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Title: DETERMINATION OF INDICATORS FOR PREDICTING
BUDGET BALANCES IN ACCOUNTING UNITS AS AN ADMINISTRA-
TIVE TOOL FOR HIGHER EDUCATION

Abstract approved: 

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Colleges and universities must be continually seeking means to improve their financial management. One improvement would be to lessen the amount of monies the state-owned university reverts to the state at the end of the fiscal year. Such reversion is caused by numerous departments, each with financial autonomy, incurring greater amounts of surpluses than those departments ending with deficits. Whatever means are developed to control this reversion should, however, not lessen departmental financial autonomy.

Budgets and budgetary control are defined and are related to the concepts of feedback and management-by-exception. These concepts provide a model of budgetary control within the university environment and explain the workings of performance, measurement, comparison, evaluation, and the taking of action to affect plans or

performance. With feedback and utilizing the management-by-exception principle, a type of budget control indicator might be developed to affect the necessary control without reducing autonomy. This budget control indicator could provide the means whereby the amount of surpluses or deficits at the departmental level would be lessened.

It would be relevant to determine a point in time which would permit the identification and hence reduction of potential surpluses or perhaps change the trend leading to deficits. The reduction of a potential surplus at an early enough point in time would permit some funding of significant projects, which otherwise might never have received funding, rather than let the money revert.

The indicator was determined from a historical study of the expenditure patterns of a population of 98 Oregon State University departments. The results obtained for 1967-68 indicated that using two-thirds of one standard deviation from the mean of the break-even departments in the month of January would provide the prediction of 50 percent of those departments ending with a surplus and 70 percent of those ending with a deficit. The error of predicting that a department would incur a surplus or deficit when it actually ended breaking even was 41 percent, while the number of ultimate surplus or deficit departments predicted to break even was 38 percent. An early prediction of 50 to 70 percent of those departments which ultimately

incur a surplus or deficit is significant in that present practices leave this unknown until it is too late to prevent the reversion. If a smaller predictive range (one-half of one standard deviation) is used, the percent predictions increase, however there is also an increase in the error of saying a department is deviant when it is not. Defining a department as breaking even if its expenditures were within \$400 of its budget provided the best criterion for the later prediction of surplus or deficit departments.

Determination of Indicators for Predicting Budget Balances
in Accounting Units As an Administrative
Tool for Higher Education

by

Anthony D. deGray Birch

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DETERMINATION OF INDICATORS FOR PREDICTING BUDGET BALANCES IN ACCOUNTING UNITS AS AN ADMINISTRATIVE TOOL FOR HIGHER EDUCATION

CHAPTER I

INTRODUCTION

Statement of the Problem

J. Douglas Brown of Princeton University has warned the academic community that "with mounting costs of sharply rising salaries, the time for drifting is past. Universities and colleges are now in a fast-moving tide, and there are rocks on either shore!" (34, p. 14). This statement gives rather succinctly a warning that perhaps one of the items colleges and universities must improve is their management practices if the universities are to remain financially solvent. One management practice, the control of the expenditure of monies in a university, is a very difficult process. Lloyd Woodburn reminds us that there is no automatic criterion of inefficiency or waste in a non-profit institution. The searching for inefficient or wasteful departments is not possible by cost analysis alone, since it primarily involves value judgments on the worth of research and the kind of quality of individual instruction desired (36, p. 14).

Most universities control the expenditure of monies through the use of a budget allocation. The budget allocation takes the form of a

fixed sum of money placed in an account, usually on a yearly basis, that the departmental administrator can draw upon to accomplish his assigned tasks. Typically, this department administrator might be given a budget for salaries and wages, teaching supplies and expenses, travel, and equipment. Prior to this allocation may occur a significant amount of planning and analysis to determine, for example on a formula basis,¹ the amount of money the academic administrator should receive. However, many environmental changes might occur during or after the time the budget is prepared and approved, which may cause the administrator to spend either more or less than he was budgeted.

The widespread decentralization of the academic institution creates another problem and that is that no one administrator is responsible for the financial affairs of instruction; rather, many persons may hold this responsibility. For example, the number of separate departments, each with its own budget and expenditures, found in the three largest units of the Oregon State System of Higher Education in 1968 is shown in Table 1 (24).

¹For an excellent discussion of this process see James L. Miller's *State Budgeting for Higher Education: The Use of Formulas and Cost Analysis* (19).

Table 1. Number of Departments Separately Budgeted,
Three Instructional Units, State of Oregon, 1968.

Institution	<u>Expenditure Units</u> (Departments)
Oregon State University	128
Portland State College	73
University of Oregon	101

This magnitude of decentralization creates considerable problems for the budget administrator and controller. One solution employed in a number of university systems is the use of line-item budgets. This practice is also followed in the Oregon State System of Higher Education for the allocation and control of expenditures for salaries. The reason is apparent, for in 1968 salaries constituted 55.2 percent of the anticipated expenditures for the system (24). However, this same degree of control is not placed on the remaining large segment of university expenditure: the requisition category, which includes wages, materials and expenses, travel, and equipment. Oregon State University's requisition budget for the fiscal year starting July 1, 1968, amounted to \$6,994,796, not an inconsequential sum (24). Line-item budgets could be instituted for the requisition category as they have in some other education institutions. The effect of a line-item budget is that in requiring too much detail, it limits the freedom of the departmental administrator to exercise management.

With the lack of line-item control for the University's requisition budget coupled with the decentralization of the spending units (departments), it could be anticipated that a number of departments would either overspend or underspend their budgets. If the University has a net balance (money unspent), the dollars revert to the State of Oregon General Fund. These dollars represent activities and projects that the University might have conducted if it had the necessary control to recapture and use the dollars in some other area before the end of the fiscal year. The magnitude of this loss of spending potential (dollars reverted) is shown in Table 2.

Table 2. Year-end Reversion of State Funds, Oregon State University, 1958-1968*.

Fiscal Period Ending June 30	Amount Reverted to State
1968	\$ 10,307
1967	24,040
1966	(28,413)
1965	7,070
1964	11,910
1963	6,023
1962	28,027
1961	42,780
1960	56,743
1959	147,205
1958	53,125
() Indicates overexpended budget	

* Taken from a management study by the author, memo to Dean M. Popovich, October 30, 1968, Office of Business Affairs, Oregon State University.

Table 3. Departmental Surpluses and Overdrafts, Oregon State University, Year Ending June 30, 1968.

Amount of Surplus or Deficit	Departments Ending with Surplus	Departments Ending with Deficit
\$ 10 - 100	12	16
100 - 500	23	15
500 - 1,000	6	3
1,000 - 2,000	3	6
2,000 and greater	6	2
TOTAL	50	42

The lack of any system or device to eliminate or lessen the reversion (or possible overdraft) of monies is not unique to Oregon State University. In a study, unfortunately done a number of years ago, Irwin Lubbers observed the following: (1) colleges that checked budgets from time to time - 55 percent, (2) checked continuously - 20 percent, (3) not carefully checked - 5 percent, (4) checked quarterly - 5 percent, (5) checked monthly - 5 percent, (6) no budget - 10 percent (16, p. 72). It is suspected that this observation has changed little. If, as J. Brooks Heckert points out, one of the purposes of budgeting is to prevent waste; then perhaps, with the rising costs of education, the waste to the university by the reversion of unused monies ought to be curtailed. (14, p. 9).

Purpose of the Study

If all indications are true that education administrators are

beginning to accept the idea that theirs is the management of a "business operation", then one can apply to education the three recognized functions of management: (1) the planning function, (2) the coordinating function, and (3) the control function (33, p. 5). It is, therefore, necessary to determine a control indicator which will assist the university administration in reducing the uncertainty in departmental fiscal affairs which may result in the reversion or overdraft of funds at year-end. This indicator could, utilizing Glen Welsch's words, allow the university to make a comparison or measurement of actual performance against predetermined plans and objectives (33, p. 9). Once an indicator is chosen, this study will conduct a test of the method to ascertain whether it is reliable and can be used to predict.

The details of incorporation of an indicator such as might be discovered here will relate, to a large degree, on the success envisioned. If a level of control could be obtained, such that all reversion or overdraft of state funds are halted without destroying the decentralization and financial autonomy of departments, then the indicator used must have a certain degree of reliability. If the developed indicator could predict where, in a historical study, surpluses or deficits actually occurred and the point in time they became apparent, then there is the likelihood that the method could somehow become a part of existing budget and accounting systems.

It would be then possible to complete the cycle of budgetary duties envisioned by J. Brooks Heckert for the controller to analyze the variances between budgeted and actual results and initiate prompt revision of the budget if circumstances require (14, p. 23). The indicator would alert the university controller or budget administrator that a problem exists in a particular department so that the problem could be corrected prior to overdraft or the reversion of funds. Surplus funds in any one department could be transferred to the many other departments critically needing funds, or the departmental administrator asked to accelerate his expenditure of funds. In the other sense fiscal imbalance might result in a potential deficit situation where the departmental administrator would be asked to decelerate his expenditure of funds or the University administration would provide added funding from other sources.

CHAPTER II

THEORETICAL CONCEPTS

Having introduced the need for and the purpose of this study, it is necessary to explore some of the considerations that would be involved or implied in the control indicator sought. These concepts include budgeting, budgetary control, management-by-exception, and feedback. This section will then conclude with an investigation and relation of some existing systems in industry and education to the control indicator.

Budgeting

Budgets and budgeting are concepts that most people acknowledge but few can define well. James L. Miller recently helped most college administrators by pointing to an earlier work.

The framework for an adequate theory of budgeting seems to have been initiated by Birkhead. Birkhead describes a process of budget decision making as the interaction of three functions--expertise, communications, and responsibility. Expertise consists of attaining as much information as possible about the causes and probable effects of the several alternatives. Communications consists of hearing the representatives interested in affected groups. Responsibility consists of making the decision and bearing responsibility for it. (19, p. 44)

In specific terms, the budget serves as a summary or projection in monetary terms of the scope of activity and standards of

performance established for responsibility centers, such as departments, by the institution (20, p. 184). In a commercial enterprise, the budget is usually based on an estimate of the income for the following period. Once this estimate has been established, it is possible to forecast what the expenditure should be for the volume of operations indicated by the expected sales (8, p. 377).

Budgets in the industrial world are by no means a new concept and have been used and accepted for many years. The concept and use of budgeting has come somewhat slower to education, and it appears that the use of budgets in the academic institution has been widely damned. For instance, the comment is made that "many members of the teaching faculty think of the college budget as one of the bogeys of academic life. The budget is not only difficult to understand, but even worse, it often seems to threaten many cherished projects!" (35, p. 122). Recent writers do not, however, hold that educators should be exempted from the budget process. "Institutional budgets may be thought of as an offshoot of policy governing the operations of the institution for a year. Final expenditures implement the accepted educational policy. This general rule applies to all institutions regardless of whether they are large or small, state supported or operating with private funds" (35, p. 122).

An interesting tieback to the problem of surpluses and deficits is given by Rautenstraub and Villers who state that "The budget, if it

is to be effective as a standard of measurement and a tool for control, must be used in all executive offices as a yardstick to discover variations of expense from that which they should be and to determine the particulars which give rise to the variations" (27, p. 184).

An advantage of budgeting, therefore, in relation to the planning, coordinating, and controlling concepts, may be that it aids in checking progress or lack of progress toward the objectives. The objectives would include, in an educational institution, the matching of expenditures with the budget allocation (33, p. 12, 13). Budgeting in many regards is tied with the aspect of control. It is said that the full potential of budgeting can best be realized through a comprehensive budgetary program embracing all phases of operations and utilized for planning, coordination and control purposes (33, p. 4).

Budgetary Control

While a major purpose of budgeting is to ascertain the most profitable course for a business to follow and to develop a balanced and coordinated program which will hold it to that course, the budget also provides a valuable tool of control over certain operations. (14, p. 8). Glen Welsch provides a good overall statement of what constitutes budgetary control:

Budgetary control involves the use of budgets and budgetary reports throughout the period to coordinate, evaluate and control the day-to-day operations in

accordance with the goals specified by the budget. The mere preparation of a budget may prove to be of considerable value to the average concern. Its maximum value lies in the planning aspects and its utilization for coordination and control purposes during the period. Budgetary control involves a constant checking and evaluation of actual results compared with budget goals which should result in corrective action where indicated. (33, p. 4)

James McKensey has three steps of budgetary control which include: the statement of the plans of all departments of the business for a certain period of time in the form of estimates, the coordination of these estimates in a well balanced program for the business as a whole, and the preparation of reports by comparison between the actual and estimated performance and the revision of the original plans when these reports show that such a revision is necessary (18, p. 8). The point of view of John MacDonald is that budgetary control implies action or an activity:

In the definition of the word "budget", it is important that a clear distinction be made between budgeting figures or estimates which indicate the future in accounting terms. Budgetary control, on the other hand, involves careful planning in the controllable functions of the enterprise. Budgetary control assumes a genuine desire on the part of the entire organization, from the president to the office boy, to keep as close to the previously charted course as possible, to accept responsibility for doing so, to check actual performance against the plans, and in every other respect to use the budget as a road map to reach the previously established goal. Real budgetary control, in a word, is a point of view, not merely a collection of figures. (17, p. 2)

Another author states that "Control, as applied to budgeting,

may be thought of as a systemized effort aimed at keeping management informed of performance or lack of performance toward predetermined plans, objectives, and policy. Control implies measurement, and this requires a yardstick for the entire organization. " (33, p. 9)

There seems to be a pattern to all these thoughts which produced the outline in Figure 1. Budgets are considered to be the plans mentioned in item (1). Budgetary control would then include the entire process: plans, performance, measurement, comparison, evaluation, action to effect plans or performance, et cetera. Some might say that the process in Figure 1 is alien to the educational system and hence is an infringement upon its academic freedom. Others, such as Raymond Gibson, believe that there are, in any college or university, certain housekeeping administrative functions that must be performed with efficiency and economy lest the educational process be seriously impaired. The process of financial control through budgeting is such a function (13, p. 240).

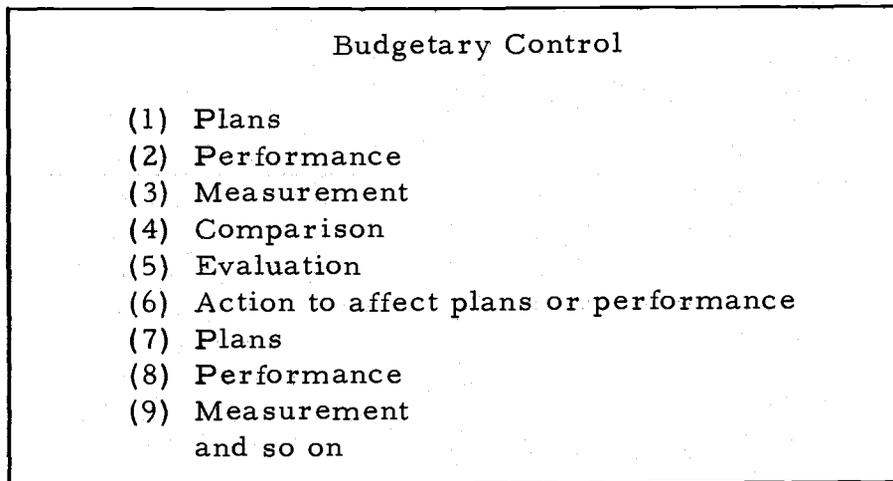


Figure 1. Components of Budgetary Control.

Management-by-Exception

In the discussion of budgetary control, there are three processes which further relate to the problem under study. These processes are measurement, comparison, and evaluation.

A concept of management, called full reporting, would require that all of the observed or measured performance be brought to the attention of management (26, p. 35). The other concept is described by one source in the following:

This type of report only shows items that fall in an exception range. The items are noted with asterisks as in full reporting with comments as described above. In effect the analytical task of evaluating performance against goals, using the exception range yardsticks, is transferred from the management people to the accountant, as is the case in reporting with full comments. In exception reporting, however, the report is reduced to include only those items within an exception range requiring special attention. (26, p.35)

Glen Welsch, in discussing the methodology of the exception principle, states that it involves showing (a) actual results, (b) budgeted amounts, and (c) the difference (budget variations) between (a) and (b). (33, p. 9). When these budget variations have reached a certain significance, the management-by-exception principle would require that these, and only these, be reported to management. The purpose of this study has been stated to be the attempt to find a control indicator which will aid university administration in reducing the uncertainty of departmental fiscal affairs. The method sought in this exploration might, therefore, become exception reporting, as it is desired to flag only those accounts where the expenditure level seems to be heading toward budget difficulty.

J. Brooks Heckert has provided a summary of the enforcement of the budget including the following steps: (14, p. 57, 58)

1. Reporting of the programs is adapted to those responsible for its execution;
2. Rigid enforcement of all controllable operations;
3. Prompt reporting of variances and non-controllable operations; and
4. Prompt analysis of adverse results.

The management-by-exception principle would aid in this process through its ability to promptly report the variances and any adverse results.

Feedback

One of the principles repeated frequently in defining the processes included in budgeting involves changing or revising the budget:

When actual operations do not develop as expected, either as a result of unexpected changes and external conditions or important variances between expected and actual performances, plans must be revised. The company must have before it at all times a coordinated program. When the original plans no longer provide such a program, they must be changed; hence the work of budgeting becomes a continuous task of follow-up and revisions. (14, p. 58)

Closely related to budgetary control and, in fact, almost a requirement to it is the process of feedback. Feedback in a very narrow sense is that part of a closed loop system which automatically brings back information about the condition under control (2, p. 385). The most common example of feedback relates to the heater-thermostat process shown in Figure 2 (12, p. 682).

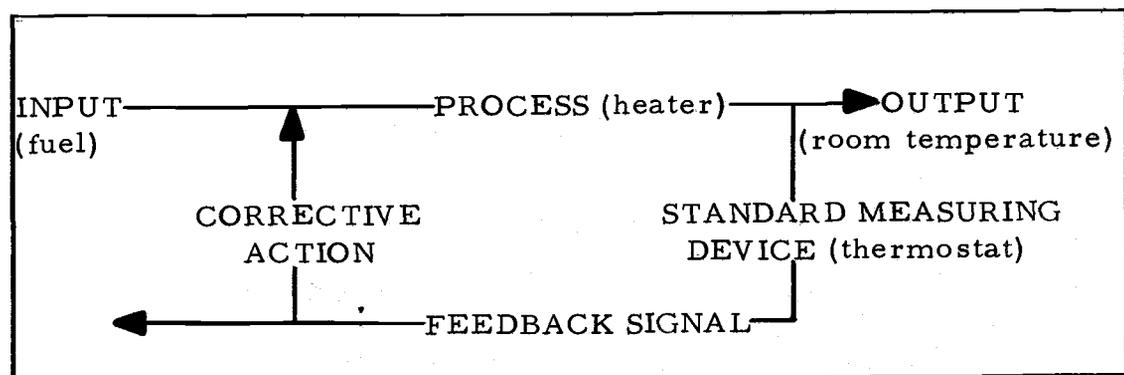


Figure 2. Feedback Process Exemplified.

Two types of feedback shown in Figure 3 may be relevant to the budget process (12, p. 28). One case (Case A) may be likened to the situation where the academic administrator is working with a fixed budget. He, therefore, must adjust the expenditure rate or incur a surplus or deficit situation. Case B relates to a situation where the budget itself may be adjusted to match the expenditure rate, thus negating surplus or deficit occurrences.

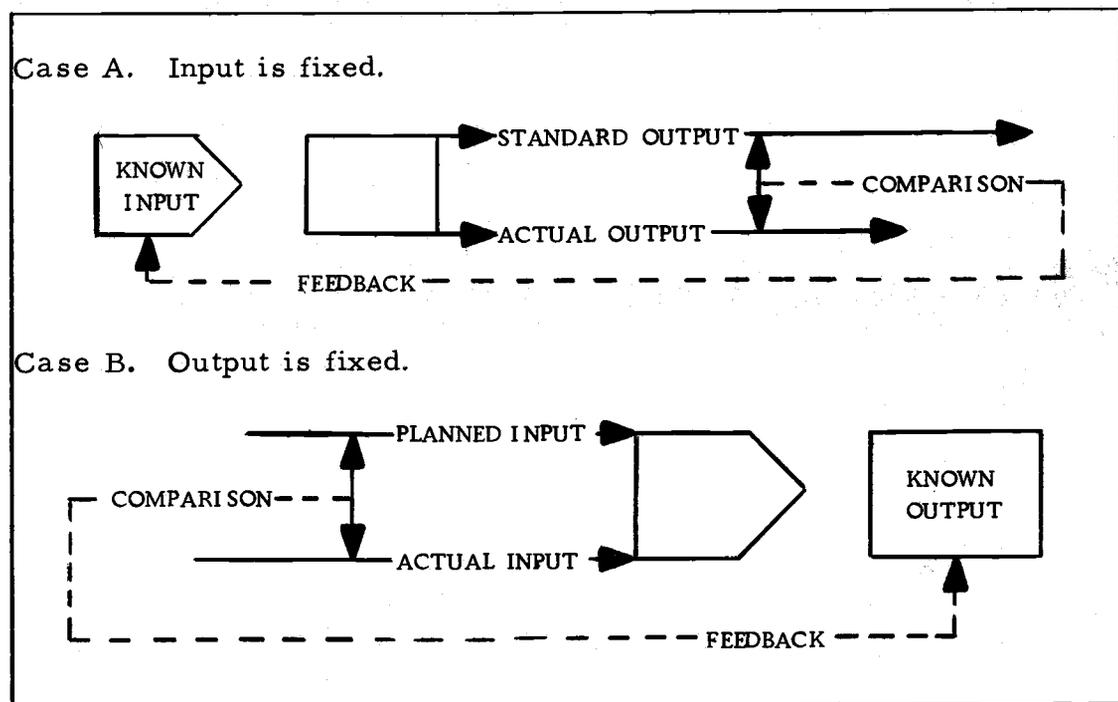


Figure 3. Two Types of Feedback.

It can be seen that feedback, creating the basis for the use of the management-by-exception principle, may result in a revision or change of the budget. This feedback signal provides, therefore, the

connecting link between the indicator necessary to alert possible budget problems and the probable change or revision of the budget.

Existing Systems

Systems for budgetary control appear to be somewhat common in business and rare in educational administration. Business firms use rather widely the concept of full reporting to keep their management advised. This concept of full reporting might result in a form such as found in Figure 4 (17, p. 260). The controller in Figure 4 is reporting the status of all the firm's accounts and indicating variances, if any, between actuals and the budget.

THE XYZ COMPANY EARNINGS-EXPENDITURES-BUDGET CONDENSED SUMMARY				
EARNINGS	This Month	To Date	Budget	Surplus or Deficit
Advertising				
Circulation				
Other Income				
TOTAL EARNINGS . .				
TOTAL EXPENDITURES AND CHARGES (All Departments)				
NET RESULT				

Figure 4. Budget Report Form Example.

In management-by-exception reporting a company first has to have a preestablished standard of variation such as found in Figure 5. (26, p. 34). Using Figure 5, the variation in actual performance either above or below the range allowed for the item would be reported.

<u>THE XYZ COMPANY</u>						
EXCEPTION RANGES FOR MONTHLY SALES VOLUME						
(Exception Ranges are Stated as a Percentage of the Monthly Sales Volume Goal)						
<u>Product</u>	<u>For the President</u>		<u>For the Sales Manager</u>		<u>For the Salesman</u>	
	<u>High Exception</u>	<u>Low Exception</u>	<u>High Exception</u>	<u>Low Exception</u>	<u>High Exception</u>	<u>Low Exception</u>
A	+20%	-20%	+10%	-10%	+5%	-5%
B	+20	-20	+10	-10	+5	-5
C	+20	-15	+10	- 7	+5	-5
D	+20	-20	+10	-10	+5	-5
E	+15	-10	+ 7	- 5	+4	-4
F	+10	- 5	+ 5	- 3	+2	-2

NOTES: The plus (+) figures indicate the trigger points for reporting "high exceptions".
The minus (-) figures indicate the trigger points for "low exceptions".

Figure 5. Example of Statement of Exception Ranges.

Similar devices, either full reporting or exception reporting, for use by the administrators of educational units appear to be non-existent or at least rare. A system, closely akin to full reporting, is found in the Departmental Statements of the Oregon State System of Higher Education (Figure 6) (23). Here the departmental

administrator is advised on a monthly basis what his annual budget is and what expenditures he has accumulated to date. The statement then shows the computed balance (budget less expenditures). This type of budgetary control reporting is undoubtedly of great help to the departmental administrator; but to the university administrator with 128 departments, a device like this is of somewhat limited value. Likewise, much university budget control reporting is apparently after the fact (after the accounting year has been completed). This after-the-fact reporting is, therefore, too late as far as budget control is concerned because the balance indicated, for example in Figure 7, automatically reverts to the State (25).

ACCOUNT NUMBER 30-1000			
	Disbursements	Allowance	Balance
Total Salaries	73,830.00	88,596.00	14,766.00
Total Wages	28,587.44	32,792.00	4,204.56
Total Material	23,719.02	32,265.00	8,545.98
Total Travel	3,566.21	4,500.00	933.79
Total Equipment	2,870.29	2,545.00	325.29 CR
Total O/S Requisitions		4,481.63	4,481.63
Total to Date	58,742.96	76,583.63	17,840.67

Figure 6. Facsimile of Computer Printout of "Departmental Statement", Comptroller's Office, Oregon State System of Higher Education.

OREGON STATE UNIVERSITY BUDGET BALANCES JUNE 30, 1968			
Description	Disbursements	Budget	Balance
30-1335 Oceanography			
Salaries	137,561.00	137,561.00	
Wages	34,401.63	34,452.00	
Material	18,168.44	12,760.00	
Travel	1,213.23		
Equipment	496.18 CR	13,125.00	
O/S Req.	9,034.30	1,951.96	
	62,321.42	62,288.96	32.46 CR
30-1337 Botany			
Salaries	201,027.99	201,582.00	554.01
Wages	9,338.02	14,261.00	
Material	7,710.89	4,984.00	
Travel	1,548.58		
Equipment	5,858.18	9,729.00	
O/S Req.	6,644.86	2,408.97	
	31,100.53	31,382.97	282.44

Figure 7. Facsimile of Computer Printout of Year-End Budget Balances, Comptroller's Office, Oregon State System of Higher Education.

It can be seen that the existing systems do not appear to provide what is desired--an indicator that will alert university administrators sufficiently ahead of the fact that a department is heading toward an expenditure surplus or deficit.

CHAPTER III

CONSTRAINTS AND ENVIRONMENT

There is concern whether a control indicator such as discussed might work in an academic environment. One author has found that part of the problem in assuring a sense of economy in universities and colleges is an attitude of aloof superiority on the part of faculty toward what they consider the business functions of their institution. Dollar budgets appear to be a cribbing control upon academic freedom in teaching and research (34, p. iii). Perhaps all that could be expected from any indicator developed is the pointing out or warning of possible problems. It would be the initial action in a whole chain of reactions that might involve changing the budget (adding to or subtracting from the allocation) or changing the management practices (affecting the rate of expenditure).

Educators are, however, beginning to be more responsive to this type of control. Lloyd Woodburn, former Dean of the College of Arts and Sciences, University of Washington, has commented that it will not excite controversy to realize that the cardinal purpose of a budget is to keep expenditures within income. No one really advocates educational insolvency. The controversy or differences of opinion are in the realm of methods of budget control (36, p. 28). Whether one should use different methods of control for business

as opposed to education is questionable. Dean Duryea of Hofstra College suggests there might be a difference:

Furthermore, the academic administrators serve a very distinctive organization. This uniqueness in an academic organization results to a high degree from the professionalized faculty members who maintain their right to participate in decisions which affect their work. They retain a monopoly of specialized knowledge, also, which makes their services difficult to appraise and which gives the departments or schools within a college or university a high degree of autonomy resulting from the power of initiative, faculty personnel policies, educational program, evaluation of students. More than this, faculty members have a commitment to their profession or discipline which transcends frequently their loyalty to the institution. These and similar factors prevent the academic administrator from acting as his counterpart in business or government. They make the exercise of leadership particularly difficult. (4, p. 29)

Perhaps the best philosophy to sum this up and one that stresses both the similarities and the differences is one offered by Raymond Gibson when he explains that "an educational institution is a spending agency, not a capital building agency. This is one of the principal differences of business philosophy between an institution of higher learning and a profit-making institution. This concept does not preclude the use of efficient business methods, nor does it encourage wanton and unnecessary spending!" (13, p. 247, 248). It has been said that the only justification for budgeting is its service to management. Therefore, a budgetary program should result in definite and tangible benefits directly related to the basic functions of management (33, p. 5). In business this may be profit making;

in education it may be to work within a departmental account of fixed dollar resources.

A related environmental factor may be the use of computers. A recent study found that 53 percent of all state institutions of higher education were using computers for administrative purposes (29, p. 20). If nothing else, the computer may have opened the way to a control indicator such as envisioned here. Rourke and Brooks comment that the computer has given new emphasis to other elements of modern management and has clearly become a major new factor in bringing on administrative innovations in American higher education (29, p. 20). It is conceivable, therefore, that the use of the computer may assist in:

- (1) Creating an environment of acceptance of an indicator;
- (2) Providing the basis for selection of the indicator; and
- (3) Providing the computational methodology to effect the necessary budgetary control.

The environment of budgetary control may be likened to that shown in Figure 8. Here all processes such as the budget, feedback, management-by-exception, computer assistance, et cetera, are shown in their perspective to the two administrative units concerned: the instructional department and the administrative (budget) office.

It is important to recognize that the type of control indicator being sought lies somewhere between two extremes. The one

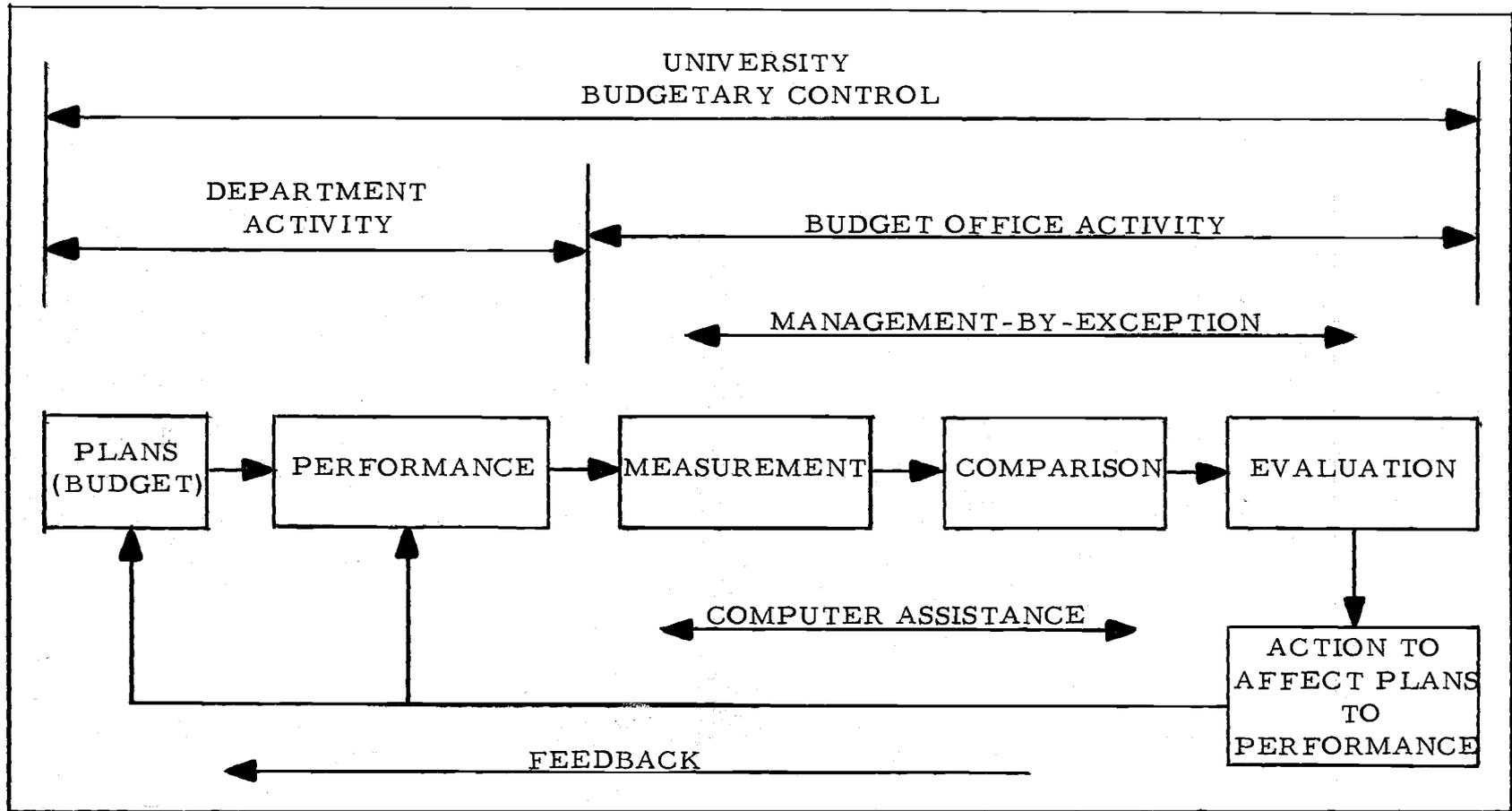


Figure 8. The Budget Control Environment Portrayed by Theoretical Concepts.

extreme would consist of maximum centralization and a very direct control by the university administration. The central university administrative offices would participate in a specific daily involvement with the fiscal affairs of the department. An example of this would be line-item budgeting and control. However, as has been pointed out, the university is still considered to be a loose collection of autonomous departments, and there exists a widespread decentralization. To foster this philosophy of decentralization, the university administrators must conduct their budgetary control as if they were standing off at a distance. Much of the budgetary control in business, as the first extreme, requires the direct involvement by administration. For the educational organization, it is desired to develop a methodology which would provide the necessary budgetary control, but not destroy the financial autonomy of each department.

CHAPTER IV

METHODOLOGY

There has now been established a framework of the related items of budgetary control, management-by-exception, feedback, and the need for a process of budgetary control in a decentralized university. This section will relate to the methodology of obtaining such an indicator. Management-by-exception and feedback provide the logical base for the indicator, though the mechanics of choosing and implementing it are difficult.

General Scheme

As was discussed in the previous chapters, the output or performance of an education institution in terms of its product, education, is difficult to quantify. Since model building and simulation techniques are not practical, it appears that past performance or history of expenditures would provide perhaps the best methodology for arriving at the desired control indicator. It is necessary, therefore, to conduct a historical study of the expenditure performance of the University's departments to see if there are different expenditure patterns between those departments that break even or experience a surplus or deficit. If there is a "normality" for those departments that break even (do not overspend or underspend their budgets),

this expected normality may be used as a standard. Those departments whose expenditures begin to deviate significantly from this expected standard (which may be a range above and below a mean) would be pointed out through exception reporting. The budget administrator could then work with the departmental administrators to ascertain whether a budget change or an acceleration or deceleration of expenditures is necessary or if there are environmental factors causing the deviation from the expected range.

Part of the consideration of whether a department is to be classified as ending the year with a surplus, deficit, or breaking even is the problem of the definitional range. For example, a department may only be classified as breaking even if its expenditures exactly equal its budget. Or perhaps a department would still be considered as breaking even if its expenditures were within plus or minus \$10 of its budget. The size of this allowance (i. e. , whether or not break-even status is to be all departments within plus or minus \$10 or plus or minus \$500, et cetera, of matching expenditures to budget) would affect the ability of the control indicator sought to predict those departments heading toward a surplus or deficit (actual difference of expenditure to budget larger than allowance). It is not known at what level to define a deficit or surplus, and yet the expenditure pattern for those departments defined as a deficit at plus or minus \$10 may be different than the expenditure pattern for

deficits calculated at plus or minus \$500. Therefore, by varying the definitional range, it would be expected that the separation for any one month of the three patterns--surplus, break-even, or deficit--would vary also. The greater the separation of the three types of departments, the less chance of associating a particular department as, for example, a department heading for a deficit when it would break even. The goal in varying the definitional range will be to maximize the ability to predict what will eventually happen to a department, but at the same time keep the error of prediction (saying a department is heading for trouble when it is not) as low as possible.

Sample--Population

The first goal of this study is to establish the expenditure pattern of the 128 departments in the instructional organization of Oregon State University. This expenditure pattern is expressed as the percent of cumulated expenditures to total budget. The percentage was calculated each of the twelve months. For example, at the end of the first month in the twelve month fiscal year (July 1 to June 30) expenditures may be 8.3 percent of the total budget, at the end of the second month 16.6 percent of the total budget, and so on. An ideal department would end at 100.0 percent signifying that it spent all of its budget and no more or less; but over a time period of one year the pattern of expenditures may not be linear. Departments

may, for example, accelerate their expenditures at the start of the year and spend proportionately less in later months.

Dealing with a relatively few variables and a total population of only 128 departments, it was decided to use the entire population to provide data for the expenditure curves. The population was finite and data on each department were obtainable. After the initial processing of data (computer assisted), it was evident that there were a number of departments in the population whose expenditure pattern was particularly unusual. These departments were found to be those used primarily as clearing accounts, or those receiving large amounts of research returned overhead earnings. Hence, their expenditure pattern was so abnormal that it was necessary to exclude such departments from the population. The expenditure pattern, (percent of accumulated expenditures to total budget) might, for one of these deviant departments, vary from one month at 15 percent to 110 percent the next, and then down to 75 percent the following month. Large amounts of returned overhead or unusual income would add to a department's budget; if there is not a corresponding increase in expenditures, the percent expenditure would drop to an unrealistic figure. Likewise, if a department clears or transfers out large amounts of its budget, the expenditure percent, without a corresponding decrease in expenditures, would increase again to an unrealistic figure. The departments where this occurred are not

normal operating departments, hence their omission from the population is justified. For 1967-68 the number of departments thus excluded was 35.

Data Collection and Coding

The following data were recorded:

- (1) Departmental designation
- (2) Fiscal year
- (3) Month
- (4) Cumulative expenditures each month
- (5) Annual budget in effect that month
- (6) Organizational type
- (7) Whether or not a deficit or surplus at year-end
- (8) Definitional range on whether or not to classify as a surplus or deficit (i. e. at plus or minus \$100 or at plus or minus \$500, et cetera)

The source document for most of these data (variables (1) through (5)) was the Departmental Statement (22, 23). The other key source was the final year-end analysis indicating whether or not a specific department incurred a surplus or deficit (25). The method of combining or grouping departments into larger groups or organizations (organizational type) was that which is prescribed for use in all Oregon State University budget documents by the State Board of

Higher Education (24). The data were coded from the source documents onto a form to facilitate the keypunching of data cards for computer data processing. The following codes and field sizes were used. (Field size would indicate the number of digits necessary for coding of data for computer processing.)

(1) Department. Coded as fiscal account number, with a four digit field size.

Example: 1011 for President's Office, et cetera.

(2) Fiscal year. Coded as year, with a two digit field size.

Example: 65 for fiscal year 1965-66, et cetera.

(3) Month. Coded as name, with a two digit field size.

Example: 03 for September, et cetera.

(4) Expenditures. Coded as amount to nearest whole dollars, with a six digit field size.

Example: 246361 for \$246,361.48, et cetera.

(5) Budget. Coded the same as expenditures.

(6) Organizational type. Coded as budget classification, with a one digit field size.

Type 1 Administration

Type 2 Libraries and Museums

Type 3 Institutional Services

Type 4 Instructional Services

Type 5 Instruction

Type 6 Other Instruction and Related Research

Type 7 Organized Activities

Type 8 Extension and General

- (7) Surplus or deficit status. Coded as result, with a one digit field size.

Result 1	Deficit
Result 2	Surplus
Result 3	Break-even

- (8) Definitional range. Coded as group, with a one digit field size.

Example: Group 4 for plus or minus \$500 would be considered to be the allowable range for those departments breaking even.

Group 1	Plus or minus \$1,500
Group 2	Plus or minus \$1,000
Group 3	Plus or minus \$ 750
Group 4	Plus or minus \$ 500
Group 5	Plus or minus \$ 400
Group 6	Plus or minus \$ 300
Group 7	Plus or minus \$ 200
Group 8	Plus or minus \$ 100
Group 9	Plus or minus \$ 50

Data for two complete fiscal years, 1967-68 and 1965-66, were coded and keypunched on data cards for computer processing. Fiscal year 1967-68 was chosen because it was the most current completed fiscal year for which data were available. Fiscal year 1965-66 was chosen because it was the only year in recent times to end with a net deficit (see Table 2). It was expected that the validity of the observations made would be severely tested by using these two recent fiscal years with obviously different net year-end results.

Expenditure Patterns

Departments were categorized into three groups by the nature of their year-end result of surplus, break-even, or deficit. The mean of the percent of cumulative expenditure to total budget for each of these three groups was calculated each month and the Cal-comp 1627 II Plotter utilized to graph the results (see the Appendix figures). The effects of organizational type and the definitional range used to specify break-even were also discerned.

The graphical results were useful in determining:

- (1) Whether or not there is an observable difference between each of the expenditure patterns for those departments ending the year with a surplus, deficit, or break-even status.
- (2) The effect of organizational type on expenditure pattern.
- (3) The point, if any, that a control indicator could begin to be used (i. e. the month when the expenditure patterns for surplus and deficit departments might begin to separate).
- (4) A useful definitional range as to what constitutes a surplus or deficit, for example whether or not break-even status should be anything within plus or minus \$50 or a higher range such as plus or minus \$500.

Analyzing the data and studying the graphical results helped to

determine the variables used in the final analysis. For example, the eight types of organizations may be classified into a larger grouping or eliminated entirely as a variable.

Determination of Variance

Since it appeared that there are differences in the expenditure patterns for departments that break-even or end with a surplus or deficit, the variance within these groups were calculated for each month. The standard deviations were useful in predicting the success of using the control indicator. For example, by using a predictive range of plus or minus two standard deviations around the mean of the break-even departments, one would expect to erroneously report a department as heading for a deficit or surplus about five percent of the time.

Predictability Measures

Two types of predictability measures were attempted. One measure determined whether the means and standard deviations of the 1967-68 fiscal year would be useful in determining a significant number of those accounts ending in a deficit or surplus some other year. In this case the other year was 1965-66. If the means and standard deviations of 1967-68 differed widely from those of 1965-66, then the predictive ranges obtained from the 1967-68 year would

likely not be useful in applying to other years, such as those in the future. Therefore, if the 1967-68 predictive ranges were successful in pointing out a reasonable percentage of those 1965-66 departments heading for a surplus or deficit, the control indicator would meet one measure of predictability.

Another measure of predictability relates to the predictive range as measured by the standard deviation of the 1967-68 data and the separation of the means of the three groups of data: break-even, surplus, or deficit. If, for example, there is no separation of the means of those departments that ended with a deficit and those that broke even, it would not be possible to make any predictions about the expected deficit or break-even status of any one department. On the other hand, it would be ideal if the means of the two types of departments were more than four standard deviations apart; for then an observation which fell within the predictive range of plus or minus two standard deviations from the mean of the group breaking even, the prediction could be made (with about 95 percent confidence) that this department would also break even. If the means of the departments breaking even and those heading for a deficit were close together, then a particular observation might have about a 95 percent probability of being associated with the break-even group but also, for example, about a 66 percent probability of being associated with those that end with a deficit.

Case 1 in Figure 9 exemplifies the situation where the means of the expenditure patterns of the break-even departments and the surplus departments are more than four standard deviations apart. Therefore, the observation would be within the predictive range of about a 95 percent probability of being associated with those departments breaking even and less than about a five percent chance of being associated with those departments ending with a surplus. The likelihood of predicting that this department would also break even is good. However, in Case 2 of Figure 9, the means of the two types of results are less than four standard deviations apart and the observation (if the 95 percent confidence interval is used) could be associated with either the surplus or break-even departments. It is, therefore, more difficult to predict whether the department observed is likely to break even or end with a surplus. The closer together the two means are, the smaller the number of those departments heading toward a deficit would be identified as such; the same also being true for those departments heading toward a surplus.

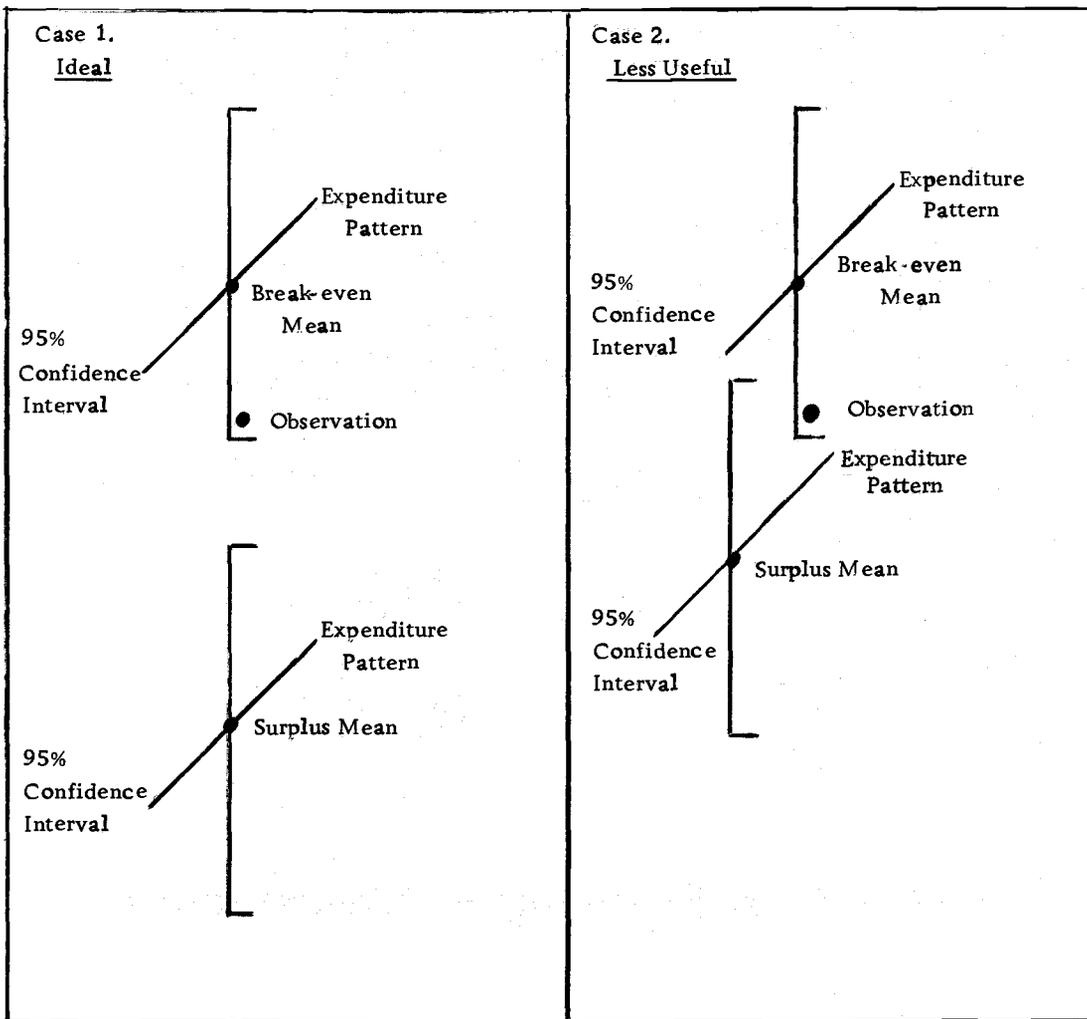


Figure 9. Effect of Separation of Means upon Associating an Observation with Surplus or Break-even Departments.

Implementation

The study of historical data to provide the means for predicting budget balances (surpluses or deficits) is to conclude with a discussion of the results of processing and evaluating the data. If it appears that this methodology provides the indicator desired, then

the implementation of such a device with the present computer assisted accounting system of the Oregon State System of Higher Education will be discussed in this report.

CHAPTER V

RESULTS OF HISTORICAL STUDY

To provide a basis for analysis, expenditure patterns were developed by plotting the departments' cumulative expenditures at the end of each month divided by the year's budget in effect that month on a graph from zero to a hundred percent which, when connected, would show the pattern of how the department expended its funds. Figure 10 exemplifies that which will be referred to as an expenditure pattern.

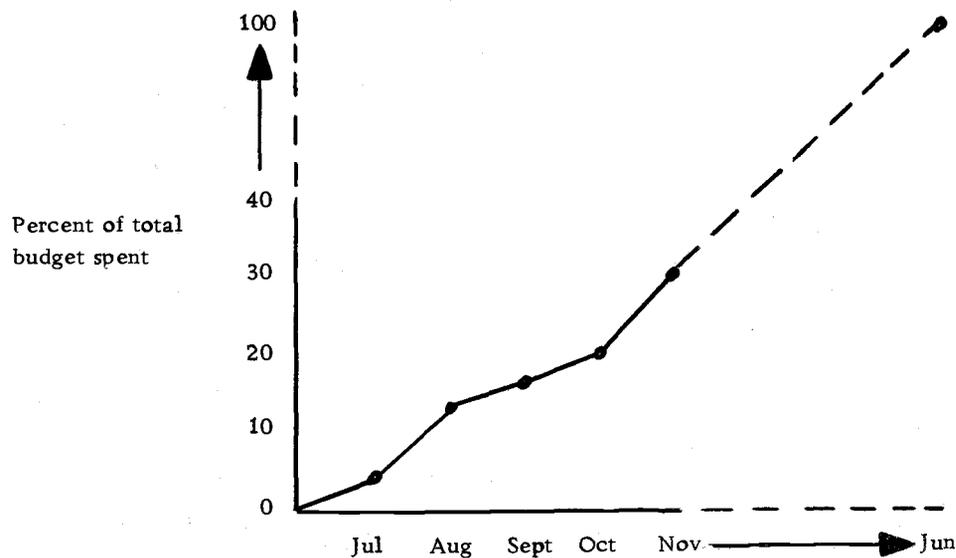


Figure 10. Example of What Is Referred to As an Expenditure Pattern.

The general characteristics of the population of departments providing the data for the expenditure patterns is provided in Table 4. Although 1965-66 was a net deficit year compared to the surplus year of 1967-68, the total number of departments ending with a surplus or deficit is not considerably different. (Surplus is defined as ending the year with total expenditures below the budget allocation by \$400 or more; deficit is defined as ending the year with total expenditures exceeding the budget allocation by \$400 or more.) As would be expected, however, the deficit year of 1965-66 does have a few more departments ending with a deficit and a few less departments ending with a surplus. Table 4 does point out that in each year studied there was an appreciable number of deviant departments (28 in 1965-66 or 32 percent of the total population, and 24 in 1967-68 or 26 percent of the total population).

Table 4. Characteristics of Population with Break-even at the Definitional Range of Plus or Minus \$400, Oregon State University, 1965-66 and 1967-68.

Characteristic	Number of Departments	
	1965-66	1967-68
<u>Result</u>		
Ending with deficit	16	10
Ending with surplus	12	14
Breaking even	<u>59</u>	<u>69</u>
Total all Results	<u>87</u>	<u>93</u>
<u>Type</u>		
Administrative Services	24	23
Instruction	51	60
Instructional Activities	<u>12</u>	<u>10</u>
Total all types	<u>87</u>	<u>93</u>

Note that the expenditure patterns for the two years are surprisingly similar. The Appendix contains the computer plots of all the different patterns and most appear to approximate a straight line. For the most part, then, the departments included in the population maintained a rather constant rate of expenditure, and the similarity of the expenditure pattern of those departments breaking even in 1967-68 to a straight line traveling from zero to 100 percent is shown in Table 5. ("Break-even" is again defined as the definitional range including plus or minus \$400.)

Table 5. Expenditure Pattern of Break-even Departments Compared to Straight Line, Zero to One Hundred Percent, Oregon State University, 1967-68.

Month	Break-even Mean	Straight Line Accumulations	Difference
July	8.45%	8.33%	(.12)%
August	16.60	16.66	.06
September	21.79	24.99	3.20
October	29.56	33.32	3.76
November	38.34	41.65	3.31
December	44.53	49.98	5.45
January	54.27	58.31	4.04
February	62.69	66.64	3.95
March	70.61	74.97	4.36
April	78.68	83.30	4.62
May	86.07	91.63	5.56
June	94.36	100.00	5.64

Both Table 5 and the expenditure pattern plots in Appendix Figure 5 indicate that the percentage of expenditures in the month of

June for those departments breaking even does not total 100 percent as would be expected if expenditures equaled budget allocation. Most of the difference is usually accounted for by the knowledge that the accounting system, from which the expenditure data were obtained, operates on a cash basis. Encumbered expenditures not yet realized in the accounting system are excluded from the expenditure figures. At the end of June, 1968, those departments breaking even at plus or minus \$400 had only expended (on a cash basis) 94.36 percent of their budget. The difference between this figure and the expected 100 percent is, therefore, explained by the omission of encumbered but not yet realized additional expense. If it were possible to include the encumbered expenses, the percentage expenditure to total budget at the end of June would be expected to be closer to 100 percent. Another factor which might affect the magnitude of the difference from the expected 100 percent is that departments defined as those breaking even are given some allowance in matching expenditures to budget. In Table 5 the allowance given is the definitional range of plus or minus \$400. Therefore, if a department's expenditures were within \$400 of its budget, the department would be considered to have broken even. With expenditures and budget differing by up to \$400, it is, of course, not always possible to have an exact 100 percent expenditure.

The expenditure patterns for all departments appear to start

close together, separate somewhat as the year goes on and then merge slightly at year-end. This occurrence is noted in Table 6 and Appendix Figure 6. Two factors would cause this convergence of expenditure patterns of deviant departments. Departmental administrators are somewhat able to assess their position regarding possible surpluses or deficits and may either slow down or speed up their expenditure rate in the closing months of the fiscal year. Also, University administrators might be alerted by departmental administrators to a possible surplus or deficit in a department and, if possible, add or subtract money from the department's budget. The author experienced this during the closing months of 1967-68 where monies were provided to departments to keep them from incurring deficits. Table 6 shows this dramatically with the sudden decrease in the difference between the mean of the deficit and break-even departments in the month of June.

The variance of the expenditure pattern each month for those departments breaking even is quite similar. Table 7 provides the standard deviation each year, 1965-66 and 1967-68, for those departments breaking even at the definitional range of plus or minus \$400. As would be expected, the variance the first and last months is somewhat less than the intervening months. Year 1965-66 has a variance each month greater than the variance for similar months in 1967-68. Through the author's experience, it is known that there

Table 6. Separation of Means of Deficit, Surplus, and Break-even Departments, with Break-even at the Definitional Range of Plus or Minus \$400, Oregon State University, 1967-68.

Month	Deficit Mean	Surplus Mean	Break-even Mean	Difference to Deficit	Difference to Surplus
July	12.97%	8.93%	8.45%	4.52%	(0.48)%
August	22.62	16.31	16.60	6.02	0.29
September	26.50	19.40	21.79	4.71	2.39
October	37.48	27.57	29.56	7.92	1.99
November	47.05	35.25	38.34	8.71	3.09
December	54.19	40.99	44.53	9.66	3.54
January	63.78	47.49	54.27	9.51	6.78
February	71.37	54.80	62.69	8.68	7.89
March	76.83	61.98	70.61	6.22	8.63
April	84.90	70.47	78.68	6.22	8.21
May	90.46	79.50	86.07	4.39	6.57
June	95.96	87.34	94.36	1.60	7.02

Table 7. Means and Deviations of Break-even Departments at the Definitional Range of Plus or Minus \$400, Oregon State University, 1965-66 and 1967-68.

Month	Mean Percent of Cumulative Expenditures		Standard Deviation of Means	
	1965-66	1967-68	1965-66 (percentage points)	1967-68 (percentage points)
July	7.03%	8.45%	4.70	3.98
August	15.03	16.60	7.94	7.26
September	21.31	21.79	9.45	7.68
October	29.08	29.56	11.21	8.60
November	36.68	38.34	12.70	9.30
December	45.02	44.53	12.86	9.71
January	53.40	54.27	13.06	9.57
February	60.69	62.69	14.20	9.05
March	68.03	70.61	13.90	10.37
April	76.53	78.68	12.17	10.80
May	84.15	86.07	12.14	10.15
June	93.63	94.36	9.23	6.10

was a greater emphasis by University administration in the latter year for departments to exercise financial responsibility and restraint. This awareness on the part of departmental administrators may have resulted in the lesser degree of variance in total departmental spending, as indicated by the comparison of the large deficit in 1965-66 with the smaller surplus in 1967-68 (Table 2).

It was thought that differences in services rendered might be a factor in determining the shape of the expenditure pattern. For example, a department in Institutional Services at Oregon State University (such as the Business Office or Office of Publications) might have an expenditure pattern quite different than a department in Instruction (such as Chemistry or English). Plots were made of the expenditure patterns for each of the eight different types of services found at Oregon State University. These plots are provided in Appendix Figures 1 and 10. Inspection of these plots reveals considerable similarity in the expenditure patterns. In an attempt to ascertain if a clearer distinction could be made between expenditure patterns, the eight different types of organizations were combined into three larger groups: Administrative Services, Instruction, and Instructional Activities. Again, visual inspection of the plot of the expenditure patterns for each of these three larger groups of organizations reveals little difference (see Appendix Figures 2 and 11). This difference is given in Table 8, where the maximum

separation is shown to be only about six percentage points. Therefore, the type of function or organization with which a department is affiliated does not appear to cause appreciable differences in the expenditure patterns.

Table 8. Means of Cumulative Expenditures by Organization Type,* Oregon State University, 1967-68.

Month	Organization			Maximum Separation
	Type 1	Type 2	Type 3	
July	9.69%	8.82%	8.58%	1.10%
August	19.23	16.58	16.24	2.99
September	24.07	21.17	21.65	2.90
October	33.46	29.00	29.08	4.46
November	42.39	37.89	36.15	6.24
December	48.59	44.02	42.93	5.66
January	57.27	52.77	56.40	4.50
February	64.29	61.16	65.88	4.72
March	72.30	68.43	73.92	5.49
April	80.20	76.66	82.03	5.37
May	87.34	84.46	88.01	3.55
June	95.76	92.39	94.74	3.37

*Type 1 includes organizations coded as 1 through 4, type 2 includes organizations coded 5, and type 3 includes organizations coded 6 through 8. See Chapter IV "Data Collection and Coding."

CHAPTER VI

SELECTION AND TEST OF INDICATOR

It is apparent in studying the plots of the expenditure patterns in Appendix Figures 6 and 15 that the patterns for those departments experiencing a surplus, deficit, or breaking even are all somewhat different. The purpose of this chapter is to ascertain whether this separation is sufficient to provide an indicator useful in predicting whether a department is likely to experience a surplus or a deficit at the end of the fiscal year.

Months Where Predictions Could Be Made

The means of the percentages of cumulative expenditure to total budgets for the departments ending with a surplus, deficit, or breaking even are given in Table 9. The maximum difference between the means appears to be the greatest during the months of January and February. Therefore, it would be logical to use either one of these months to predict the departments heading for a surplus or deficit as there is less likelihood of making an error of prediction. (See the discussion at the end of Chapter IV.) The earlier the prediction of a possible problem can be made, the greater the chances that either the administration of the department or the University will be able to correct the situation. For these reasons the month of

January will hereafter serve as the month where predictions will be attempted. The months of March and April also have considerable separation between the surplus and deficit means, and it is likely that these months would be used later in the fiscal year for a reevaluation of whether improvements have been made by the departments noted in January.

Table 9. Means of Cumulative Expenditures of Deficit, Surplus, and Break-even Departments, Oregon State University, 1967-68.

Month	Means of Cumulative Percent Expenditure			Maximum Difference of Means
	Deficit	Relative Surplus	Break-even	
July	12.97%	8.93%	8.45%	4.52%
August	22.62	16.31	16.60	6.31
September	26.50	19.40	21.79	7.10
October	37.48	27.57	29.56	9.91
November	47.05	35.25	38.34	11.80
December	54.19	40.99	44.53	13.20
January	63.78	47.49	54.27	16.29
February	71.37	54.80	62.69	16.57
March	76.83	61.98	70.61	14.85
April	84.90	70.47	78.68	14.43
May	90.46	79.50	86.07	10.96
June	95.96	87.34	94.36	8.62

Definitional Range

The discussion in Chapter IV on methodology explained that it was necessary to determine at what level or definitional range to

define a surplus or deficit. Whether or not a surplus or deficit is defined at plus or minus \$500 or plus or minus \$50 would probably have an effect upon the shape of the expenditure patterns and ultimately upon the ability to predict surpluses or deficits. The greater the range allowed for defining a break-even department, the more departments which are called break-even and the fewer called surplus or deficit. The range which defines what is break-even also determines what is surplus or deficit; therefore, the distance apart of the means of surplus, deficit, and break-even will vary with the definition of break-even. As was portrayed by Figure 9, the separation of means will ultimately affect the ability to predict the outcome of a department.

Nine different definitional ranges were chosen and the means of surplus, deficit, and break-even departments were calculated for each definitional range. Using a possible predictive range of one standard deviation, Table 10 shows the results at the different definitional ranges. It is seen in Table 10 that the number of deficit and surplus departments predicted increase with the decrease in the definitional range specifying the break-even departments. As the definition includes greater allowance or range, the number of departments defined as break-even increases and the number of remaining departments, the surpluses or deficits, decreases.

Table 10. Effect of Varying Definitional Ranges upon January Predictions of Surplus or Deficit Departments, Oregon State University, 1967-68.

Group Number and Definitional Range	Break-even Mean	Standard Deviation (Percentage Points)	Deficit Departments			Surplus Departments		
			Total	Pre-dicted	%	Total	Pre-dicted	%
#1 ± \$1,500	54.45%	9.84	4	1	25	6	3	50
#2 ± \$1,000	54.33	10.03	7	1	14	7	3	43
#3 ± \$ 750	54.53	10.07	7	1	14	10	4	40
#4 ± \$ 500	54.58	10.13	7	1	14	11	4	36
#5 ± \$ 400	54.27	9.57	10	4	40	14	5	36
#6 ± \$ 300	54.65	9.79	11	4	36	18	5	28
#7 ± \$ 200	54.37	10.21	14	4	29	27	6	22
#8 ± \$ 100	54.50	10.51	20	4	20	32	7	22
#9 ± \$ 50	53.27	9.69	24	7	29	33	6	18

If one were arbitrarily to say all actual departmental expenditure percents (cumulative expenditure divided by total budget) falling outside a predictive range of plus or minus one standard deviation of the mean percent of those departments breaking even were likely to be departments heading for a surplus or deficit, then one would have the desired budget control indicator. If the percent expenditures of break-even departments are normally distributed, then about one-third of the departments will be reported as heading toward a surplus or deficit when, in fact, they will break even. In Table 10 all observations falling within one standard deviation of the mean of the break-even departments were considered to be departments likely to break even. All others would either be surplus or deficit departments. If the particular observation (percent expenditure for a department)

was 71.30 percent and the sum of the mean plus one standard deviation of the break-even departments totaled 64.44 percent that month, the observation would be labeled as representing a department likely to incur a deficit.

It appears in Table 10 that the definitional range of plus or minus \$400 for specifying a break-even department would maximize the numbers predicted. Of the known departments ending in a surplus, group 5 would predict 36 percent. Likewise, of those departments which ultimately ended with a deficit, group 5 would result in a prediction of 40 percent. Using the data of the base year 1967-68, it appears that the definition of a break-even department as being anything within plus or minus \$400 of matching expenditures maximizes the prediction of those ultimately ending with a deficit and also provides a reasonably high level of prediction of those ending with a surplus.

Another way of portraying the predictive ability of this indicator is shown in Figure 11. This figure shows that by using a predictive range of one standard deviation above and below the mean of the break-even departments, 31 surplus and deficit departments would be predicted. Of these 31 departments, 9 would eventually end the year as surplus or deficit and the remaining 22 would break even. Of those 62 departments predicted to break even, 15 would actually end with a surplus or deficit.

January 1968 Prediction of Number of Departments That Will End with:		Actual Year-end Results Number of Departments Ending with:			
Deficit	16	{ Deficit	4	Deficit	10
		{ Break-even	12		
		{ Surplus	0		
Break-even	62	{ Deficit	6	Break-even	69
		{ Break-even	47		
		{ Surplus	9		
Surplus	15	{ Deficit	0	Surplus	14
		{ Break-even	10		
		{ Surplus	5		
TOTAL	93		93		93

Figure 11. Comparison of January 1967-68 Prediction with Actual Year-end Results; Predictive Range of Plus or Minus One Standard Deviation from Break-even Mean, Oregon State University.

Predicting against Another Year

Knowing that fiscal year 1965-66 is somewhat different than 1967-68 in that it ended with a net deficit rather than the typical net surplus, it is necessary to see whether using a predictive range of plus or minus one standard deviation and a definitional range of plus or minus \$400 will be as useful in predicting for 1965-66 as it was in 1967-68. Table 11 shows the results of using the 1967-68 data to select departments appearing to be heading for a surplus or deficit. For both results, about 40 percent of those actually becoming deviant departments in 1965-66 were predicted with the indicator

chosen from the 1967-68 data, i. e., 54.27 percent plus or minus 9.57 percent.

Table 11. Effect of Using 1967-68 Predictive Ranges to Predict Surplus and Deficit Departments for 1965-66, Oregon State University.

Effects	Surplus Departments	Deficit Departments
Actual 1965-66 results	12	16
Number predicted (above or below the range of 1967-68 means plus or minus one standard deviation)	6	6
Percent of actual predicted	50%	38%
Comparable prediction for 1967-68 (See Table 10)	36%	40%

The similarity of the effectiveness of the predictive indicator (plus or minus one standard deviation from 1967-68 break-even mean) for both years is encouraging. It indicates that enough compatibility exists between two different fiscal years so that the values of a control indicator determined in the year just completed could perhaps have validity for use in budgetary control during the current year. It appears that the control indicator meets the first test of predictability discussed in Chapter IV.

Discussion of Errors

There have been several mentions of possible errors in using a control indicator determined on the basis of the distance a particular department expenditure percent is from the mean percent of those departments breaking even the prior year. One error is labeling an observed department as one that is likely to end with a surplus or deficit when it will actually break even. The other error occurs when an observed department appears to be breaking even, when it actually is a department that will end with a surplus or deficit.

At this stage in the discussion any department whose percent of expenditures to total budget, as of January, is greater than one standard deviation above the prior year's mean for break-even departments would be labeled as a department heading toward a deficit. Conversely, any department with a percent expenditure less than one standard deviation below the mean of the break-even departments would be labeled as a department heading toward a surplus. If one were dealing with a random sample drawn from an infinite population and could make some assumptions about the normality of the distribution of values around the means of the break-even, deficit and surplus departments, the errors mentioned above would be predictable. In this study with finite populations, it is possible to actually count or measure the two types of errors. Table 12

provides the measurement of errors observed in using a predictive range of one standard deviation above and below the mean.

Table 12. Effects of Using a Range of One Standard Deviation to Predict Deviant Departments, Month of January, Oregon State University, 1965-66 and 1967-68.

Measure	1965-66	1967-68
Number surplus departments	12	14
Number surplus predicted	6	5
Percent of total predicted	50%	36%
Number deficit departments	16	10
Number deficit predicted	6	4
Percent of total predicted	38%	40%
Number of break-even predicted to be surplus or deficit	24	22
Percent error	41%	32%
Number of surplus and deficit predicted to be break-even	14	15
Percent error	50%	63%

One type of error occurs when an observation leads to the statement that a department is heading toward a surplus or deficit when it is not. In 1965-66 the percentage of this error is 41 percent, and in 1967-68 32 percent. (There were 69 break-even departments, of which 22 were predicted to be either surplus or deficit

departments.) Since about 32 percent of the distribution of a normal curve lies outside plus or minus one standard deviation, the errors of 41 and 32 percent obtained from the actual counts are allowable.

The second prediction error occurs when a department is said to be breaking even when it actually is a department that will end with a surplus or deficit. Table 12 shows that this occurs 50 percent and 63 percent of the time for years 1965-66 and 1967-68 respectively. (There were 24 surplus and deficit departments of which 15 were predicted to break even.) This error is the second error of prediction discussed in Chapter IV and is closely related to the amount of separation of the means of the surplus, break-even, and deficit expenditure patterns (see the discussion accompanying Figure 9, Chapter IV).

Other Predictive Ranges

It is apparent that the decision to use the predictive range plus or minus one standard deviation as the criteria for prediction of surplus or deficit departments could be modified. A significant separation between the expenditure patterns would facilitate using a larger range or criteria for identifying a department as break-even. If a predictive range of two standard deviations were used rather than one, there should be less chance of error of predicting that a department is going to be a surplus or deficit when it is not.

(From the shape of the curve of a normal distribution, it is known that using one standard deviation above and below the mean will result in about one-third chance of error; using two standard deviations would reduce this error to about five percent.)

Likewise, if a smaller predictive range (something less than one standard deviation) were used to predict the break-even departments, the error would be considerably greater. By using a range of two-thirds standard deviation from the mean to include the break-even departments, the error of saying a department is not break-even when it is would approach about 50 percent. This error, however, is counterbalanced by an increase in the number of departments predicted as surplus or deficit that actually do end with a deficit or surplus. Table 13 shows the results of using a predictive range of plus or minus two-thirds standard deviation on predicting those departments that actually become deviant. In comparing the results of Table 13 with those included in Table 12, it is seen that the error of predicting that a department is going to break even when it actually incurs a surplus or deficit decreases with the change in the predictive range from one standard deviation to two-thirds standard deviation. Conversely, there is an increase in the error of predicting that a department will incur a surplus or deficit when it actually breaks even.

Table 13. Effects of Using a Range of Two-thirds Standard Deviation to Predict Deviant Departments, Month of January, Oregon State University, 1965-66 and 1967-68.

Measure	1965-66	1967-68
Number surplus departments	12	14
Number surplus predicted	6	7
Percent of total predicted	50%	50%
Number deficit departments	16	10
Number deficit predicted	7	7
Percent of total predicted	44%	70%
Number of break-even predicted to be surplus or deficit	37	28
Percent error	63%	41%
Number of surplus and deficit predicted to be break-even	11	9
Percent error	39%	38%

Figure 12 provides the summary of the results of the predictions made in January, 1968, with a predictive range of two-thirds standard deviation. In comparing Figure 12 to Figure 11, it is seen that using a smaller predictive range of two-thirds standard deviation will increase the number of departments predicted to end with a surplus or deficit from 31 to 43. Of the 43 departments predicted using two-thirds standard deviation, 14 would eventually end the year with a surplus or deficit. This is a substantial gain over the

nine predicted using a predictive range of one standard deviation.

Of the 50 departments predicted to break even, 41 would actually end the year as break-even.

January 1968 Prediction of Number of Departments That Will End with:		Actual Year-end Results, Number of Departments Ending with:							
Deficit	22	{	Deficit	7	}	Deficit	10		
			Break even	14				Break even	69
			Surplus	1				Surplus	14
Break-even	50	{	Deficit	3	}	Break-even	69		
			Break even	41				Surplus	14
			Surplus	6					
Surplus	21	{	Deficit	0	}	Surplus	14		
			Break even	14					
			Surplus	7					
TOTAL	93			93			93		

Figure 12. Comparison of January 1967-68 Prediction with Actual Year-end Results; Predictive Range of Plus or Minus Two-thirds Standard Deviation from Break-even Mean, Oregon State University.

If the predictive ranges obtained from the 1967-68 data are applied to 1965-66 data, similar results are obtained. Figure 13 provides the summary of the predictions made in January 1966, compared to actual year-end results.

January 1966 Prediction of Number of Departments That Will End with:		Actual Year-end Results, Number of Departments Ending with:			
Deficit	27	{ Deficit	7	→ Deficit	16
		{ Break-even	19		
		{ Surplus	1		
Break-even	33	{ Deficit	6	→ Break-even	59
		{ Break-even	22		
		{ Surplus	5		
Surplus	27	{ Deficit	3	→ Surplus	12
		{ Break-even	18		
		{ Surplus	6		
TOTAL	87		87		87

Figure 13. Comparison of January 1965-66 Prediction with Actual Year-end Results; Predictive Range of Plus or Minus Two-thirds Standard Deviation from Break-even Mean, Oregon State University.

CHAPTER VII

SUMMARY

This chapter will attempt to relate the indicator determined to the previously discussed concepts of budgetary control and the constraints under which the indicator could function. The chapter will then end with an explanation of a possible method of implementation.

Conclusions

The initial goal of this study was to determine an indicator which would aid the University administration in lessening the occurrences of year-end surpluses and deficits in the many university departments. Surpluses could, for example, be transferred to cover deficits in other departments or placed into areas critically needing additional funds (for example, teaching equipment). It is seen that this control indicator could help considerably in achieving the necessary budgetary control. As early as January, 50 percent of the departments ultimately ending with a surplus and 70 percent of those departments finally ending with a deficit were predicted in 1967-68 (Table 13). The ultimate would be to predict all surplus and deficit departments, but even predicting one or two is a considerable improvement over the present system. Predicting as many as 50 percent of those that will end with a surplus or deficit would be

financially significant.

Another consideration was that the budget control indicator must function within the present University environment of decentralization, with most of the financial decision-making delegated to the departmental level. The indicator would not impose any greater controls upon the departmental administrator, as would line-item budgeting. It would, however, alert the University administration that some problem was occurring in a department. The necessary action would then be to isolate the factors that may cause a department to end the year with a surplus or deficit. Perhaps the University administration would alter budget allocations or the departmental administrator would accelerate or decelerate expenditures. The control indicator would, therefore, help achieve the desires of University administration without impinging on departmental prerogatives.

It is apparent that the method resulting in the budget control indicator would be of assistance in attaining the desired results. Figure 8 is modified and reproduced here as Figure 14 to aid in placing the control indicator in the framework of the theoretical discussion of what "should" happen. The budget control indicator is "feedback" that with computer assistance could, through the management-by-exception principle, provide the steps of measurement, comparison, evaluation and action that will affect the plans

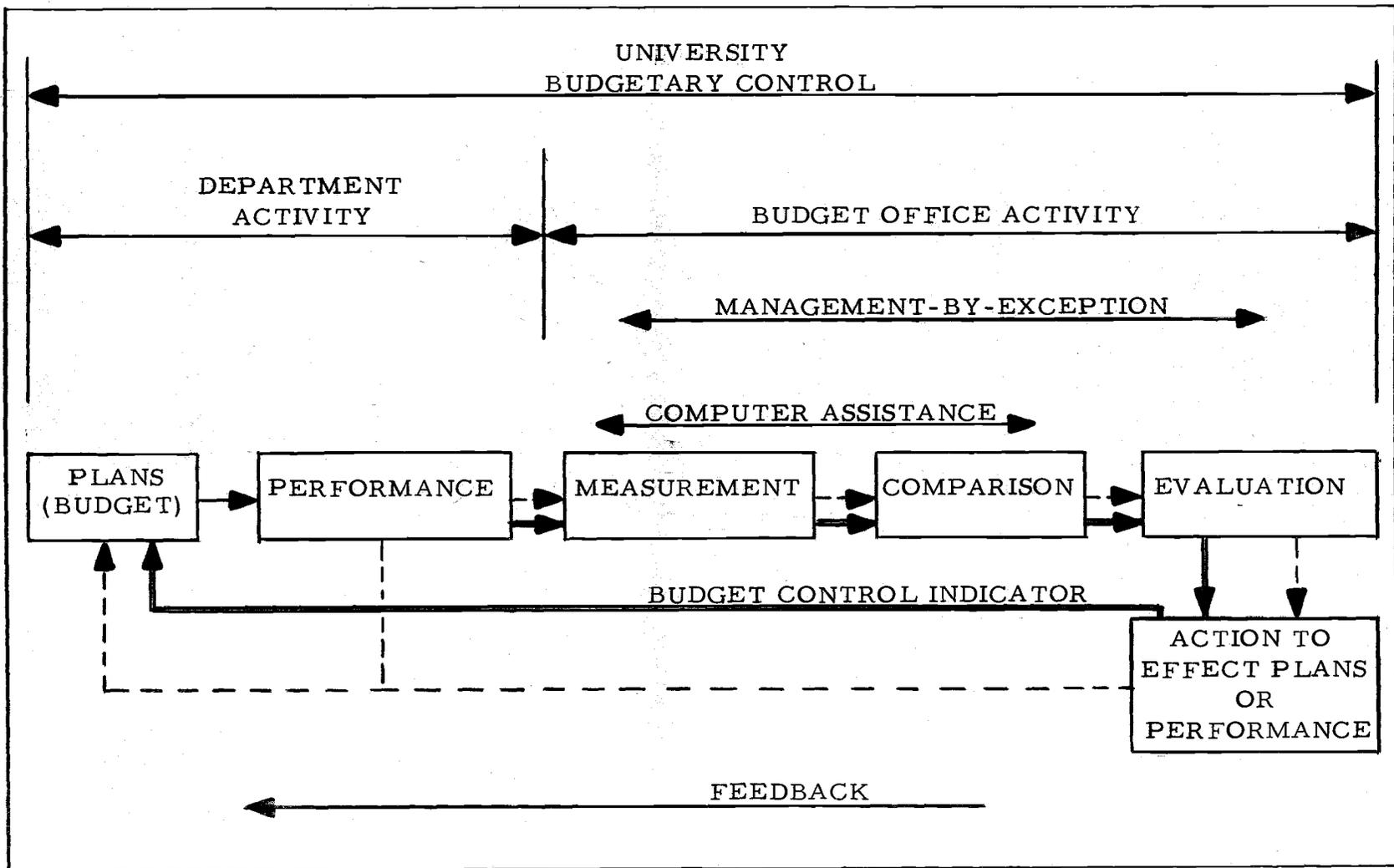


Figure 14. The Control Indicator Working in the University Budgetary Control Environment.

and performance.

Since the initial purpose of the budget control indicator is to give a warning of a possible problem, the decision of whether to use a predictive range of one standard deviation or two-thirds standard deviation is evident. The fault of not bringing attention to a possible deficit or surplus department is considerably more serious than the error of pointing out one as that which is heading for a surplus or deficit when it is not. Therefore, two-thirds or even one-half standard deviation would appear to be the predictive range from the break-even mean that should be used.

Implementation

The implementation of the control indicator at Oregon State University does not seem to be a major task. The existing computerized accounting system maintained by the Comptroller's Office of the State System of Higher Education contains the framework or basis for the indicator. Figure 6 provides a facsimile of the computer printout of the data in this accounting system. The elements needed for the control indicator, specifically the cumulative expenditures and total budget, are included.

The control indicator would be obtained if the computer program producing this printout were modified as follows:

- (1) The program should divide total requisition disbursements to date by total budget allowance to compute the percentage expenditure.
- (2) A table of allowable predictive ranges must be added to the computer program. The allowable predictive range would be obtained by using (for example) plus or minus two-thirds standard deviation from the previous year's mean of break-even departments. Different tables with different ranges could be provided for the maximization of prediction or the minimization of error at the option of the administration.
- (3) The program should compare the computed percentage expenditure for a department to the inputted allowable predictive range for that month.
- (4) If the computed percent expenditure is within the range for that month, the system would do nothing and go on to the calculations for the next department. If the computed percent was either above or below the predictive range that month, a message would be printed on both the Departmental Statement and the Summary Financial Statement (the latter is a report prepared for University administrators).

(5) The messages might appear as:

Departmental Statement - "YOU ARE SPENDING AT
A POSSIBLE DEFICIT RATE. PLEASE TAKE
NECESSARY CORRECTIVE ACTION, " (In the
other case the word "SURPLUS" would be substi-
tuted for "DEFICIT.")

Summary Financial Statement - "EXPENDITURE
RATE OF _____ NOT WITHIN ALLOWABLE
RANGE; PLEASE CONTACT DEPARTMENT
HEAD" (actual percent expenditure would be
printed in the blank space).

The departmental administrator, upon seeing the message on the monthly Departmental Statement, would hopefully begin analysis of the cause. The University administration, noting the message on the Summary Financial Statement, would follow up with the departmental administrator ensuring that corrective action has been taken. If the action is successful and percent expenditures fall within the allowable range, the messages would not appear on the statements the following month.

After each year is completed, it would be necessary to compute new predictive ranges from the means and the standard deviations of the break-even accounts from the year-end accounting data. The process could be that which was followed in this study, or a

computer program could be written to accomplish the calculation and analysis in one step. The resultant means and standard deviations could then be used for the predictive ranges to provide the budget control indicator for the following year. However, if the year just completed was significantly different than other prior years (perhaps ending with major surpluses or deficits), then the use of the data for future predictions would have to be qualified. In this case a more appropriate base for prediction might be the most recent year completed having normal results.

Considerations for Additional Research

The methods outlined in this study have resulted in a process whereby departments heading toward a surplus or deficit situation may be identified prior to the completion of the fiscal year. The method does not identify why a department's expenditures deviate from the budget. Additional research should be done to isolate the factors leading to the deviant situation, as these factors could also aid in predicting as well as preventing future surpluses or deficits. A partial list of these additional considerations or variables include:

- (1) Experience of department administrator. (Does he have financial management experience?)
- (2) Length of service of department administrator. (Was he recently appointed?)

- (3) Financial philosophy of department administrator. (Does he follow good business principles?)
- (4) Newness of department. (Is it well established or was it recently created?)
- (5) Internal problems. (Was the bookkeeper on sick leave?)
- (6) Nature of department. (Does it have unusual educational purposes or methods?)

Other factors should be included in the research such as the effect of implementing the proposed encumbrance system by the State System of Higher Education and an investigation and isolation of the effects of external environmental forces upon departmental expenditures. Some of these considerations relate specifically to the initial process of funding. A funding process (perhaps a formula approach as used by many universities) that is flexible and is reapplied when the environment changes (such as a sudden increase in enrollment) would also assist in lessening possible future surpluses or deficits.

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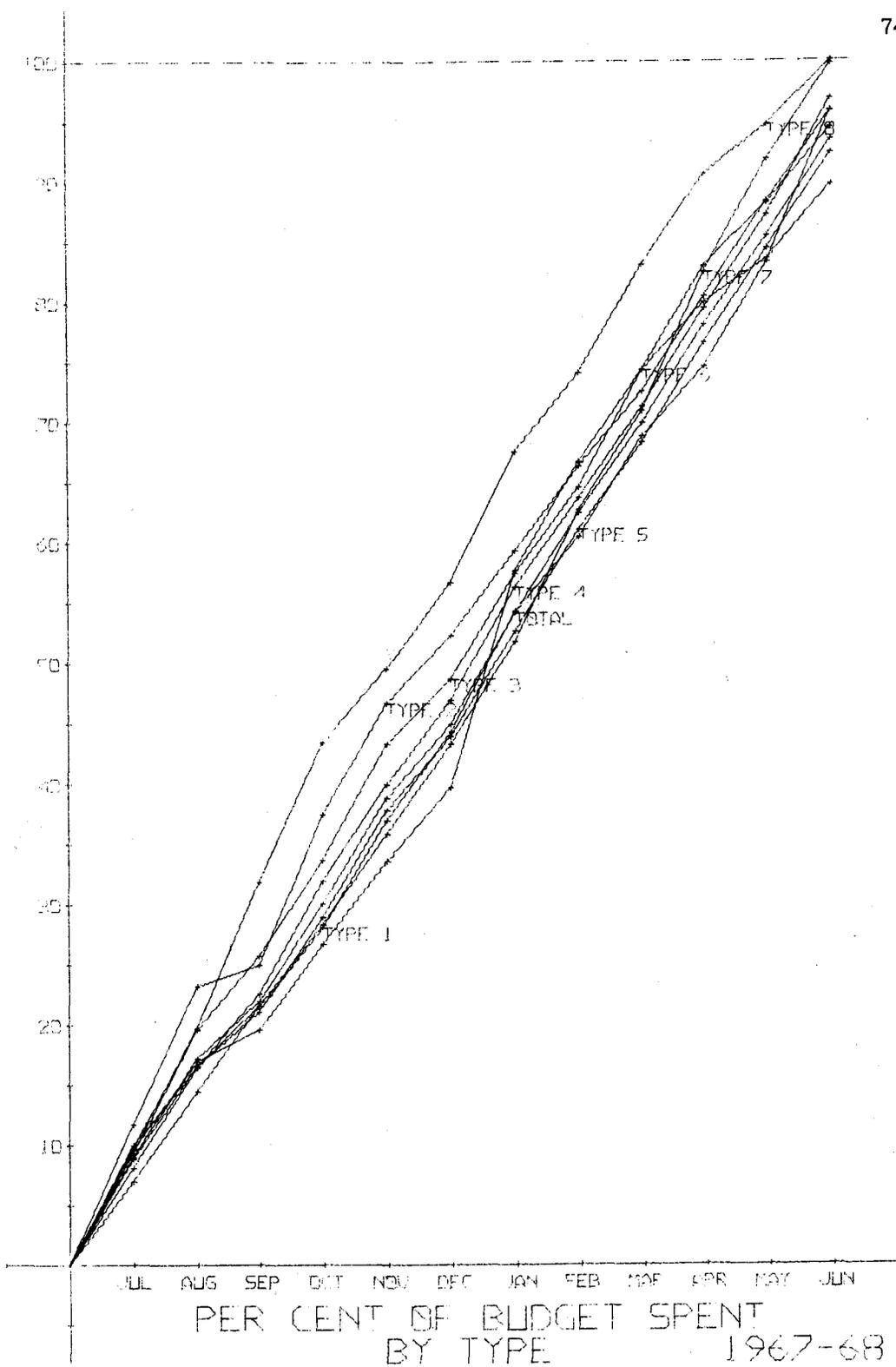
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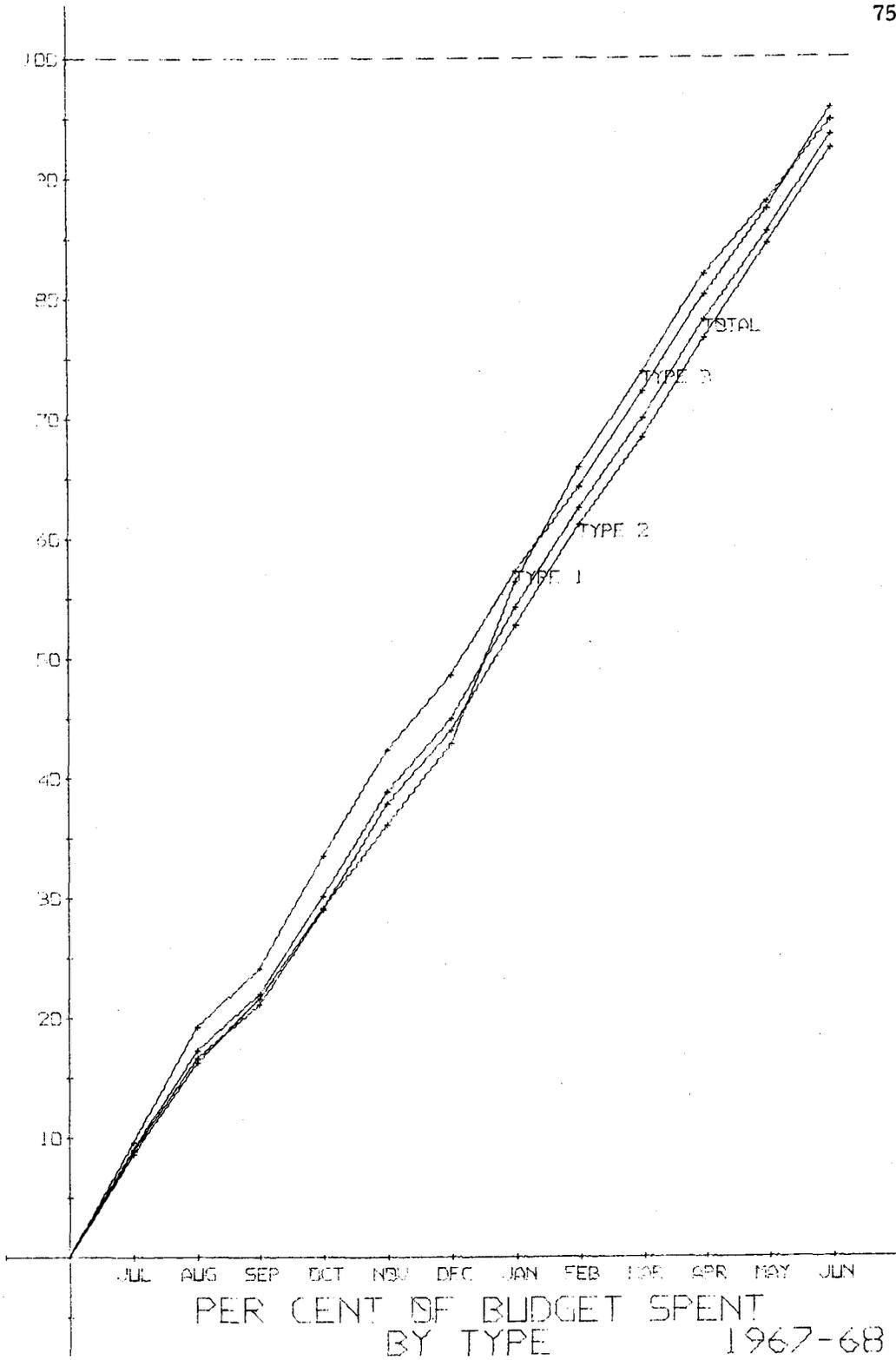
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Appendix Table 1. Codes Used in Appendix Figures for Organizations, Combined Organizations, and Results.

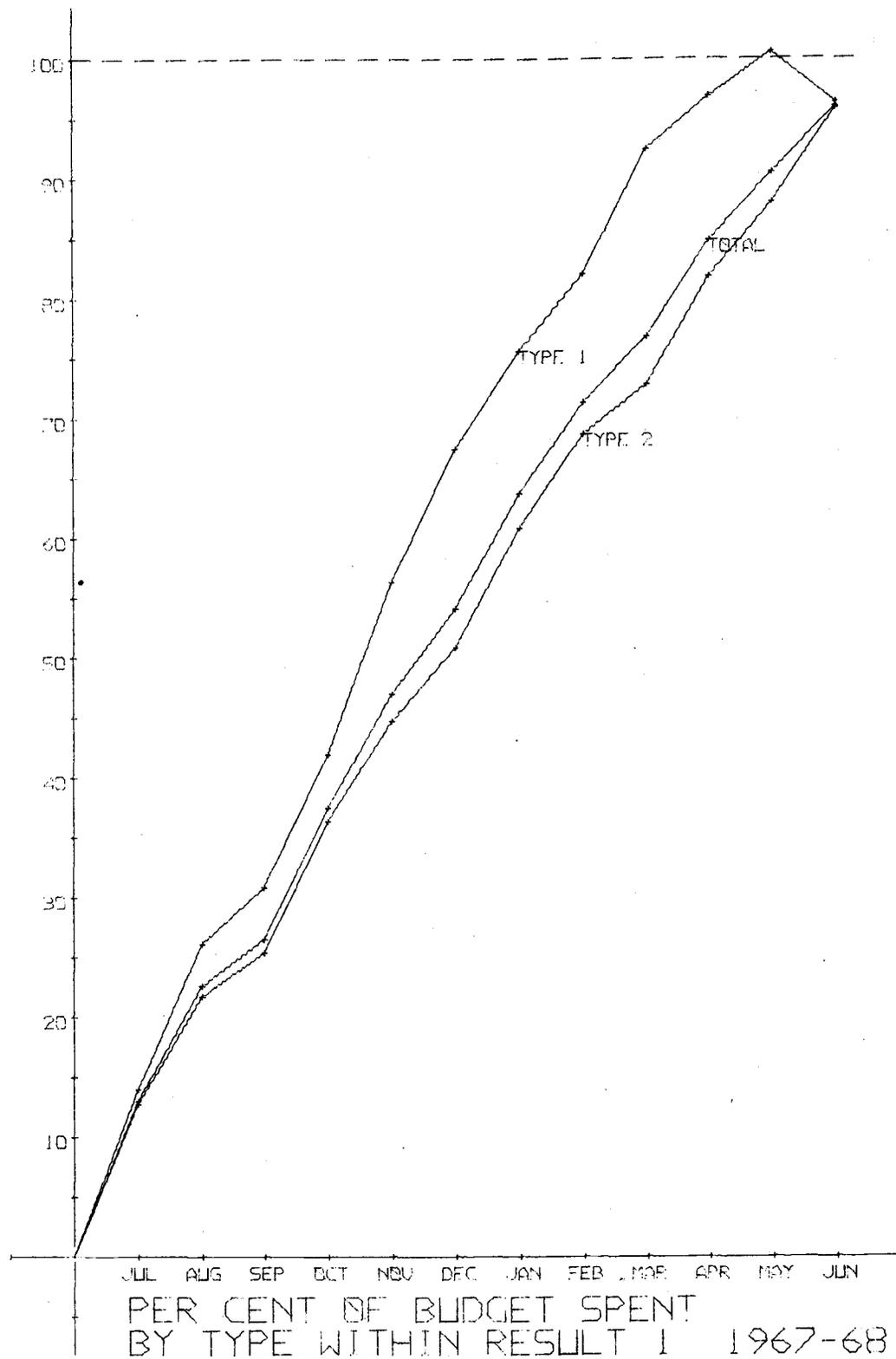
CODES USED IN APPENDIX FIGURES	
Organizations	
Type 1	Administration
Type 2	Libraries and Museums
Type 3	Institutional Services
Type 4	Instructional Services
Type 5	Instruction
Type 6	Other Instructional Activities
Type 7	Organized Activities
Type 8	Extension and General
Combined Organizations	
Type 1	Administrative Services
Type 2	Instruction
Type 3	Instructional Activities
Results	
Result 1	Ending with Deficit
Result 2	Ending with Surplus
Result 3	Breaking Even



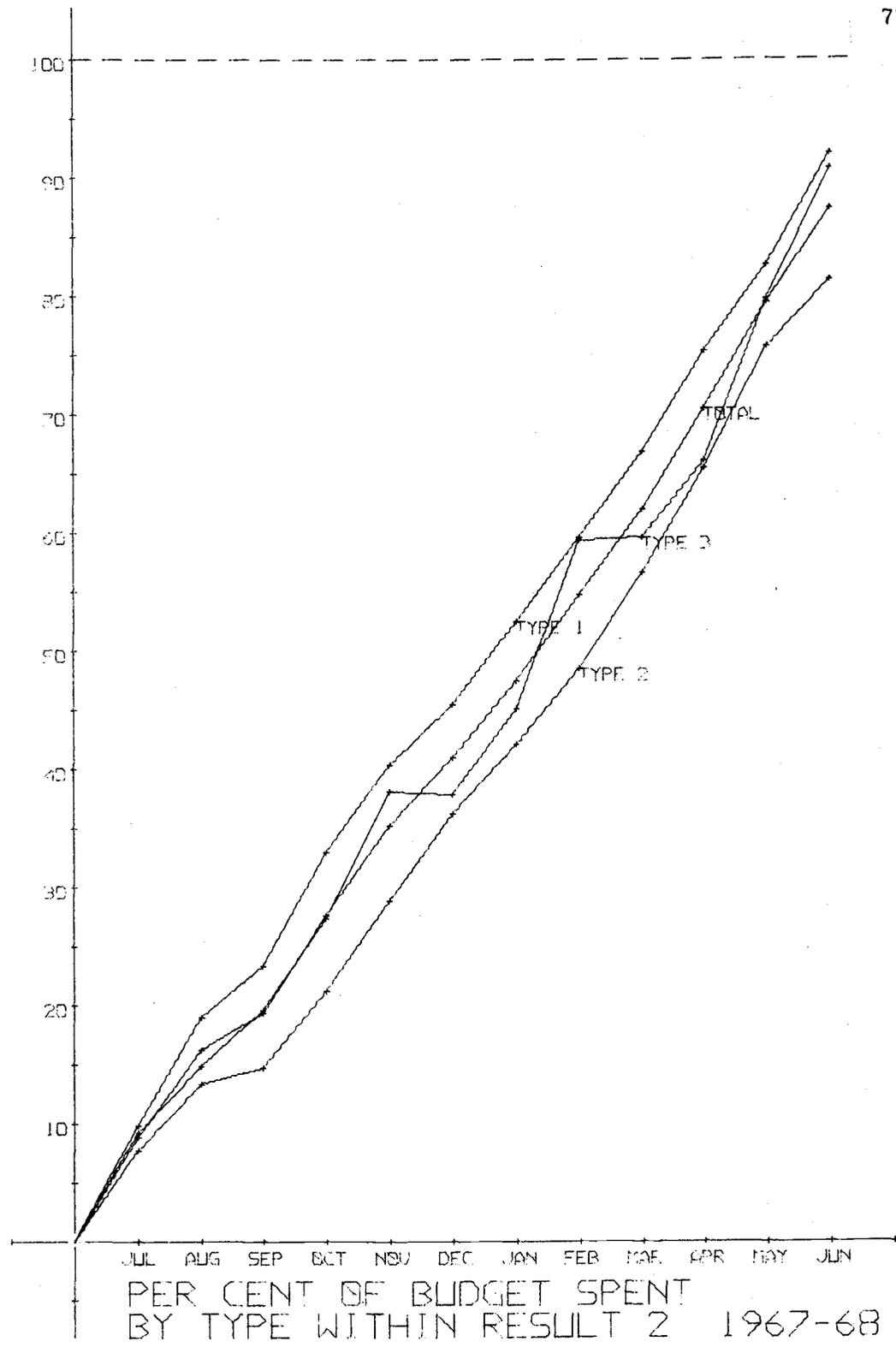
Appendix Figure 1. Expenditure Patterns for Eight Types of Organizations, Oregon State University, 1967-68.



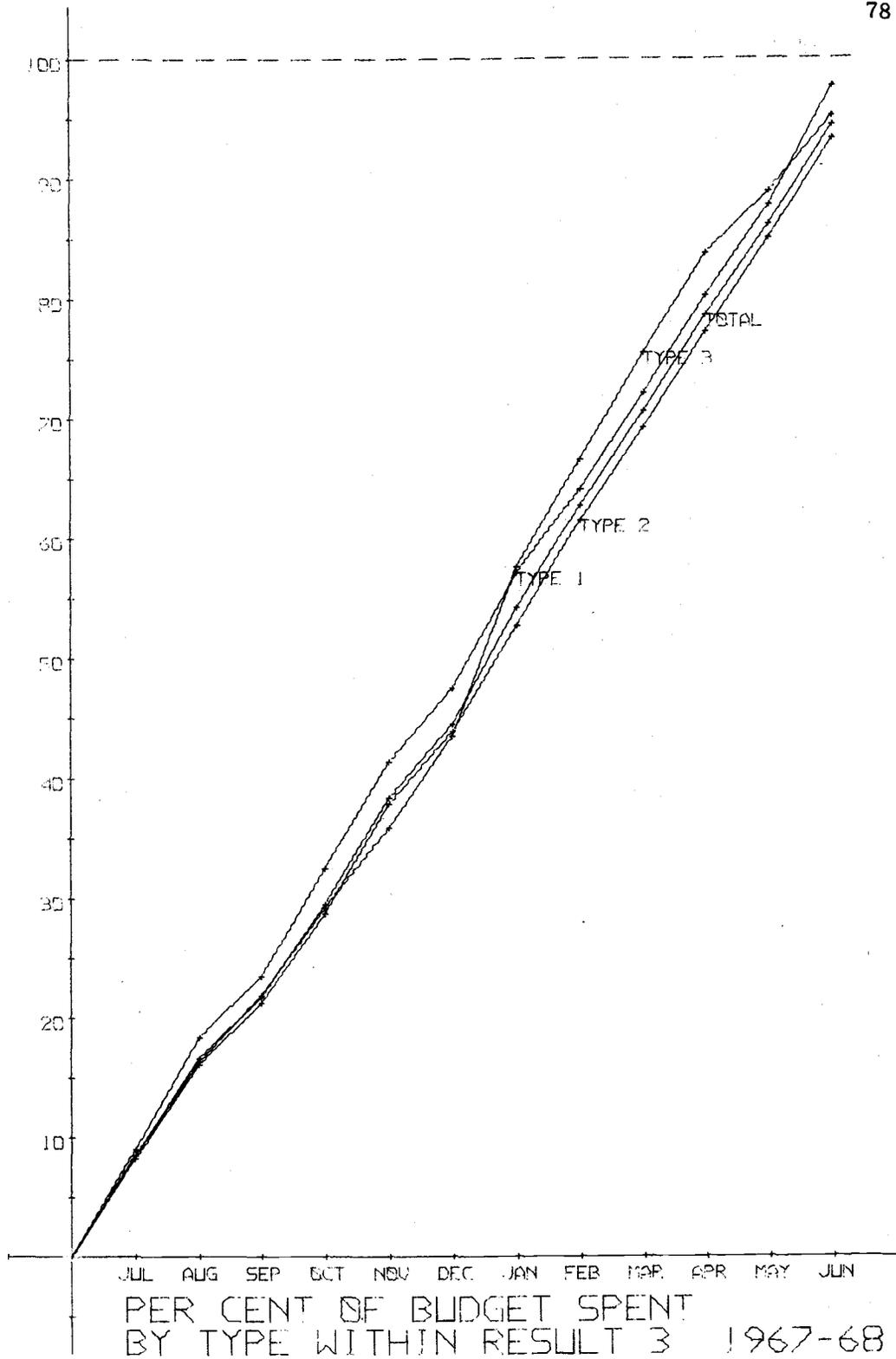
Appendix Figure 2. Expenditure Patterns for Three Combined Groupings of Organizations, Oregon State University, 1967-68.



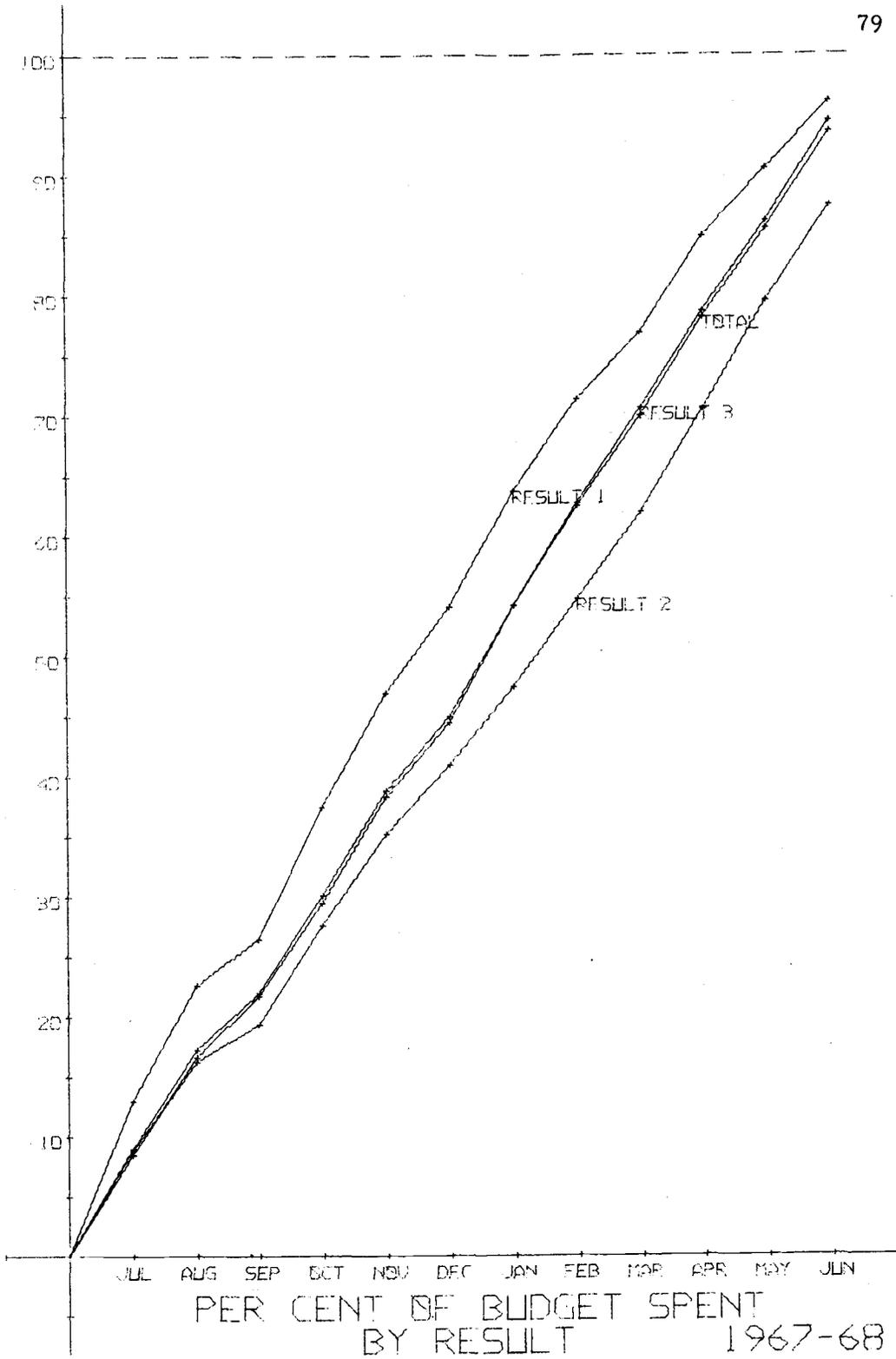
Appendix Figure 3. Expenditure Patterns for Departments Ending with a Deficit by Organizational Type, Oregon State University, 1967-68.



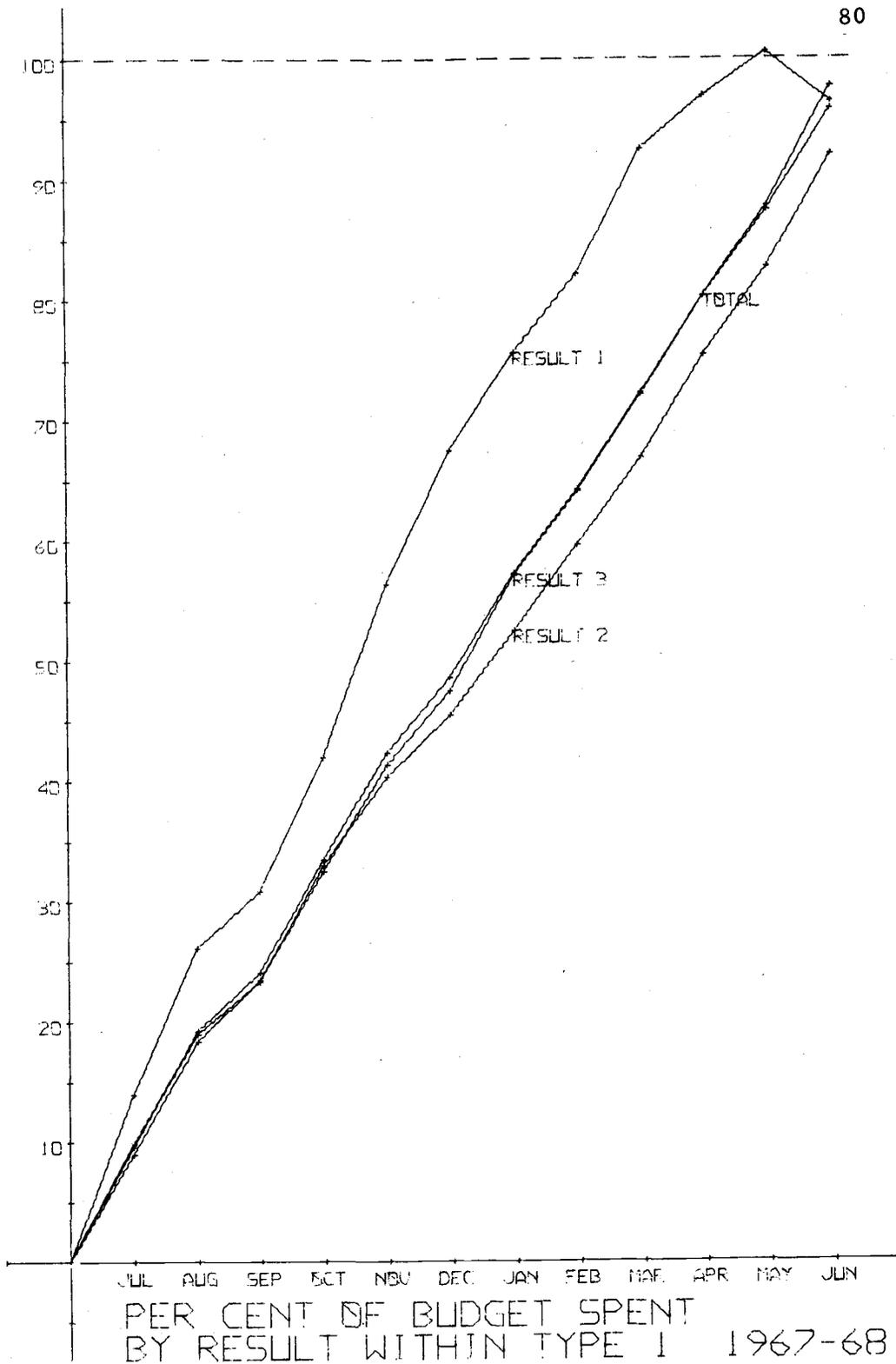
Appendix Figure 4. Expenditure Patterns for Departments Ending with a Surplus by Organizational Type, Oregon State University, 1967-68.



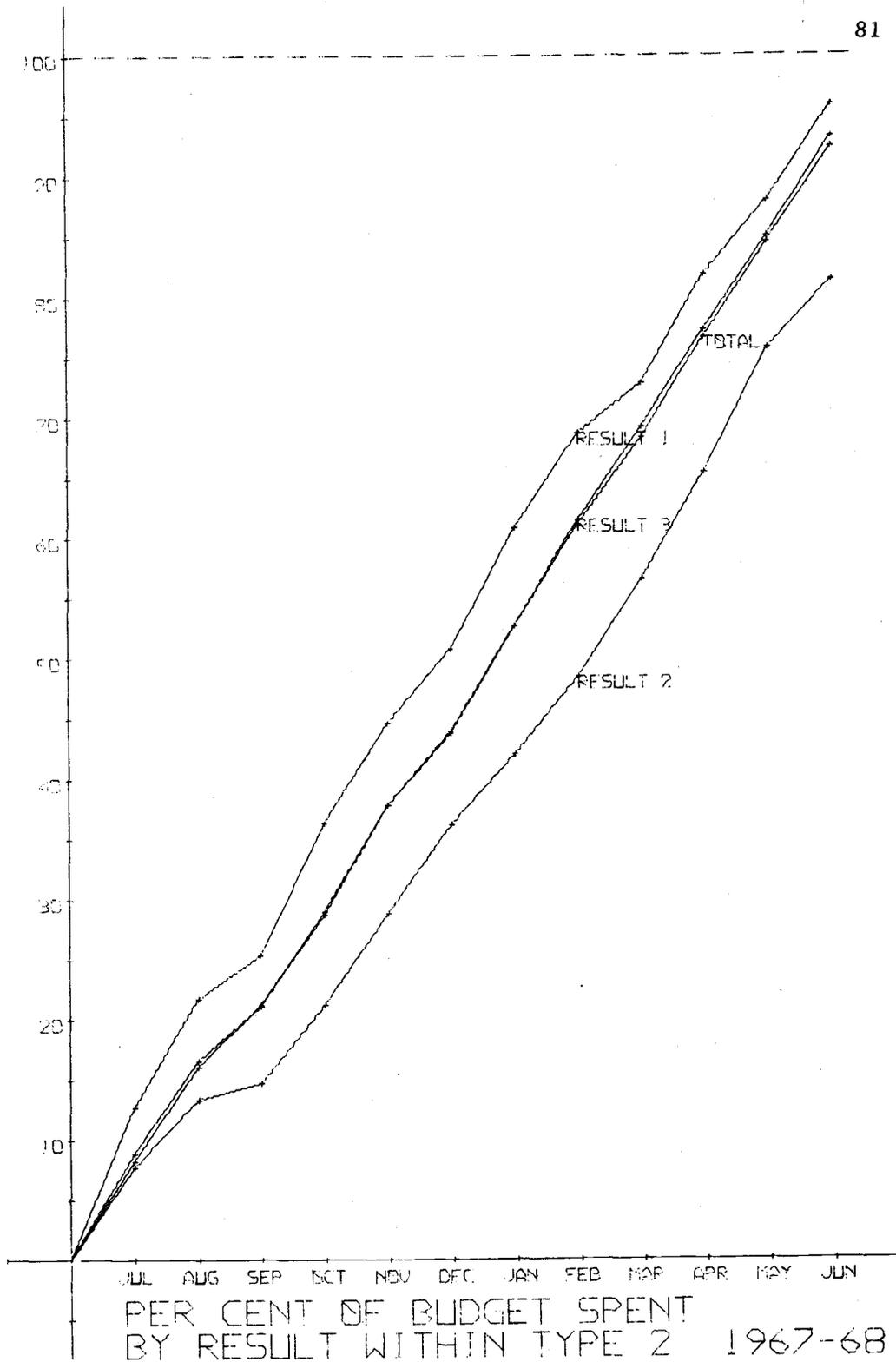
Appendix Figure 5. Expenditure Patterns for Departments Ending at Break-even by Organizational Type, Oregon State University, 1967-68.



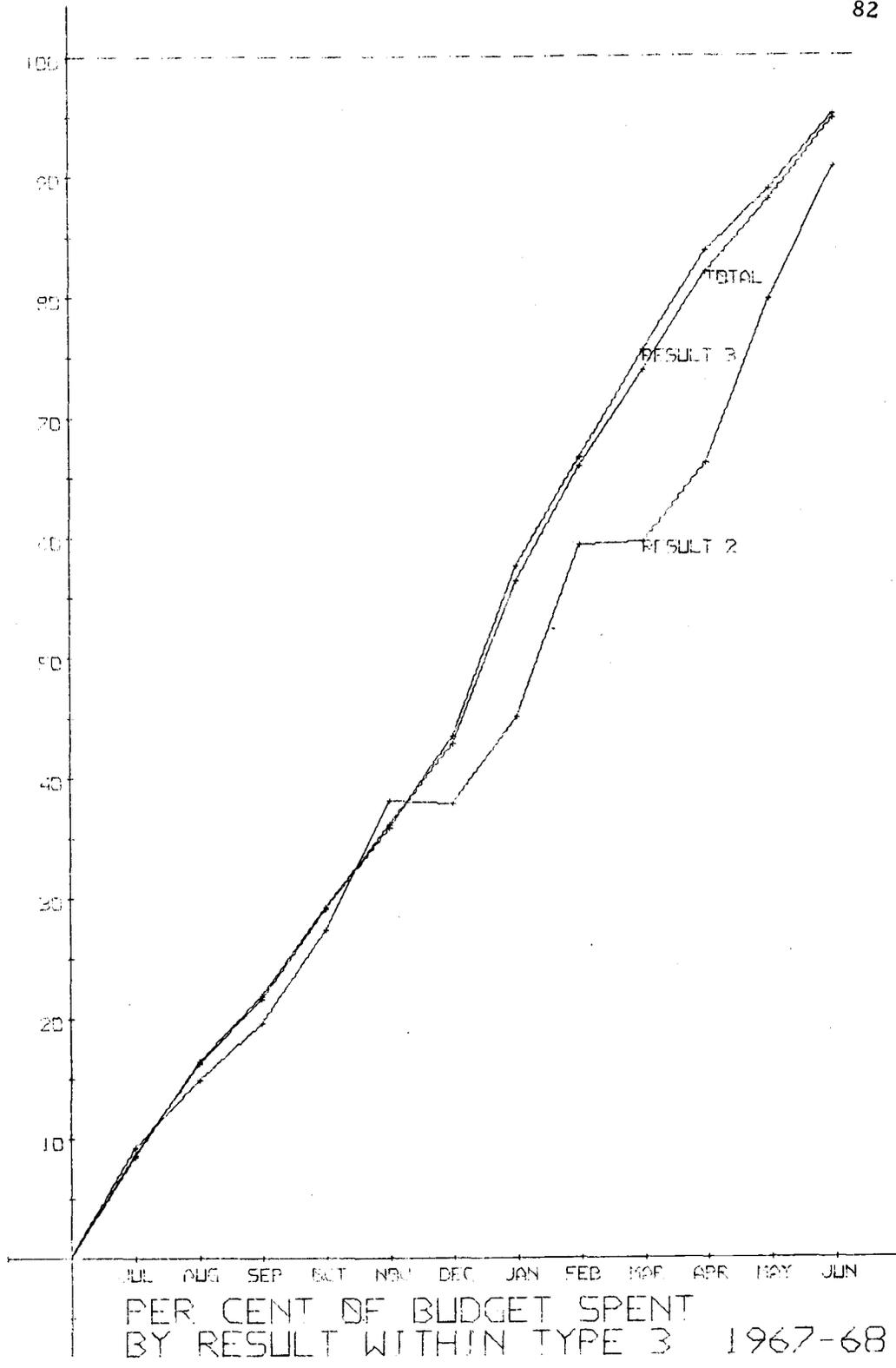
Appendix Figure 6. Expenditure Patterns of Organizations by the Results, Deficit, Break-even, and Surplus, Oregon State University, 1967-68.



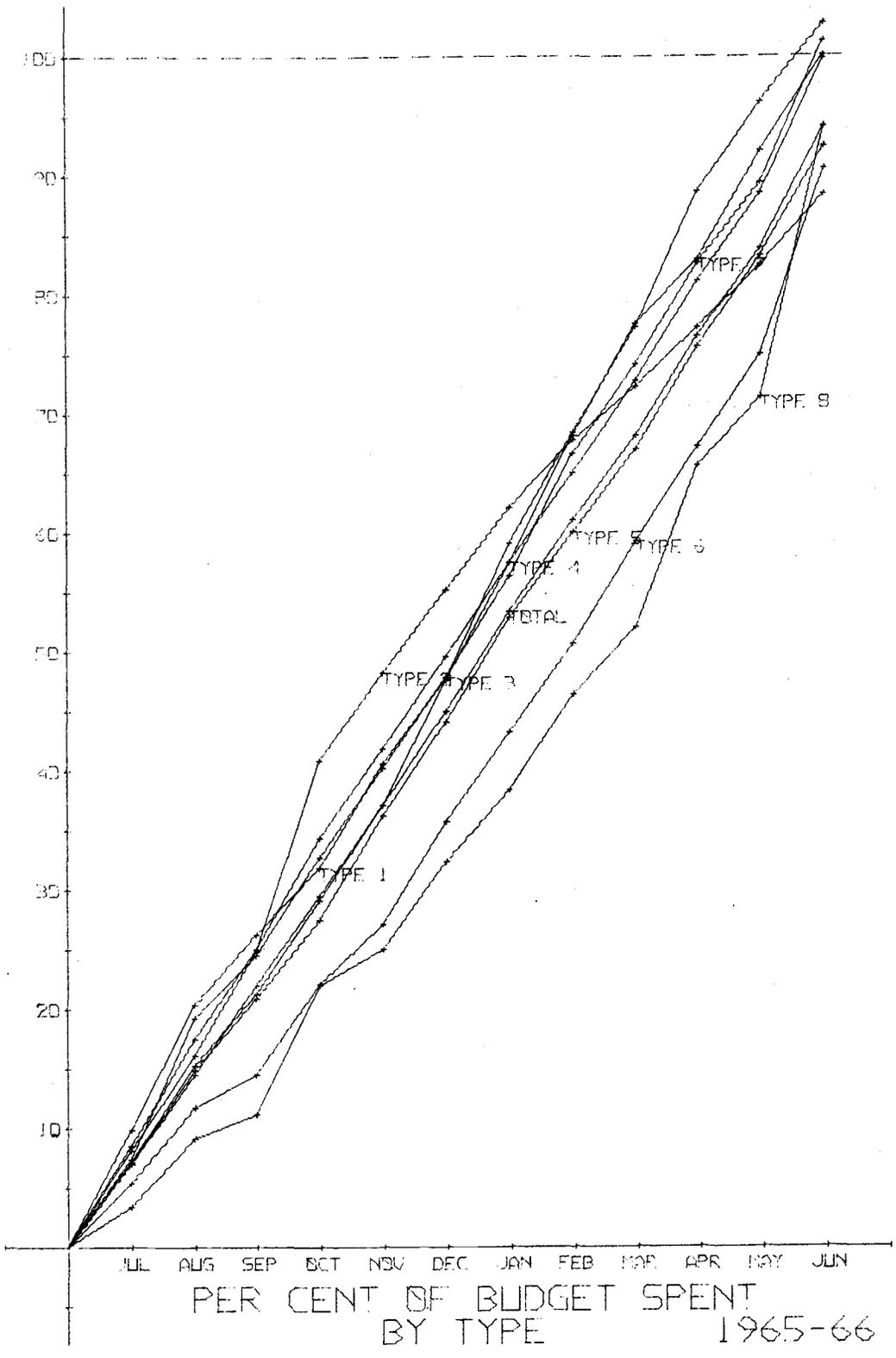
Appendix Figure 7. Expenditure Patterns of Administrative Services Organization Showing Surplus, Deficit, and Break-even Departments, Oregon State University, 1967-68.



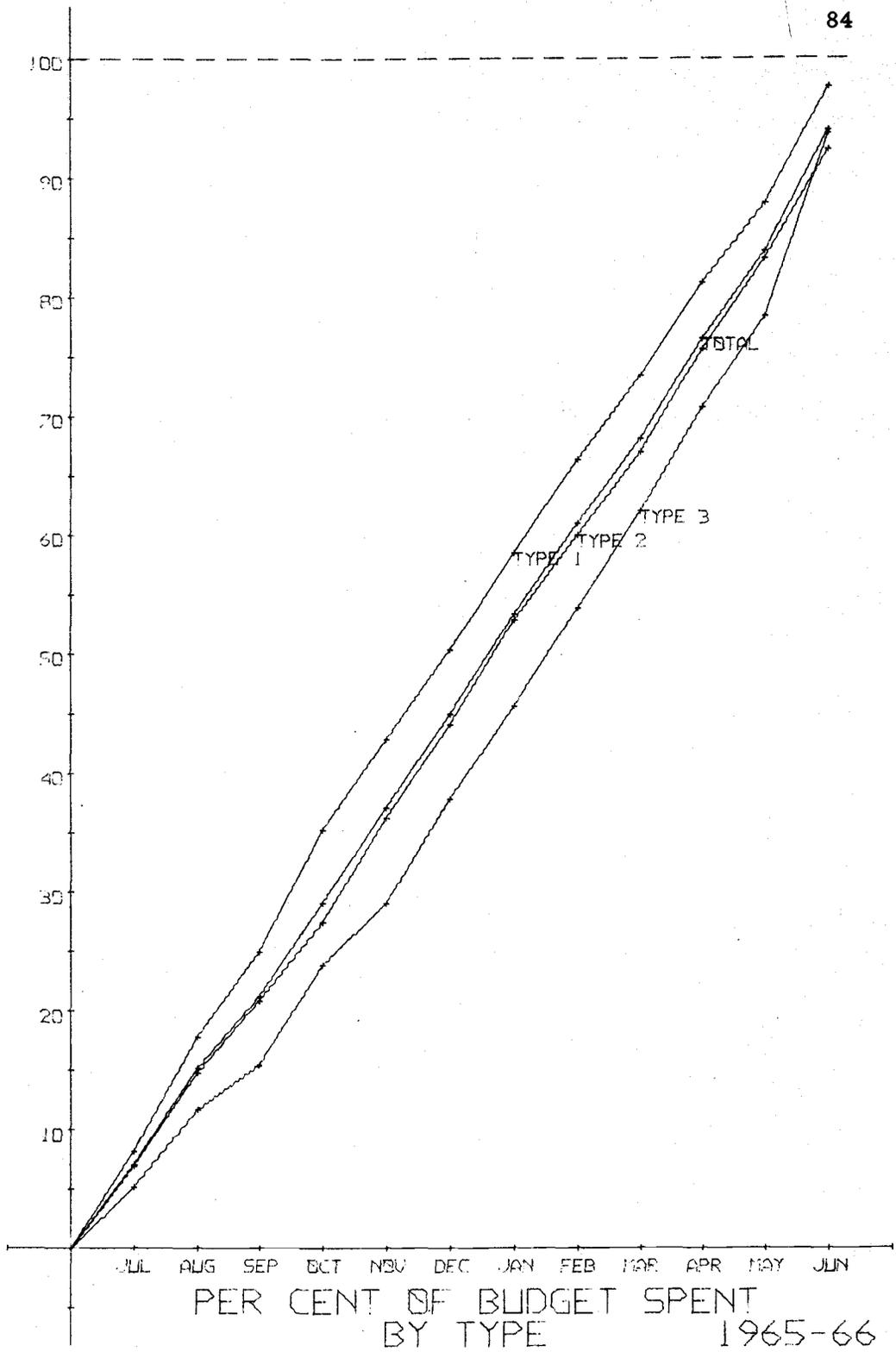
Appendix Figure 8. Expenditure Patterns of Instruction Organization Showing Surplus, Deficit, and Break-even Departments, Oregon State University, 1967-68.



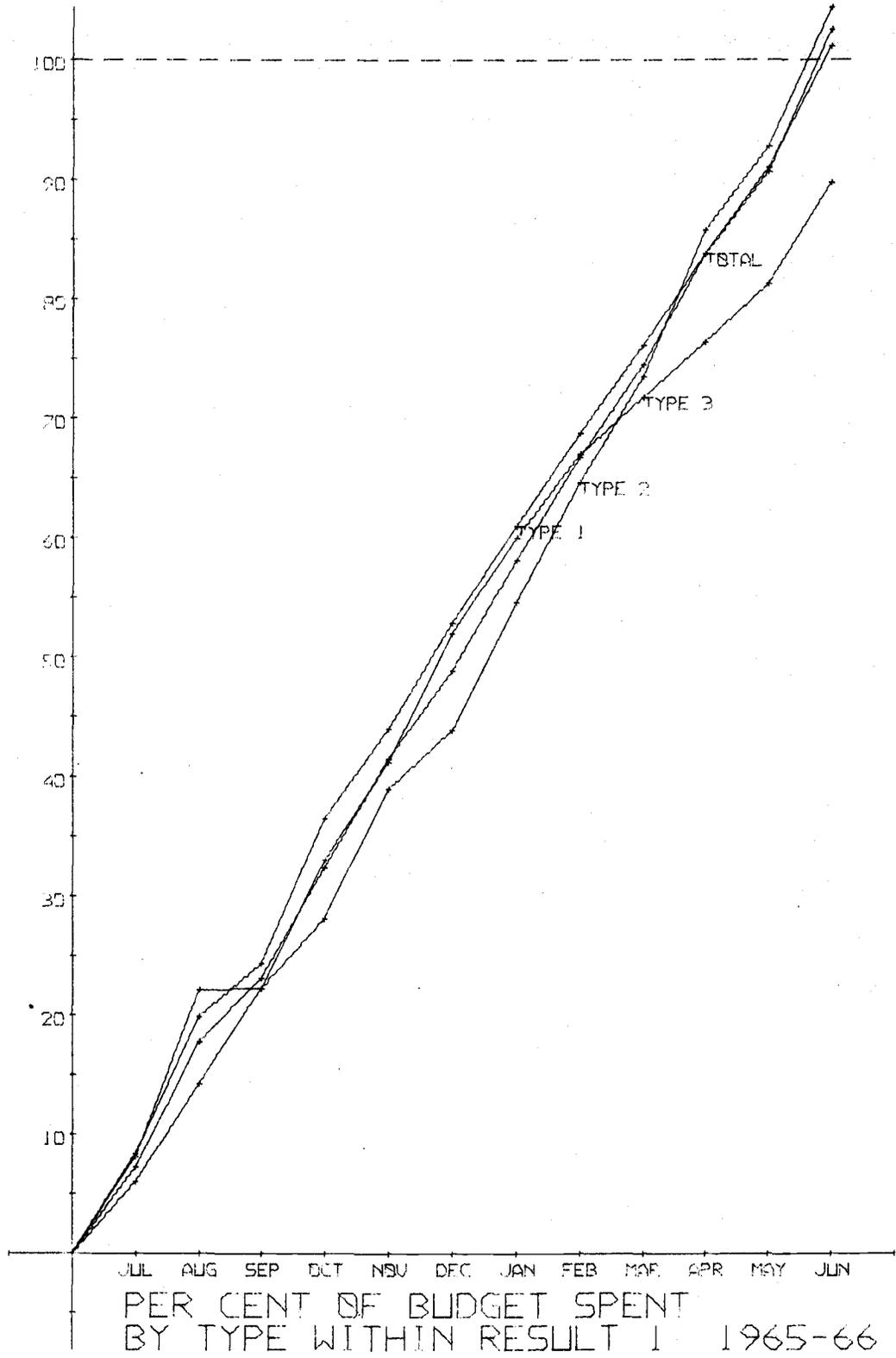
Appendix Figure 9. Expenditure Patterns of Instructional Activities Organization Showing Surplus, Deficit, and Break-even Departments, Oregon State University, 1967-68.



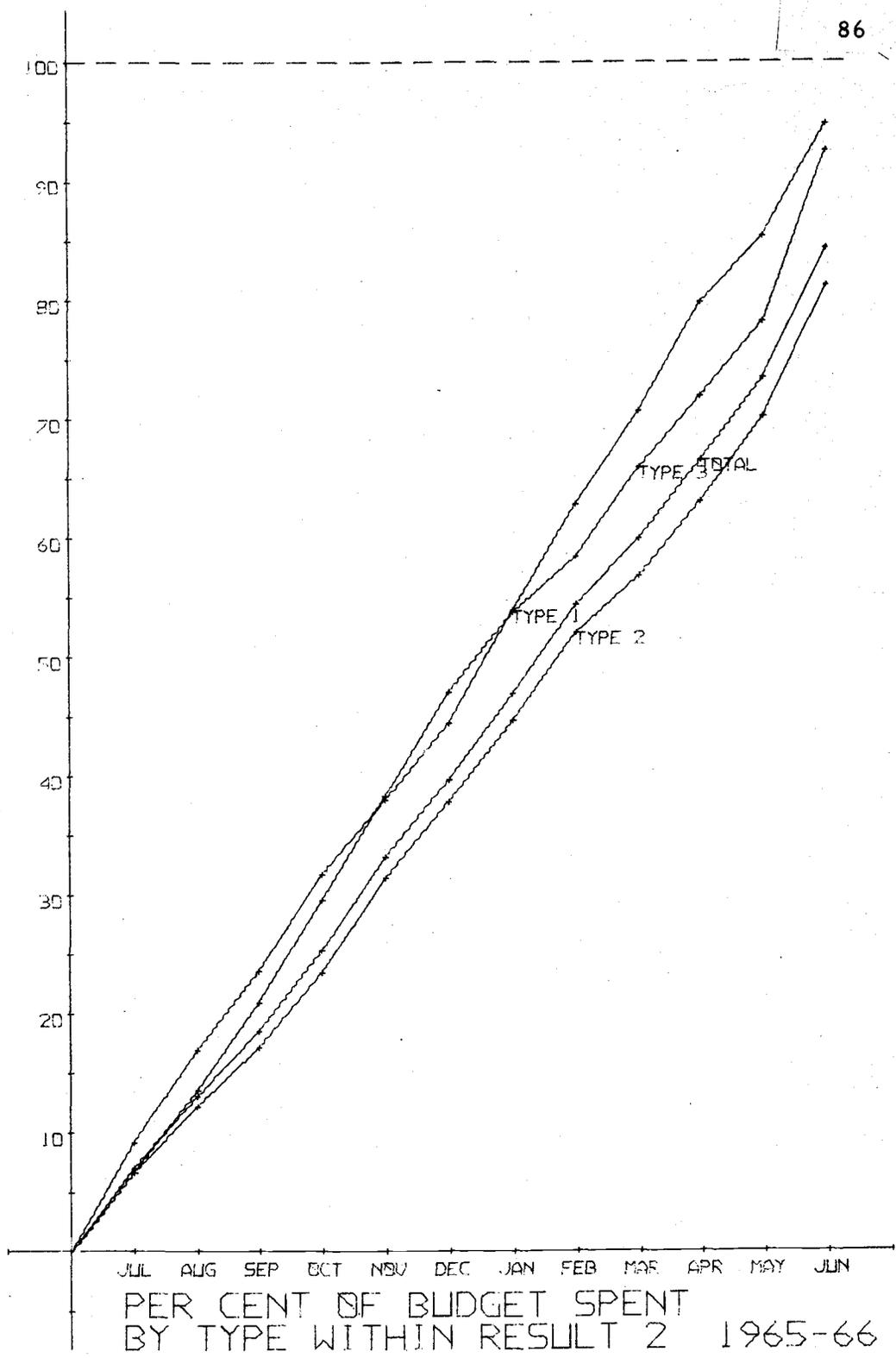
Appendix Figure 10. Expenditure Patterns for Eight Types of Organizations, Oregon State University, 1965-66.



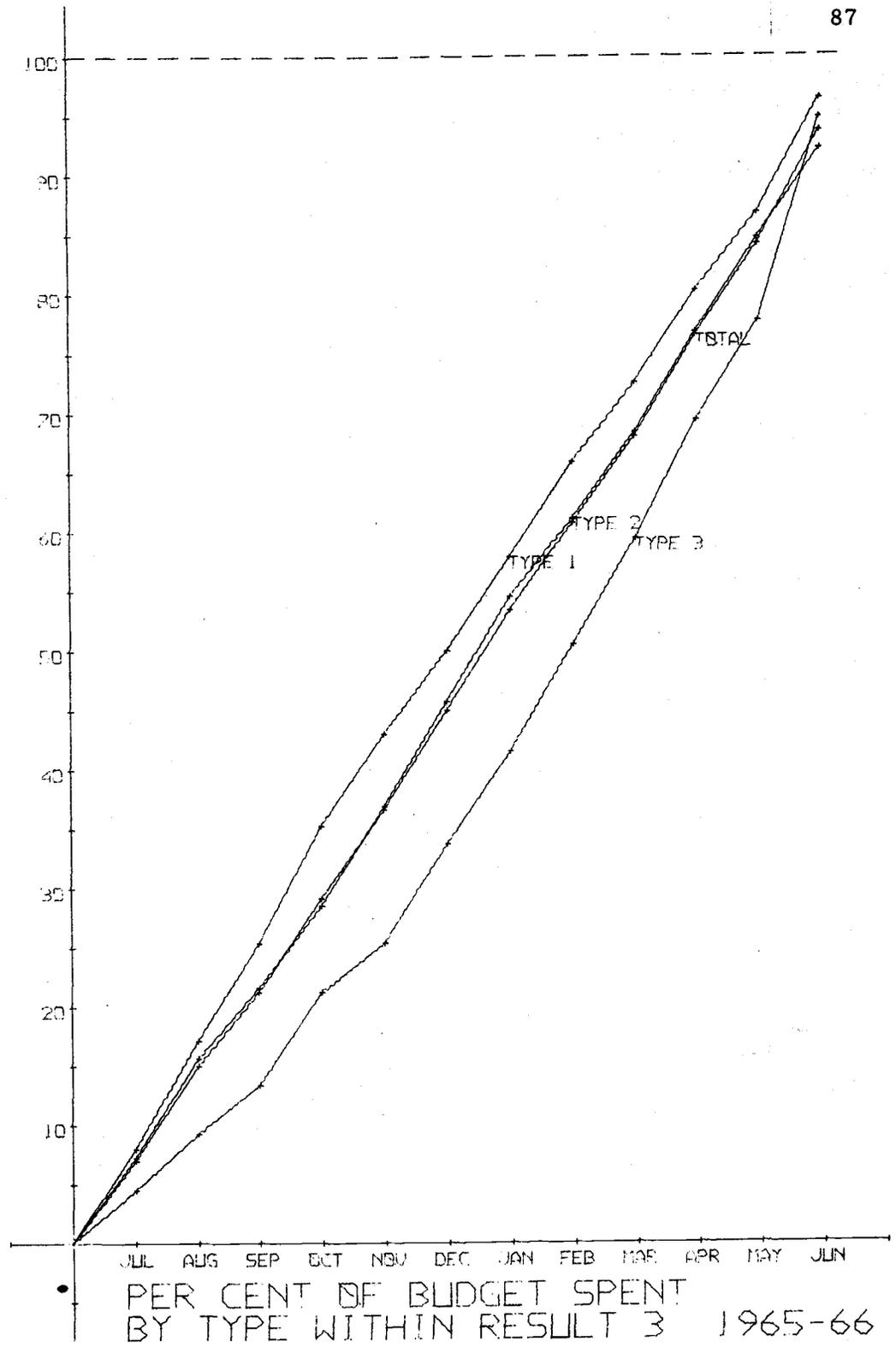
Appendix Figure 11. Expenditure Patterns for the Three Combined Groupings of Organizations, Oregon State University, 1965-66.



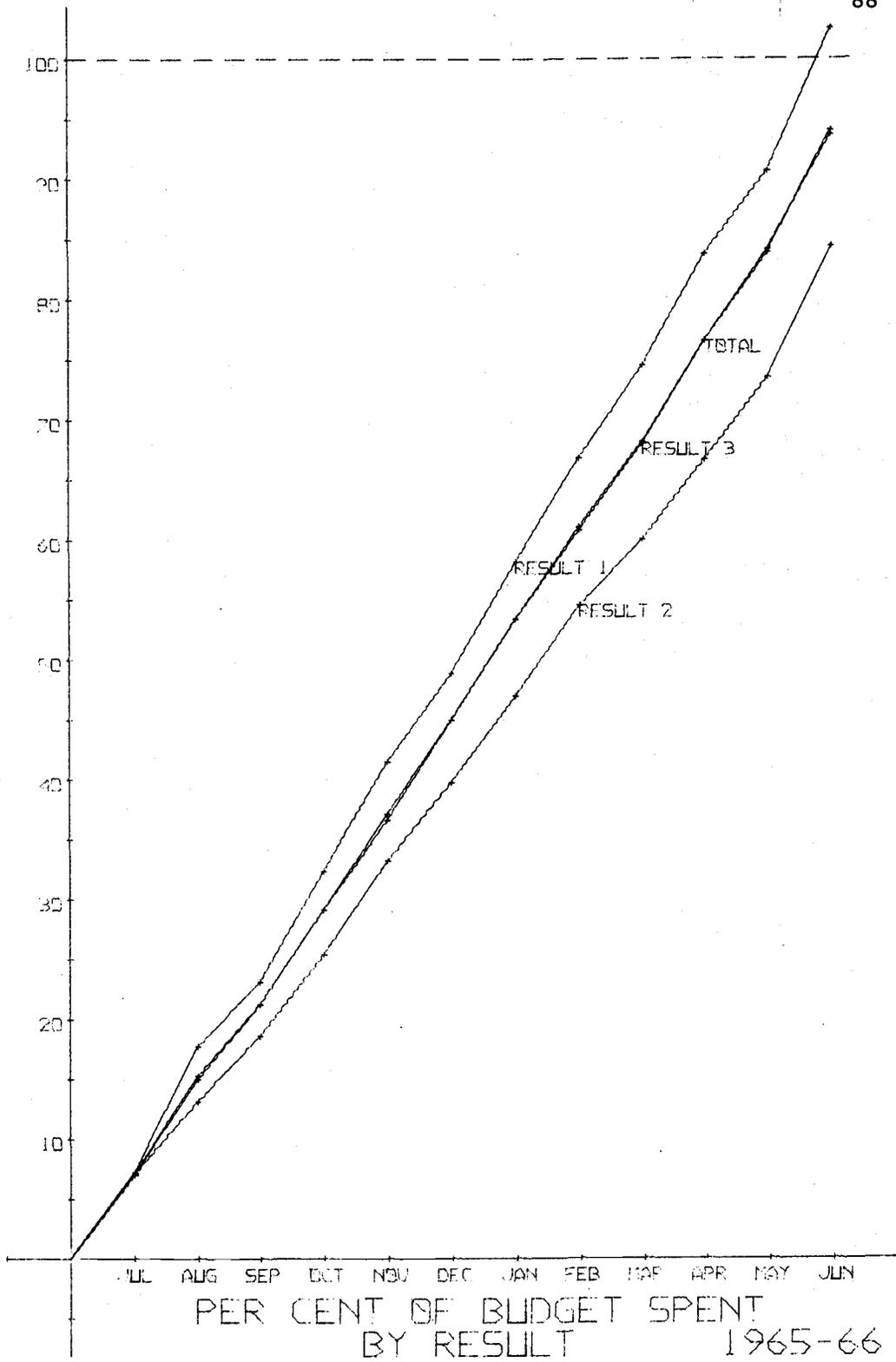
Appendix Figure 12. Expenditure Patterns for Departments Ending with a Deficit by Organizational Type, Oregon State University, 1965-66.



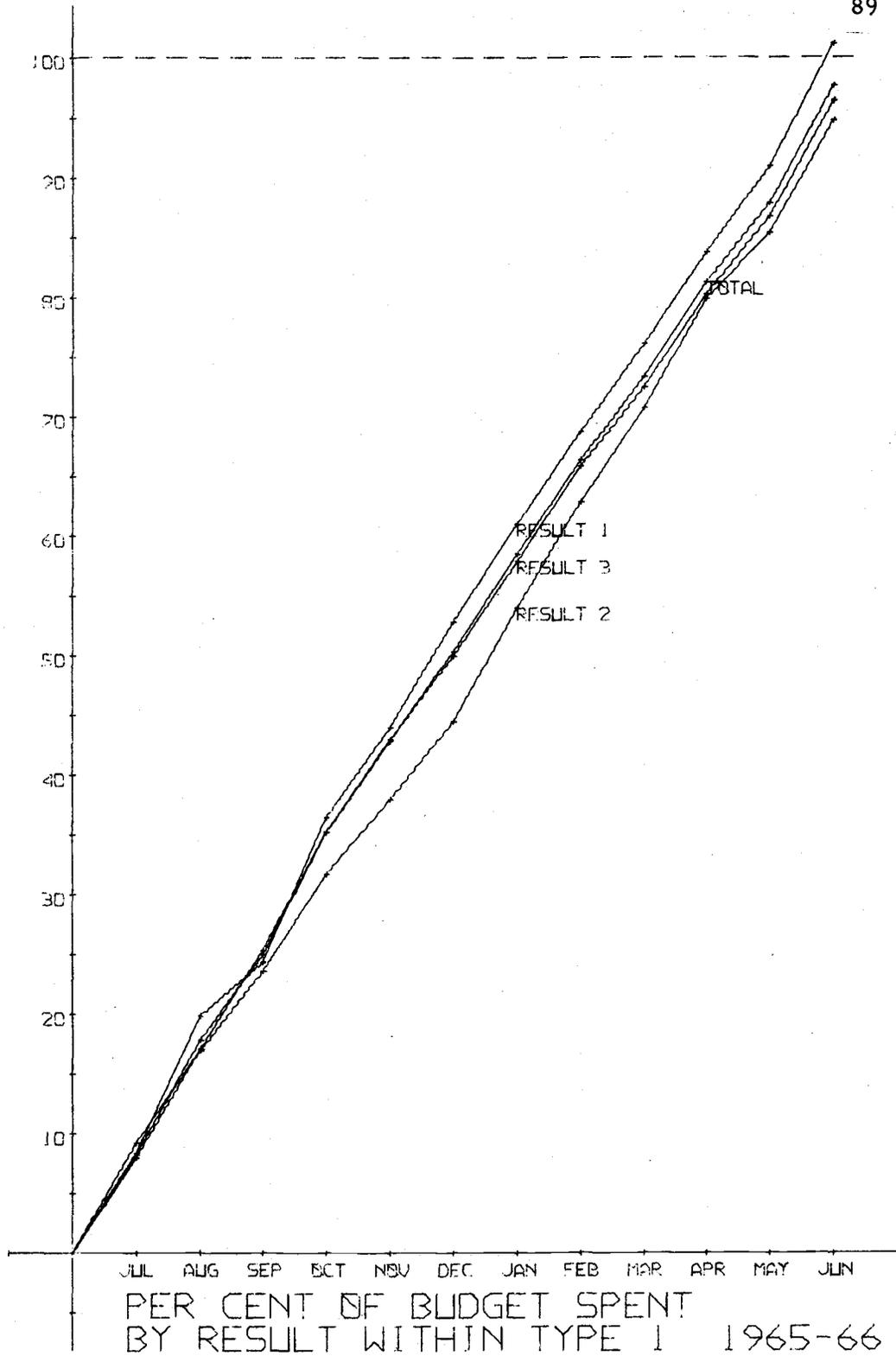
Appendix Figure 13. Expenditure Patterns for Departments Ending with a Surplus by Organizational Type, Oregon State University, 1965-66.



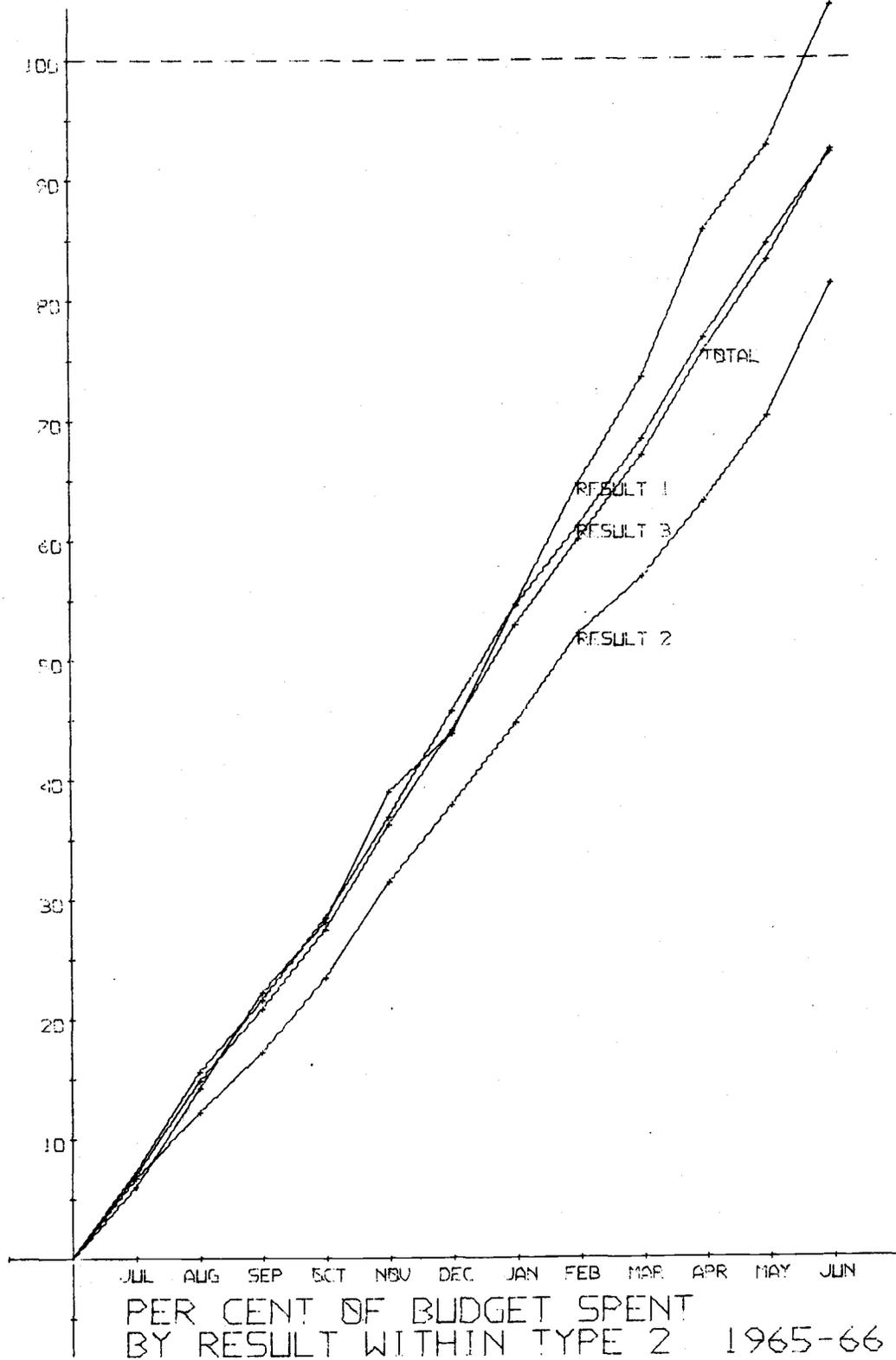
Appendix Figure 14. Expenditure Patterns for Departments Ending at Break-even by Organizational Type, Oregon State University, 1965-66.



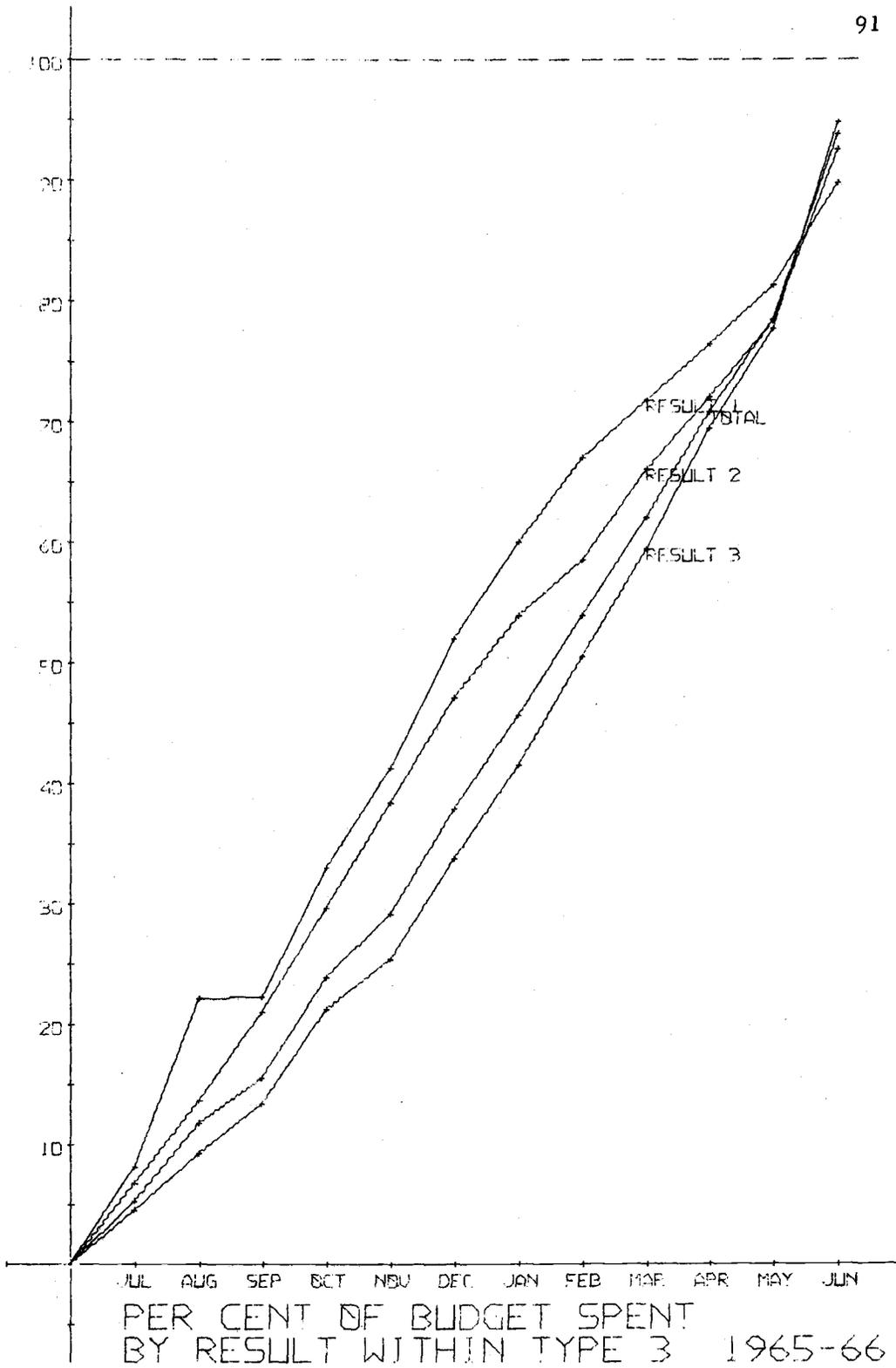
Appendix Figure 15. Expenditure Patterns of Organizations by the Results, Deficit, Break-even, and Surplus, Oregon State University, 1965-66.



Appendix Figure 16. Expenditure Patterns of Administrative Services Organization Showing Surplus, Deficit, and Break-even Departments, Oregon State University, 1965-66.



Appendix Figure 17. Expenditure Patterns of Instruction Organization Showing Surplus, Deficit, and Break-even Departments, Oregon State University, 1965-66.



Appendix Figure 18. Expenditure Patterns of Instructional Activities Organization Showing Surplus, Deficit, and Break-even Departments, Oregon State University, 1965-66.