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Allocating the Book Budget: An Economic Model

A model is presented in which the division of library resources among competing interests is based upon considerations of economic efficiency. The complete model cannot be made operational until better means are developed to measure library-resource units. It is argued that allocation decisions should depend upon the prospective usage rate of materials, explicit value judgments about how much such use contributes to the university's goals, and costs.

JOSEPH J. KOHUT RECENTLY PROPOSED A MODEL for dividing a library's budget among departments and between serials and monographs in a time of inflation.[1] While his goal of making explicit decisions which are usually implicit is admirable, his model is defective due to its own implicit assumptions. This paper will summarize Kohut's model; present an alternative model; and discuss the application of the alternative model.

THE KOHUT MODEL

Kohut begins with two assumptions: (1) each department is assigned a certain number of library-resource units; and (2) the resource units for each department are divided between monographs and periodicals. (Although this paper will refer to each academic unit as a department, the model can be used for larger or smaller units, such as entire colleges or parts of departments. It may also be used by nonacademic libraries in dividing their budgets among subject areas. The library-resource unit is a volume as defined by and reported to the U.S. Office of Education in the annual Higher Education General Information Survey.)

The problem with which Kohut is concerned is that the rate of price inflation of monographs and serials in different academic fields is very uneven. For example, from 1967–69 to 1972 the price of chemistry and physics periodicals rose 186 percent, compared to only 26 percent for art periodicals.[2] If each department receives a constant share of the library's budgeted expenditures, there must be a relative reduction in the number of resource units acquired by departments whose price indexes rise more than average. Kohut considers this reduction inappropriate, since the initial division of resource units was presumably optimal. Thus, given uneven rates of inflation, an "imbalance" develops.

As an alternative, Kohut suggests that each department should receive a constant share of the total resource units which the library acquires, not a con-

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stant share of its expenditures, as is customary. If this advice is followed, departments for which the rate of price inflation is higher will receive a larger share of the total expenditure budget.

The Alternative Model

This model represents an application of basic economic principles to library budget decisions. Although the discussion will deal with departmental allocations, it can also be applied to the monograph-serial and material-staff choices. The model applies not only to the inflationary situation which Kohut considers, but also to the noninflationary problem (which Kohut ignores) of how the division of resources should be undertaken in the first place. We assume, as Kohut did, that library resource units can be satisfactorily measured. The consequence of relaxing this assumption is analyzed in the following section.

The basic criticism of Kohut's model is that it ignores considerations of economic efficiency. Simply stated, efficiency requires that the library budget be allocated so as to equate marginal benefits (MB) and marginal costs (MC) for each department.[3] These concepts will be explained in the following paragraphs.

The benefit of a resource unit depends upon the contribution which the library resources make to the educational objectives of the university, whatever they may be. The estimation of how large these benefits are is admittedly rather difficult, but it must be done. Some value judgments are implicitly made in any case.

The marginal benefit of a resource unit is the change in total benefits when the number of resource units changes one unit. The marginal benefits of resource units for department P are shown by curve MB_p in Figure 1. The curve has a negative slope because the marginal benefits from resource units

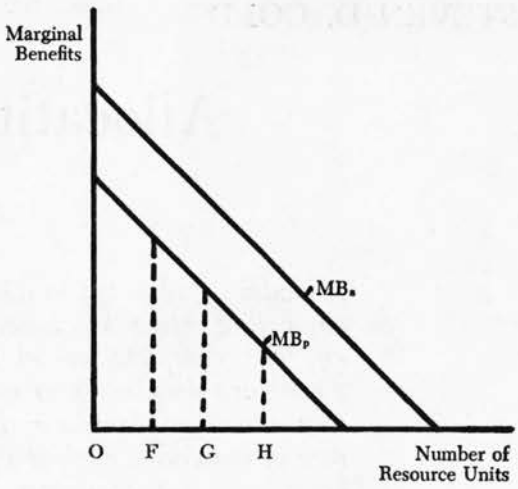

Fig. 1
Marginal Benefit Curves for P and S

tend to decline as the number of units increases. In other words, the first few monographs and serials, *OF*, have very great benefits, but when a larger number are available, such as *OG*, each additional unit provides a smaller benefit. When the library becomes very large, as at *OH*, the marginal benefits are even smaller.

The marginal benefit for material in department S's field is shown by MB_s. (This paper throughout analyzes the simple case in which there are only two or three departments, but it can easily be extended to all of the colleges of a large university.) It is higher than MB_p, because library resources play a greater role in the educational process in S than P, as the courses are taught at this particular university. This may be, for example, because in P greater use is made of computer facilities rather than the library or simply because S has more students.

The marginal benefit curve may not only differ for various departments at a given university but also for the same department at different universities. For example, the marginal benefits of a given collection of books for use by sociology students at University Y are like-

ly to differ from the benefits at University Z if the schools differ in the size of their student bodies or academic emphasis.

The second element in the determination of budget size is marginal costs, which are the change in total costs when there is a change of one unit in the number of resource units. In other words, the marginal cost is the price of a resource unit, including purchase price and such costs as cataloging, ordering, and bill-paying.

The efficient size of each department's budget is the number of resource units at which marginal benefits equal marginal costs. This is the level of output at which the difference between total benefits and total costs is maximized. (If marginal benefits are greater than marginal costs, there will be a net gain from expanding the size of the budget since the rise in benefits will exceed the rise in costs. If marginal benefits are less than marginal costs, there will be a net gain from contracting the size of the budget as the reduction in benefits will be smaller than the reduction in costs. This expansion or contraction should continue until MB = MC.)

Although it is not necessary, for the sake of simplicity marginal costs are assumed to be constant in Figure 2 and subsequent figures. In Figure 2 marginal costs are equal in departments P and S. In this case, department S should receive a larger number of resource units (OQ_s) than department P (OQ_p).

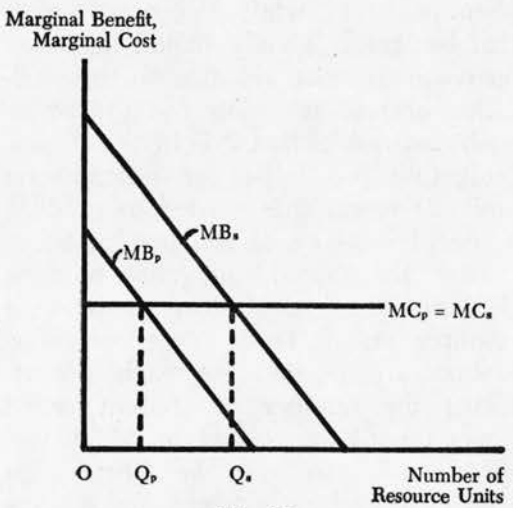

Fig. 22
Equal Marginal Costs and Unequal Marginal Benefits

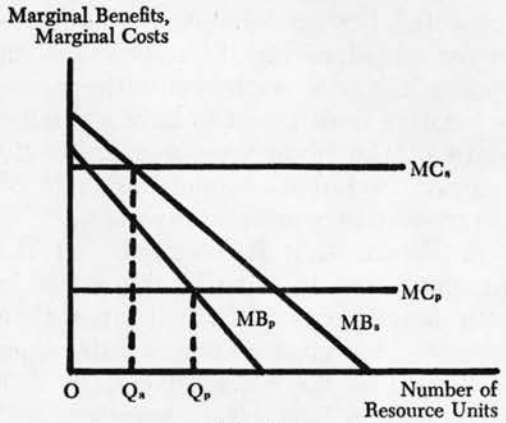

Fig. 3
Unequal Marginal Benefits and Costs

The case in which marginal costs differ between departments is illustrated in Figure 3, where the benefit curves are as in Figure 2, but the marginal cost of library material for S is twice as high as for P. As the curves are drawn, department P should receive a larger number of resource units (OQ_p) than department S (OQ_s). However, it is still possible that expenditures for S will be higher than for P ($MC_s \times OQ_s$ compared with $MC_p \times OQ_p$. Also, if the positions of the curves were different, department S might receive more resource units than P: the result depends on the distance between the MB curves compared to the distance between the MC curves.

The Appendix analyzes the important case in which the benefit curves are identical but marginal costs differ. It clearly shows the loss which results from ignoring cost differences in allocating resources.

The final issue to be considered is the effect of inflation on departmental budget allocations, the question which Kohut considered. According to the model

presented here, if inflation is more rapid for one department's resources than another's, it will usually cause the rapidly inflating department to have a smaller share of the library-resource units. By contrast, in Kohut's model the share of library-resource units is invariant.

In Figure 4, it is assumed that the marginal cost is initially the same in both departments, MC_1. If inflation then raises the marginal cost in S faster than in P, so that the marginal cost in P is MC_{p2} and in S is MC_{s2}, resources will probably fall more in S than P,

$$OQ_{s1} - OQ_{s2} > OQ_{p1} - OQ_{p2}.$$

This definitely will be true if the slope of MB_s is not steeper than the slope of MB_p. If MB_s is steeper than MB_p, meaning that marginal benefits in S rise more rapidly than in P as resources are reduced, it is possible that S may finish with a larger share of resource units, even though the rate of inflation is higher in S. Which department winds up with a greater share of expenditures also depends on the shape of the MB curves and the difference in the rate of inflation.

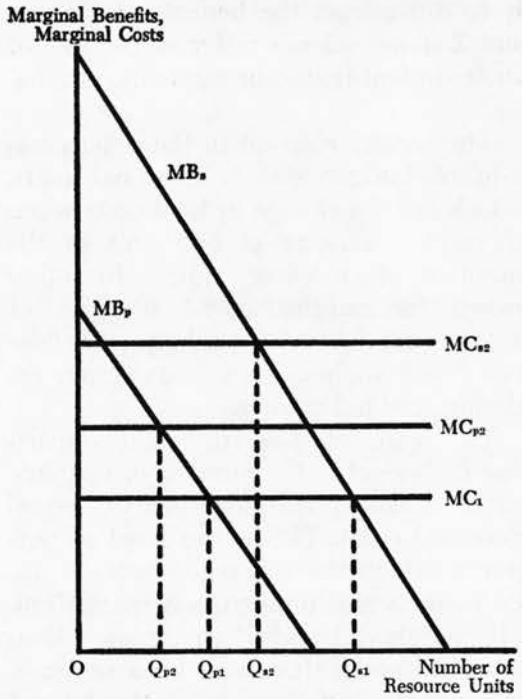

Fig. 4
Impact of Inflation

Application of the Model

Thus far this paper has followed Kohut's procedure of assuming that there is something called a "resource unit" which is to be distributed. In fact, this ignores the troublesome question of how resource units should be measured. It is not satisfactory to simply use the definition of resource units by the U.S. Office of Education as Kohut recommends. This practice is defective because it equates all library volumes regardless of length or quality.

For example, Kohut cites data showing that the average cost of monographs at Portland State University is nearly three times as high in physics as in education.[4] He interprets this as evidence that resource units in physics are more expensive. On the contrary, it may simply mean that literary conventions are such that physics monographs are much longer than education monographs. The equivalent contents of one work in physics might be split into several in education.

The preceding argument has two implications: (1) while Kohut is correct that budgeting ideally should be based on resource units, reliance on this definition of resource units could produce such bad results that it is better to base budgeting on dollars of expenditure; and (2) research is needed to produce a useful measure of resource units.

How, then, should budgeting be done if there is no satisfactory measure of resource units? Three pieces of information are needed for each department: the number of student credit hours taught, the extent to which students make use of the library for courses in each department, and a value judgment about how important such use is in the program of the university. To-

gether these three ingredients determine the benefits from library resources provided for each department.

Table 1 presents an illustration for three departments, J, K, and L. J has more credit hours than the other two,

TABLE 1

HYPOTHETICAL DATA FOR BENEFIT ESTIMATION

	Academic Department		
	J	K	L
Student credit hours	1,500	1,000	1,000
Usage rate per credit hour	10	10	20
Value weight	2	1	4
Total weighted usage	30,000	10,000	80,000

but L has greater usage (as measured by some index), and each unit of usage in L is valued four times as much as in K and twice as much as in J. Multiplying each of the three lines together produces a "total weighted usage." Since L has two-thirds of the weighted usage (80,000/120,000), J has one-fourth, and K one-twelfth, they should each receive those proportions of the budget. (Two complications are not mentioned in the text. The data in Tables 1 and 2 should refer to the prospective use of newly acquired library material, not simply the use of already-acquired material. Also, the value weights are not constant but should vary depending on how much material is acquired.)

The value of this model is that it makes explicit the factors which affect the optimal division of the budget. For example, consider the data in Table 2, in which each department receives an equal budget of $15,000. Such an equal allocation can only be optimal if the value weights are as follows: J, 1; K, 1.5; L, .75. (Total unweighted usage is 15,000, 10,000, and 20,000 respectively. Dividing each of these into $15,000 yields 1, 1.5, and .75 respectively. Only if these—or their linear transformations—are the value-weights, is it correct for each department to have equal budgets.) That is, the value weight for K is twice as great as for L and 1.5 times as great as for J. The question which must then be asked is whether such value-weights are defensible. Is there any valid justification why usage in K should count more than in J and L? If not, then K should receive lower expenditures.

The methodology presented here is a special case of the model of the preceding section. The complete model is

TABLE 2

HYPOTHETICAL BUDGETARY DATA

	Academic Department		
	J	K	L
Student credit hours	1,500	1,000	1,000
Usage rate per credit hour	10	10	20
Budgeted library expenditures	$15,000	$15,000	$15,000
Total unweighted usage	15,000	10,000	20,000

not operational if resource units cannot be measured satisfactorily. The methodology here amounts to assuming that marginal costs are uniform for all departments. The student credit hours, usage rates, and value-weights determine the shape of the MB curve.

CONCLUSION

The basic argument of this paper is that the division of resources within a library should be based upon considerations of economic efficiency, meaning that it should explicitly consider the benefits and costs of alternative uses of funds. The optimal distribution of funds must be determined annually in light of the benefits and costs at the time when the decision is made. This is one basic difference from Kohut's model, in which it was assumed that the optimal distribution of resource units is unchanging.

Three complications must be recognized. First, it has been assumed that the library is free to expand to the point where MB = MC for each department. In a period of tight budgets, resources might not be sufficient to reach that level. If so, the ratio of marginal benefit to marginal cost should be equalized for all departments. The type of questions which must be faced are precisely the same as in the situation analyzed in this paper.

Second, the analysis has assumed that benefits from library use can be measured. Obviously, this is not a measurement whose accuracy everyone will agree upon. But making value judgments is absolutely inescapable. While to some extent estimating benefits involves assessing intangibles, it can also rest partly on research into the extent and type of use which is made of resources provided to each department.

Finally, it has been assumed that efficiency is the only goal of budgeting. This contrasts with Kohut, who considered only equity. It seems to this writer that a comment about less-developed countries is also applicable to many libraries: "They are too poor to despise efficiency."

References

1. Joseph J. Kohut, "Allocating the Book Budget: A Model," *College & Research Libraries* 35:192–99 (May 1974).
2. Ibid., p.194.
3. See, e.g., A. F. Schreiber et al., *Economics of Urban Problems* (Boston: Houghton, 1971), chapter 2.
4. Kohut, "Allocating the Book Budget," p.198.

Appendix

A hypothetical example can be cited to show the loss resulting from ignoring cost considerations. Suppose that the marginal benefit curves for two departments are identical but that marginal costs are twice as high for one of them, S, as in Figure 5. If costs are ignored, resources will probably be divided equally, so that each receives OQ_c. But this involves sacrificing benefits which could be obtained by giving OQ_s to S and OQ_p to P. By expanding resources for P from OQ_c to OQ_p, there is a gain equal to the triangle *XYZ*, since marginal benefits exceed marginal costs until OQ_p is reached. By contracting resources for S from OQ_c to OQ_s, there is a gain equal to triangle *VWX*, since marginal costs are greater than marginal benefits. Thus, a library is wasting resources if it gives each department an equal share of resources and ignores costs.

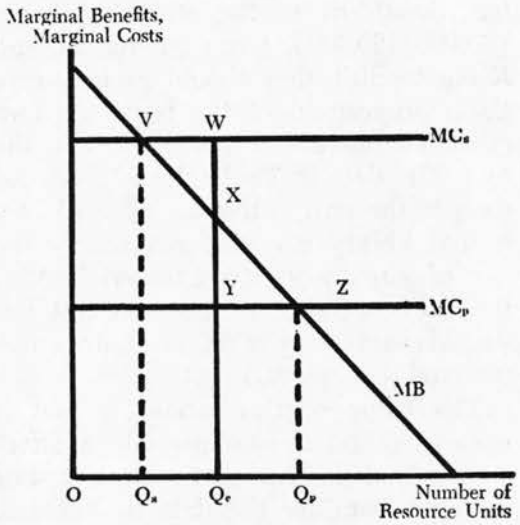

Fig. 5
The Loss from Ignoring Cost Differences