the larger cities after the 1980 census, it also produced unintended results. Some of the most distressed cities had torn down their oldest housing in the previous decade. Accordingly, their CDBG allocations were reduced, though their need was probably the same or greater than it was when the formula was introduced several years earlier (Bunce and Neal 1984).

The Problem of Formulas for Broad Programs

The problem of designing a formula for a limited-purpose program is difficult, but when many programs are combined into a single grant system, the task of developing a suitable formula can become virtually impossible. This combining of programs has been done in the U.S. in a variety of policy areas, and "block" grants have been given out for such broad purposes as community development and general social services. Formulas are a blunt policy tool for such block grants, and they have many conceptual and practical difficulties.

A formula which on the average allocates funds to the jurisdictions that seem to deserve them on the basis of other measures of need will produce a few anomalies. The anomalies will include giving what appear to be too many funds to non-needy places and too few to some with clear needs. This is true even with limited purpose programs. Formulas are typically not complex enough to reflect the unique characteristics of every locale. This is inevitable, however, and, if anomalies are random and minor, changes in the formula may be unnecessary.

The problem becomes more severe the more diverse the aims of the grant program. Formulas then must address both diversity in characteristics of beneficiary groups and diversity in program goals. The opportunities grow geometrically for the allocation of funds to be unexpected or unintended. Thus, for example, programs

providing services for alcoholism, drug abuse, and mental health have been clustered together in a block grant. As this is a need-based grant, it would be reasonable to use a formula which weights a state's allocation according to its population share in the groups at risk for these problems. But drug dependency, alcoholism, and mental illness are each most common in different age and sex groups. In addition, states spend at different levels for these programs, in ways not necessarily related to prevalence of the at-risk population. A formula to deal with this complexity would have to include the share of age groups at risk, weighted for program spending and for gender (Newcomer and Stoddard 1986). The allocation, however, as legislated, is based on a simple formula using total population and population weighted by per capita income.

There is, in any formula design for a block grant, a tension between the policy intent of the individual programs within the grant and the policy intent of the block grant itself. Block grants in the U.S. were created largely to decentralize responsibility and choice among priorities from federal to local levels. Given that most block grants still attempt to direct funds to jurisdictions with need, there is a dilemma. It may be that block grants should be offered on a pure redistributive basis using a measure of fiscal capacity. Alternatively, greater ingenuity might be applied to develop formulas which account for each of the program goals and the range of problems they address. The simplest strategy, however, would be to separate the programs and use individual formulas for each.

POLITICAL CONSEQUENCES OF MEASUREMENT WITHOUT THEORY

Designing formulas in the absence of a strong context of measurement principles to guide and constrain the process can lead to political consequences that

distort policymaking. When the meaning of the formulas is unclear, policy debate cannot effectively deal with policy intent.

The Politics of Printouts: Dollar Outcomes Rather Than Policy Principles[7]

A first case in point is the use of ad hoc formulas in combination with modern computer technology. The capability of instantly producing printouts showing how much each Congressional district will receive under a particular formula has created a new kind of decision-making. "Who gets what?" is a classic question that has always implicitly motivated Congressional debates, and a member of Congress could only guess what the adoption of a particular policy principle would mean to his or her constituents. But now dollar outcomes for each Congressional district can become the central focus of attention.

The best-documented illustration is in the debate over changing the CDBG formulas in 1977. This program, begun in 1972, folded urban renewal and housing programs into a block grant. Because the formula used at the outset of the program seemed to shift funds from the large, distressed cities to the smaller and better-off jurisdictions, there were many advocates for changing the formulas. The House of Representatives was presented each morning with a printout of allocations for each member's district under the formula being considered that day.

It is hard to imagine how even the most idealistic or public-spirited of congressional representatives could focus attention on the merits of a particular formula component for policy goals when the dollar implications for his constituents were staring him in the face. Although congressional representatives have always made rough calculations of outcomes, there was, prior to this, no certainty. But now every formula has its winners and losers, visible in black and white.

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[7]The term, "politics of printouts," and most of the basic story can be found in Nathan (1987).

The political dynamic is nicely illustrated in the case of another program, General Revenue Sharing, where the decision was particularly problematic. After long days of examining printouts on formula outcomes, the House of Representatives

> quit not because we hit on a rational formula, but because we were exhausted. And finally we got one that almost none of us could understand at the moment. We were told the statistics were not available to run the print on it. So we adopted it.... (Nathan et al. 1975, p. 135)

Somehow it was easier to agree without knowing the formula's consequences. The politics of printouts is thus problematic, both from the practical standpoint of reaching agreement and from the normative standpoint of focusing attention away from a program's substantive goals.

Pleasing Everyone: The Dual Formula Approach

The political process of debating ad hoc formulas can ultimately undermine the whole principle of formula allocation. This has happened in Congress's "dual formula" solution to its bitter debates over choosing or changing formulas. This approach compromises by using two formulas rather than one. It has been used in major programs where there has been substantial controversy, such as CDBG and General Revenue Sharing.

In the case of revenue sharing,[8] for example, each house of Congress adopted a formula reflecting its political makeup. The Senate, where each state has equal representation, adopted a three-factor formula favoring rural and smaller states. The House of Representatives, where representation is based on population, adopted a five-factor formula favoring urban states. The Senate formula attempted to provide fiscal equalization, but included no need measures, while the House formula was based heavily on need measures:

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[8]General Revenue Sharing was phased out in the mid-1980s, as part of cutbacks in federal spending.

General Revenue Sharing Formulas

1. Three-Factor Formula:

   State share = state population (U.S. per capita income ÷ state per capita income) (state and local tax revenues in the state ÷ aggregate personal income of state residents) ÷ sum of numerator

2. Five-Factor Formula:

   State share = 0.22 (state population ÷ U.S. population)
   + 0.22 (state urban population ÷ U.S. urban population)
   + 0.22 [state population (U.S. per capita income ÷ state per capita income) ÷ sum of numerator]
   + 0.17 [(state and local tax revenues in state) (state and local tax revenues in state ÷ aggregate personal income in state) ÷ sum of numerator]
   + 0.17 (state income tax collected in state : state income tax collected in U.S.)

Since both houses of Congress must agree to any legislation, a conference committee was established, but it could negotiate agreement only by adopting both formulas and letting each state receive an allocation under whichever formula was most favorable to it. The conclusion of a General Accounting Office report was that the whole exercise was a waste of time from a policy viewpoint. The report contended,

> The dual formula compromise effected by the House and Senate neutralizes the fiscal equalization that would be achieved by the three-factor Senate formula, it eliminates the systematic targeting to urban states contained in the five-factor House formula, and significantly reduces the targeting to states with high poverty rates. . . . The dual formula compromise introduces a random element into the targeting of revenue sharing aid. . . . (Fastrup 1985, p. 24)

The dual formula has considerable political appeal, as the second formula provides extra for some jurisdictions without forcing others to be losers. This solution is only possible, however, in periods of budget growth. The important point is,

however, that the "random element" in the dual formula makes the whole concept into political nonsense.

Overview of Formula Design Issues

If formulas do not embody policy principles, then the only criterion for approving a formula design is whether it can get political agreement. Ad hoc measurement in formula design, however, obscures the meaning of formulas and has perverse consequences for policymaking. A formula can give an incorrect impression that need or equity issues have been addressed, simply because it contains factors which have a rough intuitive connection to such objectives. In giving this impression, ad hoc measurement can make it legitimate to focus policy attention on the numbers and funding outcomes instead of on the goals. It can thus encourage cynical political arguments, where competing interests argue for their preferred variables without evidence and without a definition of what these variables measure. The debate is likely to focus on which jurisdictions get what, rather than on what the basic distributional principles should be. Moreover, formula components with no assigned meaning can be inappropriately transferred from one formula to another. In this process, the formula can be manipulated to serve special interests in ways that would be more difficult if formula components were included on grounds of measurement criteria and meaning. In addition, ad hoc formulas can have unpredictable results when applied over time and across places. Because they produce indeterminate results, such formulas fail either to implement program objectives or to serve political interests.

All formulas are subject to becoming quickly institutionalized. The winners under a chosen formula group to protect their position, and once a bargain is achieved, all are reluctant to reopen the issue. The use of ad hoc measures reinforces this inertia and discourages substantive and technical evaluation of the formula. If

the formula is not clearly intended to represent identifiable concepts, then not only is it up for political grabs in its first stage, it is hard to make the case for revising it in the second stage. This problem has been amply illustrated in efforts to change CDBG formulas, which ended in simply adding a formula and in continuing debates over General Revenue sharing formulas, which remained unchanged despite many critiques and challenges.[9]

The most important time, therefore, to pay attention to formula design is at the outset of a program or when first changing it to formula allocation. Yet, in practice, many of the technical studies on formula design (evaluating the components and testing outcomes against alternative measures) have been done only after the formula is in place. Then it is too late.

STRATEGIES FOR SOLUTION

Relying on Principles of Measurement

As we have suggested, reliance on explicit principles of measurement is crucial to any strategy for improving the value of formulas as tools for distributional policy. The formula design process requires a finely meshed collaboration of political and technical judgments. Political judgments require understanding of the technical properties of formulas, and adequate technical advice is depends on an understanding of policy purposes.

At the simplest and most technical level are several characteristics that should be sought in a formula. First, a good measure should be replicable and comparable -- that is, a formula's components should be based on data collected in a standardized way across states and over time. This problem is normally dealt with by relying solely

[9]See Bunce 1979, Nathan et al. 1975, and Dommel and Rich (unpublished) for further discussion.

on federal data sources like the U.S. Census, rather than state or local data. Second, a good measure is sensitive to variations in the conditions it is intended to reflect. A component should not be included unless it discriminates effectively among desired beneficiaries. Third, a measure should have some stability or predictability. Wide and unexpected fluctuations are particularly problematic for formula allocations, as communities need to budget for long-term commitments. Finally, the measures used in formulas should be as current as possible. Lead time for national data series is often several years, which can make considerable difference in fast-changing communities.

Though each of these characteristics can be assessed in technical terms, each is, to some degree, in conflict with the others. A more sensitive indicator may be less stable than a less sensitive one, and a standardized national data set is likely to be less up-to-date than a local one. Tradeoffs must be made, and these are questions of policy judgment.

The second set of measurement issues -- around the question of validity -- is less intrinsically technical and therefore more difficult to assess. These issues are, however, even more fundamental to assuring that formulas reflect policy. The basic question is whether a formula measures what it is intended to. This question incorporates the technical issues discussed above -- a measure cannot be valid unless it is sensitive, reliable, and so on. But the problem of validity extends into a realm where political and social judgments are central. Validity has frequently been ignored or given cursory attention as a criterion of measurement because there is no purely mechanical way to evaluate it. Ultimately, validity of a formula can only be assessed if a notion of its intended meaning exists separately from the formula itself.

If a formula's meaning can only be detected from examining the formula rather than from other statements about its purpose, then its validity is indeterminate.[10]

A number of key questions are involved in determining the validity of a formula. Do the components of the formula actually measure the conditions that merit funding? Does the way they are combined reflect the relative importance placed on them by policymakers? Additive measures can be particularly problematic here; components of an additive formula should each measure distinct dimensions of a problem -- level of poverty and housing quality, for example -- but the potential for double-counting is high. Poor housing may measure poverty almost as directly as income level. Moreover, there can be no general rule for weighting such components, so it is particularly important for policymakers to understand the implications of the weights and to make the weighting a policy decision.

While validity can never be conclusively determined, there are technical ways to demonstrate that a measure is invalid. The results of using one measure of poverty, for example, can be compared with the results of using another. If the distributions of jurisdictions differ significantly, one measure may be invalid, or the two may measure different concepts of poverty. A second strategy is to compare the behavior of a measure to the movements of other measures that are causally related. Thus a formula designed to reflect urban distress could be assessed on the degree to which it changed after serious economic dislocation, or on how well it was associated with urban fiscal health. If the relationship of the formula allocation to these other factors is not as theory would predict, then the formula is unlikely to be a valid way of targeting distressed cities.

Technical methods of invalidating a formula, however, cannot be conclusive, because they require a prior theory about the issues -- theory which may be incorrect -

[10]For further discussion of the difference between measurement with theory and "operational measurement," see Blalock and Blalock 1968, Chapters 1 and 2.

- and because no technical method can say what is valid. The ultimate test of validity is subjective, as it requires the matching of a measure or formula to a concept. Validity is about meaning. Part of validation process, therefore, appropriately involves the policymakers (de Neufville, 1978-9). They can often validate a simple measure by deciding, on the basis of their shared understandings, whether it has a logical, meaningful relation to what they intend to measure. Sometimes they may require technical assistance to help determine what a variable really represents. Only those involved in the political part of the process are legitimately entitled, however, to decide what it is they want to measure and whether a particular formula component is a good enough proxy for the purpose.

Currently, however, the necessary channels for interaction of technical experts and decision-makers are not clearly institutionalized. Technical input does not routinely inform the process in standard ways, and essential discussion between technicians and policymakers does not necessarily occur. Policymakers thus may be unaware of consequences of the formulas they choose. Technicians, on the other hand, are apt to have only a partial idea of what the formulas should try to achieve. The precise specification of the policy objective may hinge on what is possible to incorporate in a formula. Policymakers should remain in continual communication with technicians until a formula is agreed on to assure that compromises made in its design are desirable. Neither policymakers nor technical analysts can fulfill their responsibilities in formula design without an interactive process of communication and mutual learning.[11]

[11](See a parallel example of political/measurement process in de Neufville, 1975, Chapter 7).

RECOMMENDATIONS: A SUMMARY

Out of this discussion we can highlight a series of recommendations to improve formulas as a tool of distributional policy:

- o Insist on definitions of policy intent distinct from the formulas themselves, and establish the norm that formulas should reflect that intent.
- o Make use of measurement principles and criteria in the design of formulas. Instead of ad hoc design using convenient measures or borrowing from other programs, seek formula components which are meaningful indexes of policy concerns. Pay attention to reliability, stability, sensitivity, and bias. Keep the standards explicit throughout the policy debate and the life of the grant program.
- o Do technical evaluations and validity assessments of formulas before they are legislated. Changing formulas is far too difficult to allow this process to wait until formulas are in use.
- o Re-analyze and re-evaluate formulas on a regular basis, applying measurement principles to see if they are working as intended. Conditions can change and, with them, formula validity can change.
- o Establish the norm that formulas which produce unintended results and are unreliable or invalid will be changed.
- o Make formulas as simple as possible while capturing basic program intent. Transparency and comprehensibility are crucial to informed policy debate. Complex formulations are hard to interpret and may add little to a formula's ability to discriminate among recipients.
- o Apply formulas to narrow-aim programs rather than to broad ones with a multiplicity of goals and types of beneficiaries.

- o Keep the policy discussion focussed on policy purpose rather than the bottom line.
- o Establish close and continuous working relationships between technicians and policymakers to examine critically proposed changes in policy and formulas.

Politics and human nature being what they, are these resolutions are far easier to pose than to achieve. Identifying these principles as the ideal for practice is, however, a beginning. The next step is to identify ways to institutionalize these as norms of practice. It is important to do so because, in the long run, formulas can be an equitable and efficient way of implementing distributional policy. If they are to succeed as policy tools however, they will have to build on measurement principles.

APPENDIX

Standard Formula Designs

The Cost Factor Approach

The simplest approach is to reimburse jurisdictions directly for all or some percentage of actual costs incurred in a program. Some formulas apply a single cost factor to a variable representing service use. The formula is expressed as C (cost) x N (number of units of service or product consumed). This formula provides an open-ended amount to a jurisdiction in relation to its provision of the service. Other programs use a formula adding costs of different services or products, differentiating, if necessary, categories of recipients which receive different subsidy levels. For these formulas, the funding level = $C_i N_i$, where C_i is the unit cost of the ith service and N_i is the amount of the ith service consumed. This type of formula works where there are limited and identifiable services, where there are standards for them, and where there is a way to establish costs. Such formulas have been used to reimburse for the costs of nutritional programs and to contribute to airport construction.

Shares Approach, Linear

Most formulas are not open-ended cost reimbursement tools. Rather, they apportion a share of a fixed total appropriation to each jurisdiction. Such formulas have evident, systematic redistributional effects. The simplest approach is in the Social Services Block Grant formula, which relies on state share of national population to establish state share of the grant: State share = state population ÷ U.S. population. Most share formulas are more complex, however, and rely on a linear, additive combination of share variables. Four or five components are not uncommon. Each component is then weighted by a percentage, with all weights adding to one. (See text for Highway Safety Grants Formula example.)

Shares Approach, Nonlinear

The formulas can be made more sensitive to variations in local conditions by the introduction of nonlinearities. The most common approach is to introduce a multiplicative term to adjust for a state's ability to raise revenue through income taxes. (See Medicaid and General Revenue Sharing examples in the text.) Such formulas also can recognize that the cost of meeting needs may increase in a nonlinear way as the concentration of the problems increases. Such formulas are more difficult to interpret than linear ones, and they tend to have consequences that are not intuitively predictable.

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