A MULTIPLE CORRELATION ANALYSIS OF THE SUPPLIES AND SERVICES GENERAL FUND BUDGETS FOR SELECTED ACADEMIC DEPARTMENTS AT MICHIGAN STATE UNIVERSITY: 1964-1965 AND 1965-1966

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This is to certify that the

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Thomas Mason Freeman

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ABSTRACT

A MULTIPLE CORRELATION ANALYSIS OF THE SUPPLIES AND SERVICES GENERAL FUND BUDGETS FOR SELECTED ACADEMIC DEPARTMENTS AT MICHIGAN STATE UNIVERSITY: 1964-1965 AND 1965-1966

by Thomas Mason Freeman

The study was intended as an investigation of Supplies and Services expenditures for the academic departments at Michigan State University for the years 1964-1965 and 1965-1966. There were four primary study objectives. First, are there significant simple and multiple correlations between Supplies and Services expenditures and the department use factors which utilize those expenditures? Second, what are the most prominent independent variables which are significantly correlated with the expenditures? Third, how well does a "general" independent variable combination which best explains the user-expenditure relationship for all departments and for all sub-categories of Supplies and Services compare with more specific independent variable combinations which explain user-expenditure relationships for department sub-groups and specific Supplies and Services sub-categories? Such a comparison is concerned with the degree of correlation, the independent variables involved, and the general predictive ability of the various regression equations. Fourth, what are the implications which can be

drawn from the analysis in terms of: (1) the expenditure-user relationship; (2) the relative validity of the independent variables which are found to be significantly correlated with expenditures; and finally (3) the predictive ability of the regression equations?

Methodology of the Study

The sample consisted of 32 academic departments at Michigan State University for the fiscal years 1964-1965 and 1965-1966. The department sample was utilized in all analysis with a further breakdown of the sample into four department groups which might have an influence on Supplies and Services expenditures.

Dependent variables consisted of expenditures for total Supplies and Services and selected sub-categories of that total. Independent variables were those items of data which are accepted measures of departmental workload, size, and special characteristics. Data were limited to general fund operations.

Simple and multiple correlation analysis was employed to determine the extent of relationship between the independent and dependent variables for the total department sample and each of its sub-groups.

Findings of the Study

It was found that the expenditures for Supplies and Services were significantly correlated with the various measures of department workload and size. The extent of

correlation varied for each department sub-group and each sub-category of Supplies and Services.

The total department sample indicated in simple and multiple correlations a very high correlation with laboratory measures and a somewhat lower correlation with faculty measures. The utilization of multiple correlation analysis improved the level of correlations but the pattern of key variables set in simple correlations did not vary greatly in multiple relationships.

The multiple correlations did, in most cases, give attention to various department workload factors but laboratory and faculty measures were predominent. Head count faculty measures usually exceeded the correlation level of full time equivalent (FTE) faculty counts suggesting that general fund Supplies and Services expenditures are not limited to general fund faculty.

The four department groups had very high correlation results with laboratory oriented departments showing the highest and most acceptable results. The non-laboratory, social science departments had high correlations but the independent variables involved were considered as unacceptable measures of Supplies and Services needs.

The "general" regression equation for all departments and total expenditures discriminates against non-laboratory departments and non-laboratory needs due to the extensive influence of laboratory measures in the equations.

The best regression equations for predicting expenditures relative to actual expenditures were the special department group equations rather than the "general" equation. However, those special group equations are doubtful as formulas because they would appear to perpetuate current expenditure levels rather than provide a guide to a more equitable funding for different needs and different departments.

Volume variations seem insufficient to fully and adequately explain expenditures. The cost factors involved in certain Supplies and Services categories and for certain departments may help clarify the level of expenditures not explained by departmental volume.

The overall results point to a consideration of two major features of adequately funding Supplies and Services needs. First, some equation and/or means of adequately discriminating for various department needs and various types of departments is needed if all departments are to be adequately and equitably funded. Second, a reorganization of the sub-categories of Supplies and Services might provide a clearer and more direct cost analysis of this budget category. The more clearly the expenditures are matched with the user of the funds the more effective the cost analysis and evaluation.

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Thomas Mason Freeman

A THESIS

Submitted to
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DOCTOR OF PHILOSOPHY

Department of Administration
and Higher Education

1967

To My Parents and Wife

This study is dedicated to my parents, and

to my wife, Florence

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CHAPTER I

RATIONALE FOR THE STUDY

Developing, allocating, and projecting Supplies and Services budget needs for those academic departments which have common and diverse needs for Supplies and Services creates a difficult problem for any university. Determining allocations which will sustain departments with needs as different as chemistry, art, and history in a generally fair and equitable manner requires objective data on which decisions can be based.

Problems of Supplies and Services

Department chairmen perform a critical task of budgeting funds for salaries, labor, equipment, and supplies and services. During the last decade the task of securing and holding qualified faculty has been the most crucial aspect of their job. Maintaining a quality faculty in a major university places a special burden on resources with the result that adequate attention has not always been given to such support functions as equipment, clerical personnel, and supplies and services. Because these support budgets have often been the last to be considered, they have often been substantially reduced when overall funds were reduced.

Although this is defensible as a temporary measure, the Supplies and Services budget is an important element in long-term faculty satisfaction, and serious attention must be given to this category.

How effectively or in what manner Supplies and Services is allocated or used by departments at Michigan State University and presumably at other institutions is not really known since data collection and analysis of this budget category have not been organized so as to relate the expenditures of Supplies and Services to various departmental factors (students, faculty, etc.) which utilize the budget category.

How well budgeting is performed is substantially dependent upon adequate information about the current budget situation. Budgeting, while future oriented, is never divorced from the present situation. Most budgeting for future needs starts with "what is," or the current practice, and then moves into the future in varying ways. Therefore a basic need and problem in any budget operation is an examination of the present situation so as to improve the possibility of objective appraisal of Supplies and Services budgeting.

Nature of Supplies and Services

This problem arises, in part, because of the following circumstances: First, Supplies and Services is a heterogeneous budget category that contains a range of categories such as travel, laboratory supplies, and clerical supplies. Second, the departments which use the Supplies and Services' funds are diverse and yet common in character. Zoology and history have a common need for funds in travel, telephone, books and magazines, but a different need for supplies and materials because of the nature of their instructional program. Third, there would appear to be no single criterion (number of faculty, students) in departments which could be used as a sole measure of need for all departments. In other words, to compare and project budget needs based only on number of faculty or students could create issues of equity and comparability. Furthermore, the use of a single criterion of need, however valid, creates the problem often raised concerning statewide budget systems. Fourth, not knowing the current situation hampers any future projection of need. It may be that the current user-expenditure relationship is such that it could be developed as a guide or formula for determining future needs, but this is not known.

In most cases enough data now exist so that an analysis of the user-expenditure relationship is feasible. First, there are considerable data available on the various use

factors in departments, such as: number of faculty, students, and class size. Second, expenditure data for Supplies and Services are available for a two-year period. Third, the use of regression and correlation analysis in industry and in comparable circumstances where analysis of relationships seems possible has provided valuable insights into user-expenditure relationships. In other words, with the data available, it is possible to analyze the relationship of the use factors to expenditures in the academic departments. This analysis would provide valuable information about the current budget situation and its possible use as a guide for future needs.

Issues of University Budgeting

Concern for the effective budgeting of Supplies and Services in a major university is a general outgrowth of certain identifiable trends and influences in higher education as well as specific problems of Michigan State University.

Since the early 1950's, higher education has been subjected to a major increase in the demand for its services. Enrollments have grown faster than resources with the result that institutions of higher education have been forced to give more consideration to the management of the resources available. Seymour Harris, Selma J. Mushkin, Dexter M. Keezer, and others[1] have documented the pressures

placed upon universities from the interaction of increasing enrollments and limited resources.

State legislative and university officials, when faced with the problem of increasing demands and limited resources, were forced to turn toward objective data and objective analysis which could aid in justifying need as well as justifying a particular allocation. M. M. Chambers, Moos and Rourke, Rourke and Brooks, and James L. Miller, Jr.[2] have traced, within the universities and within state systems of higher education, reactions to and experiences with the use of "objective data" which have been increasingly required for justification of budget requests. The growth of statewide budgeting systems, cost analysis techniques, institutional research, curriculum models for increased faculty productivity, and cooperative cost studies were methods and procedures for handling the budgeting problem. This concern for more objectively-based budgeting has often been centered on staffing and space utilization to the exclusion of other budget needs. The time has come to consider an analysis of budgets, such as Supplies and Services, which perform significant roles in academic support.

Budgeting Supplies and Services funds is a necessary task if the needs of the academic programs of Michigan State University are to be reasonably and fairly met. Lacking unlimited resources, this University faces a demand,

both internal and external, that the decisions about its budget be arrived at within a general context of objective analysis. Legislators, faculty, students, and university administrative personnel are working within a social and business milieu which requires that policy decisions (which include budgets) about an institution be arrived at through some systematic analysis of the problem. To do an adequate and reasonable job of developing budget requests and determining budget allocations for Supplies and Services this University must develop and analyze data on current expenditure-user relationships. This information can aid in determining future budget needs as well as assist administrative personnel in appraising past allocations.

Dimensions of Supplies and Services

The budget category Supplies and Services is defined and detailed in various ways at different institutions, but at Michigan State University, Supplies and Services includes the following nine major object class sub-categories: Travel (all categories), Communication Services (telephone, postage and related items), Rentals and Utility Services, Printing and Binding, Physical Plant Services, Off-Campus Contractual Services, Other Contractual Services, Supplies and Materials, and Books and Magazine Subscriptions. In a more general sense, Supplies and Services is a major support budget for departmental teaching and research. This budget

category, while small relative to the salary budget, is vital to a department because of its direct influence upon teaching, research, and the general operation of a department.

Adequate, equitable, and properly allocated Supplies and Services not only strengthen instruction and research but sustain it. Without sustained support, the efficiency and effectiveness of the academic and professional staff are severely curtailed and this in turn weakens the instructional program.

Each of the various sub-categories of Supplies and Services performs a significant task for the academic departments. Travel funds are necessary in order to provide faculty personnel with a means of attending conferences and meetings for the purpose of maintaining active contact with their academic disciplines. Travel funds are also vital to a department for recruitment of new faculty. Books and Magazine Subscriptions represent an active communications process for academic disciplines and must be maintained if department personnel, including students, are to remain aware of current work in their field.

Telephone facilities and postage are necessary features of a modern university and as such require an outlay of funds. These funds promote communications among faculty, students, and administrators and may serve in lieu of travel funds.

Physical Plant Contract Services, Off-Campus Contractual Services, and other Contractual Services sustain equipment repair, and provide for services which are essential to the maintainance of laboratories.

Supplies and Materials, a major heterogeneous sub-category, covers a wide range of items such as clerical materials (paper, mimeograph materials, and other clierical supplies) as well as materials (art supplies, drafting materials, glassware, and chemicals) directly related to teaching and research in a major university. Students, as well as faculty, are directly affected by this category which has a definite influence on the quality of an academic program. Insufficient clerical materials, art supplies, test tubes, chemicals, slides, and other such items pose a direct handicap to teachers and often put additional burdens on their time. For example, if adequate and proper supplies are not available, then faculty must revert to antiquated methods of teaching.

Need for Supplies and Services

The President's Commission on Higher Education states

> . . . the most effective policies regarding salaries and personal and professional security will fail their purpose unless the institution provides for support of the faculty in laboratory apparatus, supplies, and books . . . the additional cost would be far outweighted by the enhanced effectiveness of the faculty member.[3]

In another report by the President's Commission on Higher Education there is a plea for support of instruction with an adequate quantity of services and supplies and other such aids which sustain high quality instruction.[4]

At Michigan State University, President John A. Hannah in his 1966 "State of the University" message called attention to the problem of Supplies and Services and emphasized the need for the University to give attention to this matter since it had not done so for several years.[5]

Provost Howard Neville and assistant provost Herman King in numerous conversations[6] have urged the investigation of Supplies and Services because of the persistent problem of adequate and equitable funding of the budget needs of diverse academic departments. Their concern has centered on projecting needs of academic departments as well as desiring to know the current-expenditure relationship in Supplies and Services.

Rollin Simonds, although he was referring specifically to faculty compensation, nevertheless stated rather well the issue for Supplies and Services when he said,

> within a university it will be necessary to dispel any impression among the faculty that funds are not allocated among colleges and departments on a systematic and reasonably equitable basis.[7]

A definition of adequate support and equity may be subject to debate, but a formal and generally acceptable definition

can be bypassed by determining the relationship between department use factors and expenditures for Supplies and Services by regression and correlation analysis.

Summary

Effective resource projection and allocation requires an analysis of the current expenditure-user relationship in Supplies and Service. It is important to know the identification of those department variables which actively use or are related to Supplies and Services expenditures because this information is basic to developing a means of funding departmental needs. This will provide administrative personnel with information that can aid in deciding future needs in some objective procedure as well as providing information which can help appraise the current situation.

CHAPTER I

FOOTNOTES

[1]Seymour E. Harris, Higher Education: Resources and Finance (New York: McGraw-Hill Book Company, Inc., 1962); Selma J. Mushkin, Economics of Higher Education (Washington: U. S. Department of Health, Education and Welfare, 1962); Dexter M. Keezer, editor, Financing Higher Education 1960-70 (New York: McGraw-HillBook Company, Inc., 1959); James L. Miller, Jr., State Budgeting for Higher Education: The Use of Formulas and Cost Analysis (Ann Arbor: The University of Michigan, 1964).

[2]M. M. Chambers, Voluntary Statewide Coordination in Public Higher Education (Ann Arbor: The University of Michigan, 1961); M. M. Chambers, Financing Higher Education (Washington: The Center for Applied Research in Education, Inc., 1963); Malcolm Moos and Francis E. Rourke, The Campus and the State (Baltimore: The Johns Hopkins Press, 1959); Francis E. Rourke and Glenn E. Brooks, The Managerial Revolution in Higher Education (Baltimore: The Johns Hopkins Press, 1966).

[3]George F. Zook, Chairman, Higher Education for American Democracy: Financing Higher Education (Washington: The President's Commission on Higher Education, 1947), p. 59.

[4]George F. Zook, Chairman, Higher Education for American Democracy: Financing Higher Education (Washington: The President's Commission on Higher Education, 1947), p. 15.

[5]John A. Hannah, A Year of Appraisal, "State of the University" Address (East Lansing: Michigan State University, February 14, 1966), no pages given.

[6]Howard R. Neville and Herman L. King, Conversations during preparation of study, Office of the Provost, (East Lansing: Michigan State University, 1966 and 1967).

[7]Rollin H. Simonds, "To Increase Man-Hour Output in Higher Education," The Educational Record, XXXIX, 4 (October, 1958), p. 338.

CHAPTER II

REVIEW OF RELATED LITERATURE AND IDEAS

Literature which is directly concerned with supplies and services budgeting is very limited. A perusal of leading journals and publications in higher education reveals that only a few brief passages are devoted to this topic. Discussion of supplies and services budgets is mentioned mainly in the literature on statewide budget systems, the emphasis being on the procedures used to determine future needs for that budget.

While there is a lack of literature bearing directly on the subject there is a basic framework of budgeting and more specially of cost analysis and formulas which serves as a focal point for this dissertation. This dissertation fits into the budgeting framework of cost analysis, budget formulas, and objective data analysis because of its orientation and concern.

Budgeting practices in higher education exhibit trends which have direct relevance for a study of supplies and services. First, budgeting practice in higher education is making greater use of objective data as an aid in budget analysis. Numerous writers have drawn attention to this trend of using objective data, cost analysis, and budget

formulas for evaluating and allocating budget needs.[1] Second, the concept of relating expenditure and user variable to one another in some systematic manner is a major example of how objective data are utilized in cost analysis and budget formulas. Neither cost analysis nor budget formulas are accepted without controversy but the concept of attempting to quantify the user-expenditure relationship offers possibilities for improving budgeting in higher education. Up to now no better system than cost analysis and formula procedures has been devised as a reasonable guide to relative need and to an evaluation of that need.[2]

Reactions to Enrollment Pressures

The concern for budgeting in higher education and the use of cost analysis, formulas, and objective data is a direct response to enrollment pressures. During the last decade enrollment increases and limited funds have forced institutions to become more concerned with the management of their resources.[3] The greater the pressures, the greater the burden of budget allocations, and the greater demand for documentation of budget needs. Four possible solutions to the enrollment pressures can be broadly categorized as those which advocate: (1) curriculum reorganization, (2) analysis of possible sources for additional funds, (3) improved general university management, and (4) improved data collection and procedures for

analysis of budget needs. They have in common a concern for maintaining quality in higher education by promoting an increase in resources for universities and by effectively utilizing those resources once they are obtained.

The curriculum reorganization concepts can be effectively characterized by the works of Dressel, and of Ruml and Morrison.[4] Their concern is centered on filling out unused classroom space, more effective utilization of faculty, and re-evaluation of curriculum patterns which would better utilize faculty and student time.

A more careful analysis of funds is recommended by Harris, Keezer, and Mushkin. They have effectively documented the extent of enrollment pressures facing higher education and evaluated the prospect for additional funds through higher tuitions and greater government appropriations.[5]

The general management improvement concept is advocated by Dobbs, Millett, Henderson and many others.[6] They share a common concern for more effective university management through a better understanding of university organization, direction, and objectives. In most cases these authors share their personal experiences and observations as actual administrators in higher education and their writings are devoted largely to issues which they have faced; the writings are descriptive rather than analytical.

Improved data-gathering procedures are demonstrated by the growth of institutional research, data collection systems, cost analysis techniques, budget formulas, and program budgeting for the purpose of more effective analysis of budgets. A primary use of objective data and objective procedures has been as an aid in budget evaluation and projection. Budgeting as outlined in the following descriptions has a particular need for objective data and objective analysis.

Budgeting

It is through budgets that institutions attempt to express the educational program of an institution.[7] Budgeting is an active process of planning, controlling and evaluating the use of resources for the purpose of achieving certain institutional objectives. As such, a budget should reflect what a university is doing or intends to do. The budgeting process may vary with the type of institution but certain aspects of budget decision making are common to all circumstances. It is always necessary to project expenditures, to determine available resources, to establish priorities, and to match resources to programs.[8] Burkhead sees budgeting as consisting of three interacting functions: "expertise, communications, and responsibility."[9] Expertise consists of obtaining as much information as possible about costs, of determining the relationship of expenditures to programs, and of deciding on the probable

effects of several alternatives. Communication consists of hearing and evaluating the views of various groups which are affected by the budget process. Responsibility consists of making budget decisions and bearing the responsibility for the decision.[10]

John Dale Russell sees budgeting as being concerned with a study of the relations of input and output. "Input" may be considered as the dollars or resources used for any or all parts of an institutions's program. "Output" is what is accomplished with these resources.[11] Russell points out that unit budget analysis requires the following three items: "(1) selection of an expenditure category to be analyzed; (2) selection of appropriate and measurable units of service; and (3) relating the expenditures to the measure of service."[12]

In each of these budget descriptions there is a key element which has direct meaning for all budgeting and certainly for supplies and services. In each case, the attempt to match expenditures to need (program objectives) in some systematic manner is a key element of budgeting. In fact, it is the concept of systematically relating expenditures to programs or needs and evaluating that relationship which is the essence of any objective budget procedure. As Herbert Simons points out, "a budget that is no more than a lot of salaries and other expenses is useless for managing a college."[13]

Budget analysis which utilizes data, cost analysis, formulas, and program concepts differs from traditional "line item" budgeting. Budget analysis using cost analysis and formulas promotes a more coordinated analysis of need with a greater emphasis on differentiating and evaluating budget uses. "Line item" budgeting tends to promote across-the-board increases rather than increases based on need, function, or program objectives.[14]

Objective Data and Procedures

The utilization of cost analysis and budget formulas for budgeting places a heavy emphasis on "objective data" and "objective procedures." "Objective data" refers to any quantified information used in financial analysis. It includes (a) programs and activities, (b) costs, (c) and the relationship of programs and costs.[15] In higher education, examples of such units of financial information are: (a) in program measurement, the use of student credit hours to measure the volume of teaching done, or square feet of floor space to measure the amount of building custodial service that is necessary; (b) in cost measurement, the identification of the number of dollars spent on salaries for teaching faculty; (c) in the measurement of relationships between cost and program, the computation of the dollar cost per student credit hour of graduate instruction.

"Objective procedure" involves the use of objective data and employs a series of steps. An objective procedure can be repeated, and so long as the same objective data are used, the results will be the same. Cost analysis formulas and program budget techniques are examples of objective procedures used in budget analysis.[16]

Objective analysis in each of its forms is based on the concept that more effective decisions can be reached whenever an institution can generate and evaluate objective data about its operations. It is obvious that objective data are a significant aid to answering complex issues of higher education and without such data the decisions which are reached are based on a more subjective, rule-of-the-thumb procedure.[17] Misused or misunderstood objective data are dangerous but such data are not inherently bad. As John Dale Russell points out,

> A vital issue is at stake if unwise formulas, standards, or other measures are devised and employed, because great damage can be done to higher education. At the same time, unnecessary and ill-founded opposition to the use of any measure, no matter what its forms, is a barrier to good administration and the pursuit of excellence.[18]

There are two major forms of objective budget analysis which are utilized as guides to budget development and evaluation. These two forms, cost analysis and formulas, are rather well documented in the budget literature as to their techniques and uses along with their advantages and disadvantages. Actual examples of their use are somewhat limited

but the literature of statewide budget systems serves as a primary source of the uses and applications of cost analysis and formulas. Secondary sources such as articles, pamphlets, and chapters in various books have drawn attention to these methods as they have gained recognition and use.[19]

Cost Analysis

Cost analysis has the longest documented history with the works of Reeves and Russell in the 1930's being among the first.[20] The actual procedures and methods of cost analysis are widely cited by other writers.[21] Cost analysis may refer to various systematic procedures of objective data and objective procedures to establish relationships between expenditures (costs) and users or programs. These relationships are expressed in quantitative terms such as dollar costs, ratios and percentage relationships.[22] This unit cost technique involves selecting an expenditure category to be analyzed, selecting an appropriate and measurable unit of service and relating the expenditure to the measure of service.

Indiana's statewide budget system uses the cost analysis approach for developing cost data. These data are then used for evaluation of programs and for the purpose of budget presentation to the state legislature. The actual computations are very detailed and elaborate, but the end result is a cost per student for each of five student levels for each institution in the state. The actual procedures

are outlined in work of Evans and Hicks published by Purdue University and to a great extent follow, with modifications, the California and Western Conference Cost and Statistical Study in which Indiana was a participant.[23]

Cost analysis provides two major results. First, it provides data which can be used for evaluation. Second, it provides data which can be used as a guide to future budget needs. In other words, cost studies are of value in the internal administration of an institution. The determination of costs may be considered as an important first step in the evaluation process. Variations in cost over time and among administrative units should signal further analysis of class size, faculty teaching load, curriculum offerings and the general efficiency of the use of the facilities of the educational plant.[24] To the extent that the cost data seem adequate or acceptable they can be used in a "formula" for estimating future budget needs, as in Indiana. Properly used in conjunction with budget preparation and review, there appears to be agreement that unit costs can be "useful in raising questions about departmental practices, user-expenditure relationships, in calling attention to undernourished departments, and in combating extravagance in others."[25]

Budget Formulas

Budget formulas refer to an objective procedure for estimating future budgeting requirements of a university through the use of objective data about future programs, and the relationships between costs and programs, in such a way as to derive an estimate of future expenditures and needs.[26] The use of budget formulas is primarily found in the statewide budget systems of Florida, Tennessee, Kentucky, California, and Oklahoma. Chambers, Rourke, Glenny, and more recently Miller have written extensively on these systems. Also officials within the statewide systems have published reports about the techniques and procedures utilized by the various states.

The actual procedures employed by the state systems vary in degree of detail and emphasis, but they all share certain common elements. These common elements are the following: (1) Each state system has as its primary objective an attempt at objectivity in budget analysis with an emphasis on equity and maintenance of adequate support. (2) Each state developed its system with the belief that the results should serve as a guide to future budget needs as well as a guide to budget evaluation. (3) Each system utilizes objective data concerning faculty and expenditures in some relationship pattern which they believe best expresses faculty workload and institutional need for funds.

Staffing Procedures

While the focus of attention in this study is on supplies and services, the methods employed and the factors considered in determining faculty for each state give a brief but important insight into the results of the use of formulas. The determination of how many faculty and what support funds a university will need for next year or at some future date is crucial to a university's continued success. The allocation of people and support funds to specific departments determines the direction a university will take. It would be simple to increase the resources for every department by a fixed percentage as is often the case in "line item" budgeting, but the fixed percentage increase ignores need. In order to judge how well the allocation responds to need there must be some basic data on, for example, current and future workload. Establishing need and differentiating for the degree of need is a basic objective of any quantitative procedure. Differentiation of need involves a multitude of considerations but the following are a few which should be considered: (1) present student load; (2) type of student load; (3) type and number of courses taught; (4) the amount of advising done, and (5) the amount of research performed. The following is a brief outline of methods of estimating the number of faculty required for future budgets.

Kentucky and Tennessee use institution-wide student-faculty ratios with no differentiation of need for instructional levels or subject matter fields. Both states allow a lower student-faculty ratio for smaller institutions.[27] Oklahoma uses a base faculty complement method with additional faculty provided on an institution-wide student-faculty ratio basis. They differentiate for faculty needs by instructional levels, by type of institutions (junior college, four-year college, and major university), but they do not generally differentiate by subject matter area. Small institutions are guaranteed a base number of faculty regardless of enrollment but as enrollment increases, faculty are added at a slower rate (higher ratio) until the institution approaches the student-faculty ratios of the larger institutions.[28]

Texas calculates need for faculty by using separate student-faculty ratio for sixteen fields and three instructional levels with a ratio ranging from 19:1 for undergraduate institutions in teacher education to 4:1 at the doctoral level for all fields.[29] Texas differentiates for undergraduate, masters, and doctoral instruction and differentiations are employed in sixteen subject fields. No special consideration is given to smaller institutions.

Florida utilizes past faculty productivity of student-credit-hours as its basic workload guide. There is no differentiation of the workload pattern for subject

matter fields but there is differentiation for instructional levels. Florida then utilizes this basic student-credit-hour workload factor to develop the number of instructional staff needed. All other faculty functions such as research, administration, and public service are then calculated in relationship to the original number of faculty needed for instruction by using certain standard ratios. For example, in 1961-1962 the University of Florida had the following faculty productivity in student-credit-hours: 375 student credit hours for lower division, 235 student credit hours for upper division, and 120 student credit hours for graduates. One research position was added for each 3.7 teacher portions with comparable ratios being used for extension, counseling, and administration.[30]

The state college system in California uses the most extensive and detailed system for estimating their need for faculty by using a course-by-course consideration of subject-matter, teaching method involved, and the level of instruction. There is a differentiation of instructional level and subject matter fields with over thirty subject matter fields being considered. It would appear that the detailed California system is based on current or estimated workload factors rather than on past indices.[31]

The above descriptions are extremely brief and hardly do justice to the considerable effort made by the

states to develop their data, but the overall concept of trying to develop methods which can aid in estimating need for faculty is, hopefully, conveyed. Estimating need for faculty is vital to an institution and as such received the greatest effort, but it is not the sole item considered in the developing of budgets by these formula methods. Library, administration, physical plant operations, and other instructional costs and activities are considered within the framework of formulas and cost analysis used by each state.

Determination of Supplies and Services Needs

Supplies and services budgets are determined by the various state systems in the following manner: California provides no systematic method with the result that each institution requests these funds on a non-formula basis.[32] Oklahoma, Tennessee, and Texas calculate their needs for supplies and services as a percentage of instructional salaries. The general basis for determining the percentage to be used is actual expenditures during prior years. In Oklahoma the percentages are different at different institutions, ranging from 20 per cent to 33 per cent depending on institution's needs.[33] Texas uses a base formula to compute departmental operating expendses. The base figure used is the total estimated semester credit hours, and the amount allowed per credit hour for supplies and services is

different for each academic program and for three instructional levels. Dollar amounts per credit hour range from $0.75 for undergraduate liberal arts to $50.00 for doctoral level engineering.[34]

In Florida, supplies and services expenditures are calculated separately for each institution on the basis of a cost per student-credit-hour but with no differential programs or instructional level. In the year 1959-1960 the instructional allocation per credit hour for supplies and services was $1.21 for the University of Florida and each of its academic departments.[35]

It would appear that supplies and services are allocated with fewer computations and less concern for differentiation of need than faculty. The extent of internal allocations by the individual college or university is not known, but it is presumed that differentials are applied. Nevertheless the attempt to differentiate need for resources by various means in the state systems indicates an awareness by the states that program and instructional differentials among and within institutions require consideration.

Miller raises an interesting and disturbing point about the methods utilized to determine supplies and services needs. He points out

> . . . that there is no evidence that any of these units of measurement used to determine supplies and services needs is a reliable basis for determining the amount needed for this purpose. The units of measurement employed in the formulas for supplies and services do not relate directly to those items of expenditure or to the workload factor which directly affect them.[36]

This issue is one that creates problems of evaluation, equity, allocation, and projection. It does little good to base budget evaluation and projection on variables which do not adequately or realistically measure need for expenditures. Nor is it worthwhile to establish a formula for projection unless the relationship of current allocations to need is known and evaluated.

Advantages of Cost Analysis and Formulas

Advantages of cost analysis, formulas, and objective data as aids to budgeting focus on their contribution to facilitating comparisons among requests, equity, adequacy of support, efficiency, and as an aid in focusing attention on policy issues. It would appear that formulas and cost analysis are used for three distinct budgeting purposes: (1) to facilitate the analysis of budgeting needs, (2) to help in the presentation of budgeting information, and (3) to focus attention on the major issues and problems of budgeting.

Accurate comparisons among activities and administrative units are greatly facilitated by objective budget

analysis. Through these procedures a large amount of apparently non-comparable information about a number of administrative units can be organized in a comparable manner and presented in terms of uniform units of measurement which make comparisons and evaluation possible. Since colleges and universities do not have the advantage of a market system as does industry, a university must substitute analytical studies of its activities and therefore quantitative data resulting from cost analysis and budget formulas aid in accomplishing this analysis.[37] Through cost analysis and formulas institutions can know with some degree of precision how much time and effort they give to various institutional objectives. Furthermore such data provide some assurance that future needs will be considered. Such data must also serve as an important first step in further analysis of the reasons for these relationships.

Equity is cited as one of the most notable successes scored by cost analysis and formulas.[38] It has provided a method for comparing administrative units, identifying and correcting inequities and thereby treating all administrative units in a comparable manner in projecting future financial requirements.

Highlighting basic policy questions would appear to be a significant asset of objective analysis because the very existence of such data makes it easier for interested personnel to concentrate on the key policy questions. The

existence of the data offers some minimum assurance that needs are analyzed in a systematic manner rather than being handled in a totally subjective or non-discriminating way. With the assurance that overall needs of the various administrative units have been considered, attention can turn to specific aspects of the analysis which have been dealt with inadequately by the objective analysis or which need to be questioned.

Statewide budget systems with their much larger administrative units find the use of formulas and cost analysis an aid to analysis of budget requests. The size and complexity of higher education seems to require a systematic organization of procedures in order to facilitate management of the budget process. There are numerous other advantages and objectives of cost analysis and formulas, but the major asset of such approaches may not be in their actual use or employment but in their fostering an atmosphere of concern about equity, objectivity, and efficiency in higher education.

Disadvantages of Cost Analysis and Formulas

While support for objective analysis is generally enthusiastic there are certain definite criticisms of their usefulness in helping administer a university. A major shortcoming of formulas and cost analysis techniques is the tendency toward standardization which can lead to mediocrity. Logan Wilson warns that indiscriminate standardization of

workloads, class size, and appropriations per student can be very dangerous to higher education because such practices may not allow for institutional differences in role, scope and programs; that is, the results tend to have a leveling influence.[39]

While formulas and cost analysis procedures can be extremely useful in analyzing university needs, they cannot make the final decisions which are so necessary in budgeting. A decision to emphasize a certain aspect of a university's instructional program must often be made on the basis of information which cannot be reducible to a formula. Formulas, cost data, and all forms of objective data can facilitate analysis, guide and highlight issues but final decisions are still required. Often choices must be made about allocations to comparable departments having the same quantitative needs but due to resource limitations they cannot be supported equally.

The greatest single limitation of formulas and cost analysis procedures is that they cannot make policy or determine the effects of non-quantitative issues on the decision process. These procedures can facilitate the analysis which should precede policy-making and then they can be used to facilitate the translation of a policy decision in specific quantitative terms but there is still a significant and important element of subjective evaluation which remains. It is worth noting that of the many

writers who generally advocate the use of quantitative measures in budget analysis there are none who dismiss or fail to recognize the serious shortcomings of quantitative methods.

Areas of Agreement

It is generally conceded that the use of quantitative measures such as cost analysis and budget formulas grew out of the enrollment pressures of the last decade with their primary use being in statewide budget systems. There is evidence that such procedures are being employed within universities but not to the extent reported by state systems.[40]

Whether these methods are formally employed for budget evaluation and preparation is not as important as the atmosphere of concern for greater objectivity and equity in managing colleges and universities which these methods have helped create. There would appear to be general agreement that the utilization of quantitative measures in higher education is an aid to analysis of need and helps support evaluation of past performance. It is generally agreed that cost analysis is primarily a measure of past effort, whereas formulas attempt to measure future needs with both measures being utilized in varying degrees by statewide budget systems and various universities. Regardless of the specific method or its proposed use a major objective in using these measures

is directed toward establishing the basis for budget need and relating that basis to expenditure as a means of budget evaluation and projection.

Comparison of Dissertation to Cost and Formula Methods

This dissertation has the major objective of establishing the existing expenditure-user relationship of supplies and services for thirty-two academic departments within Michigan State University utilizing objective data on those departments with correlation and regression as the primary tool of analysis. This study has certain features in common with cost analysis and formulas but also departs from those procedures in a few ways.

First, this dissertation has in common with cost analysis and formulas the use of quantitative data as a basic ingredient of analysis. Second, there is an attempt to relate expenditures to factors which utilize those expenditures. Third, there is a common concern that the expenditure-user relationship will serve as a guide to evaluation as well as a potential guide to budget projection. Finally, there is a common goal of providing information which will aid in administering the budget more effectively.

This study differs from cost analysis and formulas in certain specific ways rather than in general objectives. First, the study is devoted to one aspect of university

budgeting which is only briefly mentioned in the literature. Therefore, this study does not build in any major way on any previous documented study about supplies and services. Second, primarily this study is designed to inform and aid in evaluation rather than to project future needs. Third, the study approaches the problem of user-expenditure relationships by utilizing regression and correlation as a means of determining the many actual current relationships that may exist between expenditures and department variables. In other words, because there are so many department variables which might be related to expenditures, the use of correlation and regression permits a more complete analysis of the relationship to the place. By using this analysis one does not have to assume any relationship exists between user and expenditure. However, if expenditures and use factors are in fact related, the extent and appropriateness of the relationship can be evaluated. Whether budget projection is derived from the analysis is subject to the extent of relationship and relative validity of that relationship.

CHAPTER II

FOOTNOTES

[1]Malcolm Moos and Francis E. Rourke, The Campus and the State (Baltimore: The Johns Hopkins Press, 1959), pp. 82-88; Francis E. Rourke and Glenn E. Brooks, The Managerial Revolution in Higher Education (Baltimore: The Johns Hopkins Press, 1966), p. 72; James L. Miller, Jr., State Budgeting for Higher Education: The Use of Formulas and Cost Analysis (An Arbor: The University of Michigan, 1964), p. 150.

[2]John M. Evans and John W. Hicks, "Studies in Higher Education," An Approach to Higher Educational Cost Analysis, No. 41 (Lafayette: Purdue University, 1961), p. 25.

[3] Selma J. Mushkin (ed.), Economics of Higher Education, Bulletin 1962 (Washington: U. S. Department of Health, Education, and Welfare, 1962), pp. 3 and 20; Dexter M. Keezer (ed.) Financing Higher Education 1960-1970 (New York: McGraw Hill Book Company, Inc., 1959) p. 15.

[4]Paul L. Dressel, The Undergraduate Curriculum in Higher Education (Washington: The Center for Applied Research in Education, Inc., 1963), pp. vii and 110. Paul L. Dressel, "Large Credit Blocks--Pro and Con," Liberal Ecucation, LI, No. 3 (October, 1965); Beardsley Ruml and Donald H. Morrison, Memo to a College Trustee (New York: McGraw Hill Book Company, Inc., 1959), pp. v and 94.

[5]Seymour E. Harris, Higher Education: Resources and Finance (New York: McGraw Hill Book Company, Inc., 1962), pp v and 713; Keezer, loc. cit.; Mushkin, loc. cit.

[6]Harold W. Dobbs, The Academic President: Educator or Caretaker? (New York: McGraw Hill Book Company, Inc., 1962), pp. v and 294; John D. Millett, The Academic Community (New York: McGraw Hill Book Company, Inc., 1962), pp. vii and 265; Algo D. Henderson, Policies and Practices in Higher Education (New York: Harper and Brothers, 1962), pp. v and 338.

[7]American Council on Education, College and University Business Administration, I (Washington: American Council on Education, 1952), p. 23.

[8]G. M. Morris, Modernizing Government Budget Administration (Chicago: Public Administrative Service, 1962), p. 11.

[9]Jesse M. Burkhead, Government Budgeting (New York: John Wiley and Sons, Inc., 1956), p. 56.

[10]Ibid.

[11]John Dale Russell, An Overview of Budgeting Analysis (Tallahassee, Florida: Institute on Institutional Research, Florida State University, July 12, 1960), p. 1.

[12]Ibid., p. 5.

[13]Herbert A. Simonds, "The Job of a College President," Educational Record, XLVIII, No. 1 (Winter, 1967), p. 70.

[14]John F. Briggs, A Refined Program Budget for State Governments, Bulletin No. 6 (Washington: The American University, 1962), p. 8.

[15]Miller, op. cit., p. 4.

[16]Ibid., p. 5.

[17]Francis E. Rourke and Glenn E. Brooks, op. cit., pp. 1 and 12.

[18]Western Interstate Commission for Higher Education, Yardsticks and Formulas in University Budgeting (Boulder: Western Interstate Commission for Higher Education, 1959), p. 15.

[19]Seymour E. Harris, op. cit., Chapters 42 and 43; Clarence Scheps, Accounting for Colleges and Universities (Baton Rouge: Louisiana State University Press, 1949), Chapter 13; Robert L. Williams, The Administration of Academic Affairs in Higher Education (Ann Arbor: The University of Michigan Press, 1965), Chapters 8 and 9.

[20]Floyd W. Reeves, Nelson B. Henry, and John Dale Russell, Size and University Costs, Vol. XI of The University of Chicago Survey (Chicago: The University of Chicago Press, 1932), pp. xxi and 229.

[21]John Dale Russell and James I. Doi, "Analysis of Institutional Expenditures" (a series of twelve articles), College and University Business, XIX (September, 1955), pp. 19-21; (October, 1955), pp. 27-29; (November, 1955), pp. 44-47; (December, 1955), pp. 39-41; XX (January, 1956), pp. 41-45; (February, 1956), pp. 47-51; (March, 1956), pp. 41-43; (April, 1956), pp. 35-37; (May, 1956), pp. 47-48; (June, 1956), pp. 48-51; XXI (July, 1956), pp. 43-46; (August, 1956), pp. 42-47; John M. Evans and John W. Hicks, loc. cit.; American Council on Education, Computation of Unit Costs (Washington: American Council on Education 1955, reprinted from Financial Reports for Colleges and Universities published by the University of Chicago Press, 1935), pp. 177 and 249; California and Western Conference Cost and Statistical Study (Berkeley: University of California, n. d.), pp. xvi and 129.

[22]Miller, op. cit., pp. 5-6.

[23]Evans and Hicks, loc. cit.; L. E. Hull, "Pitfalls in the Use of Unit-Cost Studies," Journal of Higher Education, XXXII (October, 1961), pp. 371-376.

[24]American Council on Education, Computation of Unit Costs, op. cit., p. 177.

[25]Dobbs, op. cit., pp. 174-175.

[26]Miller, op. cit., pp. 6-7.

[27]Ibid., p. 118.

[28]Oklahoma State Regents for Higher Education, Financing Current Operating Costs of Higher Education in Oklahoma, Self-Study of Higher Education in Oklahoma, Report 4 (Oklahoma City: Oklahoma State Regents for Higher Education, January, 1963), pp. 56-61.

[29]Texas Commission on Higher Education, Basis of Commission Recommendation on Institutional Requests for Legislative Appropriations 1963-65 Biennium (Austin: Texas Commissions on Higher Education, n. d.), pp. 1 and 11.

[30]Budget Director's Office, University System of the State of Florida: Educational and General Budgets (Tallahassee: Budget Director's Office, Biennium 1961-1963), p. 8.

[31]California Department of Education, Memorandum to Deans of Instruction, From Jon S. Peters, Subject: Genesis--The Faculty Staffing Formula. California State Department of Education, June, 1961, p. 30. (Mimeo)

[32]Miller, op. cit., p. 121.

[33]Oklahoma State Regents for Higher Education, op. cit., p. 57.

[34]Texas Commission on Higher Education 1963-65 Biennium, op. cit., p. 3.

[35]University System of the State of Florida, op. cit., p. 35.

[36]Miller, op. cit., p. 122.

[37]Harry Williams, Planning for Effective Resource Allocation in Universities (Washington: American Council on Education, 1966), p. 12.

[38]Miller, op. cit., p. 152.

[39]Logan Wilson, "Analyzing and Evaluating Costs in Higher Education," The Educational Record, XXXXII, No. 2 (April, 1961), p. 102.

[40]Rourke and Brooks, op. cit., p. 80.

CHAPTER III

OBJECTIVES OF THE RESEARCH

Summary of the Rationale for the Study

Effective resource projection and allocation requires an analysis of the current expenditure-user relationship in Supplies and Services. It is important to know the identification of those department variables which actively use or are related to Supplies and Services expenditures because this information is basic to developing a means of funding departmental needs. These data will provide administrative personnel with information that can aid in deciding future needs in some objective procedure as well as providing information which can help appraise the current budget situation.

Basic Objectives

The basic objectives of this dissertation are to answer four questions concerning Supplies and Services expenditures in academic departments at Michigan State University. First, are there significant correlations (simple and multiple) between expenditures (dependent variables) for Supplies and Services and use factors (independent variables) in departments? Second, what are the major independent variables (use factors) which are

significantly correlated with the expenditures? Third, how well does a "general" independent variable combination which explains the user-expenditure relationship for all department types and sub-categories of Supplies and Services compare with more specific independent variable combinations which explain user-expenditure relationships for specific department sub-groups and specific Supplies and Services sub-categories? Such a comparison is concerned with degree of correlation, independent variables involved, and general predictive ability. Fourth, what impressions or implications can be drawn from the analysis in terms of: (1) the expenditure-user relationship; (2) the effect of department sub-groups and Supplies and Services sub-categories on total expenditure-user relationships; (3) the relative validity of the independent variables which are found to be significantly correlated with expenditures; and finally, (4) the predictive ability of the regression equations.

Parameters of the Data

Although in the analysis and procedures section a description of the data will be given, it is necessary to briefly identify the parameters of the data so that the objectives are more clearly understood. First, there is the sample of thirty-two academic departments with two years' data. The two years' data are being treated as a single set of data and therefore the thirty-two departments

are actually equivalent to sixty-four. This department sample can be treated in total or it can be subdivided into four equal groups which have similar needs. Second, there is total Supplies and Services expenditures for each department which is the dependent variable in the analysis. This dependent variable for each department can be treated in total or it can be subcategorized into several categories. Third, there are the seventy-two use factor department variables, such as students and faculty, which are the independent variables in this analysis. These are employed in various combinations for analysis of all dependent variables.

The independent, predictive variables (use factors) will be used in all the analysis and as such are not a major concern in terms of being subgrouped or subcategorized. However, as pointed out, the dependent variable, expenditures, can be subcategorized into several categories and the total department sample can be subgrouped into four groups. Therefore, the data consist of the following: (1) independent variables known as use factors; (2) the dependent variable Supplies and Services with certain major subcategories; and (3) a total department sample, with both the dependent and independent variables, which can be subgrouped into four similar groups.

Specific Objectives

The first objective of the analysis is to determine the extent of simple correlations between the dependent variable, expenditures, and the independent variables, use factors, for the total department sample and for total Supplies and Services. This objective should provide a general picture of the user-expenditure relationships. Further and more detailed analysis will come through multiple correlation.

The second objective of the study is to investigate, through multiple correlation and regression analysis, the use factor-expenditure relationship for the following: (1) the most "general" independent variable combination which explains expenditures for total Supplies and Services for the complete department sample; (2) specific independent variable combinations derived from the results of the major subcategories of Supplies and Services utilizing the complete department sample; and (3) specific variable combinations derived from total Supplies and Services with the department sample being subdivided into four groups.

The results of this analysis will afford broad comparisons of the "general" independent variable combination which explains the user-expenditure relationship for total Supplies and Services and the total department sample with the more specific independent variable

combinations which explains the user-expenditures relationship for the subcategories of Supplies and Services and the subgroups of the department sample. It will help determine whether a single, "general" independent variable equation is sufficient to explain the use factor-expenditure relationship for different department types and different subcategories or whether more specific equations are required.

The third objective of this study, which is an outgrowth and somewhat of a duplication of the multiple correlation, is to determine the "general regression equation for total Supplies and Services utilizing the total department sample. Then, as in the multiple correlation analysis, the objective is to determine the more specific equations for the four subgroups of the department sample and the subcategories of Supplies and Services. The analysis will be concerned with comparing the results of the "general" equation which explains the user-expenditure relationship for all departments and all subcategories with the more specific equations which explain the user-expenditure relationship for subgroups and subcategories.

This latter objective is concerned with the predictive qualities of the "general" equation and the specific equations in two ways. First, there is a statistical analysis of predictive qualities which is concerned with the overall predictive ability of each equation. Second,

there is an analysis which is concerned with results as reflected in actual versus predicted values for each department.

The first analysis is concerned with general predictive qualities of a multiple correlation and regression equation which include the following: (1) the difference in independent (use factors) variables which show up in the analysis; (2) the degree of correlation; (3) the total amount of variance (coefficient of determination) explained by the combined independent variables; (4) the variance explained by each separate independent variable in the total combined equation; (5) the standard error of estimate.

The second analysis is concerned with the specific departments in the sample rather than overall statistical measures which are concerned with the general state of predictive analysis but which do not say anything about individual results. Therefore, results of the regression equation will show predicted and actual values with residuals for each department. In addition, the predictive ability of the equation will be analyzed for each department and department group as a percentage difference between actual and predicted values.

A fourth and final objective is concerned with evaluating the results from the above four objectives. The evaluation will be concerned with the following items:

1. A general discussion of the simple correlation results with particular attention focused on the variables which show high correlation.

2. Discussion of the multiple correlation analysis with emphasis on the independent variables involved; the variance in expenditures explained by the combined independent variables; the variance of individual, independent variables which make up the multiple correlation; the differences in results for the "general" versus specific variable combinations, and finally, possible reasons for the results.

3. Discussion of the regression results as to the independent variables involved, their variance, the results of the predictive qualities of the "general" versus "specific" equations, and possible explanation for the results of the "general" and "specific" equations.

4. Discussion of problem areas which showed up in the analysis. Possible problem areas might be low correlations; high correlations but the validity of independent variables seems questionable; indications of inequities, and possible reasons for the differences between the "general" variable combinations and the more "specific" variable combinations.

5. Discussion of the possible uses of the results in terms of evaluating the present situation in Supplies and Services and the possibility of utilizing the regression results for future budgeting.

Summary

The objectives of this research are concerned with the following: (1) the extent of correlation between independent (use factors) variables and dependent (expenditures) variables; (2) the identification of the independent variables which are significantly correlated with expenditures; and finally, (3) a multiple correlation and regression comparison of the "general" results for the total sample, total expenditures with specific results for sample subgroups and expenditure subcategories.

CHAPTER IV

DESCRIPTION OF SAMPLE, VARIABLES, AND PROCEDURES OF ANALYSIS

In cost analysis and formulas there is usually a single measure which is commonly used to estimate budget needs, with a heavy emphasis on projection. As noted in the review of literature, any number of factors is employed to estimate the need for supplies and services funds in state systems but few show any relationship to supplies and services. Therefore one of the major reasons for using regression and correlation for analysis purposes is its ability to aid in revealing the many relationships which may exist between budget uses and expenditures. Regression and correlation, unlike cost analysis or formulas, is not limited to or dependent upon a single variable as an estimate of need or as a guide to evaluation. By using regression and correlation it is possible to determine numerous simple and multiple relationships, the strength of those relationships, the differences in relationships, and the effect of maintaining those relationships in the future.

In analyzing the relationship between varying quantities as in regression and correlation analysis, dependent and independent variables are usually established. When a

change in the value of one variable corresponds to a change in the value of the other variable, a functional relationship is said to exist. In this study, the expenditures for supplies and services of thirty-two academic departments for a two-year period will serve as the dependent variables, and those departmental use factors which characterize departmental workload will serve as the independent variables.[1] Explanations of the statistical techniques employed in analyzing the functional relationships between the dependent and independent variables will follow a discussion of the sources from which the basic data were derived.

Dependent Variables

The dependent variables are the Supplies and Serivces expenditures for thirty-two academic departments for the fiscal years 1965-1965 and 1965-1966. The dependent variables[2] include total Supplies and Services expenditures with five major subcategories of that total being employed for analysis. For each department in the sample the dependent variables are the following: (1) total Supplies and Services expenditures (Variable No.4); (2) total Supplies and Materials (Variable No. 17); (3) total Supplies and Services expenditures less Supplies and Materials expenditures (Variable No. 20), this derived category includes all Supplies and Services expenditures except Supplies and Materials; (4) total travel expenditures (Variable No. 10);

(5) total faculty-related expenditures (Variable No. 6), including travel expenditures, printing expenditures, off-campus contractual expenditures (072), book and magazine subscriptions, and telephone, telegraph, and postage expenditure.

These expenditure data for each department are obtained from the annual "Object Class Report" of the University Business Office. This report serves as a primary source of data for the Michigan State University Annual Financial Report.

Independent Variables

The independent variables consist of 73 kinds of data which are collected on a quarterly basis by the Office of Institutional Research from various University sources. Thirty-six are collected in the fall quarter of each year, 22 items collected for the full year which match comparable fall data, and another 15 items of faculty data which can be counted in either category. These independent variables can be broadly classified as general department data, faculty and staff data, and student data and can be said to provide a reasonable guide to a department's workload and expenditure needs.

The general department data consist of such items as the number of courses taught, class hours of instruction, the number of sections taught, and the equipment inventory of a department by type of equipment. Faculty and staff

data consist of faculty head count, full time equivalent faculty, faculty time distribution, A and B faculty counts, and faculty head counts by rank. Student data consist of student credit hours, majors, and student credit hours by type of section. The above listings are not complete or detailed but provide examples of the type of data utilized.[3]

Department Sample

Thirty-two academic departments assumed to be representative of all University departments were chosen as a sample which included departments with a variety of programs and functions, along with variations in size. These departments were chosen on the basis of department type and on the basis of size variations in the independent variables. The departments vary in overall department size from the small (entomology) to the large (chemistry and history) with all intermediate sizes.

A major concern in choosing a sample of departments was to include enough to provide a wide range of size coupled with variation in functions that might have an influence on supplies and services expenditures. While in certain analyses the thirty-two departments chosen are treated as a single group, they are also broken down into four groups of eight departments each for other analysis. These four groups are based on a National Science

Foundation scheme for departmental groupings. The four groupings[4] are:

1. Group 1 are laboratory science departments with evidence of direct student consumption of supplies and are classified as basic science disciplines by NSF.

2. Group 2 are laboratory science departments with evidence of direct consumption of supplies and are classified as applied science disciplines by NSF.

3. Group 3 are non-laboratory departments having no laboratory sections, no evidence of direct student consumption of supplies and are classified as belonging to the social sciences and the humanities by NSF.

4. Group 4 are laboratory-oriented departments having laboratory sections with evidence of direct student consumption of supplies and are classified as social sciences and humanities by NSF.

Assumptions of the Study

The assumptions of this study are the following:

1. While departments may have individual and special preferences for Supplies and Services resources the broad and more general subcategories chosen in this analysis, as well as the total expenditures for Supplies and Services, should respond to various common workload factors in every department. Volume variations should be a primary and first approximation of need for each department.

2. Supplies and Services, and especially Supplies and Materials, should reflect the laboratory needs of department groups 1, 2, and 4.

3. The large number and variety of independent variables should account for and explain variations in department needs for Supplies and Services.

4. That there is a linear relationship between independent and dependent variables.

5. Normal distribution of variables--assumption not necessary because skewness and kurtoses values (Bastat 5) of all variables indicate a generally normal distribution of values with few observable exceptions.

6. That the thirty-two department sample is reasonably representative of all academic departments. A check on this was provided by comparing the mean values and standard deviations of selected sample variables to the mean value and standard deviation of the University total. The results confirm the assumption that the thirty-two departments are representative of the total University.

Limitation of the Study

The limitations of the study are the following:

1. The department sample is limited to academic departments and to university general fund money and does not include non-general funds resources from research grants or the Agricultural Experiment Station.

2. Dependent variable expenditure data are limited to the two-year period 1964-1965 and 1965-1966 when expenditure data were first available in its present form.

3. The departmental groupings (4 major groups) may have some overlap; however, these department groups represent a fair approximation of departments having similar characteristics and needs.

4. Quantitative relationships (volume) between dependent and independent variables may not be sufficient to totally or adequately explain department needs but the independent variables in the study should be a first approximation of need.

5. The use of regression and correlation analysis may not uncover all the factors useful in estimating the need for Supplies and Services but the analysis is a beginning of such an evaluation.

Statistics Employed

In analyzing the functional relationship between the dependent and independent variables, a multiple correlation and regression analysis was employed. Correlation permits us to establish the extent two things are related, to what extent variations in the one go with variations in the other. Regression's main use is to predict the most likely measurement in one variable from the known measurement in another, for example, predicting the amount of expenditures in Supplies and Services for a department where the size of

its faculty is known. The higher the correlation between independent and dependent variables the greater is the accuracy of prediction from regression and the smaller the errors of prediction.

Multiple correlation and regression extends the analysis beyond the establishment of relationships between two items at a time and the prediciton of some variable y from another variable x. The coefficient of multiple correlation indicates the strength of relationship between one variable and two or more variables taken together.

To facilitate analysis three Michigan State University STAT series computer programs were utilized. STAT Series No. 5 (Bastat) was utilized to develop basic statistics on the data, including simple correlation, means, standard deviation, skewness, kurtoses and test statistics on the correlations. STAT Series No. 9 (LSADD) program, which is explained later in more detail, was utilized to reduce the large number of independent variables to a number usable in the STAT Series No. 7 program (LS). STAT Series 7 (LS) was utilized as the primary analysis program for multiple regression and as a further check on the multiple correlation results of STAT Series 9.[5]

The basic statistical measures of the study will be outlined here in order to facilitate reporting the results in these statistical terms. Analysis results will be reported primarily in overall statistical measures but

measures that pertain specifically to individual variables and department will also be reported. Overall statistical results include the following:[6]

1. r is the simple correlation coefficient. This measures the extent to which variations in one item are associated with variations in the other.[7]

2. R is the multiple correlation coefficient. This indicates the extent of relationship between a dependent variable and two or more independent variables. +1.00 is a perfect positive relationship, -1.00 is a perfect negative relationship. The following verbal description of coefficients by Guilford gives a general guide for interpreting R.[8]

Less than .20	Slight, almost negligible relationship
.20 - .40	Low correlation; definite but small relationship
.40 - .70	Moderate correlation; substantial relationship
.70 - .90	High correlation; marked relationship
.90 - 1.00	Very high correlation; very dependable relationship

3. R^2 is the coefficient of multiple determination or variance (the square of the multiple correlation coefficient). This measure indicates the proportion of variance in the dependent variable that is accounted for by the independent variables combined with the regression weights used. R^2 of .8878 indicates that 88.78 per cent of the variance in variable y is explained by the variation in z and x. K^2 $(1-R^2)$ is sometimes used to indicate

the percentage of variance still to be accounted for. This is known as the coefficient of multiple non-determination.[9]

4. $\bar{R}^2$ (R Bar 2) is the coefficient of determination adjusted by degrees of freedom. It takes into acocunt the number of independent variables relative to the number of observations. Though not commonly reported, it is mentioned in case the size of R Bar 2 differs considerably from R^2.[10]

5. S is the standard error of estimate--a standard deviation measure for correlation and regression which provides an overall measure of how far the predicted values of a regression equation would deviate from the actual values.[11]

6. F value for significance testing. This tests the hypothesis, at a prescribed significance level (.05) that the relationship between dependent and independent variables is different from zero and not the result of a chance happening.[12]

Statistical results pertaining to individual variables:

1. Regression coefficient[13] is an obtained value for each independent variable in a linear least squares equation which tells how many units y increases for every increase of one unit in x. Regression coefficients indicate the rate of change in one variable per unit of change in the other.

2. Beta weights[14] provide a standard comparison of individual variables by expressing each variable in terms of its own standard deviation. Beta weights provide a means of establishing the relative contribution each independent variable makes to the total variation explained by all independent variables. R^2 (coefficient of determination) is the sum of the product of beta times its corresponding simple r.

3. Residuals are the difference between the predicted and actual expenditure values for each department.[15]

Design

To study the relationship between the dependent variables and the independent variables multiple correlation and regression analysis was utilized. The pattern of analysis included correlation and regression results between the independent variables and total expenditures for the complete sample of thirty-two departments. A further independent-dependent variable analysis of four a priori selected subgroups of the entire sample was made.

Additional analysis included utilizing the entire sample with a breakdown of the total dependent variable into 5 subcategories. Pearson-product-moment correlations for simple correlations were calculated with the least squares method being utilized to calculate multiple correlation and regression. Significance tests at .05 level of confidence were employed in all the analysis.

Analysis Procedures

The large number of independent, predictive variables in the study necessitated utilizing the Bastat 9 (LSADD) and Bastat 7 (LS) computer routines. The LSADD and LS routines are basically the same in developing overall multiple correlation and regression statistical results with significance testing, but they differ in two ways: First, the LSADD routine develops only overall correlation and regression results and does not develop results for individual variables such as regression coefficients, beta weights, partial correlation and importantly, residuals for each department. The LS routine goes beyond the LSADD routine in performing the above-mentioned calculations. Second, the LSADD routine performs a vital task of selecting (denoting) from a larger set of independent variables those variables in combination which have the highest multiple correlation with the dependent variable.

Sixteen independent variable combinations were chosen for the LSADD routine. Some were chosen on an a priori basis of probable relationship to the dependent variables and two sets of variables, one for all fall data, the other for the full year, included all independent variables in the study. These sixteen sets of variables provided complete coverage of all independent variables in the study that might be significantly correlated with the dependent variables. These sixteen combinations were

processed with the LSADD computer routine for each dependent variable and sample combination. The LSADD routine approximates the Wherry-Doolittle Method[16] which begins with the selection of the most valid predictor, other predictors are added, one at a time, until the multiple correlation, corrected for shrinkage, exhibits no further appreciable increment.

The LSADD routine has several features that merit its use in multiple correlation and regression: (1) whenever the number of independent variables is too large for use on the LS routine; (2) the program handles the normally difficult problem of variable selection for multiple correlation and regression in a manner approximating the Wherry-Doolittle method; (3) the program overcomes any personal bias in selecting from a large number of independent variables which could not be utilized on the LS routine.

The significant variable combinations derived from the LSADD routine were then utilized in the Bastat 7 (LS) routine for computation of the following statistics: (1) multiple correlation coefficients of R^2, R Bar 2, R Bar and the standard error of estimate along the F test statistic variables; (2) regression coefficients for each independent variables with beta weights, standard errors of coefficients and betas, t and f statistics, and partial correlation coefficients; (3) predicted and actual expenditure values for each department along with residuals.

CHAPTER IV

FOOTNOTES

[1]See Appendices E and A for a complete list of the department sample, the dependent and the independent variables.

[2]See Appendix A for a complete listing of dependent variables.

[3]See Appendix A for a complete listing of independent variables.

[4] See Appendix E for a complete list of departments by group.

[5]Michigan State University Agricultural Experiment Station, Stat Series Descriptions No. 5 (Bastat), No. 7 (LS), and No. 9 (LSADD), (East Lansing, Michigan: Michigan State University, 1967).

[6]J. P. Guilford, Fundamental Statistics in Psychology and Education (3d ed.; New York: McGraw Hill Book Company, Inc., 1956), Chapters VIII, X, XV, and XVI; Philip H. Dubois, An Introduction to Psychological Statistics (New York: Harper and Row, 1965), Chapters VI, VII, and VIII; Helen M. Walker and Joseph Lev, Statistical Inference (New York: Henry Holt and Company, 1953), Chapters X and XIII; Mordecai Ezekiel, Methods of Correlation Analysis (New York: John Wiley and Sons, Inc., 1941), pp. 50-54, 128-130, 136-139, 146-152, Chapter IX, pp. 208-218, and 312-325; John E. Freund and Frank J. Williams, Modern Business Statistics (Englewood Cliffs, J. J.: Prentice-Hall, Inc., 1958), Chapters XIII and XIV.

[7]Guilford, op. cit., p. 135.

[8]Ibid., p. 145.

[9]Ezekiel, op. cit., p. 159 and Guilford, op. cit., p. 397.

[10]Guilford, op. cit., pp. 398-399.

[11]Ezekiel, op. cit., p. 159 and Guilford, op. cit., p. 360.

[12]Walker and Lev, op. cit., pp. 251-255; Freund and Williams, op. cit., pp. 226-227, and Guilford, op. cit., p. 207.

[13]Guilford, op. cit., p. 366.

[14]Ibid., p. 394.

[15]Walker and Lev, op. cit., p. 236.

[16]Harry E. Anderson, Jr., and Benjamin Fruchter, "Some Multiple Correlation and Predictor Selection Methods," Psychometrika, XXV, No. 1 (March, 1960), p. 63.

CHAPTER V

ANALYSIS OF RESULTS

Objectives of the Research

The basic objective of this dissertation is to answer four questions concerning Supplies and Services expenditures in academic departments at Michigan State University. First, are there significant correlations (simple and multiple) between expenditures (dependent variables) for Supplies and Services and use factors (independent variables) in departments? Second, what are the most prominent independent variables (use factors) which are significantly correlated with the expenditures? Third, how well does a "general" independent variable combination which best explains the user-expenditure relationship for all department types and subcategories of Supplies and Services compare with more specific independent variable combinations which explain user-expenditure relationships for specific department subgroups and specific Supplies and Services subcategories? Such a comparison is concerned with degree of correlation, independent variables involved, and general predictive ability. Fourth, what impressions or implications can be drawn from the analysis in terms of: (1) the expenditure-user relationship; (2) the effect of department subgroups

and Supplies and Services subcategories on total expenditure-user relationships; (3) the relative validity of the independent variables which are found to be significantly correlated with expenditures; and finally, (4) the predictive ability of the regression equations?

Simple Correlations

Findings

As shown in Tables 1 through 6 an analysis of the data indicates a wide range of positive and negative correlations for the total department sample and total expenditures. Each of the four subgroups of the total sample reveals significantly high correlations between the dependent variable and the various independent variables with Group 3 departments having the lowest and fewest significant correlations. The results for fall and full year data do not indicate any significant differences in results so that fall data results will be reported.

Total Sample

The total sample results in Tables 1 and 2 indicate high positive correlations for a large number of the independent variables. Using J. P. Guilford's scheme (as outlined in Chapter IV) for a verbal description of coefficients, there were 5 variables showing significant correlations greater than .70 which is considered high correlation with a marked relationship. Nine independent

variables had correlations from .40 to .70 which is moderate correlation with a substantial relationship. Thirteen variables showed low correlation with a small but definite relationship. Correlations for these latter 13 variables ranged from .20 to .40. There were 22 variables having correlations below .20 and therefore were considered having negligible relationship. Negative correlations were not large enough to be considered significant. Variables above .26 correlation were significant at the .05 level of confidence.

The five independent variables above .70 correlation included Variable 32, total number of laboratory sections, with the highest correlation of .83. Variable 68, total part-time FTE faculty, was second with a correlation of .81. Following at correlations of .75, .71, and .70 are Variable 51, total laboratory student credit hours, Variable 65, total part-time faculty, and Variable 66, total head-count faculty. These variables are common to all departments with the exception of Variables 32 and 51 which are peculiar to Groups 1, 2, and 4, but not Group 3. Group 3 is non-laboratory departments. Variables 68, 65, 66 are faculty variables which cut across all departments. It is reasonable to assume that Variables 32 and 51 would show a high correlation due to the laboratory-related function of all departments with the exception of Group 3. Variable 68, with its strong graduate assistant bias, is not a really

good measure of faculty need independent of laboratory influence. It more likely reflects laboratory operations than it reflects ranked faculty.

The strength of several faculty variables is a welcome indication that expenditures for Supplies and Services are related to a major user of such variables. Of particular significance is the strength of the head-count faculty (Variables 65 and 66) relationship to expenditures. Their high correlation suggests that the use of Supplies and Services funds is not clearly segregated into general fund versus non-general faculty. Expenditures for certain department functions do not appear to be based solely on the number of general fund (FTE) faculty. A good example is telephone expenses. These expenditures apparently serve all faculty regardless of the individual faculty member's source of salary funds. It might be worthwile to question why departments expend general fund resources on non-general fund faculty if this latter group is supposedly self-sustaining from funds which supply their salaries. The most reasonable answer would seem to be the inability or desire of a department to segregate funds for the various derived faculty categories.

Independent variables which might have been expected to show higher correlations were Variable 49, total student credit hours, and Variable 72, total A faculty count. Variable 49 had a correlation of .36 which was significant,

and Variable 72 had a correlation of .32 which was not statistically significant. The low correlation of Variable 72 seems to be in the nature of the variable and what it represents. Variable 72 is the position count of A and B faculty as of July 1 each fiscal year. Since it is a position count and not a count of people filling positions, as is the fall FTE faculty count (Variable 69), the correlations with expenditures might be low. Comparing the faculty counts for Variable 72 and Variable 69, its fall counterpart, there is sufficient difference in the faculty size of these two variables to support this interpretation. Furthermore the much higher and significant correlation of .61 for Variable 69 supports the belief that actual faculty are more directly related to the level of expenditures for Supplies and Services than a position count. An evaluation of Variable 72 as a guide to department needs may be required if the pattern for Supplies and Services is true for other department requirements and is true for all departments.

The low correlation of Variable 49, total student credit hours, suggests that the uses of Supplies and Services are more specific than general in nature. While all students might influence the size of expenditures for Supplies and Services, the influence is less than the direct influence of faculty needs, laboratory needs, or

other comparable measures which reflect the expenditures for Supplies and Services in a more specific manner.

Subgroups

The four subgroups of the department sample show Group 1 (Table 3) to be the closest to the results for the total sample in terms of high correlations and comparable variables. Group 1, which includes laboratory, basic science departments, shows 27 independent variables having a positive and significant correlation greater than .70. Of those variables, 12 are above .90 which is considered very high correlation with a very dependable relationship. Group 1 departments show more independent variables with an overall higher correlation than the other three groups. Faculty, students, and general department data are adequately represented. The highest correlation of the independent variables is Variable 51, number of student credit hours in laboratory sections. The next eleven independent variables suggest that the expenditures in Group 1 are highly correlated with those variables, faculty and students, which have a legitimate need for Supplies and Services. Once again, the highest variables reflect the basic character of these departments. Both variables, 51 and 32, measure laboratory needs and both are among the higher correlations. There are other independent variables which have correlations almost as high as Variable 51 and Variable 32, indicating that the expenditures in Group 1

are also covered by more general variables. Variable 49, total student credit hours, and Variables 60 and 62, concerned with department service load, support the correlation results of Variables 51 and 32.

The high and numerous correlations of Group 1 suggest, in general, a group of departments that have received and expended funds sufficient to cover all their basic needs. There are faculty-related needs, student-related needs, and the more specific needs of laboratory--all are represented with significant and high positive correlations. It would seem that volume considerations for Group 1 may more adequately reflect need than the total sample. The relative homogeneity of a special group may help explain these results but it must also be considered that laboratory demands may have created a special leverage for total Supplies and Services funds that other departments have not had. Therefore, most of their other needs are also adequately funded under an umbrella of laboratory leverage.

Group 2 Departments

Group 2 (Table 4) which is applied laboratory science departments shows a marked drop in overall correlation results. The six highest significant independent variables range from .50 to .72 correlation which is considered as moderate correlation with substantial relationships. The two highest correlation variables, 36 and 68, represent

total graduate weighted average section size and part-time FTE faculty. Variable 36 is a variable which exhibits a fairly high correlation, but it is doubtful that it can be considered significant in a face validity sense. A measure such as graduate weighted average section size might not be considered a reliable measure of need due to the complexity of what it purports to measure. Variable 68 is a more representative measure of need, as is Variable 66, both of which are faculty measures; however, more general measures of need as in Group 1 are not evident, nor are specific laboratory measures such as Variables 32 and 51 present. There is justification in expecting that Group 2, having laboratory needs, would show the above two variables in high positive correlation comparable to Group 1. However, the very low correlation of Variables 32 and 51 is significant, not statistically, but practically. Variables 32 and 51 show correlations of .12 and .00 which would indicate that the expenditures for Group 2 Supplies and Services are not correlated with two major independent variables concerned with laboratory operations.

Several explanations seem feasible in light of these results. First, both the specific and general needs of these departments are not adequately reflected in laboratory and general department variables because volume variations may not be sufficient to explain the basic needs of these departments. Second, the laboratory and general needs of

these departments may be supplemented by non-general fund sources to a greater extent than the other groups and therefore are sufficiently funded. Finally, the reaction to low correlations for laboratory variables tends to place the burden on insufficient funds; however, the cause of low correlations could be excessive funds relative to need. This latter conclusion seems more justified when residuals are examined in Table 30.

Group 3 Departments

Group 3, non-laboratory departments, (Table 5) shows simple correlations comparable to Group 2 but generally they are lower and less valid than any of the four groups. Of the top four independent variables, which range from .45 to .71, which is considered moderate correlation with substantial relationship, there is no general variable that indicates that the overall expenditures of Supplies and Services for this group are represented. Variable 48, doctoral SCH, has the highest significant correlation of .71. There is no particular characteristic of these departments which would indicate that doctoral students would place a special burden on Supplies and Services. Variable 29 at .45 correlation is also a doctoral measure. Variable 35, undergraduate weighted average section size, and Variable 54, non-general fund faculty, appear to represent a more general basis of need but neither is sufficient alone to

serve as adequate measures of department need. Group 3 has no special need for supplies and services as was true for Groups 1 and 2, but the requirements for supporting faculty for travel, books and magazine subscriptions, telephone facilities, and general department operations would justify much higher correlations with faculty measures. None of these faculty variables show a statistically significant correlation except Variable 75 at .49 correlation. Basic expenditures for students, while not directly identifiable as is true with laboratory departments, should also show correlations at a higher level than is shown. Variable 26, number of courses, and Variable 49, total student credit hours, show correlations of -.14 and .26 respectively. Generally Group 3 appears deficient in significant correlations comparable to the results of Groups 1 and 2.

Group 4 Departments

Group 4, (Table 6) social science and humanities departments with laboratory section, has high correlations comparable to Group 1 with 18 independent variables having significant correlations between .72 and .91. Results in this range are considered high correlations with marked relationships. Variables 69 and 72 are comparable faculty counts with Variable 69 being the full-time equivalent count (FTE) and 72 being the total A and B faculty count. The conclusions

and implications about Variable 72 (A and B faculty) which were reached in discussion of the total sample are not fully supported in Group 4 where the correlations for Variable 72 and Variable 69 (FTE faculty) are the same. It must be noted that Group 4 is joined by Group 1 in this pattern whereas Groups 2 and 3 deviate most prominently when Variable 72 is considered. The effect of Groups 2 and 3 is sufficient to cause the overall decline in correlation for the total sample and therefore to single out Groups 2 and 3 for investigation seems justified. Of the next nine variables ranging from .84 to .90 correlation, five variables are faculty measures, two variables are student-related measures, and two variables are general department measures. These results indicate rather strongly that these departments are well represented by faculty, student, and general department variables. Variables 51 and 32 which were very high for the total sample are less for Group 4 but are nevertheless significant at .60 and .64 correlation.

Group 4 displays the ideal pattern of having numerous faculty, student, and general department measures significantly correlated with total Supplies and Services expenditures; however, the more prominent variables of this group are relatively suppressed when the total sample variables are perused. Perhaps it is unrealistic to expect the same independent variables to have identical

high correlations across the four groups but there is a hope that the total results will reflect the group patterns more uniformly rather than reflecting one or two of the groups predominantly.

Summary of Total Sample and Four Groups

A summary of the total sample and the four department subgroups indicates significantly high correlations. Groups 1 and 4 have the highest correlations and the best cross section of independent variables. Groups 2 and 3 have moderately high correlations but the independent variables have less validity. Primarily, the independent variables that have the highest correlations for these latter two groups are specific in character and more restrictive than expected. That is, the results show specific sub-units of a more general variable. For example, Variables 48 and 47 for Group 3 are sub-units of Variable 49. Both Variables 48 and 47 show relatively high correlations but Variable 49 does not show a comparable level. Furthermore, the needs of Group 3 are not justifiably reflected by these specific values when faculty and other independent variables show up so poorly. If a variable is specific in nature, as Variables 51 or 32 for Group 1, then a predominant need of that group must be laboratory needs. Group 3 has needs commensurate with its character, and its basic orientation is more general than masters and doctoral level work.

Three results seem to stand out from the simple correlation results. First, faculty-related measures are most prominent across departments as significant independent variables. This result is encouraging because faculty measures cut across all department types and faculty members are expected to be prominent users of Supplies and Services. While various faculty measures show up as significant, the presence of head-count faculty measures suggests the line of demarcation between sources of funds is not always followed, nor perhaps can it be followed.

Second, the lower correlations and less prominent variables of Groups 2 and 3 suggest that these departments have not reacted in the same manner as Groups 1 and 4 according to volume consideration. There is no guarantee that the funds available for expenditures in departments will be sufficient because volume variations may not do justice to actual need when cost factors are also considered; however, if volume is a first approximation to need, then the departments in Groups 2 and 3 have not responded in the same general manner as 1 and 4. It should not be concluded that the lack of correlation is due alone to insufficient funds.

Third, laboratory measures stand out as prominent independent variables but it was expected since laboratory operations utilize a sizable proportion of Supplies and Services in the form of Supplies and Materials (Variable 17).

What was not expected was the overall influence of these factors in the total sample. Group 3 does not possess these variables, and Group 2 shows lower correlations than 1 or 4; however, laboratory measures dominate the total sample with Group 1 appearing to have a major and substantial influence on the total results.

Multiple Correlations

Multiple correlation analysis was desired in order to ascertain the level of correlation and variance accounted for by several significant independent variables in combination when these variables were correlated with various dependent variables. A second reason was to determine the relative contributions several independent variables might make to a single multiple equation which would best explain expenditure levels. Further it was hoped that multiple correlation analysis might bring into a single equation enough different variables to adequately explain and represent different department types. While 16 variable combinations were run for each cell of analysis, there was considerable repetition. Therefore the results reported focus on the multiple correlation and regression results with the lowest standard error of estimate, the highest correlation, and the highest variance accounted for by a combination of significant, independent variables. In all cases the best results were fall and full year variable combinations with fall term results being the better.

Total Supplies and Services (Department Variable No. 4)

Total Sample

An independent variable combination which included seven significant variables (Table 7) produced a multiple correlation of .96, a high variance at .93, and a relatively low standard error of estimate of $8,919. Variable 32, total number of laboratory sections, had the highest correlation at .83 with a variance of .70. Variable 68, part-time FTE faculty, but with a very heavy laboratory bias, added 11 per cent to the variance while Variable 26, total number of courses taught, added another six per cent to the overall variance. These first three variables accounted for 87 per cent of the total variance in Supplies and Services expenditures. The remaining four variables, although statistically significant, added only six per cent to the total explained variance. The results of the multiple correlation analysis show the laboratory influence being most obvious. The remaining independent variables, with the exception of Variable 51, have a less specialized orientation. These latter variables may be able to account for the other needs of departments even though that influence is less than 20 per cent of the total explained variance.

Group 1 Departments

Group 1 (Table 8) generally duplicates the total results in level of correlation at .99 and a total variance at .99. In Group 1, Variable 51, the number of laboratory student credit hours, replaces Variable 32 as the predominant laboratory influence accounting for 95 per cent of the explained variance in expenditures for this group. The other two variables in this multiple combination add only four per cent to the total explained variance. The results of this analysis are expected but not to this extent. It is understandable that laboratory measures would be important in this particular department group but it is disturbing that expenditures in these departments are so dominated by laboratory needs. The simple correlations suggest that more general measures of need are also highly correlated so that this particular laboratory emphasis does not distract from other department requirements. In fact, the leverage for these departments provided by laboratory requirements may be a key element in producing funds for other department needs.

Group 2 Departments

Group 2 departments (Table 9) show an equation which has Variable 68, part-time FTE faculty, and Variable 32, number of laboratory sections, producing a standard error of estimate of $3,289, a total variance of .66 with a multiple correlation of .81. Part-time FTE faculty accounts

for 51 per cent of the total variance which leaves 10 per cent of the variance explained by the number of laboratory sections. The results are disappointing relative to Group 1 but as pointed out in simple correlations this group may not be expected to duplicate Group 1 even though it has laboratory needs.

Group 3 Departments

Group 3 (Table 10) shows the combined results of its most prominent but relatively invalid simple correlations. The analysis shows Variable 48, doctoral student credit hours; Variable 47, masters and graduate-professional student credit hours; Variable 61, majors in department courses; Variable 37, masters and graduate-professional class hours; and finally, Variable 46, upper division student credit hours, accounting for a .96 variance with a standard error of estimate of $1,065 and multiple correlation of .98. This group, as pointed out in a discussion of simple correlation, reflects statistically significant high correlations but the independent variables are subject to question as valid indicators or measures of Group 3's needs. While trying to avoid forcing every department group or dependent variable subcategory into a fixed set of desirable independent variables, the needs and character of these departments do not suggest why doctoral and masters student credit hours should account for 65 per cent of the variance in level of expenditures. There is a

temptation to accept these multiple correlation results because their combined effect is so much greater than any of the simple correlations. The high correlation results are very impressive; however, knowing that Group 3 does not have special and unique features reinforces a belief that a rejection of the above results is justified. If the major purpose of this study was to obtain high correlations in order to project current practice into the future, then the Group 3 results are satisfactory. But the results suggest, and they are not discredited by other evidence, that these departments do not appear to have their expenditures correlated with notable independent variables comparable to the other departments. Therefore the results serve as a signal for further investigation.

Group 4 Departments

Group 4 departments have high correlation with a low standard error of estimate produced by three significant independent variables. As was true in the simple correlations, faculty-related variables play a prominent role in Group 4. Table 11 shows that Variable 69, total FTE faculty, accounts for 83 per cent of the variance with Variable 27, lower division class hours, and Variable 25, total number of graduate courses, explaining another 15 per cent of the total variance. In combination the three variables produced a correlation of .98 with a variance of .96 and a standard error of estimate of $1,566.

Each of the above three variables reflects the program efforts of these departments. Total FTE faculty should and apparently does account for a very high proportion of the Supplies and Services expenditures in this department group. The two other variables also reflect two distinct qualities of these departments. The amount of lower division class hour work produced is significant because class hours reflect to some extent the laboratory orientation of these departments. The third variable, total number of graduate courses, also gives some recognition to a sizable function of these departments. Although direct laboratory variables such as Variables 32 or 51 do not appear in this multiple correlation, they do show up in simple correlations. Furthermore Variable 27, lower division class hours, may be an adequate substitute for these variables.

Summary of Four Groups

An overall impression of the total results and of each separate group indicates high correlation and high variance with faculty and laboratory variables being most prominent. The results for the total sample reflect specific needs of certain departments by giving weight to laboratory needs. Faculty and staff needs and the general overall department needs have far less emphasis given to them by the "general" equation. The very high weight given to laboratory needs

would appear to be a primary reflection of Group 1 and a much lesser result of Groups 2 and 4. Variables 68, part-time FTE faculty, and 26, total number of courses, come fairly close to reflecting the other non-laboratory needs of all departments. Also it was hoped that these total equation variables would also reflect the overall needs of Group 3 but this appears doubtful.

Group 2 is disappointing because it does not reflect, in level of correlation or the type of variables that it has, the total results in the same manner as Group 1. Group 3 is very disappointing because the results reflect rather specific variables that do not reflect the needs of an academic department relative to its faculty size or to its general student population. It is evident that Group 3 needs greater attention than any other group if these results are accepted as being meaningful.

Subcategories of Supplies and Services Utilizing the Total Department Sample

The subcategories of Supplies and Services selected for analysis reflect a combination and duplication of categories in certain cases (Variables 6, 20, 21, and 4) and in two cases (Variables 17 and 10) are very specific in orientation. The results of the multiple correlation analysis (Tables 12 through 17) should reflect the character of these categories as well as the variations in department needs for expenditures from these categories. The matching

simple correlations for these subcategories are reported in Tables 33 through 38.

Dependent Variable No. 17

Variable 17, Supplies and Materials, (Table 12) duplicates the results for total Supplies and Services, (Table 7) with high variance, high correlation, low standard error of estimate, and almost identical variables. For example, Variable 17 results (Table 12) show a total variance of .93, a correlation of .96, and a standard error of estimate of $6,755 with the first three variables. These independent variables are Variable 32, number of laboratory sections; Variable 68, part-time FTE faculty, and Variable 26, number of courses, with individual variances of .60, .09 and .08 respectively. This compares with the "general" or total results of .70, .11 and .06 for the same variables.

Variable 17 is the subcategory of Supplies and Services which contains expenditures for laboratory work, general department operation, and is a major source of student consumption. The results of multiple correlation uphold this belief since the three higher correlations are the number of laboratory sections, the number of part-time faculty, and the number of courses taught. These three independent variables give emphasis to laboratory needs, including student consumption, and also partially reflect in the faculty variables and the number of courses offered

the special requirements of faculty and the general department needs. The results for Variable 17 are gratifying in having high correlation with expected variables; however, the almost complete duplication of total Supplies and Services with subcategory Supplies and Materials points out the tremendous impact of a single subcategory on the total equation and the obvious influence of laboratory operations.

Dependent Variable No. 20

Variable 20, which is total Supplies and Services less Supplies and Materials (Variable 17) represents a derived category. The results of the multiple correlation analysis (Table 13) show a high correlation with moderately high variance and a standard error of estimate of $3,408. The multiple correlation combination shows four variables producing a total variance of .75 and a correlation of .86. Variable 65, part-time head-count faculty, accounts for 61 per cent of the variance. Variable 32, number of laboratory sections, adds eight per cent to the variance while Variable 36, graduate weighted average section size, and Variable 9, inventory value of department equipment, add the remaining six per cent to the explained variance.

The above results indicate faculty variables are of prime importance with general student measures and laboratory

student credit hour load playing an important but secondary role. The nature of this category suggests that faculty needs would be of primary importance with laboratory needs, general student load, and equipment having a direct but secondary bearing on the expenditures in this category. Travel, telephone, books and magazine subscriptions contained in this category are most generally faculty related. Contractual services, the remaining portion of the category, are concerned with equipment maintenance and therefore bear a relationship to the number of laboratories and the amount of equipment in a department. The tendency for the faculty variables not to be FTE counts suggests, as was true in simple correlations, that the academic departments expend general fund money on all faculty and not alone on those deriving funds from general fund sources.

Dependent Variable No. 10.

Variable 10, Travel, (Table 14) has correlations that are moderately low at .61, variance is low at .40, and the standard error of estimate ($729) is high relative to the average expenditure for travel. There are no faculty variables having a major influence in the results. Dependent Variable 64, faculty head-count, accounts for less than five per cent of the total variance. This is an extremely low influence considering the primary use of travel funds is by faculty. Variable 10, travel, should have had faculty variables at a high correlation for the total sample with

supporting results from all department groups. The lack of these multiple results is upheld by the simple correlations for Variable 10. Table 36 shows there are no faculty variables, except Variable 69, with a significant simple correlation above .32. One possible explanation for the low correlation might be the expenditure of travel funds for faculty interviews. The lack of data on the number of faculty recruitment interviews could be an important variable which would help explain travel expenditure. Another point to consider is whether the low correlation reflects all departments or whether one or two departments groups might have high correlations while the remianing departments do not.

Dependent Variables No. 6 and No. 21

Variables 6 and 21 are closely related because the expenditures for one match closely the expenditures of the other. Variable 6 (Table 15) is a derived subcategory which brings together all subcategories of Supplies and Services which have a faculty orientation. Variable 21 (Table 16) achieves the same basic results by subtracting from total Supplies and Services those expenditures for Supplies and Materials, and expenditures for Contractual Services.

Both dependent variables have a high independent variable correlation with a high variance and a moderately

low standard error of estimate. The results for Variable 21 show a total variance of .63 with the following three variables. Variable 66, total faculty head-count, accounts for 59 per cent of the explained variance while Variable 36, graduate weighted average section size, and Variable 51, number of laboratory student credit hours, add four per cent variance to the total. Variable 6 generally duplicates the results for Variable 21 with the exception of the last variable. Both dependent variables have expected results because faculty measures should be the primary factor in expenditures in these categories. The fact that a head-count faculty measure is the major variable signals, once again, the importance of all faculty as participants in using certain supplies and services regardless of the source of their salaries. The secondary variable in both cases is graduate weighted average section size. This is not an unlikely secondary measure because the use of telephones, magazine subscriptions, and travel allowances have been enjoyed by graduate students in most academic departments.

Dependent Variable No. 8

Variable 8 (Table 17) is a derived equipment-related subcategory which includes expenditures for on and off campus contractual services and equipment rentals. The results show a moderately high correlation of .81 and a variance of .66 with a standard error of estimate of $1,906.

Forty-eight per cent of the total explained variance is provided by Variable 32, number of laboratory sections. Variable 9, equipment inventory, and Variable 36, graduate weighted average section size, add another 12 per cent variance to the total. Variables 32 and 9, which account for 56 per cent of the total variance, are expected variables since the expenditures for Variable 8 should be related to the amount of department equipment and the number of laboratories which require repair and maintenance.

Summary of Subcategories

The multiple correlation results for the subcategories have fairly high correlations with expected independent variables. Dependent Variable 17 has the highest total correlation with no unexpected results. Dependent Variables 20, 6 and 21 show the importance of faculty measures. The fact that head-counts show up as a primary variables suggests that expenditures for these categories are related to total faculty and not alone FTE faculty. Variable 10, Travel, has a fairly high correlation which is invalid because there is lacking any significant faculty measure in the results.

The extremely high correlation of dependent Variable 17, with its emphasis on laboratory-related measures, reinforces the impression that the total or "general"

equation is a better reflection of laboratory needs than it is any other aspect of Supplies and Services.

Total Analysis Results Compared with Department Subgroups and Supplies and Services Subcategories

An appraisal of the total results as compared with the results of individual analysis of subgroups and subcategories requires three considerations. First, does it appear that results for each subgroup and each subcategory are unique to that unit or can the total results be applied to that individual cell? Second, how well does the independent variable combination for the total sample compare with the variable results for the individual units in overall statistical results and overall consideration of department needs? Third, how well does the total equation treat the subgroups in predictions as compared with the predictions made by the individual cells?

General Statistical Comparisons

The statistical results for dependent Variable 4, total sample and total expenditures, (Table 7) show four major independent variables accounting for 90 per cent of the explained variance out of a total variance of .93. These four primary independent variables are Variable 32, number of laboratory sections; Variable 68, number of part-time FTE faculty; Variable 26, total number of courses; and Variable 51, total number of laboratory

student credit hours. These four variables plus the remaining three, Variables 33, 57, and 64, would appear to cover the range of departmental needs as represented by the four groups. The overall correlation and variance level exceeds the results for all subgroups and subcategories with the exception of Groups 1 and 4 and subcategory Variable 17. The first reaction is to accept the total results as an adequate reflection of all department needs and therefore as an acceptable means of forecasting or predicting future needs; however, certain aspects of the total results can be seriously questioned.

The total results (Table 7) reflect the laboratory needs of Groups 1 and 2 (Tables 8 and 9) and Variable 17 (Table 12) much better than any other group or subcategory. It is not unreasonable to expect that the subunits of the total would reflect in some measure the total results. Furthermore it is not necessary that each group and/or subcategory duplicate the total regression equation in level of correlation or type of variable, but it is desirable and necessary that the independent variables in the total or "general" combinations adequately reflect the various needs of all department types. The laboratory needs of the various departments appear adequately reflected in the total combinations as represented by Variables 32 and 51. Faculty needs are far less directly represented by Variable 68 even though it is strongly represented in Group 2. General

department needs are directly represented by several variables such as Variables 26 and 33 but these seem of little consequence in the total equation.

Only one of the special subgroup formulas seems to more adequately reflect its special needs in a more realistic manner than the total equation because two major factors of need, faculty and laboratories, are better represented by the special equation of Group 4. Group 3's special formula appears to give no representation to its own general department needs or faculty needs. Most certainly the total equation does not give any meaningful representation to Group 3 since this group has absolutely no laboratory variables. Also the weight given to the other variables in the "general" equations seems insufficient to adequately represent Group 3.

Both Groups 1 and 2 are represented in the total equation by Variables 32 and 68 although the relative importance of each variable is different for each group. How effectively Variable 68 represents faculty needs is difficult to assess but it is believed to be less reliable than Variables 69, 67, 72, or 73.

An important point to be made concerning these equations is the simple fact that when a variable representing laboratory needs has a high correlation with Supplies and Services expenditures, it does not mean that all the expenditures for those departments are spent on

that particular function. In fact, other department functions may derive funds commensurate with their other more direct measures of need, even though these more direct measures are not at an equally high correlation to the laboratory measures. Group 1 is an excellent example of departments having high correlations between expenditures and almost every measure of need that it has (Table 3). The implication seems to be that laboratory variables help derive these funds even though their use is not limited to that specific function. Those departments that draw attention to their Supplies and Services requests through laboratories may be in an overall better position for every other Supplies and Services function that they perform than they would be without the laboratory leverage.

Summary Comparison

At the overall level the total or "general" results appear to reflect what has happened to laboratory departments, especially Group 1, and certain laboratory subcategories, Variable 17, much better than it reflects non-laboratory departments and/or non-laboratory functions. It does a fair job of representing the subcategories of total Supplies and Services with Variables 17 and 8 being most closely represented. It does not reflect the results for subcategories No. 6, 21, or 20; those categories most closely related to faculty. The department subgroups of the total

sample and the subcategories of supplies and services indicate that the other needs (non-laboratory) of the various departments are not reflected in the total equation in either comparable variables or in the strength of the correlations. Also the total results do not appear to reflect Group 3 needs in any meaningful way. Group 2, while represented in the total equation by variables responsive to its needs, is not the same level of representation that Group 1 seems to convey. An ideal equation, not necessarily one derived from regression and correlation analysis, would give weight to laboratory needs, to faculty needs, and to general department needs with some differentiation of each factor according to actual differences among departments. This is an ideal and not easily achieved under any method of analysis or procedure.

Predictions Versus Actual Expenditures for Departments Derived by Each Major Regression Equation

The overall statistical results point to a very high correlation for total results and high to very high correlations for all subgroups and subcategories with the exception of Variable 10, Travel. However, how well does the "general" regression equation for the total sample perform when compared with residual results of the specific equation of four department groups and the Supplies and Services subcategories? The residuals for each department were computed by determining the difference between the

actual expenditure for a department and its predicted expenditure as given by the different regression formulas (Tables 18 through 28). Each residual (Tables 29 through 32) was expressed as a percentage above or below the actual to show to what extent the predicted value falls above or below the actual for that department. A predicted value below the actual expenditure is reported as a minus percentage while a predicted value above the actual expenditure is reported as a plus percentage. For example, in the total regression equation Chemistry has an estimated expenditure of $363,734 as compared with an actual value of $375,903. The estimated value is 3.3 per cent below the actual and is reported as a minus 3.3 per cent (Table 29). A minus percentage indicates that a department would receive less from an equation than it is currently expending. A plus percentage indicates that a department would receive more from an equation than it is currently expending.

The individual department results of the regression equations support the general statistical results but also point to the effect of these best correlation combinations in a very dynamic manner because the results show the direct effect on individual departments. The "general" equation for the total department sample and total expenditures (Variable 4) exhibits results which are rather typical in correlation and regression analysis with certain departments

clustered around the zero-point, where actual expenditures match prediction, with the remaining departments going away from this zero point to rather wide differences. The nature of the formula for the total is reflected in the individual departments. Group 1 departments (Table 29) show a typical pattern: the departments of Chemistry, Entomology and Physiology have the closest fit, Pathology and Microbiology show estimates below the actual, and Botany, Physics, and Zoology show estimates exceeding the actual. These results for Group 1 suggest that Chemistry, Entomology, and Physiology are best represented by the "general" equation while Microbiology and Pathology do not generate volume data comparable to their expenditures. Zoology, Physics, and Botany substantially exceed their actual expenditures becasue their laboratory volume is greater than their commensurate reward. This "general" equation pattern for Group 1 is generally upheld in the other regression formulas for subcategories of Supplies and Serivces with the exception of dependent Variable 6 which has a closer pattern around the zero point.

Group 1's special formula shows the department's predictions much closer to the actual with only Pathology showing an excessive deviation. When one looks at the results of all the equations applied to Group 1, Zoology and Botany stand out as departments in need of greater support as

measured by volume, whereas Pathology is most often shown receiving excessive support relative to volume.

Group 2 (Table 30) follows the Group 1 pattern although there are no truly close-fitting departments. The pattern for Group 2 departments is followed in most subcategory equations with the special Group 2 formula for total Supplies and Services showing a closer pattern than any other formula. The departments falling above or below the line are fairly consistent throughout. Civil Engineering, and Foods and Nutrition are consistently above the line in the overall equation results and as such warrant consideration of greater support relative to their volume. Mechanical Engineering most persistently deviates from actual expenditures by receiving less support from every formula.

Group 3 (Table 31) departments exhibit two conflicting results when the total formula residuals are compared with the special subcategories or subgroup formula. Most of the Group 3 departments are below their actual expenditures for the "general" results as well as for subcategory 17. The departments of History and Economics are the exceptions. The total equation would give six of eight departments far less funds than they currently receive. These results are due to the character of the formula and its emphasis on laboratory variables. History and Economics appear above the line due to one factor (Variable 33, number of graduate

section) in the formula (Tables 18 and 23) which was sufficient to reward both above their current level. History's higher-than-usual graduate sections count provides the wide difference over its comparable departments. Regardless of the results for History and Economics it would seem reasonable to conclude that the total equation, unlike the subcategories or special subgroup, is not sufficiently realistic to serve as a guide to Group 3 needs. Subcategory Variable 17 results match the total results so that the pattern for Group 3 is repeated. Variables 20, 6, and 21 formulas tend to treat Group 3 in a more realistic manner and in a manner consistent with available information on the needs of these departments. After discounting the results of the general equation and the Variable 17 equation, four departments stand out as needing greater support. English, History, Philosophy, and Accounting and Finance actual expenditures appear to be consistently short of estimated values. Group 3's special equation shows a closer fit than any other equation, but as mentioned before, the value of the variables in the formula are questionable as adequate or realistic measures of need.

Group 4 (Table 32) tends to reverse the spread pattern of the other three groups by being most generously treated by the general equation. Only two of eight departments have estimates of expenditure below the actual in any equation.

The Group 4 departments would be most highly rewarded under the total equation than any other group of departments or any other equation.

The two more consistent deviations away from the pattern for Group 4 are the departments of Music, and Urban Planning. In most formulas, the department of Music and the department of Urban Planning fall short of the actual while the rest of Group 3 is consistently rewarded by the various formula in excess of their actual expenditures.

The special formula for Group 4 places the departments in a much tighter pattern around the zero line than any other equation but still places the departments in a plus or minus role consistent with the other equations. Urban Planning stands out as the department which most consistently deviates from the rest of the departments. This is difficult to understand since other evidence (not in this study) seems to indicate that Urban Planning is deficient in funds whereas the formula would consistently give less funds to this department. Once again the cost effects of the department may be such that volume is an insufficient measure of need.

Formula Overview

An overview of all formulas suggests the following results: (1) the total formula and the Variable 17 formula are most alike followed closely by Group 1. The general spread of departments in the total formula suggests a pattern which is followed by all subcategory formulas with the subcategory formulas exhibiting a trend toward a somewhat tighter fit. (2) The Dependent Variable 6 formula is the best example of the subcategories showing a close pattern of expenditures and predictions with certain departments exhibiting the spread characteristic of other formula. (3) The general placement of departments is consistent throughout the various formulas with certain exceptions. One minor test of this consistency is to count the placement of the various departments above or below the line. The "equation results" in Tables 20 through 32 show only two departments, Economics and Philosophy, that are split evenly with five formulas placing them above the line and five formulas placing them below the line. Three more departments, Soil Science, Foods and Nutrition, and Accounting and Finance, are split at 6 and 4 with the remaining 27 departments having splits at 7 and 3 or greater. Twelve departments are consistently treated in the same manner by the various equations in placing the departments consistently above or below zero point. For example, Botany and Plant Pathology is placed above the line by seven out of eight equations.

The total equation along with the various subcategory formulas represent a fairly good approximation to what actually has been the correlation between expenditures and department variables when all department types are included. In general, these formulas do not appear usable as a means of predicting future need but the value of each formula varies. The "general" formula discriminates extensively against non-laboratory departments as does the Variable 17 equation. If a choice must be made in selecting an equation for estimating future needs from among the subcategories, choosing the Variable 17 equation for Supplies and Materials and Variables 20, 6, or 21 (preferably 6) for all other academic needs would be better than the total equation. Under this arrangement the primary needs of laboratories would be handled by the Variable 17 equation while all other needs, faculty and general department, would be provided by the Variable 6 equation.

If the purpose of an equation is to reasonably perpetuate current levels of expenditures into the future, the special group formulas would do the job better than any subcategory formula. The level of correlation and the close pattern of the departments suggest that these formulas are ideal for the purpose of predicting future needs. However, there is sufficient evidence to immediately cast doubt on the Group 3 formula. Furthermore there is reason to raise serious issue with the concept of maintaining in the future

the current levels of departments under special formulas when a more generalized formula suggests that the equal treatment of departments for equal volume may not exist and/or that the various needs of different departments are not adequately represented in the total equation.

Obviously the spread of departments under the total formula and the subcategory formulas suggests that (1) either volume is not the only consideration of need, (2) or if volume is a valid consideration of need then there are departments receiving a great deal more or less than their volume dictates. Quite obviously volume alone is not the sole factor in Supplies and Materials and perhaps this observation can also be applied to Contractual Services. To the extent that cost differences exist in purchasing materials for certain departments, expenditures above volume are partially explainable. A complete explanation of these differences would require cost accounting analysis beyond the scope or intent of this study; however, what about those areas of Supplies and Serivces not covered in Supplies and Materials? For example, Variables 20, 6 and 21 are combinations of categories where comparable needs among departments are more likely explained by volume than cost or special needs but these have not responded with the level of correlations found in Group 1 and Variable 17. These results suggest that Supplies and Serivces is not a homogenous grouping that can be funded adequately or fairly

on the primary basis of laboratory needs. The results point to finding a means of more adequately differentiating for two major department functions. A better system of funding and evaluation would be facilitated by a re-evaluation of department functions and/or the current Supplies and Services subcategory structure. The easier method is through a re-evaluation of the subcategory structure of Supplies and Services. The more closely these categories reflect their primary use the more easily the process of direct evaluation of program costs.

TABLE 1.--Simple Correlations of Independent Variables with the Dependent Variable No. 4 (Total Supplies and Services) for Total Sample and Four Department Groups.

No.	Independent Variable	Simple Correlation				
		Total Sample	Group I	Group II	Group III	Group IV
9	Office Equipment					
22	No. of Undergraduate Courses	.01	.72*	.25	-.11	.75*
23	Masters and Grad.-Pro.	-.00	.07	.38	.17	.63*
24	Number of Doctoral Courses	.46*	.77*	.37	.42	.50*
25	Number of Graduate Courses	.26*	.53*	.45	.44	.64*
26	Total Number of Courses	.10	.72*	.40	.03	.90*
27	Lower Division Class Hours	.65*	.91*	.15	-.14	.86*
28	Upper Division Class Hours	.43*	.84*	-.38	-.08	.51*
29	Doctoral Class Hours	.20	.68*	.03	.45	.46
30	Total Class Hours	.60*	.93*	-.28	.13	.80*
31	Number Non-Laboratory Sections	.11	.66*	.12	.11	.52*
32	Number Laboratory Sections	.83*	.92*	.12	.00	.64*
33	Number Graduate Sections	.13	.23*	.33	.19	.63*
34	Lab Weighted Average Sec. Size	.17	.23*	.33	.23	.02
35	Undergrad. Weighted Av. Sec. Size	.04	.07	-.15	.67*	.32
36	Grad. Weighted Av. Sec. Size	.24*	.30	.72*	.11	.10
37	Grad.-Pro. & Masters Class Hours	-.02	.29	.23	-.08	.32
45	Lower Division Student Credit Hours	.50*	.90*	-.04	.10	.72*
46	Upper Division Student Credit Hours	.07	.62*	-.12	.38	.35
47	Masters and Grad.-Pro. SCH	.08	.31	.57*	.19	.65*
48	Doctoral Student Credit Hours	.40*	.61*	.36	.71*	.42
49	Total Student Credit Hours	.36*	.90*	-.04	.26	.65*
50	Lecture & Recitation SCH	.18	.83*	-.23	.18	.48*
51	Laboratory Student Credit Hours	.75*	.97*	.01	-.00	.60*
52	Total Classes Undergrad. SCH	.35*	.91*	-.22	.17	.63*
53	Total Classes Grad. SCH	.13	.33	.51*	.28	.52*
54	Grad. Independent Variable SCH	.21	.75*	.33	.18	.72*
55	Total Number of Majors	.00	.71*	-.21	-.18	.21
56	Number of Masters Majors	.18	.87*	.23	.11	.89*
57	Number of Doctoral Majors	.47*	.63*	.50*	.30	.51*
58	Number of Undergraduate Majors	-.05	.64*	-.24	-.21	.09
59	Undergrad. Majors in Dept. Courses	.02	.74*	-.24	-.18	.83*
60	Total undergrads in Dept. Courses	.33*	.91*	.09	.13	.76*
61	Total Majors in Dept. Courses	.13	.83*	-.06	-.19	.89*
62	No. Non-Majors in Dept. Courses	.37*	.91*	.22	.24	.57*
63	Total in Department Courses	.33*	.91*	.24	.10	.75*
64	Instr.-Prof. Head Count	.21	.69*	-.22	-.01	.84*
65	Part-Time Faculty Head Count	.71*	.75*	.48*	.44	.62*
66	Total Head Count	.70*	.75*	.53*	.33	.85*
67	FTEF Instr.-Prof.	.21	.69*	-.22	-.01	.84*
68	Part-Time FTEF	.81*	.91*	.71*	.23	.59*
69	Total FTEF	.61*	.86*	.00	.09	.91*
70	% Instruction	.01	.51*	.18	-.35	.22
71	% Research	-.01	-.13	.15	.43	-.29
72	A + B Faculty	.32	.85*	.17	.10	.91*
73	Total A Faculty	.10	.58*	.15	.10	.88*
74	Total B Faculty	.63*	.92*	.19	.06	.52*
75	Non-General Fund Faculty	.07	.62*	.45	.49*	-.03
76	Professor, Assoc. Professor	.23	.42	.21	.12	.87*
77	Assistant Professor, Instr.	.15	.73*	.19	-.14	.63*

*Correlation value significant at .05 level.

TABLE 2.--Simple Correlation of Independent Variables with the Dependent Variable No. 4 (Total Supplies and Services) Total Department Sample

No.	Independent Variable	Simple Correlation	No.	Independent Variable	Simple Correlation
32	No. Laboratory Sec.	.83*	67	FTEF Instr.-Prof.	.21
68	Part-Time FTEF	.81*	29	Doctoral Class Hours	.20
51	Laboratory SCH	.75*	50	Lect. & Rec. SCH	.18
65	Part-Time Fac. H. C.	.71*	56	No. Masters Majors	.18
66	Total Head Count	.70*	34	Lab. Wtd. Avg. Sec. Size	.17
27	Lower Div. Class Hours	.65*	77	Asst. Prof., Instr.	.15
74	Total B Faculty	.63*	33	No. Graduate Sec.	.13
69	Total FTEF	.61*	53	Total Class Grad. SCH	.13
30	Total Class Hours	.60*	61	Total Maj. Dept. Courses	.13
45	Lower Division SCH	.50*	31	No. Non-Lab Section	.11
57	No. Doctoral Majors	.47*	26	Total No. of Courses	.10
24	No. Doctoral Courses	.46*	73	Total A Faculty	.10
28	Upper Div. Class Hours	.43*	47	Masters, Grad.-Pro. SCH	.08
48	Doctoral SCH	.40*	46	Upper Division SCH	.07
62	No. Non-Major Department Courses	.37*	75	Non-Gen. Fund Faculty	.07
49	Total SCH	.36*	35	Undergrad. Weighted Average Section Size	.04
52	Total Cl. Undergrad SCH	.35*	59	Undergrad. Major Department Courses	.02
60	Total undergraduate Department Courses	.33*	22	No. Undergrad. Courses	.01
63	Total Dept. Courses	.33*	70	% Instruction	.01
72	A + B Faculty	.32*	55	Total Number Majors	.00
25	No. Graduate Courses	.26*	23	Masters & Grad.-Pro.	-.00
36	Grad. Wtd. Avg. Sec. Size	.24	71	% Research	-.01
76	Prof., Assoc. Prof.	.23	37	Grad.-Pro., Masters Class Hours	-.02
64	Instr.-Prof. Head Count	.21	58	No. Undergrad. Majors	-.05
54	Grad. Indep. Var. SCH	.21			

*Correlation value significant at .05 level.

TABLE 3.--Simple Correlation of Independent Variables with the Dependent Variable No. 4 (Total Supplies and Services) Group I Departments.

Number	Independent Variable	Simple Correlation	Number	Independent Variable	Simple Correlation
51	Laboratory SCH	.97*	26	Total No. of Courses	.72*
30	Total Class Hours	.93*	55	Total Number Majors	.71*
32	No. Laboratory Sec.	.92*	64	Instr.-Prof.Head Count	.69*
74	Total B Faculty	.92*	67	FTEF Instr.-Prof.	.69*
52	Total Cls.Ungrad.SCH	.91*	29	Doctoral Class Hours	.68*
60	No.Undergrad. in Department Courses	.91*	31	No. Non-Laboratory Sec.	.66*
62	No. Non-Majors in Department Courses	.91*	58	No. Undergrad.Majors	.64*
63	Total in Dept.Courses	.91*	57	No. of Doctoral Majors	.63*
68	Part-Time FTEF	.91*	46	Upper Division SCH	.62*
27	Lower Div. Cls. Hrs.	.91*	75	Non-Gen.Fund Faculty	.62*
45	Lower Division SCH	.90*	48	Doctoral SCH	.61*
49	Total Stu. Credit Hrs.	.90*	73	Total A Faculty	.58*
56	No. of Masters Majors	.87*	25	No. of Grad. Courses	.53*
69	Total FTEF	.86*	70	% Instruction	.51*
72	A + B Faculty	.85*	76	Prof., Assoc. Prof.	.42*
28	Upper Div. Cls. Hrs.	.84*	53	Total Classes Grad.SCH	.33
50	Lect. and Recit.SCH	.83*	47	Masters & Grad.-Pro.SCH.	.31
61	Total Majors in Department Courses	.83*	36	Graduate Weighted Average Section Size	.30
24	No. of Doctoral Courses	.77*	37	Grad.-Pro.,Masters Class Hrs.	.29
54	Grad. Indep. Var. SCH	.75*	33	N. Graduate Sections	.23
65	Part-Time Faculty Head-Count	.75*	34	Laboratory Weighted Average Section Size	.23
66	Total Head Count	.75*	23	Masters and Grad.-Prof	.07
59	Undergrad. Majors in Department Courses	.74*	35	Undergrad.Weighted Average Section Size	.07
77	Asst. Prof., Instr.	.73*	71	% Research	-.13
22	No. of Undergraduate Courses	.72*			

*Correlation value significant at .05 level.

TABLE 4.--Simple Correlation of Independent Variables with the Dependent Variable No. 4 (Total Supplies and Services) Group II Departments.

Number	Independent Variable	Simple Correlation	Number	Independent Variable	Simple Correlation
36	Graduate Weighted Average Section Size	.72*	72	A + B Faculty	.17
68	Part-Time FTEF	.71*	27	Lower Div. Class Hrs.	.15
47	Masters & Grad.Pro.SCH	.57*	71	% Research	.15
66	Total Head Count	.53*	73	Total A Faculty	.15
53	Total Cls.Grad.SCH	.51*	31	No. Non-Laboratory Sec.	.12
57	No. of Doctoral Majors	.50*	32	Number of Lab. Sec.	.12
65	Part-Time Faculty Head-Count	.48*	60	Total Undergraduates in Department Courses	.09
25	No. of Graduate Courses	.45*	29	Doctoral Class Hours	.03
75	Non-Gen.Fund Faculty	.45*	51	Laboratory SCH	.00
26	Total No. of Courses	.40	69	Total FTEF	.00
23	Masters and Grad.-Pro.	.38	45	Lower Division SCH	-.04
24	No. of Doctoral Courses	.37	49	Total Stu. Credit Hrs.	-.04
48	Doctoral SCH	.36	61	Total Majors in Department Courses	-.06
54	Grad.Indep.Var. SCH	.33	46	Upper Division SCH	-.12
33	Number of Grad.Sec.	.33	35	Undergrad.Weighted Average Section Size	-.15
34	Laboratory Weighted Average Section Size	.33	55	Total Number of Majors	-.21
22	No. of Undergraduate Courses	.25	52	Total Classes Undergraduate SCH	-.22
63	Total in Dept.Courses	.24	64	Instr.-Prof.Head Count	-.22
56	No. of Masters Majors	.23	67	FTEF Instr.-Prof.	-.22
37	Grad.-Pro. & Masters Class Hours	.23	50	Lect. & Recit. SCH	-.23
62	No. Non-Majors in Department Courses	.22	58	No. of Undergraduate Majors	-.24
76	Prof.,Assoc.Prof.	.21	59	Undergraduate Majors in Dept. Courses	-.24
74	Total B Faculty	.19	30	Total Class Hours	-.28
77	Asst. Prof., Instr.	.19	28	Upper Division Class Hours	-.38
70	% Instruction	.18			

*Correlation value significant at .05 level.

TABLE 5.--Simple Correlation of Independent Variables with the Dependent Variable No. 4 (Total Supplies and Services) Group III Departments.

Number	Independent Variable	Simple Correlation	Number	Independent Variable	Simple Correlation
48	Doctoral SCH	.71*	31	No. Non-Laboratory Sec.	.11
35	Undergraduate Weighted Average Section Size	.67*	36	Graduate Weighted Average Section Size	.11
75	Non-Gen.Fund Faculty	.49*	56	No. of Masters Majors	.11
29	Doctoral Class Hours	.45*	45	Lower Division SCH	.10
25	No. of Graduate Courses	.44*	63	Total in Dept. Courses	.10
65	Part-Time Faculty Head Count	.44*	72	A + B Faculty	.10
71	% Research	.43	73	Total A Faculty	.10
24	No. of Doctoral Courses	.42	69	Total FTEF	.09
46	Upper Division SCH	.38	74	Total B Faculty	.06
66	Total Head Count	.33	26	Total No. of Courses	.03
57	No. of Doctoral Majors	.30	32	No. of Laboratory Sec.	.00
53	Total Classes Grad.SCH	.28	51	Laboratory SCH	.00
49	Total Student Cr.Hrs.	.26	64	Instr.-Prof.Head Count	-.01
62	No. Non-Majors in Department Courses	.24	67	FTEF Instr.-Prof.	-.01
34	Laboratory Weighted Average Section Size	.23	28	Upper Division Class Hours	-.08
68	Part-time FTEF	.23	37	Grad.-Pro. and Masters Class Hours	-.08
33	No. Graduate Sections	.19	22	No. of Undergrad. Courses	-.11
47	Masters & Grad.-Pro.SCH	.19	27	Lower Div. Class Hrs.	-.14
50	Lec. & Rec. SCH	.18	77	Asst. Prof., Instr.	-.14
54	Grad. Indep. Var.SCH	.18	55	Total No. of Majors	-.18
23	Masters and Grad.-Pro.	.17	59	Undergraduate Majors in Dept. Courses	-.18
52	Total Classes Undergraduate SCH	.17	61	Total Majors in Department Courses	-.19
30	Total Class Hours	.13	58	Number of Undergraduate Majors	-.21
60	Total Undergraduates in Department Courses	.13	70	% Instruction	-.35
76	Prof., Assoc. Prof.	.12			

*Correlation value significant at .05 level.

TABLE 6.--Simple Correlation of Independent Variables with the Dependent Variable No. 4 (Total Supplies and Services) Group IV Departments.

Number	Independent Variable	Simple Correlation	Independent Variable	Simple Correlation
69	Total FTEF	.91*	77 Asst. Prof., Instr.	.63*
72	A + B Faculty	.91*	65 Part-Time Faculty Head-Count	.62*
26	Total No. of Courses	.90*	51 Laboratory SCH	.60*
61	Total Majors in Department Courses	.89*	68 Part-Time FTEF	.59*
56	No. of Masters Majors	.89*	62 No. Non-Majors in Department Courses	.57*
73	Total A Faculty	.88*	31 No. Non-Laboratory Sec.	.52*
76	Prof., Assoc. Prof.	.87*	53 Total Classes Grad.SCH	.52*
27	Lower Division Cl.Hr.	.86*	74 Total B Faculty	.52*
66	Total Head Count	.85*	28 Upper Division Cl.Hr.	.51*
64	Instr.-Prof.Head Count	.84*	57 No. of Doctoral Majors	.51*
67	FTEF Instr.-Prof.	.84*	24 No. of Doctoral Courses	.50
59	Undergraduate Majors in Department Courses	.83*	50 Lec. & Rec. SCH	.48
30	Total Class Hours	.80*	29 Doctoral Class Hours	.46
60	Total Undergraduates in Department Courses	.76*	48 Doctoral SCH	.42
22	No. of Undergraduate Courses	.75*	46 Upper Division SCH	.35
63	Total in Dept. Courses	.75*	35 Undergraduate Weighted Average Section Size	.32
45	Lower Division SCH	.72*	37 Grad.-Pro. and Masters Class Hours	.32
54	Grad. Indep.Var. SCH	.72*	70 % Instruction	.22
47	Masters & Grad.Pro.SCH	.65*	55 Total No. of Majors	.21
49	Total SCH	.65*	36 Graduate Weighted Average Section Size	.21
25	No. of Graduate Courses	.64*		
32	No. Laboratory Sections	.64*		
23	Masters and Grad.-Pro.	.63*	34 Laboratory Weighted Average Section Size	.02
33	No. Graduate Sections	.63*	58 No. of Undergrad. Majors	.09
52	Total Classes Undergraduate SCH	.63*	75 Non-Gen.Fund Faculty	-.03
			71 % Research	-.29

*Correlation value significant at .05 level.

TABLE 7.--Multiple Correlation Values of Combined Independent Variables Correlated With the Dependent Variable No. 4 (Total Supplies and Services) Total Department Sample.

	No. Lab. Sections	Part-Time FTEF	No. of Courses	No. of Lab. SCH	No. Grad. Sections	Doc Majors	Inst.-Prof. Head-Count	Total Analysis Results
Fall independent variables	32	68	26	51	33	57	64	
Multiple correlation (R)	.8384*	.9006*	.9368*	.9504*	.9587*	.9637*	.9670*	.96*
Increase in R contributed by each variable	.8384	.0622	.0362	.0136	.0083	.0050	.0033	--
Variance (R^2)	.7030	.8111	.8776	.9032	.9191	.9287	.9350	.93
Increase in R^2 contributed by each variable	.7030	.1081	.0665	.0256	.0159	.0096	.0063	--
Standard error of estimate (S)	$18,122	$14,569	$11,824	$10,603	$ 9,776	$ 9,262	$ 8,919	$8,919
Decline in S	--	$ 3,553	$ 2,745	$ 1,221	$ 827	$ 514	$ 345	--

*All independent variables in the analysis are individually significant at .05 level of confidence with an F test. Analysis of Variance for overall regression indicates total results are significant at .05 level of confidence with an F value of 115.09 with 7 and 56 degrees of freedom.

TABLE 8.--Multiple Correlation Values of Combined Independent Variables Correlated with the Dependent Variable No. 4 (Total Supplies and Services) Group 1 Departments Sample.

	No. Lab. SCH	Grad. Whtd. Av. Sec. Size	No. of Courses	Total Analysis Results
Fall independent variables	51	36	26	
Multiple correlation (R)	.9779*	.9922*	.9956*	.99*
Increase in R contributed by each variable	.9779	.0143	.0034	--
Variance (R^2)	.9563	.9844	.9912	.99
Increase in R^2 contributed by each variable	.9563	.0281	.0068	--
Standard error of estimate (S)	$12,892	$7,995	$6,250	$6,250
Decline in S	--	$4,897	$1,745	--

*All independent variables in the analysis are individually significant at .05 level of confidence with an F test. Analysis of Variance for overall regression indicates total results are significant at .05 level of confidence with an F value of 450.43 with 3 and 12 degrees of freedom.

TABLE 9.--Multiple Correlation Values of Combined Independent Variables Correlated with the Dependent Variable No. 4 (Total Supplies and Services) Group 2 Departments.

	Part-Time FTEF	No. Lab. Sections	Total Analysis Results
Fall year independent variables	68	32	
Multiple correlation (R)	.7174*	.8183*	.81*
Increase in R contributed by each variable	.7174	.1009	--
Variance (R^2)	.5147	.6696	.66
Increase in R^2 contributed by each variable	.5147	.1549	--
Standard error of estimate (S)	$3,841	$3,289	$3,289
Decline in S	--	$ 552	--

*All independent variables in the analysis are individually significant at .05 level of confidence with an F test. Analysis of Variance for overall regression indicates total results are significant at .05 level of confidence with an F value of 13.17 with 2 and 13 degrees of freedom.

TABLE 10.--Multiple Correlation Values of Combined Independent Variables Correlated with the Dependent Variable No. 4 (Total Supplies and Services) Group 3 Departments.

	Doctoral SCH	Masters G-P SCH	Majors in Dept. Courses	Masters G-P Class Hrs.	Upper Div. SCH	Total Analysis Results
Fall independent variables	48	47	61	37	46	
Multiple correlation (R)	.7149*	.8084*	.9045*	.9566*	.9803*	.98*
Increase in R contributed by each variable	.7149	.0935	.0961	.0521	.0237	--
Variance (R^2)	.5111	.6535	.8181	.9150	.9611	.96
Increase in R contributed by each variable	.5111	.1424	.1646	.0969	.0461	--
Standard error of estimate (S)	$3,191	$2,788	$2,103	$1,501	$1,065	$1,065
Decline in S	--	$ 403	$ 685	$ 602	$ 436	--

*All independent variables in the analysis are individually significant at .05 level of confidence with an F test. Analysis of Variance for overall regression indicates total results are significant at .05 level of confidence with an F value of 49.35 at 5 and 10 degrees of freedom.

TABLE 11.--Multiple Correlation Values of Combined Independent Variables Correlated with the Dependent Variable No. 4 (Total Supplies and Services) Group 4 Departments Sample.

	Total FTEF	Lower Div. Class Hrs.	No. Grad. Sections	Total Analysis Results
Fall independent variables	69	27	25	
Multiple correlation (R)	.9140*	.9539*	.9835*	.98*
Increase in R contributed by each variable	.9140	.0399	.0296	--
Variance (R^2)	.8355	.9100	.9673	.96
Increase in R^2 contributed by each variable	.8355	.0745	.0573	--
Standard error of estimate (S)	$3,252	$2,497	$1,566	$1,566
Decline in S	--	$ 755	$ 931	--

*All independentvariables in the analysis are individually significant at .05 level of confidence with an F test. Analysis of Variance for overall regression indicates total results are significant at .05 level of confidence with an F value of 118.26 at 3 and 12 degrees of freedom.

TABLE 12.--Multiple Correlation Values of Combined Independent Variables Correlated with the Dependent Variable No. 17 (Supplies and Materials) Total Department Sample.

	No. Lab. Sections	Part-Time FTEF	No. of Courses	Doc. Majors	Lab. SCH	No. Grad Section	Total Head-Count Faculty	Total Analysis Results
Fall independent variables	32	68	26	57	51	33	66	
Multiple correlation (R)	.8353*	.8865*	.9295*	.9473*	.9535*	.9617*	.9660*	.96*
Increase in R contributed by each variable	.8353	.0512	.0430	.0178	.0062	.0082	.0043	--
Variance (R^2)	.6977	.7860	.8639	.8973	.9091	.9248	.9332	.93
Increase in R^2 contributed by each variable	.6977	.0983	.0079	.0034	.0118	.0151	.0084	--
Standard error of estimate (S)	$15,253	$12,940	$10,403	$ 9,114	$ 8,646	$ 7,934	$7,545	$7,545
Decline in S	--	$ 2,313	$ 2,537	$ 1,289	$ 468	$ 712	$ 389	--

*All independent variables in the analysis are individually significant at .05 level of confidence with an F test. Analysis of Variance for overall regression indicates total results are significant at .05 level of confidence with an F value of 111.73 with 7 and 56 degrees of freedom.

TABLE 13.--Multiple Correlation Values of Combined Independent Variables Correlated with the Dependent Variables No. 20 (Total Supplies and Services Less Supplies and Materials) Total Department Sample.

	Part-Time Faculty Head Count	No. Lab. Sections	Grad. Whtd. Ave. Sec. Size	Office Equip.	Total Analysis Results
Fall independent variables	65	32	36	9	
Multiple correlation (R)	.7841*	.8343*	.8565*	.8688*	.86*
Increase in R contributed by each variable	.7841	.0502	.0222	.0123	--
Variance (R^2)	.6148	.6960	.7336	.7548	.75
Increase in R^2 contributed by each variable	.6148	.0812	.0476	.0212	--
Standard error of estimate (S)	$4,168	$3,733	$3,523	$3,408	$3,408
Decline in S	--	$ 435	$ 210	$ 185	--

*All independent variables in the analysis are individually significant at .05 level of confidence with an F test. Analysis of Variance for overall regression indicates total results are significant at .05 level of confidence with an F value of 45.40 with 4 and 59 degrees of freedom.

TABLE 14.--Multiple Correlation Values of Combined Independent Variables Correlated with with Dependent Variable No. 10 (Travel) Total Department Sample.

	Total Classes Grad. SCH	Undergrad. Upper Div. Class Hrs.	Total No. Courses	Full-Time Inst.-Prof. Head Count	Upper Div. SCH	Total Analysis Results
Fall independent variables	53	28	26	64	46	
Multiple correlation (R)	.4579*	.5115*	.5556*	.5943*	.6345*	.63*
Increase in R contributed by each variable	--	.0536	.0441	.0387	.0402	--
Variance (R^2)	.2097	.2616	.3087	.3532	.4026	.40
Increase in R^2 contributed by each variable	--	.0519	.0471	.0445	.0494	--
Standard error of estimate (S)	$811	$791	$771	$752	$729	$729
Decline in S	--	$ 20	$ 20	$ 19	$ 23	--

*All independent variables in the analysis are individually significant at .05 level of confidence with an F test. Analysis of Variance for overall regression indicates total results are significant at .05 level of confidence with an F value of 7.81 with 5 and 58 degrees of freedom.

TABLE 15.--Multiple Correlation Values of Combined Independent Variables Correlated with the Dependent Variable No. 6 (Faculty Related Expenditures) Total Department Sample.

	Total Faculty Head-Count	Total Grad. Whtd. Ave. Sec. Size	Total Analysis Results
Fall independent variables	66	36	
Multiple correlation (R)	.8338*	.8468*	.8468*
Increase in R contributed by each variable	.8338	.0130	--
Variance (R^2)	.6952	.7171	.7171
Increase in R^2 contributed by each variable	.6952	.0219	--
Standard error of estimate (S)	$2,024	$1,965	$1,965
Decline in S	--	$ 139	--

*All independent variables in the analysis are individually significant at .05 level of confidence with an F test. Analysis of Variance for overall regression indicates total results are significant at .05 level of confidence with an F value of 77.31 with 2 and 61 degrees of freedom.

TABLE 16.--Multiple Correlation Values of Combined Independent Variables Correlated with the Dependent Variable No. 21 (Total Supplies and Services Less Supplies and Materials and Contractual Services) Total Department Sample.

	Total Head-Count Faculty	Grad. Whtd. Ave. Sec. Size	No. Lab. SCH	Total Analysis Results
Fall independent variables	66	36	51	
Multiple correlation (R)	.7686*	.7788*	.7937*	.79*
Increase in R contributed by each variable	.7686	.0102	.0149	--
Variance (R^2)	.5907	.6065	.6300	.63
Increase in R^2 contributed by each variable	.5907	.0158	.0235	--
Standard error of estimate (S)	$2,574	$2,544	$2,488	$2,488
Decline in S	--	$ 30	$ 56	--

*All independent variables in the analysis are individually significant at .05 level of confidence with an F test. Analysis of Variance for overall regression indicates total results are significant at .05 level of confidence with an F value of 55.08 with 3 and 60 degrees of freedom.

TABLE 17.--Multiple Correlation Value of Combined Independent Variables Correlated with the Dependent Variable No. 8 (Equipment Related Expenditures) Total Department Sample.

	No. Lab. Sections	Office Equip.	Grad. Whtd. Ave. Sec. Size	Lab. Whtd. Ave. Sec. Size	Total B Faculty	Total Analysis Results
Fall independent variables	32	9	36	34	74	
Multiple correlation (R)	.6948*	.7495*	.7764*	.8029*	.8180*	.81*
Increase in R contributed by each variable	.6948	.0547	.0269	.0265	.0151	--
Variance (R^2)	.4828	.5617	.6028	.6447	.6692	.66
Increase in R^2 contributed by each variable	.4828	.0789	.0411	.0419	.0245	--
Standard error of estimate (S)	$2,305	$2,139	$2,053	$1,958	$1,906	$1,906
Decline in S	--	$ 166	$ 86	$ 95	$ 52	--

*All independent variables in the analysis are individually significant at .05 level of confidence with an F test. Analysis of Variance for overall regression indicates total results are significant at .05 level of confidence with an F value of 26.76 with 4 and 59 degrees of freedom.

TABLE 18.--Multiple Regression Results for Total Department Sample Dependent Variable No. 4. (Total Supplies and Services)

No.	Independent Variables	Regression Coefficient	Std. Errors of Coefficients	Beta Weights	Standard Errors of Beta	F Values	Partial Correlation Coefficients
0	Constant	2856.86	2447.90	--	--	1.36	
32	No. Laboratory Sections	268.73	84.46	.28	.09	10.12*	.39
68	Part-time FTE Faculty	2400.75	328.91	.66	.09	53.27*	.69
26	No. of Courses	-464.84	197.37	-.20	.08	5.54*	-.30
51	No. of Laboratory SCH	11.53	2.59	.39	.08	19.71*	.51
33	No. of Graduate Sections	1842.87	414.75	.24	.05	19.73*	.51
57	No. Doctoral Majors	-338.84	110.12	-.24	.07	9.46*	-.38
64	Inst.-Prof. Head Count	-788.23	337.20	-.21	.09	5.46*	-.29

Multiple Correlation Coefficients

R^2	R	R Bar 2	R Bar
.93	.96	.92	.96

*Significant F values for coefficient at .05 level of confidence with 1 and 56 degrees of freedom.

TABLE 19.--Multiple Regression Results for Group 1 Departments Dependent Variable No. 4 (Total Supplies and Services)

No.	Independent Variables	Regression Coefficient	Std. Errors of Coefficients	Beta Weights	Standard Error of Betas	F Values	Partial Correlation Coefficients
0	Constant	3973.01	3442.05	--	--	1.53	
51	No. Laboratory Student Credit Hours	38.04	1.55	1.05	.04	596.19*	.99
36	Grad. Whtd Average Section Size	798.52	122.82	0.17	.02	42.26*	.88
26	No. of Courses	-984.76	323.46	-0.13	.04	9.26*	-.66

Multiple Regression Results

R^2	R	R Bar 2	R Bar
.99	.99	.98	.99

*Significant F values for coefficients at .05 level of confidence with 1 and 12 degrees of freedom.

TABLE 20.--Multiple Regression Results for Group 2 Departments Dependent Variable No. 4 (Total Supplies and Services)

No.	Independent Variables	Regression Coefficient	Std. Errors of Estimate	Beta Weights	Standard Errors of Betas	F Value	Partial Correlation Coefficients
0	Constant	-11230.15	5212.67	--	--	4.64*	
68	Part-time FTE Faculty	2960.46	597.33	.81	.16	24.56*	.80
32	No. Laboratory Sections	220.62	89.36	.40	.16	6.09*	.56

Multiple Correlation Coefficients

R^2	R	R Bar 2	R Bar
.66	.81	.61	.78

*Significant F values for coefficients at .05 level of confidence with 1 and 13 degees of freedom.

TABLE 21.--Multiple Regression Results for Group 3 Departments Dependent Variable No. 4. (Total Supplies and Services)

No.	Independent Variables	Regression Coefficient	Std. Errors of Coefficients	Beta Weights	Standard Error of Betas	F Values	Partial Correlation Coefficients
0	Constant	1269.98	929.36	--	--	1.86	
48	Doctoral SCH	6.10	1.23	.59	.12	24.46*	.84
47	Masters and G-P SCH	.55	.24	.18	.08	5.06*	.57
61	Majors in Dept. Courses	-8.92	1.12	-.90	.11	62.52*	-.92
37	Masters and G-P Class Hours	37.71	6.80	.50	.09	30.68*	.86
46	Upper Division SCH	0.36	.10	.52	.15	11.81*	.73

Multiple Correlation Coefficients

R^2	R	R Bar 2	R Bar
.96	.98	.94	.97

*Significant F values for coefficients at .05 level of confidence with 1 and 10 degrees of freedom.

TABLE 22.--Multiple Regression Results for Group 4 Departments Dependent Variable No. 4. (Total Supplies and Services)

No.	Independent Variable	Regression Coefficients	Std. Errors of Coefficients	Beta Weights	Standard Error of Betas	F Values	Partial Correlation Coefficients
0	Constant	-31.01	26.56	--	--	1.50	
69	Total FTE Faculty	177.01	52.35	.33	.09	11.43*	.69
27	Lower Division Class Hours	39.26	6.11	.53	.08	41.18*	.87
25	No. Graduate Sections	371.02	80.91	.31	.06	21.03*	.79

Multiple Correlation Coefficients

R^2	R	R Bar 2	R Bar
.96	.98	.95	.97

*Significant F values at .05 level of confidence with 1 and 12 degrees of freedom.

TABLE 23.--Multiple Regression Results for Total Department Sample Dependent Variable No. 17. (Supplies and Materials)

No.	Independent Variables	Regression Coefficient	Std. Errors of Coefficients	Beta Weights	Standard Errors of Betas	F Values	Partial Correlation Coefficients
0	Constant	-2583.22	2097.81	--	--	1.51	
32	No. Laboratory Sections	223.56	72.38	.28	.09	9.53*	.38
68	Part-time FTE Faculty	2156.00	281.87	.71	.09	58.50*	.71
26	No. of Courses	- 386.29	169.14	-.20	.08	5.21*	-.29
51	No. of Laboratory SCH	9.48	2.22	.38	.09	18.12*	.49
33	No. of Graduate Sections	1436.57	355.43	.23	.05	16.33*	.47
57	No. Doctoral Majors	-372.61	94.37	-.31	.08	15.58*	-.46
64	Inst.-Prof. Head Count	-672.59	299.98	-.21	.09	5.41*	-.29

Multiple Correlation Coefficients

R^2	R	R Bar 2	R Bar
.93	.96	.92	.96

*Significant F values for coefficients at .05 level of confidence with 1 and 56 degrees of freedom.

TABLE 24.--Multiple Regression Results for Total Department Sample Dependent Variable No. 20. (Total Supplies and Services Less Supplies and Materials)

No.	Independent Variables	Regression Coefficients	Std. Errors of Coefficient	Beta Weights	Standard Error of Betas	F Values	Partial Correlation Coefficients
0	Constant	2751.64	784.16	--	--	12.31*	
65	Part-Time Faculty Head Count	56.14	28.80	.24	.12	3.78*	.24
32	No. Laboratory Sections	72.92	17.02	.38	.09	18.35*	.48
36	Grad. Whtd. Average Section Size	126.65	38.56	.24	.07	10.78*	.39
9	Office Equipment	0.006	00.002	.25	.11	5.09*	.28

Multiple Correlation Coefficients

R^2	R	R Bar 2	R Bar
.75	.86	.73	.85

*Significant F values for coefficients at .05 level of confidence with 1 and 59 degrees of freedom.

TABLE 25.--Multiple Regression Results for Total Department Sample Dependent Variable No. 10. (Travel)

No.	Independent Variables	Regression Coefficient	Standard Error of Coefficients	Beta Weights	Standard Error of Betas	F Values	Partial Correlation Coefficients
0	Constant	1315.75	236.88	--	--	30.85*	
53	Total Class Graduate SCH	0.23	0.09	.32	.13	5.59*	.29
28	Under Division Class Hours	-0.15	.96	-.02	.17	0.02*	-.02
26	No. of Courses	-18.21	4.98	-1.07	.29	13.35*	-.43
64	Instr.-Prof. Head Count	94.74	32.26	.93	.31	8.62*	.35
46	Upper Division SCH	0.05	0.02	.40	.18	4.79*	.27

Multiple Correlation Results

R^2	R	R Bar 2	R Bar
.40	.63	.35	.59

*Significant F values for coefficients at .05 level of confidence with 1 and 58 degrees of freedom.

TABLE 26.--Multiple Regression Results for Total Department Sample Dependent Variable No. 6. (Faculty Related Expenditures)

No.	Independent Variables	Regression Coefficient	Std. Errors of Coefficient	Beta Weights	Standard Errors of Betas	F Values	Partial Correlation Coefficients
0	Constant	1221.93	490.13	--	--	6.21*	
66	Total Head Count Faculty	89.25	8.46	.77	.07	111.15*	.80
36	Grad. Whtd. Average Section Size	44.19	20.31	.15	.07	4.73*	.26

Multiple Correlation Coefficients

R^2	R	R Bar 2	R Bar
.71	.84	.70	.84

*Significant F values for coefficients at .05 level of confidence with 1 and 61 degrees of freedom.

TABLE 27.--Multiple Regression Results for Total Department Sample Dependent Variable No. 8. (Equipment Related Categories)

No.	Independent Variables	Regression Coefficients	Std. Errors of Coefficients	Beta Weights	Standard Error of Betas	F Values	Partial Correlation Coefficients
0	Constant	-882.08	591.59	--	--	2.22	
32	No. Laboratory Sections	39.01	9.92	.43	.11	15.45*	.45
9	Office Equipment	00.002	00.001	.15	.11	2.80*	.17
36	Grad. Whtd. Average Section Size	57.60	19.70	.23	.08	8.54*	.35
34	Laboratory Whtd. Average Section Size	72.93	22.76	.27	.08	10.26*	.38
74	Total B Faculty	60.16	29.03	.20	.09	4.29*	.26

Multiple Correlation Coefficients

R^2	R	R Bar 2	R Bar
.66	.81	.64	.80

*Significant F values for coefficients at .05 level of confidence with 1 and 58 degrees of freedom.

TABLE 28.--Multiple Regression Results for Total Department Sample Dependent Variable No. 21. (Total Supplies and Services Less Supplies and Material, and Contracted Services)

No.	Independent Variables	Regression Coefficient	Std. Errors of Coefficients	Beta Weights	Standard Errors of Betas	F Values	Partial Correlation Coefficients
0	Constant	1210.68	620.48	--	--	3.80*	
66	Total Head Count Faculty	75.14	13.40	.59	.10	31.43*	.58
36	Grad. Whtd. Average Section Size	61.60	27.75	.20	.09	4.92*	.27
51	No. Laboratory SCH	0.68	0.34	.19	.09	3.80*	.24

Multiple Correlation Coefficients

R^2	R	R Bar 2	R Bar
.63	.79	.61	.78

*Significant F values for coefficients at .05 level of confidence with 1 and 60 degrees of freedom.

TABLE 29.--Comparison of Multiple Regression Equation Residuals for Individual Departments Expressed as Percentages Above or Below the Actual Department Expenditure for the Specified Dependent Variable (Group 1 Departments).

	Var. 4 Equa.	Var. 17 Equa.	Var. 20 Equa.	Var. 10 Equa.	Var. 6 Equa.	Var. 21 Equa.	Var. 8 Equa.	Group 1 Sample Var. 4 Equa.	Equation Results
	Total Department Sample Equations								
Multiple correlation (R)	.96	.96	.86	.63	.84	.79	.81	.99	
Variance (R^2)	.93	.93	.75	.40	.71	.63	.66	.99	
	Residuals Above or Below Expenditures (percent)								
Physics and Astronomy	+56.6	+126.9	+30.2	- 15.7	+ 5.1	- 2.6	+109.3	- 9.1	5 Above, 3 Below
Botany and Plant Pathology	+17.8	+ 36.1	+22.4	+ 34.4	+35.7	+29.3	- 7.0	+ 3.9	7 Above, 1 Below
Chemistry	- 3.3	- 5.2	- 1.1	+ 9.4	- 8.6	- 5.3	- 3.2	- 0.2	1 Above, 7 Below
Entomology	- 5.8	+ 9.1	- 1.7	+480.6	-19.6	-25.3	+ 14.7	- 7.4	3 Above, 5 Below
Zoology	+61.6	+157.7	-26.7	+ 5.0	+24.7	+25.7	- 46.7	+21.0	6 Above, 2 Below
Physiology and Pharmacology	+ 4.7	+ 4.5	+ 6.8	+100.7	+ 9.9	+33.3	+ 8.3	+ 8.6	8 Above,
Microbiology	-33.2	- 27.0	-25.0	- 29.5	-28.5	-17.4	- 38.9	- 1.1	8 Below
Pathology	-24.2	- 77.3	+29.1	+429.0	-13.3	- 7.3	+266.7	-97.7	3 Above, 5 Below
Residual Range	- 3.3 to +61.6	- 77.3 to +157.7	- 1.1 to +29.1	- 15.7 to +480.0	-28.5 to +35.7	- 2.6 to +33.3	- 3.2 to +266.7	-97.7 to +21.0	

NOTE: Residuals are the difference between the actual and predicted expenditures for the various Supplies and Services Category. The percentages represent the extent to which the predicted value of a department's expenditures resulting from a regression equation is above (+) or below (-) the actual amount expended for the specified Supplies and Services Category. A negative (-) value indicates that the equation would give less funds to the department than it is currently receiving.

TABLE 30.--Comparison of Multiple Regression Equation Residuals for Individual Departments Expressed as Percentages Above or Below the Actual Department Expenditure for the Specified Dependent Variable (Group 2 Departments).

	Var. 4 Equa.	Var. 17 Equa.	Var. 20 Equa.	Var. 10 Equa.	Var. 6 Equa.	Var. 21 Equa.	Var. 8 Equa.	Group 2 Sample Var. 4 Equa.	Equation Results
	Total Department Sample Equations								
Multiple correlation (R)	.96	.96	.86	.63	.84	.79	.81	.81	
Variance (R^2)	.93	.93	.75	.40	.71	.63	.66	.66	
	Residuals Above or Below Expenditures (percent)								
Mechanical Eng.	-20.0	- 16.3	-40.9	- 53.3	- 46.4	- 50.0	- 43.4	-20.7	8 Below
Civil Eng.	+47.6	+ 23.7	+32.6	- 6.5	+ 3.4	+ 3.8	+ 35.8	+51.4	7 Above, 1 Below
Metallurgy, Mechanics and Materials Science	-32.5	- 83.2	- 1.3	-26.4	- 12.2	- 12.3	+ 36.2	-10.5	1 Above, 7 Below
Soil Science	+36.2	+119.7	- 2.3	+11.3	- 7.9	- 12.0	- 12.1	+14.9	4 Above, 4 Below
Food Science	-21.8	- 49.4	+23.5	- 5.7	- 21.1	- 25.7	+140.0	-10.6	2 Above, 6 Below
Horticulture	-36.2	+ 15.5	-28.1	-46.1	- 22.7	- 33.4	- 39.4	- 2.7	1 Above, 7 Below
Nursing	-14.2	- 32.3	-38.1	- 3.6	- 28.6	- 28.7	- 56.9	+16.5	1 Above, 7 Below
Foods and Nutrition	+ 5.0	- 39.4	+44.5	+147.6	+120.8	-138.6	- 40.6	+ 3.0	6 Above, 2 Below
Residual Range	-36.2 to +47.6	- 49.4 to +119.7	-40.9 to -32.6	- 53.3 to +147.6	- 46.4 to +120.8	- 50.0 to +138.6	- 56.9 to +140.0	-20.7 to +51.4	

NOTE: Residuals are the difference between the actual and predicted expenditures for the various Supplies and Services Category. The percentages represent the extent to which the predicted value of a department's expenditures resulting from a regression equation is above (+) or below (-) the actual amount expended for the specified Supplies and Services Category. A negative (-) value indicates that the equation would give less funds to the department than it is currently receiving.

TABLE 31.--Comparisons of Multiple Regression Equation Residuals for Individual Departments Expressed as Percentages Above or Below the Actual Department Expenditure for the Specified Dependent Variable (Group 3 Departments).

	Var. 4 Equa.	Var. 17 Equa.	Var. 20 Equa.	Var. 10 Equa.	Var. 6 Equa.	Var. 21 Equa.	Var. 8 Equa.	Group 3 Sample Var. 4 Equa.	Equation Results
	Total Department Sample Equations								
Multiple correlation (R)	.96	.96	.86	.63	.84	.79	.81	.98	
Variance (R^2)	.93	.93	.75	.40	.71	.63	.66	.96	
	Residuals Above or Below Expenditures (percent)								
English	- 81.9	- 300.4	+29.6	+130.5	+62.3	+80.9	+ 84.5	0.0	6 Above, 2 Below
History	+141.1	+ 274.9	+40.0	- 18.6	+56.1	+42.9	+159.0	- 8.0	6 Above, 2 Below
Philosophy	-179.0	-1150.9	+48.9	+ 72.7	+51.3	+57.3	- 73.0	+ 4.1	5 Above, 3 Below
Economics	+ 9.3	+ 47.5	-20.3	+ 0.1	-13.2	-16.9	+ 40.0	- 0.9	4 Above, 4 Below
Accounting and Finance	- 10.3	- 166.6	+49.0	- 11.5	+51.6	+28.5	+148.0	+15.5	5 Above, 3 Below
Political Science	- 51.7	- 78.6	-47.2	- 22.5	-27.2	-33.4	- 77.0	+ 3.3	1 Above, 7 Below
Social Work	- 21.8	- 79.4	+22.0	+ 5.1	- 3.4	- 8.7	+ 21.7	-10.4	3 Above, 5 Below
Sociology	- 35.7	- 85.0	- 7.3	- 39.1	-17.3	+19.0	- 63.1	- 3.1	1 Above, 7 Below
Residual Range	-179.0 to +141.1	-1150.9 to + 274.0	-47.2 to +48.9	- 39.1 to + 72.7	-27.2 to +62.3	-16.9 to +80.9	- 77.0 to +159.0	-10.4 to +15.5	

NOTE: Residuals are the difference between the actual and predicted expenditures for the various Supplies and Services Category. The percentages represent the extent to which the predicted value of a department's expenditures resulting from a regression equation is above (+) or below (-) the actual amount expended for the specified Supplies and Services Category. A negative (-) value indicates that the equation would give less funds to the department than it is currently receiving.

TABLE 32.--Comparison of Multiple Regression Equation Residuals for Individual Departments Expressed as Percentages Above or Below the Actual Departments Expenditure for the Specified Dependent Variable (Group 4 Departments).

	Var. 4 Equa.	Var. 17 Equa.	Var. 20 Equa.	Var. 10 Equa.	Var. 6 Equa.	Var. 21 Equa.	Var. 8 Equa.	Group 4 Sample Var. 4 Equa.	Equation Results
	Total Department Sample Equations								
Multiple correlation (R)	.96	.96	.86	.63	.84	.79	.81	.98	
Variance (R^2)	.93	.93	.75	.40	.71	.63	.66	.96	
	Residuals Above or Below Expenditures (percent)								
Urban Planning	- 3.9	- 13.1	- 25.2	- 12.7	- 14.0	- 44.2	+ 99.2	-19.4	1 Above, 7 Below
Art	+14.6	+ 75.7	+ 4.2	+ 15.6	- 7.4	+ 31.6	+ 51.1	+ 0.3	6 Above, 2 Below
Music	-58.0	- 33.5	- 16.7	- 7.6	- 1.3	- 1.2	- 21.4	- 0.6	8 Below
Textiles	+71.0	+115.4	+ 87.5	+ 12.1	+114.5	+135.8	+ 32.5	- 5.9	7 Above, 1 Below
Geography	+62.5	+ 59.8	+22.5	- 73.3	+ 1.9	- 1.3	+ 57.9	+10.5	6 Above, 2 Below
Psychology	+16.2	+ 70.6	- 5.2	+ 25.7	+ 1.3	+ 17.8	+ 22.2	+ 1.1	7 Above, 1 Below
Journalism	+76.3	- 8.4	+ 52.8	- 10.3	+ 2.6	+ 11.9	+151.6	+13.4	6 Above, 2 Below
Business Law	+13.5	- 87.9	+102.0	+109.3	+116.6	+156.2	+155.8	+ 9.4	7 Above, 1 Below
Residual Range	-58.0 to +76.3	- 87.9 to +115.4	- 25.2 to +102.0	- 73.3 to +109.3	- 14.0 to +116.6	- 44.2 to +156.2	- 21.4 to +155.8	-19.4 to +13.4	

NOTE: Residuals are the difference between the actual and predicted expenditures for the various Supplies and Services Category. The percentages represent the extent to which the predicted value of a department's expenditures resulting from a regression equation is above (+) or below (-) the actual amount expended for the specified Supplies and Services Category. A negative (-) value indicates that the equation would give less funds to the department than it is currently receiving.

CHAPTER VI

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS FOR FUTURE RESEARCH

Providing equitable and adequate funds for Supplies and Services functions requires that information concerning those expenditures be analyzed as effectively as possible. An evaluation of current expenditures compared with factors that might reasonably be expected to use those expenditures should provide administrators a means of evaluating and classifying problem areas. To evaluate the situation in Supplies and Services requires a willingness to experiment in the procedures used for evaluation. Typically Supplies and Services has not been extensively scrutinized by this University although this budget category has posed some of the most difficult problems of funding and hence evaluation.

Evaluation of this budget category has generally failed to receive much attention as evidenced by lack of literature on the subject. State systems of higher education have done the most with regard to Supplies and Services but typically their attention has been on funding for the future under a standardized ratio or formula. Obviously the issue not faced by the state systems is the question of

evaluating their practice to a greater extent than is reported in the literature. Also at issue is the tendency to select one factor or measure of need and then utilize this as a guide to budget planning and evaluation even where there is not adequate justification for this factor being used.

Correlation and regression analysis, while used extensively in industry as a tool of budget evaluation, has not been effectively utilized in higher education budget analysis or at least it has not been reported in the literature. Correlation and regression analysis provides a tool of analysis which is suitable for instances where volume relationships are important and where no single measure of volume or need has been established as a totally appropriate evaluation criterion.

Correlation and regression analysis in this study has been applied to a sample of academic departments with a range of similar, and yet different, needs for Supplies and Services. Dependent variables and independent variables have been chosen for analysis with the dependent variables being various Supplies and Services expenditure categories. Independent variables are data collected by various University agencies which have commonly been used to measure workload in academic departments. Four department subgroups of the total sample and the total department sample have been analyzed using total Supplies and Services

expenditures as the dependent variable. Further analysis has involved utilization of the total department sample with various subcategories of total Supplies and Services serving as dependent variables. The results have focused on the independent variables which were significantly correlated with the various dependent variables. These results have included the extent of correlation, the different variables which were correlated, the strength of such variables in a multiple correlation, and finally the ability of various regression equations to predict actual expenditures for the various departments in the sample.

Summary of Findings

1. There are statistically significant high correlations between the various dependent variables and the independent variables suggesting that expenditures do have some distinct volume relationship to departmental use factors.

2. The utilization of multiple correlation analysis generally improved the level of correlations but the pattern of key variables set in simple correlations did not vary greatly in multiple relationships.

3. The multiple correlations did, in most cases, give attention to various independent variables but laboratory measures and faculty measures were predominant.

4. Head count faculty measures usually exceeded in level of correlation the FTE faculty counts suggesting that general fund Supplies and Services expenditures are not limited to general fund faculty.

5. Department groups had very high correlations when total expenditures were analyzed, with Groups 1 and 4 being the highest and most valid. Group 3 had high correlations but generally invalid independent variables. Therefore this group deserves attention beyond this study.

6. Subcategories of total Supplies and Services showed generally high correlations with expected results. Again FTE faculty did not show up as well as the faculty head count measures but in some cases the differences were not significant.

7. Travel, Variable 10, had the worst results of the subcategories with no major faculty variable being correlated with these expenditures.

8. The "general" equation for all departments and all expenditures discriminates against non-laboratory departments in allocations due to the extensive influence of laboratory measures.

9. The best equations for predicting expenditures relative to actual expenditures were the special department group equations rather than the total or "general" equation and/or the equations for the subcategories.

10. The best subcategory equation was Variable 6 while Groups 1 and 4 did the best jobs for the groups.

11. Volume alone seems insufficient to explain expenditures. Those expenditures directly related to laboratories (Supplies and Materials) may be justified in deviation from volume because of differential cost factors not measured in this study; however, volume variations for other department needs seem fairly defensible. In that case, results of subcategory equations 6, 20 and 21 need attention because they show departments with expenditures extensively above or below volume measures.

12. The results suggest a laboratory pattern with Groups 1 and 2 being most closely represented by this pattern but the results for the subcategories suggest that other functions have also been considered.

Conclusions

The pattern of departmental expenditures generally has followed a fairly rational basis of volume and need with certain notable exceptions. It is gratifying to know that the expenditures in academic departments do bear some identifiable relationship to factors which are believed to use those expenditures.

The laboratory influence is overwhelming to such an extent that funds may be derived for departments based on laboratory needs, but they are extensive enough to allow

more than adequate funding for all other categories. This statement is difficult to absolutely document, but the analysis seems to point to a laboratory syndrome which indicates that as you move away from the basic science, laboratory departments, and the applied science laboratory departments, the results are either: (1) low correlations, or as in the case of Group 3, high invalid correlations, with insufficient funding or (2) highly correlated but greatly under-funded departments such as Group 4. This conclusion seems substantiated in one major way. The results for the subcategory Supplies and Materials (primarily a laboratory subcategory) duplicate the total equation. Therefore to a very great extent the total equation is really an equation for laboratory needs much more than it is an equation for all needs and all departments.

The laboratory influence of Group 1 or Variable 17 should not diminish the exceptional overall correlations found in the various subcategories of Supplies and Services. Whatever the cause, the fact that correlations were significantly high between dependent and independent variables should serve as a focal point for improvement in a situation that is not perfect but is not at the same time hopeless or totally unrealistic.

Recommendations for Further Study

Several recommendations seem feasible as a result of this study. Further investigation of cost problems for certain departments and certain categories seems required. Volume alone is not sufficient to adequately explain how or why certain departments expend funds at the level that they do. Certainly the cost of certain materials poses a special problem not answered but raised by this study. A second study should be concerned with volume as a measure of need if we are to know to what extent a department's needs are adequately measured by volume considerations. In what cases is volume a good measure and in what cases is it unable to adequately discriminate the extent or degree of need? This applies to all budgets and not alone to Supplies and Services.

A study of the feasibility and desirability of changing the current Supplies and Services categories so that the categories will better reflect the direct use of these funds. The more closely expenditures are identified with actual users the better the cost data and the better the evaluation process. For example, at least two major functions are identifiable in Supplies and Services. First, those expenditures which are directly related to teaching or the instructional process. Laboratories are the major factors in this area but there are also expenditures directly related to the teaching function which are not

laboratory related. At the present time several subcategories of Supplies and Services are related to teaching and/or the operation of laboratories. There is no single comprehensive measure of laboratory costs that is readily available for the purpose of evaluating and managing these costs. For example, the subcategory Supplies and Materials contains both laboratory as well as non-laboratory expenditures. Furthermore the non-laboratory expenditures also contain general office or clerical supplies and those materials are related to teaching functions which are non-laboratory.

Second, there are expenditures directly related to faculty. These are also contained in several categories so that there is no measure of how much it takes to add one faculty member to a department. Travel is directly related to both ranked and unranked faculty and so is Telephone, Telegraph and Postage. Part of the clerical outlay contained in Supplies and Materials and certainly the expenditures for Books and Magazine Subscriptions are primarily faculty related but neither these categories nor the preceding categories are easily or distinctly developed in a simple measure of faculty cost.

The point being made is that a better system of identifying direct costs in Supplies and Services is a worthwhile consideration. Quite obviously the way in which a department chairman chooses to spend his funds

would still be his prerogative but his basis for requesting funds would be greatly facilitated. Also the evaluation of that need could be far better performed than is currently the case. So long as certain departments can exert leverage for funds based on laboratory needs, which are not easily identifiable, the issue of adequate and equitable funding for all departments will be unresolved.

Other possible studies would include a personal evaluation of the outlay of funds for Supplies and Services over the past two or three years by department chairmen. Such a study has been initiated and hopefully the results will help clarify some of the conclusions of this dissertation. Finally a study could focus on trying to determine the influence that non-general fund and general fund resources have on one another. The issue may not be worth the expense of investigation but until the exact influence is known this University seems justified in imposing an overhead charge on non-general fund contracts.

APPENDICES

APPENDIX A

INDEPENDENT AND DEPENDENT VARIABLES USED IN CORRELATION AND REGRESSION ANALYSIS OF SUPPLIES AND SERVICES

The following variables are those items which are collected regularly by various Michigan State University Offices (including the Office of Institutional Research) for the purpose of providing data about the operations of the University academic departments.

The data fall into four broad groups and are concerned with general fund operations only. The groups are (1) dependent variables including total Supplies and Services expenditures and the subcategories of that total; (2) independent variables including (a) faculty data; (b) student population data; and (c) general department data.

The source of the data is the Office of Institutional Research quarterly and yearly reports, as well as the Annual Financial Report and "Object Class Report" of the University Business Office.

I. Fiscal Year Expenditure Data from Michigan State University Annual Financial Report and "Object Class Report."

	Variable No.	
A.	(1)	Total Budget Expenditure.
B.	(2)	Salaries.
C.	(3)	Labor.
D.	(5)	Equipment.

E. Supplies and Services Expenditures (Dependent Variables).

1.	(10)	Travel (020); all travel categories treated as one.
2.	(11)	Postage, Telephone and Telegraph (040).
3.	(7)	Utilities, Rentals and Leases (050); three combined categories.
4.	(12)	Printing and Related Expenses, and Bookbinding (060); two combined categories.
5.	(13)	Physical Plant Department Services (070).
6.	(14)	Contractual Services (071).
7.	(15)	Other Contractual Services (072).
8.	(17)	General Supplies and Materials (082).
9.	(19)	Books and Magazine Subscriptions (180).

F. Categories for analysis.

1.	(4)	Total Supplies and Services
2.	(20)	Total Supplies and Services less Supplies and Materials.
3.	(17)	Supplies and Materials (082).
4.	(10)	Travel.
5.	(6)	Faculty-Related Subcategory:--Travel (020's), Postage, Telephone, and Telegraph (040), Printing and Related Expenses (060), Other Contractual Services (072), and Books and Magazines Subscriptions (180).
6.	(8)	Equipment-Related Categories including Physical Plant Department Services (070), Contractual Services (071); and Utilities, Rentals, and Leases (050).

II. General Department Data from Office of Institutional Research quarterly reports.

	Variable No.	
A.		Number of Courses Taught from Volume of Instruction.
1.	(22) (78)	Undergraduate courses for fall term and full year.
2.	(23)	Master and Graduate-Professional Courses for fall term
3.	(24)	Doctoral Courses for fall term.
4.	(25) (79)	Graduate Courses for fall term and full year.
5.	(26) (80)	Total Number Courses taught for fall term and full year.
B.		Class Hours from Volume of Instruction.
1.	(27) (81)	Lower Division Class Hours for fall term and full year.
2.	(28) (82)	Upper Division Class Hours for fall term and full year.
3.	(37)	Master and Graduate-Professional Class Hours for fall term.
4.	(29)	Doctoral Class Hours for fall term.
5.	(30)	Grand Total Class Hours for fall term.
6.	(83)	Undergraduate Total Class Hours for full year.
7.	(84)	Graduate Total Class Hours for full year.
C.		Number Sections Taught from Section Size Analysis.
1.	(31) (85)	Number Undergraduate Non-Laboratory Sections for fall term and full year.
2.	(32) (86)	Number of Undergraduate Sections for fall term and full year.
3.	(33) (87)	Number Graduate Sections for fall term and full year.
4.	(88)	Total Number Sections for full year.

D. Weighted Average Section Size from Section Size Analysis for fall term only.

1. (34) Laboratory.
2. (35) Total Undergraduate.
3. (36) Total Graduate.

E. Equipment Inventory (Full Year).

1. (9) Clerical Equipment, Scientific Equipment and Kitchen Equipment combined.

III. Faculty and Staff Data from July 1 position counts, and fall quarter Teaching Load and Time Distribution Analysis.

A. Faculty Head Count from fall quarter Teaching Load and Time Distribution Analysis.

1. (64) Full Time Faculty (Instructor-Professor).
2. (65) Part-time Faculty.
3. (66) Total Faculty and Other.

B. Full Time Equivalent Faculty (FTEF) from Teaching Load and Time Distribution Analysis.

1. (67) Full Time (Instructor-Professor).
2. (68) Part-time FTE Faculty.
3. (69) Total FTE Faculty.

C. Faculty Time Distribution from Teaching Load and Time Distribution Analysis.

1. (70) Per cent of faculty time devoted to Instruction.
2. (71) Per cent of faculty time devoted to Research.

D. A & B Faculty in Full Time Equivalent Faculty (FTE) Position Counts.

1. (73) A Faculty (Instructor-Professor).
2. (74) B Faculty (Grad. Asst., Asst. Instructors, etc.).
3. (72) Total A & B Faculty.

E. (75) Total Non-General Fund Faculty (Derived by subtracting Total Full Time Equivalent Faculty from Total Faculty Head Count).

F. (76) Professor and Associate Professors (FTE).

G. (77) Assistant Professors and Instructors (FTE).

IV. Student Data from Office of Institutional Research quarterly reports and the OIR "Brown Book."

Variable No.

A. Student Credit Hours (SCH) from Volume of Instruction Analysis.

1. (45) Lower Division Student Credit Hours for fall term
   (38) and full year.
2. (46) Upper Division Student Credit Hours for fall term
   (39) and full year.
3. (40) Undergraduate Student Credit Hours for the full year.
4. (47) Master and Graduate-Professional for fall term
   (41) and full year.
5. (48) Doctoral Student Credit Hours for fall term
   (42) and full year.
6. (43) Graduate Student Credit Hours for full year.
7. (49) Grand Total Student Credit Hours for fall term
   (44) and full year.

B. Number of Student Credit Hours by Type of Section from Volume of Instruction Analysis.

1. (50) Lecture and Recitation Student Credit Hours for fall term
   (89) and full year.
2. (51) Laboratory Student Credit for fall term
   (90) and full year.
3. (52) Total Number Undergraduate Section Student Credit Hours for fall term.
4. (53) Total Number Graduate Section Student Credit Hours for fall term
   (91) and full year.
5. (54) Graduate Independent Variable Student Credit Hours for fall term
   (92) and full year.

C. Number of Majors from OIR "Brown Book."

1. (58) Undergraduate Majors.
2. (56) Master Level Majors.
3. (57) Doctoral Level Majors.
4. (55) Grand Total.

D. Number Majors and Non-Majors Taking Courses Offered by Academic Departments from Course Enrollments by Majors, Curriculum, Class Level and Sex.

1. Undergraduate
   (59) a. Majors.
   (60) b. Total (Majors and Non-Majors).
2. Combined Undergraduate and Graduate.
   (61) a. Majors.
   (62) b. Non-Majors (Services).
   (63) c. Total.

APPENDIX B

SUPPLIES AND SERVICES SUBCATEGORIES

(DEPENDENT VARIABLES)

Total List of Supplies and Services Subcategories from Which Dependent Variables Were Selected Taken from the Michigan State University Manual of Business Procedures

020--Travel in State:

Includes transportation of persons, lodging, and subsistence while in an authorized travel status, and other expenses incidental to travel which are to be paid by the University, as follows:

a. The cost of rail, air or bus tickets and tokens when travel is performed by a commercial carrier; mileage allowance granted when traveling by private conveyance or a rented car.

b. Subsistence including reimbursement for food and lodging.

c. Incidental travel expenses including telephone, telegraph, taxi fares, registration fees at conventions, etc.

021--Travel within the Home Community Area:

Mileage allowance only when authorized by the Dean.

022--Travel Out-of-State:

Includes transportation of persons, lodging, subsistence while in an authorized travel status, and other expenses incidental to travel which are to be paid by the University.

023--Travel Out-of-State

Includes transportation only.

024--Travel Interview for Positions:

Includes first-class transportation and normal expenses.

025--Travel--Non-University Employee: (Excluded from study)

Includes first-class transportation and normal expenses.

026--Travel Overseas:

Includes travel expenses as authorized by the University.

027--Team Travel: (Excluded from study)

030--Transportation of Things:

Does not include transportation on equipment classified 090.

040--Postage, Telephone & Telegraph, as follows:

a. All postage, telephone and telegraph services.

b. Switchboard service charges and telephone installation cost.

c. Leased-wire for Extension Radio.

d. Purchase of stamped envelopes.

051--Utilities:

Electricity, gas, water and steam.

052--Rentals:

a. Monetary payment for the right of possession and use of land, structures, and equipment owned by another, the possession of which is to be relinquished at a future date.

b. Charges for purchase rental agreements. (Under such agreements, until the title to the equipment is acquired, payments should be classified as rentals.)

c. Post Office Box Rentals; also storage.

053--Leases:

This code is to be used only where a 10% of the entire cost of equipment is charged on a yearly basis.

061--Printing & Related Expenses:

Cost of all contractual services for the printing of

a. Books, pamphlets, documents, and other publications.

b. University catalogs, bulletins, reports, student publications, technical bulletins.

c. Engravings, cuts, half-tones, zinc etcings, zinc linecuts, and art work for printed matter.

d. Programs, athletic and other.

062--Bookbinding & Misc. Small Printing Not for Publication:

Printing of tickets.

070--Physical Plant Department Services Only

071--Contractual Services:

a. Repairs and maintenance to equipment, including maintenance contracts.

b. Photographing, developing, engraving and blue-printing.

c. Multigraphing and mimeographing work if performed by a vendor.

d. Entertainers or entertainment by contract.

e. Entrance fees, membership dues, press news service.

f. Ambulance and taxi services; hospitalization and any work performed by a business establishment.

g. Commissions, fees, etc., for special and miscellaneous services rendered by others.

h. Guarantees.

i. State News delivery

j. Registration of animals.

k. Wiping cloths rental service.

l. Advertising and publication notices.

m. Any contractual service not otherwise classified.

072--Other Contractual Services:

a. Alterations, repairs and maintenance to buildings which are not capital improvements.

b. Professional services and physical examinations.

c. Honoraria.

d. Insurance and surety bonds.

e. Laundry and dry cleaning.

f. Payment of insurance premiums carried on retired University employees.

082--General Supplies and Materials:

All commodities which are ordinarily consumed or expended within a comparatively short length of time; or converted into the process, construction, and manufacture of equipment; or form a minor part of it.

a. Glassware for laboratories.

b. Office supplies.

c. Chemicals, surgical and medical supplies.

d. Fuels, such as coal, wood, petroleum, or oil used in cooking, heating and generating power.

e. Provisions, food and beverages for human consumption.

f. Forage and stable supplies; food used for livestock and small animals; also bedding, horseshoes, collar pads, etc.

g. Parts for the repair of equipment and machinery.

h. Press clippings.

i. Carpeting, drapes and venetian blinds.

j. Furnaces, hot-water heaters, sinks, etc., which are permanently attached to the building.

k. Rope and garden hose.

l. Small tools.

180--Books and Magazine Subscriptions:

All books and magazine subscriptions purchased by the University except those for resale.

APPENDIX C

"STANDARDIZED" USE VARIABLE COMBINATIONS

(INDEPENDENT VARIABLES)

Each combination or variation in grouping of departments or in the use of different dependent variables (budgets) was analyzed with the same set of sixteen independent variable (use factors) combinations. By using a "standardized" set of independent variables the analysis with the LSADD routine selected the highest significant multiple correlation combination for each dependent variable. The following sixteen variable combinations include fourteen a priori selected sets which appear related to the various dependent variables. Two combinations, one for fall and the other for the total year, include all important independent variables in the study. This procedure insures impartial analysis of the dependent-independent relationship.

Supplies and Services Independent Variable Combinations

These sixteen variable combinations represent variables which showed a definite relationship to dependent variables in preliminary data analysis as well as two combinations which cover all important independent variables in the study. These combinations were processed on LSADD routines and then the significant results were utilized in the LS routine.

1. Fall Quarter Independent Variables--Variables No. 9, 22, 24...28, 30...36, 45...53, 57, 61, 62, 64...69, 71...74.

   9 (office and scientific equipment inventory), 22 (No. of undergraduate courses), 24 (No. of doctoral courses), 25 (No. of graduate courses), 26 (total No. of courses), 27 (lower division class hours), 28 (upper division class hours), 30 (grand total class hours), 31 (No. non-lab sections), 32 (No. lab sections), 33 (No. grad. sections), 34 (lab whtd. ave. sec. size), 35 (total undergraduate whtd. ave. sec. size), 36 (total grad. whtd. ave. sec. size), 45 (lower div. SCH), 46 (upper div. SCH), 47 (Master and graduate-professional SCH), 48 (doctoral SCH), 49 (total SCH), 50 (lecture and recitation SCH), 51 (laboratory SCH), 52 (total classes undergraduate SCH), 53 (total classes grad. SCH), 57 (No. of doctoral SCH), 61 (total undergraduate and grad. majors taking dept.

courses) 62 (No. undergraduates and grad. non-majors taking dept. courses), 64 (full-time instructor-professor head count), 65 (part-time faculty head count), 66 (total faculty and other head count), 67 (full-time instructor-professor FTE), 68 (part-time faculty FTE), 69 (total FTE), 71 (per cent time devoted to research), 72 (total A + B faculty count), 73 (total A faculty, instructor-professor), 74 (total B faculty; grad. asst., asst. instructors).

2. Total Year Independent Variables--Variables No. 9, 38...44, 57, 61, 62, 64...69, 71...74, 78...92.

9 (office and scientific equipment inventory), 38 (lower div. SCH), 39 (upper div. SCH), 40 (undergraduate total SCH), 41 (masters and graduate-professional SCH), 42 (doctoral SCH), 43 (grad. total SCH), 44 (total SCH), 57 (doctoral majors), 61 (total undergraduate and grad. majors taking dept. courses), 62 (No. undergraduate and grad. non-majors taking dept. courses), 64 (full-time instructor-professor head count), 65 (part-time faculty head count), 66 (total faculty and other head count), 67 (full-time instructor-professor FTE), 68 (part-time faculty FTE), 69 (total FTE), 71 (per cent time devoted to research), 72 (total A + B faculty count), 73 (total A faculty, instructor-professor), 74 (total B faculty; grad. asst., asst. instructors), 78 (total No. undergrad

courses), 79 (No. grad. courses), 80 (total no. courses), 81 (lower div. class hours), 82 (upper div. class hours), 83 (total undergraduate courses), 84 (grad. class hours), 85 (No. non-lab sections, U. G.), 86 (No. lab sections, U. G.), 87 (No. grad. sections), 88 (total No. sections, classes), 89 (No. non-lab SCH), 90 (laboratory SCH), 91 (grad. classes SCH), 92 (grad. ind.-var. SCH).

3. Independent variables--Variables No. 49, 51, 69.
   49 (total fall SCH), 51 (lab SCH), 69 (total FTE faculty).
4. Independent variables--Variables No. 24, 45, 49, 51, 68, 69.
   24 (No. doctoral courses), 45 (fall lower div. SCH), 49 (total fall SCH), 51 (laboratory SCH), 68 (part-time FTE), 69 (total FTE faculty).
5. Independent variables--Variables No. 51, 57, 61, 69.
   51 (lab SCH), 57 (No. doctoral majors), 61 (No. majors taking department courses), 69 (total FTE faculty.
6. Independent variables--Variables No. 47, 51, 68.
   47 (masters and graduate-professional SCH), 51 (lab. SCH), 68 (part-time FTE).
7. Independent variables--Variables No. 36, 51, 68.
   36 (total grad. whtd. ave. sec. Size), 51 (lab SCH), 68 (part-time FTE).

8. Independent variables--Variables No. 36, 51, 66.
   36 (total grad. whtd. ave. sec. size), 51 (lab SCH), 66 (total faculty and other head count).
9. Independent variables--Variable No. 32, 47, 68.
   32 (No. lab sections), 47 (masters and graduate-professional SCH), 68 (part-time FTE).
10. Independent variables--Variables No. 32, 35, 51, 57.
    32 (No. lab. sections), 35 (total U. G. whtd. ave. sec. size), 51 (lab SCH), 57 (No. doctoral majors).
11. Independent variables--Variables No. 28, 32, 65, 68.
    28 (upper div. class hours), 32 (No. lab sections), 65 (part-time faculty, head count), 68 (part-time FTE).
12. Independent variables--Variables No. 30, 35, 69.
    30 (total class hours), 35 (total undergraduate whtd. ave. sec. size), 69 (total FTE faculty).
13. Independent variables--Variables No. 31...33, 35, 51.
    31 (Non-lab sections), 32 (No. lab section), 33 (No. grad. sections), 35 (total undergraduate whtd. ave. sec. size), 51 (lab SCH).
14. Independent variables--Variables No. 32, 35, 69.
    32 (No. lab sections), 35 (total undergraduate whtd. ave. sec. size), 69 (total faculty FTE).
15. Independent variables--Variables No. 22, 32, 51, 57, 68.
    22 (total U. G. courses), 32 (No. lab sections), 51 (lab SCH), 57 (No. doctoral majors), 68 (part-time FTE).
16. Independent Variables--Variable No. 35, 49, 73.
    35 (total undergraduate whtd. ave. sec. size), 49 (total fall SCH), 73 (total A faculty).

APPENDIX D

VARIABLES FOR LS ROUTINE ANALYSIS

The following variables were those variables which were selected as significantly related to the dependent variables based upon analysis results of the LSADD routine. Of the sixteen variable combinations used in the LSADD routine there were obvious duplications. Results as shown here are the best results of the analysis with a minimum of duplication. These results were re-run on the LS routine for three reasons: (1) as a check on LSADD results; (2) as a means of checking the effect of the best variable combination for the entire sample when applied to individual subgroups and subcategories; (3) as a means of developing regression results for the study, i.e., the LSADD routine does not go beyond multiple correlation results.

Variables from LSADD Routines for Use on LS Routine

Dependent Variable No. 4; Total Sample

Independent Variables: 86, 68, 80, 57, 84,
32, 68, 26, 51, 33, 57, 64
68, 51, 69, 49

Dependent Variable No. 4; Group 1 departments

Independent Variables: 90, 39, 41, 79
51, 36, 26

Dependent Variable No. 4; Group 2 departments

Independent Variables: 68, 32

Dependent Variable No. 4: Group 3 departments

Independent Variables: 42, 41, 61, 84, 39
48, 35, 47

Dependent Variable No. 4; Group 4 departments

Independent Variables: 69, 81, 79
69, 27, 25

Dependent Variables 17; Total Sample

Independent Variables: 86, 68, 80, 57
32, 68, 26, 57, 51,33,66,9,36,62
32, 68, 22, 57, 51

Dependent Variable 20; Total Sample

Independent Variables: 65, 86
66, 32, 36, 9

Dependent Variable 10; Total Sample

Independent Variables: 91, 82, 80, 64, 39
53, 28, 26, 64, 46

Dependent Variable 6; Total Sample

Independent Variables: 65, 84, 9, 43
66, 36

Dependent Variable 8; Total Sample

Independent Variables: 86, 9
32, 9, 36, 34, 74
68, 49, 51

Dependent Variable 21; Total Sample

Independent Variables: 65, 86
65, 32, 36
66

APPENDIX E

SAMPLE OF 32 MICHIGAN STATE UNIVERSITY ACADEMIC DEPARTMENTS FROM THE TWO FISCAL YEARS 1964-1965 AND 1965-1966 (N = 64) FOR THE SUPPLIES AND SERVICES ANALYSIS

I. Organized by Type of Department

A. Laboratory Science departments; Basic Disciplines from Life and Physical Sciences; 8 Departments (Group 1)

1. Physics and Astronomy--Natural Science
2. Botany and Plant Pathology--Natural Science
3. Chemistry--Natural Science
4. Entomology--Natural Science
5. Zoology--Natural Science
6. Physiology and Pharmacology--Veterinary Medicine
7. Microbiology--Veterinary Medicine
8. Pathology--Veterinary Medicine

B. Laboratory Science Departments; Applied Disciplines from Life and Physical Sciences; 8 Departments (Group 2)

1. Mechanical Engineering--Engineering
2. Civil Engineering--Engineering
3. Metallurgy, Mechanics and Material Science (M,M&M)--Engineering
4. Soil Science--Agriculture
5. Food Science--Agriculture
6. Horticulture--Agriculture
7. Nursing--Natural Science
8. Foods and Nutrition--Home Economics

C. Non-laboratory Science; Basic and Applied Disciplines from the Social Sciences and Humanities; 8 Departments (Group 3)

1. English--Arts and Letters
2. History--Arts and Letters
3. Philosophy--Arts and Letters
4. Economics--Business
5. Accounting and Financial Administration (AFA)--Business
6. Political Science--Social Science
7. Social Work--Social Science
8. Sociology--Social Science

D. Laboratory Type Departments; Basic and Applied Disciplines from the Social Sciences and Humanities; 8 Departments (Group 4)

1. Urban Planning and Landscape Architecture--Social Science
2. Art--Arts and Letters
3. Music--Arts and Letters
4. Textiles, Clothing and Related Arts--Home Economics
5. Geography--Social Science
6. Psychology--Social Science
7. Business Law, Insurance and Office Administration--Business
8. Journalism--Communication Arts

II. Organized by Size of Department (This was not a part of the analysis scheme but it is intended to show the general range in size reflected in these departments).

A. Small Departments; Average Undergraduate SCH of 3565 for 1964-1965; 10 Departments

1. Entomology--Natural Science (Group 1)
2. Physiology and Pharmacology--(Veterinary Medicine (Group 1)
3. Pathology--Veterinary Medicine (Group 1)
4. Mechanical Engineering (Group 2)
5. Civil Engineering--Engineering (Group 2)
6. Metallurgy, Mechanics, and Material Science (M,M&M)--Engineering (Group 2)
7. Soil Science--Agriculture (Group 2)
8. Food Science--Agriculture (Group 2)
9. Horticulture--Agriculture (Group 2)
10. Nursing--Natural Science (Group 2)

B. Intermediate Departments; Average Undergraduate SCH of 10,980 for 1964-1965; 12 Departments

1. Physics and Astronomy--Natural Science (Group 1)
2. Botany and Plant Pathology--Natural Science (Group 1)
3. Zoology--Natural Science (Group 1)
4. Microbiology--Veterinary Medicine (Group 1)
5. Foods and Nutrition--Home Economics (Group 2)
6. Philosophy--Arts and Letters (Group 3)
7. Social Work--Social Science (Group 3)
8. Urban Planning and Landscape Architecture--Social Science (Group 4)

9. Music--Arts and Letters (Group 4)
10. Textiles, Clothing and Related Arts--Home Economics (Group 4)
11. Geography--Social Science (Group 4)
12. Business Law, Insurance, and Office Administration--Business (Group 4)

C. Large Departments Average Undergraduate SCH of 34,438 for 1964-1965; 10 Departments

1. Chemistry--Natural Science (Group 1)
2. English--Arts and Letters (Group 3)
3. History--Arts and Letters (Group 3)
4. Economics--Business (Group 3)
5. Accounting and Financial Administration--Business (Group 3)
6. Political Science--Social Science (Group 3)
7. Art--Arts and Letters (Group 4)
8. Psychology--Social Science (Group 4)
9. Sociology--Social Science (Group 3)

APPENDIX F

SIMPLE CORRELATION RESULTS FOR SUBCATEGORY DEPENDENT VARIABLES

TABLE 33.--Simple Correlation of Independent Variables with the Dependent Variable No. 17 (Total Supplies and Materials) Total Department Sample.

No.	Independent Variable	Simple Correlation	No.	Independent Variable	Simple Correlation
32	No. Laboratory Sec.	.83*	76	Prof., Assoc. Prof.	.18
68	Part-Time FTEF	.78*	54	Grad. Indep. Var. SCH	.17
51	Laboratory SCH	.76*	29	Doctoral Class Hours	.16
9	Office Equipment	.70*	34	Laboratory Weighted Average Section Size	.16
65	Part-Time Faculty Head Count	.66*	50	Lec. & Rec. SCH	.16
27	Lower Division Class Hours	.65*	56	No. of Masters Majors	.16
66	Total Head Count	.65*	77	Asst. Prof., Instr.	.14
74	Total B Faculty	.62*	61	Total Majors in Department Courses	.11
30	Total Class Hours	.59*	31	No. Non-Laboratory Sec.	.10
69	Total FTEF	.58*	33	No. Graduate Section	.09
45	Lower Division SCH	.49*	53	Total Classes Grad. SCH	.09
28	Upper Division Class Hours	.45*	73	Total A Faculty	.08
24	No. of Doctoral Courses	.42*	26	Total Number of Courses	.07
57	No. of Doctoral Majors	.42*	75	Non-Gen. Fund Faculty	.07
48	Doctoral SCH	.35*	46	Upper Division SCH	.05
62	No. of Non-Majors in Department Courses	.35*	47	Masters & Grad.-Pro. SCH	.05
49	Total SCH	.34*	55	Total No. of Majors	.01
52	Total Classes Undergraduate SCH	.33*	59	Undergraduate Majors in Department Courses	.01
60	Total Undergraduates in Department Courses	.31*	70	% Instruction	.01
63	Total in Dept. Courses	.31*	22	Number of Undergraduate Courses	.00
72	A + B Faculty	.31*	71	% Research	-.02
25	No. of Grad. Courses	.22	23	Masters & Grad.-Pro.	-.03
36	Graduate Weighted Average Seciton Size	.20	35	Undergraduate Weighted Average Section Size	-.03
64	Instructor-Professor Head Count	.19	58	No. of Undergrad. Majors	-.03
67	FTEF Instructor-Professor	.19	37	Grad.-Pro. and Masters Class Hours	-.04

*Correlation value significant at .05 level.

TABLE 34.--Simple Correlation of Independent Variables with the Dependent Variable No. 20 (Total Supplies and Services Less Supplies and Materials). Total Department Sample

	Independent Variable	Simple Correlation	No.	Independent Variable	Simple Correlation
65	Part-Time Faculty Head Count	.78*	33	No. Graduate Section	.27
66	Total Head Count	.78*	28	Upper Division Class Hours	.27
68	Part-Time FTEF	.75*	64	Instructor-Professor Head Count	.24
32	No. Laboratory Sec.	.70*	67	FTEF Instr.-Prof.	.24
69	Total FTEF	.60*	56	No. of Masters Majors	.22
51	Laboratory SCH	.57*	50	Lec. & Rec. SCH	.21
57	No. of Doctoral Majors	.55*	61	Total Majors in Department Courses	.18
74	Total B Faculty	.53*	47	Masters & Grad. Pro. SCH	.18
24	No. of Doctoral Courses	.52*	26	Total Number of Courses	.18
27	Lower Division Class Hours	.51*	34	Laboratory Weighted Average Section Size	.16
48	Doctoral SCH	.50*	73	Total A Faculty	.14
30	Total Class Hours	.46*	77	Asst. Prof., Instr.	.13
45	Lower Division SCH	.43*	35	Undergraduate Weighted Average Section Size	.12
36	Graduate Weighted Average Section Size	.39*	31	No. Non-Laboratory Sec.	.11
76	Professor, Assoc. Prof.	.38*	23	Masters and Grad.-Pro.	.09
25	No. of Graduate Courses	.36*	46	Upper Division SCH	.08
62	No. of Non-Majors in Department Courses	.35*	22	Number of Undergraduate Courses	.06
52	Total Classes Undergraduate SCH	.33*	59	Undergraduate Majors in Department Courses	.06
63	Total in Dept. Courses	.33*	75	Non-Gen. Fund Faculty	.06
49	Total SCH	.33*	37	Grad.-Pro. and Masters Class Hours	.01
60	Total Undergraduates in Department Courses	.32*	70	% Instruction	-.00
72	A + B Faculty	.31	71	% Research	-.01
29	Doctoral Class Hours	.29	55	Total No. of Majors	-.17
54	Grad. Indep. Var. SCH	.28	58	No. of Undergrad. Majors	-.14
53	Total Classes Grad. SCH	.27			

*Correlation value significant at .05 level.

TABLE 35.--Simple Correlation of Independent Variables with the Dependent Variables with the Dependent Variable No. 6 (Faculty-Related Expenditures). Total Department Sample

No.	Independent Variable	Simple Correlation	No.	Independent Variable	Simple Correlation
65	Part-Time Faculty Head Count	.84*	50	Lec. & Rec. SCH	.35*
66	Total Head Count	.83*	56	No. of Masters Majors	.34*
68	Part-Time FTEF	.76*	47	Masters & Grad.-Pro. SCH	.30*
57	No. of Doctoral Majors	.71*	35	Undergraduate Weighted Average Section Size	.26*
48	Doctoral SCH	.67*	72	A + B Faculty	.26*
24	No. of Doctoral Courses	.63*	64	Instructor-Professor Head Count	.25
69	Total FTEF	.61*	67	FTEF Instr.-Prof.	.25
32	No. of Laboratory Sec.	.58*	26	Total Number of Courses	.23
45	Lower Division SCH	.52*	61	Total Majors in Department Courses	.21
25	No. of Graduate Courses	.51*			
27	Lower Division Class Hours	.49*			
76	Professor, Assoc. Prof.	.49*	31	No. Non-Laboratory Sec.	.21
62	No. of Non-Majors in Department Courses	.48*	23	Masters & Grad.-Pro.	.20
			28	Upper Division Class Hours	.20
30	Total Class Hours	.46*	46	Upper Division SCH	.19
74	Total B Faculty	.46*	37	Grad.-Pro. and Masters Class Hours	.11
51	Laboratory SCH	.45*			
36	Graduate Weighted Average Section Size	.44*	73	Total A Faculty	.11
			77	Asst. Prof., Instr.	.09
49	Total SCH	.44*	22	No. of Undergrad. Courses	.07
52	Total Classes Undergraduate SCH	.44*	59	Undergraduate Majors in Department Courses	.07
63	Total in Dept. Courses	.44*	75	Non-Gen. Fund Faculty	.02
60	Total Undergraduates in Department Courses	.43*	34	Laboratory Weighted Average Section Size	-.00
29	Doctoral Class Hours	.42*	55	Total No. of Majors	-.03
54	Grad. Indep. Var. SCH	.42*	71	% Research	-.03
53	Total Classes Grad. SCH	.40*	70	% Instruction	-.08
33	No. Graduate Sections	.38*	58	No. of Undergrad. Majors	-.13

*Correlation value significant at .05 level.

TABLE 36.--Simple Correlation of Independent Variables with Dependent Variable No. 10 (Travel) Total Department Sample.

No.	Independent Variable	Simple Correlation	No.	Independent Variable	Simple Correlation
53	Total Classes Grad. SCH	.48*	48	Doctoral SCH	.22
47	Masters & Grad.-Pro. SCH	.42*	61	Total Majors in Department Courses	.22
33	No. Graduate Sections	.40*	66	Total Head Count	.20
46	Upper Division SCH	.37*	35	Undergraduate Weighted Average Section Size	.18
56	No. of Masters Majors	.33*			
49	Total SCH	.33*			
69	Total FTEF	.32*	72	A + B Faculty	.18
50	Lec. & Rec. SCH	.32*	24	No. of Doctoral Courses	.16
52	Total Classes Undergraduate SCH	.32*	59	Undergraduate Majors in Department Courses	.16
57	No. of Doctoral Majors	.30*	26	Total Number of Courses	.15
55	Total Number of Majors	.30*	30	Total Class Hours	.15
76	Prof., Assoc. Prof.	.29*	77	Asst. Prof., Instr.	.15
25	No. of Graduate Courses	.29*	31	No. Non-Laboratory Sec.	.14
23	Masters & Grad.-Pro.	.28*	65	Part-Time Faculty Head Count	.14
64	Instructor-Professor Head Count	.27*	73	Total A Faculty	.12
67	FTEF Instr.-Prof.	.27*	29	Doctoral Class Hours	.11
68	Part-Time FTEF	.27*	54	Grad. Indep. Var. SCH	.11
58	No. Undergrad. Majors	.26	27	Lower Division Class Hours	.08
63	Total Dept. Courses	.26	22	No. Undergrad. Courses	.06
28	Upper Division Class Hours	.25	51	Laboratory SCH	.04
62	No. of Non-Majors in Department Courses	.25	71	% Research	.04
45	Lower Division SCH	.24	37	Grad.-Pro. and Masters Class Hours	.03
60	Total Undergraduates in Department Courses	.24	32	No. Graduate Sections	.02
74	Total B Faculty	.23	70	% Instruction	.01
36	Graduate Weighted Average Section Size	.22	75	Non-Gen. Fund Faculty	-.02
			34	Laboratory Weighted Average Section Size	-.35

*Correlation value significant at .05 level.

TABLE 37.--Simple Correlation of Independent Variables with the Dependent Variable No. 8 (Equipment Related Expenditures) Total Department Sample.

No.	Independent Variable	Simple Correlation	No.	Independent Variable	Simple Correlation
32	No. Laboratory Sec.	.69*	25	No. Graduate Courses	.16
9	Office Equipment	.66*	52	Total Classes Undergraduate SCH	.16
68	Part-Time FTEF	.64*	73	Total A Faculty	.16
65	Part-Time Faculty Head Count	.61*	77	Asst. Prof., Instr.	.16
66	Total Head Count	.61*	29	Doctoral Class Hours	.13
51	Laboratory SCH	.60*	33	No. Graduate Sections	.12
74	Total B Faculty	.50*	61	Total Majors in Department Courses	.12
69	Total FTEF	.50*	54	Grad. Indep. Var. SCH	.11
27	Lower Division Class Hours	.43*	26	Total Number of Courses	.10
30	Total Class Hours	.39*	75	Non-Gen. Fund Faculty	.10
34	Laboratory Weighted Average Section Size	.35*	70	% Instruction	.06
24	No. of Doctoral Courses	.35*	53	Total Classes Grad. SCH	.06
57	No. of Doctoral Majors	.33*	56	No. of Masters Majors	.06
72	A + B Faculty	.32*	59	Undergraduate Majors in Department Courses	.06
48	Doctoral SCH	.30*			
28	Upper Division Class Hours	.28*	22	No. Undergrad. Courses	.05
45	Lower Division SCH	.26*	35	Undergraduate Weighted Average Section Size	.05
36	Graduate Weighted Average Section Size	.24	50	Lec. & Rec. SCH	.03
76	Prof., Assoc. Prof.	.23	71	% Research	.01
60	Total Undergraduates in Department Courses	.21	47	Masters & Grad.-Pro. SCH	.00
			31	No. Non-Laboratory Sec.	-.01
64	Instructor-Professor Head Count	.20	40	Upper Division SCH	-.02
67	FTEF Instr.-Prof.	.20	37	Grad.-Pro. & Masters Class Hours	-.03
63	Total Dept. Courses	.19	43	Masters & Grad.-Pro.	-.05
49	Total SCH	.18	55	Total Number of Majors	-.11
62	No. of Non-Majors in Department Courses	.18	58	No. of Undergrad. Majors	-.15

*Correlation value significant at .05 level.

TABLE 38.--Simple Correlation of Independent Variables with the Dependent Variable No. 21 (Total Supplies and Services Less Supplies and Materials and Contractual Services) Total Department Sample.

No.	Independent Variable	Simple Correlation	No.	Independent Variable	Simple Correlation
65	Part-Time Faculty Head Count	.77*	56	No. of Masters Majors	.29
66	Total Head Count	.76*	50	Lec. & Rec. SCH	.26
68	Part-Time FTEF	.70*	47	Masters & Grad.-Pro. SCH	.25
32	No. of Laboratory Sec.	.60*	72	A + B Faculty	.24
57	No. of Doctoral Majors	.60*	64	Instructor-Professor Head Count	.23
69	Total FTEF	.56*	67	FTEF Instr.-Prof.	.23
48	Doctoral SCH	.52*	28	Upper Division Class Hours	.21
24	No. of Doctoral Courses	.51*	26	Total Number of Courses	.19
27	Lower Division Class Hours	.48*	61	Total Majors in Department Courses	.18
51	Laboratory SCH	.47*			
73	Total B Faculty	.44*	31	No. Non-Laboratory Sec.	.17
45	Lower Division SCH	.43*	23	Masters & Grad.-Pro.	.16
30	Total Class Hours	.42*	46	Upper Division SCH	.10
76	Prof., Assoc. Prof.	.42*	73	Total A Faculty	.09
25	No. of Graduate Courses	.41*	77	Asst. Prof., Instr.	.09
36	Graduate Weighted Average Section Size	.40*	35	Undergraduate Weighted Average Section Size	.09
62	No. of Non-Majors in Department Courses	.37*	22	No. Undergrad. Courses	.07
52	Total Classes Undergraduate SCH	.35*	59	Undergraduate Majors in Department Courses	.05
49	Total SCH	.35*	75	Non-Gen. Fund Faculty	.03
63	Total in Dept. Course	.34*	34	Laboratory Weighted Average Section Size	-.01
53	Total Classes Grad. SCH	.33*	37	Grad.-Pro. and Masters Class Hours	-.01
60	Total Undergraduates in Department Courses	.33*	71	% Research	-.03
54	Grad. Indep. Var. SCH	.32*	55	Total Number of Majors	-.04
33	No. of Graduate Sec.	.31*	70	% Instruction	-.07
29	Doctoral Class Hours	.29	58	No. of Undergrad. Majors	-.12

*Correlation value significant at .05 level.

BIBLIOGRAPHY

American Council on Education. College and University Business Administration, I. Washington: American Council on Education, 1952.

American Council on Education. Computation of Unit Costs. Washington: American Council on Education, 1955.

Anderson, Harry E., Jr., and Fruchter, Benjamin. "Some Multiple Correlation and Predictor Selection Methods," Psychometrika, XXV, No. 1 (March, 1960), 63.

Briggs, John R. A Refined Program Budget for State Governments. Bulletin No. 6. Washington: The American University, 1962.

Burkhead, Jess. Government Budgeting. New York: John Wiley and Sons, Inc., 1956.

California and Western Conference Cost and Statistical Study. Berkeley: University of California, n. d.

California Department of Education. Memorandum to Deans of Instruction, from Jon S. Peters. Subject: Genesis--The Faculty Staffing Formula. California State Department of Education, June, 1961.

Chambers, M. M. Voluntary Statewide Coordination in Public Higher Education. Ann Arbor: The University of Michigan, 1961.

Chambers, M. M. Financing Higher Education. Washington: The Center for Applied Research in Education, Inc., 1963.

Dobbs, Harold W. The Academic President: Educator or Caretaker? New York: McGraw Hill Book Company, Inc., 1962.

Dressel, Paul L. "Large Credit Blocks--Pro and Con," Liberal Education, LI, No. 3 (October, 1965), 382-390.

Dressel, Paul L. The Undergraduate Curriculum in Higher Education. Washington: The Center for Applied Research in Education, Inc., 1963.

Dubois, Philip H. An Introduction to Psychological Statistics. New York: Harper and Row, 1965.

Evans, John M., and Hicks, John W. An Approach to Higher Educational Cost Analysis. "Studies in Higher Education," XCI. Lafayette, Indiana: Purdue University, 1961.

Ezekiel, Mordecai. Methods of Correlation Analysis. New York: John Wiley and Sons, Inc., 1941.

Freud, John E., and Williams, Frank J. Modern Business Statistics. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1958.

Guilford, J. P. Fundamental Statistics in Psychology and Education. 3d ed. New York: McGraw-Hill Book Company, Inc., 1956.

Hannah, John A. A Year of Appraisal. "State of the University," Address. East Lansing: Michigan State University, February 14, 1966.

Harris, Seymour E. Higher Education: Resources and Finance. New York: McGraw-Hill Book Company, Inc., 1962.

Henderson, Algo D. Policies and Practices in Higher Education. New York: Harper and Brothers, 1962.

Hull, L. E. "Pitfalls in the Use of Unit-Cost Studies," Journal of Higher Education, XXXII (ctober, 1961), 371-376.

Keezer, Dexter M., ed. Financing Higher Education 1960-70. New York: McGraw-Hill Book Company, Inc., 1959.

Michigan State University. Financial Report, 1964-65 and 1965-66. East Lansing: Michigan State University, November, 1965 and 1966.

Michigan State University Agricultural Experiment Station. Stat Series Descriptions No. 5 (Bastat); No. 7 (LS); and No. 9 (LSADD). East Lansing: Michigan State University, 1967.

Miller, James L., Jr. State Budgeting for Higher Education: The Use of Formulas and Cost Analysis. Ann Arbor: The University of Michigan, 1964.

Millet John D. The Academic Community. New York: McGraw-Hill Book Company, Inc., 1962.

Moos, Malcolm, and Rourke, Francis E. The Campus and the State. Baltimore: The Johns Hopkins Press, 1959.

Morris, G. M. Modernizing Government Budget Administration. Chicago: Public Administration Service, 1962.

Mushkin, Selma J. Economics of Higher Education. Washington: U. S. Department of Health, Education and Welfare, 1962.

Neville, Howard R., and King, Herman L. Conversations during preparation of study. East Lansing: Office of the Provost, Michigan State University, 1966 and 1967.

Office of Institutional Research. Volume of Instruction Analysis, Fall Term (S) 1964-65. East Lansing: Office of Institutional Research, Michigan State University, March, 1965 and April, 1966.

Office of Institutional Research. Teaching Load and Time Distribution Analysis, Fall Term (S), 1964-65. East Lansing: Office of Institutional Research, Michigan State University, March, 1965 and April, 1966.

Office of Institutional Research. Section Size Analysis, Fall Term (S), 1964-65. East Lansing: Office of Institutional Research, Michigan State University, March, 1965 and April, 1966.

Office of the Registrar. Course Enrollments by Major, Curriculum, Class Level, and Sex, Quarterly Report. East Lansing: Michigan State University, n. d.

Office of Institutional Research. Basic Statistics on Credit Hours, FTE Faculty, Tenure, Course Listings, Courses Taught, Budget, Expenditures, Majors, Degrees, Library, Gifts and Grants, Research Budget, Operation Revenues, and New Plant Construction by Colleges and by Departments for 1956-57 thru 1965-66. "Brown Book." East Lansing: Office of Institutional Research, Michigan State University, Fall, 1966.

Oklahoma State Regents for Higher Education. Financing Current Operating Costs of Higher Education in Oklahoma. Self-study of Higher Education in Oklahoma, Report 4. Oklahoma City: Oklahoma State Regents for Higher Education, January, 1963.

Reeves, Floyd W., Henry, Nelson B., and Russell, John Dale. Class Size and University Costs. The University of Chicago Survey, XI. Chicago: The University of Chicago Press, 1932.

Rourke, Francis E., and Brooks, Glenn E. The Managerial Revolution in Higher Education. Baltimore: The Johns Hopkins Press, 1966.

Ruml, Beadsley, and Morrison, Donald H. Memo to a College Trustee. New York: McGraw-Hill Book Company, Inc., 1959.

Russell, John Dale. An Overview of Budgeting Analysis. Tallahassee: Institute on Institutional Research, Florida State University, July 12, 1960.

Russell, John Dale, and Doi, James I. "Analysis of Institutional Expenditures: (a series of twelve articles), College and University Business, XIX (September, 1955), 19-21; (October, 1955), 27-29; (November, 1955), 44-47; (December, 1955), 39-41; XX (January, 1956), 41-45; (February, 1956), 47-51; (March, 1956), 41-43; (April, 1956), 35-37; (May, 1956), 47-48; (June, 1956), 48-51; XXI (July, 1956), 43-46; (August, 1956), 42-47.

Scheps, Clarence. Accounting for Colleges and Universities. Baton Rouge: Louisiana State University Press, 1949.

Simonds, Herbert A. "The Job of a College President," Educational Record, XXXXIII (Winter, 1967), 70.

Simonds, Rollin H. "To Increase Man-Hour Output in Higher Education," The Educational Record, XXXIX (October, 1958), 338.

Texas Commission on Higher Education. Basis of Commission Recommendation of Institutional Requests for Legislative Appropriations 1963-65 Biennium. Austin: Texas Commission on Hihger Education, n. d.

University System of the State of Florida: Educational and General Budgets. Tallahassee: Budget Directors Office, Biennium, 1961-1963.

University Business Office. "Object Class Report," Fiscal Year 1964-1965 and 1965-1966. East Lansing: Michigan State University, September 23, 1965 and August 10, 1966. (Computer print out.)

University Business Office. Manual of Business Procedures. East Lansing: Michigan State University, 1965.

Walker, Helen M., and Lev, Joseph. Statistical Inference. New York: Henry Holt and Company, 1953.

Western Interstate Commission for Higher Education. Yardsticks and Formulas in University Budgeting. Boulder, Colorado: Western Interstate Commission for Higher Education, 1959.

Williams, Harry. Planning for Effective Resource Allocation in Universities. Washington: American Council on Education, 1966.

Williams, Robert L. The Administration of Academic Affairs in Higher Education. Ann Arbor: The University of Michigan Press, 1965.

Wilson, Logan. "Analyzing and Evaluating Costs in Higher Education," The Educational Record, XXXXII (April, 1961), 102.

Zook, George F., Chairman. Higher Education for American Democracy: Financing Higher Education. Washington: The President's Commission on Higher Education, 1947.

Zook, George F., Chairman. Higher Education for American Democracy: Staffing Higher Education. Washington: The President's Commission on Higher Education, 1947.