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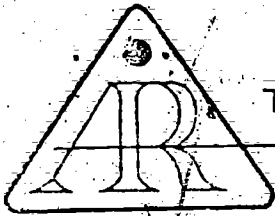
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ABSTRACT

As a response to the concerns associated with the allocation of state resources to institutions of higher education, several states have developed budget formulas to derive estimates of the institutional financial requirements. Formulas, however, were developed during a period of rapid growth, and might be unresponsive to institutional needs during the forthcoming decade of stabilized or declining enrollment. Two major questions are addressed in this paper: (1) To what extent are budget formulas responsive to changing enrollments? and (2) To what extent are the internal budget factors concerning formula adequacy affected by enrollment shifts? Characteristics of an hypothetical institution were developed for the base FY 1977 and then projected to FY 1978 under five conditions of enrollment. These characteristics were applied, as required, to five selected FY 1978 state budget formulas: Louisiana, New Mexico, Ohio, Tennessee, and Texas. Examination of the results indicated that under conditions of declining enrollment, the fixed costs of institutional support and maintenance are not adequately reflected in the budget. This appears to be the case even when the formula is designed specifically to address such costs accurately. (Author/LBH)

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Adequacy of Budget Formulas for Balancing
Institutional Needs and Resources in Non-Growth Periods

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As a response to the concerns associated with the allocation of state resources to institutions of higher education, several states have developed budget formulas to derive estimates of the institutional financial requirements. Formulas, however, were developed during a period of rapid growth, and some have suggested that they will be unresponsive to institutional needs during the forthcoming decade of stabilized or declining enrollment. Two major questions are addressed here. First, to what extent are budget formulas responsive to changing enrollments? And secondly, to what extent are the internal budget factors concerning formula adequacy affected by enrollment shifts? Characteristics of an hypothetical institution were developed for the base FY 1977 and then projected to FY 1978 under five conditions of enrollment. These characteristics were applied, as required, to five selected FY 1978 state budget formulas: Louisiana, New Mexico, Ohio, Tennessee, and Texas. Examination of the results indicated that under conditions of declining enrollment, the fixed costs of institutional support and maintenance are not adequately reflected in the budget. This appears to be the case even when the formula is designed specifically to address such costs accurately.

Adequacy of Budget Formulas for Balancing Institutional Needs and Resources in Non-Growth Periods

The Rationale for State Budget Formulas

While the concept of state financial support to public institutions of higher education is generally unquestioned and the practice has a long history, the process is fraught with many political uncertainties. These uncertainties result from institutional concerns regarding the adequacy of funding and the appropriation of state tax funds on some basis of reasonable equity. Institutions desire to have sufficient funds to initiate and maintain their educational programs, as well as to have funds distributed equitably. On the state agencies' side, accountability is the concern. Given that a specified level of state support is provided to an institution, the state wants to be assured that the funds were put to an appropriate use and that they were well managed. Thus, the four factors of: (a) political uncertainties; (b) adequacy; (c) equity; and (d) accountability, are the major considerations involved in the appropriation of state funds to higher education institutions (Moss and Gaither, 1976).

As a response to these needs, certain states have developed budget formulas to derive estimates of the fiscal requirements of institutions. The first uses of budget formulas to appropriate state funds were during the period 1948 to 1954 when they were introduced in six states: Indiana, California, Oklahoma, Texas, New Mexico, and Kentucky (Summers, 1975). Subsequently, other states tried this mechanism, and in 1973 Gross reported that 25 states used a budget formula in the state budgeting process. Not all of the original group retained use of the procedure, however; and since 1973 some states

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have adopted formulas while others have suspended use. Regardless of these fluctuations, the budget formula continues to be a viable part of state budgeting processes for funding institutions of higher education.

Essentially, a budget formula is an objective procedure whereby future budgetary requirements are determined through manipulation of quantitative data which reflect relationships between program and costs (Miller, 1964). Gross (1973) also points out that the formula may consist of several components reflecting distinct functional budget areas, and it may be represented mathematically. Because of the inherent objectivity of a budget formula, its use is seen as a way which can reduce the political uncertainties associated with the state budgeting process. Regardless of their structure and the specific relationships defined, budget formulas reduce the complexity of the budget standards by providing an agreed upon framework for discussion.

The Question of Adequacy

The introduction and development of state budget formulas has occurred during the continued periods of growth for institutions of higher education. With the returning veterans of World War II and the Korean and Vietnamese wars, enrollments increased tremendously. When the post-war baby boom reached college age, the enrollment momentum continued, particularly when draft exemptions for college attendance were available. In addition to these external growth factors, the Sputnik era had a significant impact on the growth of research for higher education and subsequent growth of the institutions in terms of faculties and physical plant. Such growth, however, is not expected to continue. Projections of enrollments for the 18- to 22-year old cohort, the usual college-bound group, indicate a decade of decline and stabilization. In addition to this birthrate factor, alternatives to the traditional college education are being made available. The advent of the community college sector and the incorporation of the proprietary schools into a transformed postsecondary education orientation will have an impact on the educational selection of this traditional college age cohort.

The question can be raised: Will the budget formulas be able to estimate an adequate funding level for higher education institutions in a projected period of stabilization or decline? Adequate funding estimates derived from budget formulas will depend on the validity of the budget formula and the derivation of the costing factors and units. The validity of the budget formula is a concern for the accuracy of the estimate of the actual fiscal requirements of the institution, and four internal budget factors can be identified as influences on the adequacy of budget formulas:

Use of Costing Units

Halstead (1974) suggests that the basic structure of budget formulas involves the multiplication of unit costs by projected loads, or volume, to estimate the future fiscal requirements. While this may be the suggested methodology, some states have implemented procedures which base the budget projection on the current fiscal year's actual performance. The question is then one of whether to project the forthcoming headcount and/or full-time equivalent enrollment, credit hour production, and other volume related cost units or whether to use the most current, actual levels of the particular cost units.

Modeling Cost Behavior

As Boutwell (1973) points out, one critical factor influencing the adequacy of budget formulas during periods of enrollment stabilization or decline is the ability of the budget formula to model the cost being considered. Modeling is a function of identifying the variables which influence the cost behavior. For example, the costs for instruction and departmental research may be represented in some states in terms of credit hours. The total instructional entitlement is derived in these states from credit hour production and specific rates per credit hour. In the other states the instructional entitlement is broken down into components, or line items, such as instructional faculty salaries and other departmental operating expenses. These two components are further modeled by considering either full-time equivalent student enrollment and student-faculty ratios or

credit hour production and credit load per faculty. In addition, units are often differentiated by discipline area and student level. The expectation would be that the more closely the costing unit is associated with the activity being modeled, the more accurate the cost estimation.

Comprehensiveness of Institutional Activities

The major purpose of a state budget formula is the estimation of the future financial requirements of an institution in support of its activities. The institutional activities addressed in state budget formulas can be conveniently classified into categories, following the guidelines recently published by the National Association of College and University Business Officers (NACUBO, 1974), which correspond to the expenditure categories associated with educational and general expenditures from the current funds group. The current funds group in the accounting practices of colleges and universities reflects the operating expenses of the institution, as contrasted with the other fund groups: loan funds, endowment and similar funds, annuity funds, plant funds, and agency funds. State budget formulas are designed to address or model the educational and general categories:

Instruction	Public Service	Student Services
General Support	Academic Support	Institutional Support
Research	Libraries	Operation and Maintenance

Typically the budget formula developed for the consideration of the financial requirements of an institution is not one formula, but rather a number of formulas, each reflecting specific component of the functional categories of the current funds group. The accuracy, and subsequently the adequacy, of a budget formula would most likely be influenced by the coverage of the categories. Thus, it could be argued that the more comprehensive the formulas relative to the activities, the closer the accuracy and adequacy of the budget estimate.

Methods for Deriving Budget Estimates

A fourth factor which may influence the adequacy of the budget estimate is the particular method used to model the cost behavior of a given functional category. As

Halstead (1974) points out, formulas can be categorized as to one of three methods: workload, staffing standard, or percentage base factor. These same approaches are discussed by Gross (1973) and Moss and Gaither (1976), but with a different terminology: rate per base factor (workload), base factor to position ratio with salary rates (staffing standard), and percentage base factor. For convenience, the discussion here will use Halstead's terminology.

In the workload method a load measurement which is relevant to the activity category is determined, and costs per unit are derived. These costs per unit, typically based on historical cost studies, are then used to estimate the level of funding required to support a functional category, given a certain or expected number of units. For example, the entitlement for library expenses could be based on the number of credit hours by student level; specific rates per credit hour by differentiated student level are then derived. An estimate for support is obtained by multiplying the projected number of credit hours by the derived rates.

The staffing standard formula determines the number of positions (faculty, administration, or staff) required for the activity category and then multiplies this requirement by a corresponding salary schedule. Two approaches to deriving the number of required positions can be identified: 1) the desired ratio of positions to a specific workload measure is specified; or 2) an appropriate organizational structure and manning table is developed. As an example of the first method, the amount of support for faculty is developed by deriving the number of faculty members required by dividing the number of credit hours by specified averages of number of credit hours expected per faculty member. This number of faculty is then multiplied by the average salary to obtain the resource requirements for faculty salaries. The number of staff positions required is then derived and multiplied by the average salary per position. When a manning table approach is taken, the organizational structure of institutions is specified, and the number of positions permitted for each level is given. The formula under this approach would specify that each instructional center or school is allowed one dean, one associate dean, and two

research assistants. Salary rates for each of these positions would be given, and the entitlement would be determined by multiplying the number of positions by the appropriate salary rate.

Expenditure estimates derived from a percentage base factor approach specifies that the amount for a given category is a certain percentage of a base activity. The base activity entitlement, such as instruction and departmental research, is typically developed by either the workload or the staffing standard method. A percentage of this entitlement is then determined as the support requirements for a second activity. As an example, given a base entitlement for instruction, academic support funding requirements may be specified as 5% of the base.

Summary of the Question

While these four internal factors: use of costing units, cost behaviors of activities, comprehensiveness of activities, and methodology used in modeling, operate in an interactive manner critical in determining the adequacy of a given formula, external factors such as size of enrollment, and inflation are becoming of increasing concern to education. Particularly the concern of size of enrollment is drawing increased attention. Formulas were introduced and developed during a period when higher education was confronted with extremely rapid growth. Such growth is, however, not expected to continue. As pointed out by Gross (1973) and Boutwell (1973) the budget formula, as conceived and implemented in a period of growth, will be affected by this "down side."

The Study

The purpose of this paper is to investigate the relative adequacy of state budget formulas under varying conditions of enrollment growth. Two major questions are addressed.

1. To what extent are budget formulas responsive to changing enrollments?
2. To what extent are the four internal budget factors concerning adequacy: the costing unit applied, the accuracy of the activity modeling, comprehensiveness of institutional activities, and the methodology used, affected by enrollment shifts?

The approach taken in considering the problem of budget formula adequacy was to develop the characteristics of an hypothetical institution under five conditions of enrollment: 7% increase, 5% increase, no growth, 3% decline, and 7% decline. The characteristics of the institution were then applied, as required, to five selected state budget formulas to develop the institution's formula derived budget. The state formulas included were: Louisiana, New Mexico, Ohio, Tennessee, and Texas.

In developing the hypothetical institution, characteristics were derived for the base year period FY 1977. The institution had 14 teaching disciplines, following the Higher Education General Information Survey (HEGIS) taxonomy, and 16 student program areas. Courses were taught in all programs at the lower and upper undergraduate levels and at the master's graduate level. Only in the education discipline were doctoral level courses taught. In addition, education had the only doctoral level student program. Table 1 summarizes several of the FY 1977 characteristics of the hypothetical institution. The FTE enrollments were then projected by student level to different FY 1978 levels

Insert Table 1 about here.

reflecting the five enrollment conditions. The methodology used to project the induced and produced credit followed that suggested by the Resource Requirements Prediction Model (RRPM) developed by the National Center for Higher Education Management Systems. Given the projected FTE enrollments, the number of credit hours induced by these enrollments was developed. Under the assumption that the course taking behavior of the students would remain consistent with that in FY 1977, the number of credit hours produced in FY 1978 for the five different enrollment conditions was determined.

The five state budget formulas incorporated in this study reflected the FY 1978 budget procedures for the states and were selected for their diversity in approach and

comprehensiveness. Table 2 summarizes the NACUBO activity categories as represented in the formulas. As shown in this table, all of the formulas selected address the

Insert Table 2 about here

instructional activities, and all in some manner differentiate the instruction formula in terms of program or discipline and of level (undergraduate, graduate, and so on). Similarities among the formulas, however, diminish at this point. Louisiana's formula derives the institution's budget entitlement by multiplying base year credit hours by rates delineated by discipline and level and by adding a percentage of this amount for general support. New Mexico's formula reflects a similar procedure, except that projected credit hours are employed. In the Ohio formula, more institutional activity categories are addressed, making the formula more explicit, but each category is defined relative to a projected FTE student enrollment differentiated by program and level. Both the Tennessee and Texas formulas address the majority of NACUBO activities and so can be described as comprehensive in their coverage. In addition for each category, unlike the Ohio formula, an attempt is made to model the activity with variables intuitively associated with the activity costs. The major difference between these two state formulas is that the Tennessee formula is based on projected credit hours, while the Texas formula considers base year credit hours.

In considering the application of the hypothetical institutional characteristics to these five state budget formulas, several limitations on the comparisons of results must be addressed. First, the budget formulas do not necessarily reflect the totality of institutional fiscal requirements. Louisiana's formula, for example, derives only the state appropriation amount. The Tennessee formula does not include such items as staff benefits, and inter-collegiate athletics; the Texas formula does not address staff benefits

and security expenses. A second consideration in comparing the application of the budget formulas is the nature of the factors included in the rates per credit hour, per student, per square foot. One important factor is the faculty salary rate implicit in the formula. Each state has a different salary scale on which the rates are based. In addition, different inflation rates are reflected in the formulas. New Mexico's formula represents an 8% increase in salaries and 10% in non-salary items, while Ohio's inflation increases are 6% and 7.5%, respectively. Texas incorporates an overall inflation rate of 7.6%. Finally, information for the hypothetical institution could not be realistically developed to the extent required for the Texas physical plant formula. Therefore, the physical plant budget amount for the hypothetical institution was directly substituted.

Results and Analysis

Given the limitations in comparing the application of budget formulas from the selected states, the necessity to develop a basis for comparison becomes critical. Assuming that the no growth enrollment condition provides the standard to which the conditions of enrollment can be compared, one consideration is the difference of the formula-derived budget amounts under the varying enrollment conditions from the no growth condition. The percentage of this difference to the standard no growth condition then provides an index for examining the budget formula amounts. Table 3 presents the formula-derived budget amounts, the differences from the enrollment growth condition, and the percentages these differences represent of the standard.

Insert Table 3 about here

Given that the no growth enrollment condition provides the standard, several outcomes relative to the sensitivity of these budget formulas to differing enrollment conditions can be noted. The first observation in Table 3 is that the Louisiana and Texas

formulas are insensitive to changing enrollment in a given fiscal year. This results from the particular costing units used in the formulas. Since the entitlements are developed from base year and not projected conditions, changes in enrollment, whether expected or unexpected, will not be addressed until the next budget period, which may be too late to meet real institutional needs at the most opportune moments. An alternative is to base the budget amount on projected units so that timely adjustments can be made, as do the formulas of New Mexico, Ohio, and Tennessee. As shown in Table 3, these formulas are sensitive to fluctuating enrollments to the point of providing essentially 7% and 3% increases or decreases in budget with corresponding enrollment changes.

While the formulas of New Mexico, Ohio, and Tennessee essentially produce 7% and 3% budget increases or decreases, the fluctuations are not exact. For both the New Mexico and Ohio formulas under the 7% enrollment decline condition a slightly larger decrease in the percentage is shown than under the 7% growth condition. The Tennessee formula, on the other hand, reflects a smaller decrease in the percentage under the 7% decline condition than under the 7% growth condition. One significant contributing factor to this observation is the modeling of the cost behavior inherent in the formulas. The Ohio formula, for example, develops the budget entitlement for physical plant on the basis of a cost per student. The Tennessee formula derives the same activity on the basis of a rate per square foot for maintenance and a separate rate per volume of utilities. The Tennessee formula more clearly models the activity being costed and presumably as a result recognizes that many institutional costs are not simply a function of enrollment.

Another factor which may account for this basic observation is the comprehensiveness of the formulas. The New Mexico formula derives a component for general institutional support as a simple percentage of the instructional budget, while the Tennessee formula, as shown in Table 2, is most comprehensive in addressing the categories of institutional activity. A second observation related to comprehensiveness is that if the formula is based on actual, rather than projected costing units, comprehensiveness of the formula is irrelevant to the issue of changing enrollments. The comparison is

the Louisiana formula, a relatively simple one, with that of Texas, a relatively complex formula. Both are insensitive to fluctuating enrollments in a given fiscal year, although adjustments for such conditions would be addressed in the next budget period.

The influence of method: workload, staffing standard, and percentage base factor, on budget formula sensitivity to changing enrollment is difficult to assess from the information available here. One comparison which may be representative is that of the New Mexico and Ohio formulas. The Ohio formula is designed using a workload method, while the New Mexico formula combines the workload and percentage base factor methods. Here the Ohio formula appears to be less sensitive to both enrollment decline and growth than the New Mexico formula. To attribute this directly to the particular method used, however, is not really possible from this study.

Conclusions

To what extent are budget formulas responsive to changing enrollments? This study focused on five selected budget formulas and their characteristics under varying enrollment conditions. As is obvious from Table 3, in a given year formula responsiveness to changing enrollment will occur when the formula is based on projected, rather than actual, costing units. Three of the selected formulas: New Mexico, Ohio, and Tennessee, reflect sensitivity to possible fluctuations in enrollment. The Louisiana and Texas formulas, however, would adjust in the subsequent budget period for enrollment shifts after they have occurred, so that the budget formula reflects a delayed sensitivity to enrollment patterns. What is interesting, and not totally unexpected, is that formula funding strictly reflects enrollment changes. Even under the conditions of 7% growth or decline in enrollment, no other factors included in the budget formula were of significant importance to offset the impact of enrollment.

The relative effect of the factors thought to influence adequacy have been shown to have only slight and marginal impacts on the funding patterns under varying conditions of enrollment. The only critical factor is whether the costing unit is projected or based on actual base period figures. The remaining factors: comprehensiveness of institutional

activities, the methodology used, and the accuracy of the activity modeling, have little influence on the total budget amount for the different enrollment conditions, at least as shown by these five budget formulas. Some evidence though was observed which would indicate that a more positive margin under more severe enrollment declines would be obtained if the formula more accurately models the cost behavior of the activity being funded. The Tennessee formula bases the physical plant entitlement, for example, on a rate per square foot rather than FTE enrollment or credit hours. Under the condition of 7% enrollment decline, this formula estimated a budget amount which reflected a smaller percentage than was provided under the 7% growth condition. Other activities which will influence this factor of accuracy include libraries, academic support, institutional support, and student services which are to varying extents not as directly tied to enrollment as are the costs of instruction.

Close examination of these formulas indicates that under conditions of enrollment growth, the institution could expect increases in funding which reflect this growth. Under conditions of declining enrollment, however, the fixed costs of institutional support and maintenance are not adequately reflected in the budget. This is the case even when the formula has been developed to model such costs separately as in the case of Tennessee's formula. Therefore, during a period of prolonged enrollment decline, fixed and mixed costs will become an ever increasing, larger proportion of the institutional budget.

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Table 1

Selected Institutional Characteristics FY 1977

Discipline	Credit Hours Produced All Levels	FTE Faculty	Average Number Credit Hours Per Faculty
Total	378,639	660	568
Biological Sciences	16,136	29	559
Business and Management	37,258	58	641
Communications	13,869	17	810
Education	43,407	86	502
Engineering	6,348	20	323
Fine and Applied Arts	36,764	81	454
Foreign Language	12,115	24	507
Letters	52,441	91	577
Library Science	3,181	7	471
Mathematics	19,341	38	512
Physical Science	20,149	39	519
Psychology	16,373	23	691
Social Sciences	94,828	138	688
Interdisciplinary	6,429	9	703

Program	Credit Hours Induced All Levels	FTE Enrollment	Headcount Enrollment All Levels
Total	378,639	13,026	18,473
Biological Sciences	21,780	740	988
Business and Management	65,418	2,211	2,983
Communications	15,570	528	711
Computer Science	2,940	98	122
Education	22,681	829	1,421
Engineering	7,590	264	389
Fine and Applied Arts	37,812	1,285	1,739
Foreign Language	8,100	276	377
Letters	35,238	1,204	1,677
Library Science	3,240	135	307
Mathematics	7,795	264	348
Physical Sciences	7,554	255	333
Psychology	18,768	635	852
Social Sciences	80,958	2,751	3,772
Interdisciplinary	4,410	147	184
Undeclared	38,785	1,404	2,270

Activity	Budget
Total	\$33,102,875
Instruction	18,582,576
Research	427,984
Public Service	347,143
Academic Support	1,517,521
Libraries	2,178,575
Student Services	3,210,075
Institutional Support	3,574,918
Physical Plant	3,264,083

Table 2
 Summary of Selected State Budget Formulas
 by Category

	Instruction	General Support	Research	Public Service	Academic Support	Libraries	Student Services	Institutional Support	Operation and Maintenance
Louisiana	X	X							
New Mexico	X	X							
Ohio	X				X		X	X	X
Tennessee	X		X	X	X	X	X	X	X
Texas	X		X	X		X	X	X	X

Table 3

Formula Derived Budget Amounts (in millions) and
Differences and Percentage Differences from No Growth Enrollment Condition

State		Enrollment Condition				
		7% Growth	3% Growth	No Growth	3% Decline	7% Decline
Louisiana	Amount	\$31,577	\$31,577	\$31,577	\$31,577	\$31,577
	Difference	0	0	0	0	0
	%	0.00%	0.00%	0.00%	0.00%	0.00%
New Mexico	Amount	\$34,855	\$33,537	\$32,560	\$31,590	\$30,259
	Difference	2,295	- 977	0	- 970	- 2,301
	%	7.05%	3.00%	0.00%	- 2.98%	- 7.07%
Ohio	Amount	\$38,948	\$37,504	\$36,400	\$35,314	\$33,838
	Difference	2,548	1,104	0	- 1,086	- 2,562
	%	7.00%	3.03%	0.00%	- 2.98%	- 7.03%
Tennessee	Amount	\$28,551	\$27,486	\$26,630	\$25,722	\$24,741
	Difference	1,921	856	0	- 908	- 1,889
	%	7.22%	3.22%	0.00%	- 3.41%	- 7.09%
Texas	Amount	\$21,701	\$21,701	\$21,701	\$21,701	\$21,701
	Difference	0	0	0	0	0
	%	0.00%	0.00%	0.00%	0.00%	0.00%