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ABSTRACT

This report describes the proceedings of a Conference on Internal Pricing for University Resource Allocation held in Berkeley, California, July 7-9, 1971. The conference was attended by approximately 25 economists and university administrators, who were organized into panels to discuss the theory and implementation of internal pricing. The report is organized as follows: Section I presents an introduction to the material. Section II contains a background paper prepared by the editor and distributed to the participants in advance of the workshop; this paper provides the focus for the topic and also describes the formal organization of the conference. Section III summarized the major ideas, issues, agreements and disagreements that emerged in the course of the two and one-half day sessions. Section IV is an analytic critique of internal pricing and an agenda of issues for the future. Appendices include: a plan for a pilot project in pricing university space; notes on university resource allocation; a structural analysis of the university resource allocation problem; and a paper on internal pricing at an institution of higher education; implementation, planning and information needs. (Author)

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INTERNAL PRICING WITHIN THE UNIVERSITY - A CONFERENCE REPORT

edited by

David W. Breneman

Paper P-24

December, 1971

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PREFACE

This is one of a continuing series of reports of the Ford Foundation sponsored Research Program in University Administration at the University of California, Berkeley. The guiding purpose of this Program is to undertake quantitative research which will assist university administrators and other individuals seriously concerned with the management of university systems both to understand the basic functions of their complex systems and to utilize effectively the tools of modern management in the allocation of educational resources.

This report describes the proceedings of a Conference on Internal Pricing for University Resource Allocation held in Berkeley, California, July 7-9, 1971. The conference was attended by approximately 25 economists and university administrators, who were organized into panels to discuss the theory and implementation of internal pricing. The present report contains a summary of the major issues discussed during the conference, together with four papers contributed by participants.

Professor David Breneman of Amherst College was responsible for organizing the conference; preparing advance instructions for it which appear here as Part II; editing this report; writing Part III, the conference highlights; and writing Part IV, an analytical critique of internal pricing and an agenda of issues for the future. We are therefore indebted to him in several ways for the work which eventuated in this report.

C. J. Hitch

F. E. Balderston

G. B. Weathersby

I. INTRODUCTION

As every member of the higher education community knows, increasing financial stringency will be the central problem confronting colleges and universities during the next decade. Although institutional response to this "new depression" will undoubtedly vary, no school can afford the luxury of mis-allocating internally its dwindling stock of resources. Instead, careful thought and analysis must be devoted to the problem of securing the most effective pattern of resource allocation within the university. Internal pricing of resources is a technique often advocated by economists as a method for achieving "optimal" allocation; in order to assess the potential of this technique for improving university management, the Ford Foundation Research Project in University Administration at the University of California sponsored a Conference on Internal Pricing, attended by approximately 25 economists and university administrators, in Berkeley, California, July 7-9, 1971. The present report contains a brief summary of the conference proceedings, together with four papers contributed by conference participants.

The report is organized as follows: Section II presents a background paper prepared by the editor and distributed to the participants in advance; this paper provides background and focus for the topic and also describes the formal organization of the conference. Section III summarizes the major ideas, issues, agreements, and disagreements that emerged in the course of the two and one-half day session. As with any act of reporting, the summary undoubtedly reflects the editor's own interests and biases in the selection of material; however, an effort was made to mention the major themes.

During the conference, several participants expressed the hope that plans for a pilot project using internal pricing might be developed, to provide a more concrete basis for further consideration of the topic. In response to this request, Julian Decyk, a summer research employee of the Ford Project, prepared a pilot project for the pricing of university space, presented as Appendix A.

Appendices B, C, and D are devoted to contributed papers prepared for the conference by three of the participants: Dr. Philip Cartwright, Executive Vice President, University of Washington; Dr. Robert Crandall, Professor of Business, Queens University, Canada; and Dr. Robert Lamson, Assistant Vice President--Planning and Budgeting, University of Washington.

Finally, a complete list of conference participants is included as Appendix E.

II. SCOPE OF THE PROBLEM: INTERNAL PRICING

The guiding purpose of the Ford Foundation Research Program in University Administration at the University of California, Berkeley, has been stated as follows:

> . . . to undertake quantitative research which will assist university administrators and other individuals seriously concerned with the management of university systems both to understand the basic functions of their complex systems and to utilize effectively the tools of modern management in the allocation of educational resources.

The Workshop on Internal Pricing Mechanisms, held July 7-9, 1971, in Berkeley, was conceived and designed to further this purpose. The present paper was prepared for the workshop participants to clarify the focus of the conference and to indicate the types of questions and issues that the organizers hoped the sessions would cover. The paper closes with a discussion of the conference format and the organization of participants into panels for the five working sessions.

The financial difficulties facing virtually all colleges and universities in this country have heightened the concern of many legislators, Regents, Trustees, administrators, and faculty members regarding the need for efficient allocation of resources within institutions of higher education. In general, resources may be allocated by many methods; economist Martin Shubik has proposed the following eight procedures as the major mechanisms:[1]

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[1] Martin Shubik, "On Different Methods of Allocating Resources," RAND Report No. P-4161, July, 1969.

1. The economic market with a price system
2. Voting procedures
3. Bidding
4. Bargaining
5. Allocation by higher authority, fiat or dictatorship
6. Allocation by force, fraud and deceit
7. Allocation by custom, including gifts and inheritance
8. Allocation by chance.

Within most colleges and universities, methods 2 through 8 have been dominant; our hope in this conference was to explore the possibilities for greater use of the first method, a system of internal prices.

Implicit in the last sentence is the assumption that greater use of prices will increase allocative efficiency within colleges and universities; a brief defense of that assumption may be in order. The efficiency results of an ideal price system are well known to economists and will not be repeated here; however, a few of the potential efficiencies will be noted:

(1) An ideal price system will reflect accurately the costs of each activity, making it possible for decision makers to compare marginal costs with marginal benefits, an essential condition for efficiency.

(2) Related to the above, greater use of prices should guard against treating certain resources, such as student and faculty time, as "free" goods, a policy which necessarily produces inefficiency.

(3) Prices should potentially reduce the information requirements for decision making.

(4) Pricing resources to the users may introduce the incentive to economize through consideration of trade-offs between resources.

(5) Decision making can be more highly decentralized in the presence of a pricing scheme, allowing individuals with the greatest knowledge of the relative value of various resources to make the decision regarding their use, a step toward increased efficiency.

(6) Prices, being impersonal, may reduce the conflict within an organization that often results from allocation by fiat or political bargaining.

The above list is hardly complete, but it does suggest that careful study of the possibilities and problems inherent in the use of internal prices is warranted. Since this area appears to be largely unexplored within the context of college and university resource allocation, the major goal of the summer workshop was to bring together a knowledgeable group of individuals who can share their experience and expertise as it bears upon the topic. We sought their advice in the most fruitful directions for research and their practical suggestions for pilot projects utilizing internal prices.

Although one can extoll the virtues of internal pricing, a vast number of theoretical, practical and organizational problems confront the attempt to implement such mechanisms. Issues such as the following were confronted:

(1) The relation between internal prices and historic costs must be carefully examined. Many colleges and universities are currently engaged in detailed cost studies, involving the allocation of overhead costs and joint costs to specific activities. For certain decisions, this data may be misleading and we should attempt to clarify the type of cost data that is properly used as an internal price. We should be particularly sensitive to the admonition that, "Information which is portrayed and set out with one purpose in mind may be worse than useless when used for another purpose."

(2) We must examine the theoretical difficulty of generating internal prices in the context of a non-profit institution lacking marketable output. Much of the economics literature on internal or transfer pricing in the large, decentralized firm, bases the internal price upon a final market price of output under conditions of profit maximization. We must explore methods for generating internal prices in the absence of output measures and output prices, under the condition that total revenue = total cost (the non-profit condition). Note that the latter condition may imply average-cost pricing rather than marginal-cost pricing, a major difference from the theory of the profit-maximizing firm.

(3) Possible trade-off sets of resources need to be identified and related to the level of decision making, i.e., can we conceive of department chairmen trading-off a budgeted faculty position for more space or more computer time? What resources can be sensibly involved in pricing schemes, and what cannot?

(4) The relation of resource <u>acquisition</u> to resource <u>allocation</u> must be examined, i.e., the problem of the university's external face and its internal face. If resource acquisition is based upon a simple formula such as student enrollments, can internal allocation realistically be treated as a separate matter? What role does this problem, if it exists, leave for internal prices?

(5) Can self-financing systems (dormitories, supply warehouses, etc.) be rationalized through the use of internal prices that reflect external market prices?

(6) How would a system of internal prices relate to other management information systems such as program budgeting systems or cost simulation models? Would implementation of internal

prices impose major new demands upon the data collecting and processing system?

(7) What sub-systems appear to be most suitable candidates for experimental pilot projects, and how might implementation best proceed? What examples do we have of successful attempts in this direction?

(8) What are the specific mechanics of an internal pricing system? Does one use real money, accounting money, "funny" money, or a combination? Does one utilize a bid and offer system, approximating real markets, or are prices set and simply treated as parameters of the decision making process?

The above represent just a sample of the types of questions and issues that were examined during the conference.

In order to keep the conference moving in a logical sequence and to insure the best use of the skills and experience of the participants, the five sessions were organized around the following topics, with a panel of participants assigned to each topic:

Session I: Internal Prices from the Perspective of the University Administrator and Decision Maker.

Session II: Economic Theory and Internal Prices - Some Theoretical and Practical Considerations.

Session III: Resources That Might be Priced - Techniques, Problems and Examples.

Session IV: Planning, Implementation and Information Systems Associated with the Use of Internal Prices.

Session V: Different Perspectives on Internal Prices.

(Panel membership is listed at the end of this section.)

Each conference participant was assigned to one panel, and each panel member was asked to speak for 10-15 minutes on an aspect of the

session's topic that was of particular interest to him. Following the panel presentations, discussion was opened to the entire group for the remainder of the session. We believe that this format insured coverage of the relevant issues, and provided each participant with the opportunity to present his perspectives on a particular topic without imposing onerous demands for advance preparation upon any single participant.

Since internal prices are directly related to decision making, the first session was designed to allow several university administrators to indicate those areas where internal prices might be most useful and most feasible. In short, what types of decisions might be improved if prices were developed, what impact would prices have upon the locus of decision making, and what areas would seem "out of bounds" to the use of prices? In this session, the panelists provided a sensible framework for subsequent discussion by suggesting the practical limits within which a system of internal prices may prove useful.

The second session dealt with the theoretical and practical issues involved in generating internal prices. Panelists touched upon the types of questions raised earlier in this paper. i.e., the relation of prices to costs, the difficulties caused by the absence of output prices and by the non-profit nature of the institutions, and so forth. This session clarified and increased our understanding of the theory behind internal pricing.

The third session was devoted to the specific resources that might be priced in various university sub-systems. The pricing of space, dining services, library services, and other resources were discussed by participants currently grappling with the problems unique to each system. This session explored the possible trade-off sets of resources mentioned earlier

in the paper.

Problems of implementation provided the basis for the fourth session. After the first three sessions made some headway in sorting out and clarifying issues and concepts and casting some light on the direction that implementation should follow, we considered the practical problems of meshing new mechanisms into the ongoing administrative apparatus. What new demands will internal prices place upon the information system? Can institutions with well-established, traditional methods for resource allocation adapt and accept the new techniques, or will internal prices be rejected by the corporate body as a foreign element? How are various groups in the university community likely to respond to the new mechanisms? How will internal prices affect the planning process? These are just a few of the possible questions considered in this session.

The fifth, and final, session was designed to allow several panelists, representing different perspectives and interests in higher education, to comment upon the discussions, arguments, and debate of the previous four sessions. The central question each panelist addressed might be phrased simply as, "Does the emperor have clothes?" In short, do the panelists see the possibilities of further work on the subject of internal pricing as being worthwhile and useful, or do the problems seem overwhelming, the prospects for successful implementation too slim? This final discussion allowed each participant to crystallize his ideas on this very complex subject.

PANEL MEMBERSHIP

Session I - Internal Prices from the Perspective of the University Administrator and Decision-Maker

Robert Sproull
David Brown
Philip Cartwright
Bertram Levy
Joseph McGuire
Chaired by David Breneman

Session II - Economic Theory and Internal Prices -- Some Theoretical and Practical Considerations

Henry Levin
C. B. McGuire
Jacob Michaelsen
Roy Radner
George Weathersby
Chaired by Fred Balderston

Session III - Resources That Might be Priced -- Techniques, Problems and Examples

Alan Grundmann
Thomas Mason
James Mnookin
Donald Davidson
Robert Crandall
Chaired by David Breneman

Session IV - Planning, Implementation and Information Systems Associated with Use of Internal Prices

Michael Roberts
Robert Lamson
Alexander Mood
Robert Adams
Chaired by George Weathersby

Session V - Different Perspectives on Internal Prices

James Doi
Salvatore Corrallo
Kenneth Roose
Warren Sanderson
Chaired by Fred Balderston

III. CONFERENCE HIGHLIGHTS

The conference opened with the presentation of the panel composed of university administrators. The attitude of these panelists toward the subject of internal pricing set a tone that prevailed throughout much of the conference--genuine interest in the potentialities of pricing and an expressed need for more refined and better management tools, tempered, however, with more than a dash of skepticism regarding the usefulness and feasibility of actually implementing such a system.

In large measure, the administrators' doubts regarding the usefulness of internal pricing were based upon an overriding concern with the financial difficulties facing their institutions. In such circumstances, a useful technique, by definition, becomes "something that will save money," and the economists were quick to point out that "saving money" through immediate cost reduction was not the primary purpose of internal pricing. Skepticism regarding the feasibility of implementing internal pricing was based upon several expressed concerns:

(1) Political and economic constraints imposed upon universities by external funding agencies, such as state and federal governments, by private donors, and by various external and internal constituencies.

(2) Difficulties in measuring inputs and outputs of various programs.

(3) Fear that flexibility might be reduced if costs (and prices) were established for academic programs. Concern was expressed that high-cost programs with hard-to-measure benefits would be difficult to justify if dollar signs were attached.

(4) A feeling that internal pricing would be difficult to explain

and justify to university members, and that implementation might be administratively cumbersome.

(5) Belief that periods of financial stringency require the centralization of control over resources rather than decentralization.

The mixture of interest and skepticism is perhaps best displayed in the words of one panelist:

> Ever since the governor reduced our budget with a few deft strokes of his sharp little blue pencil late last week, I've been pondering whether this conference on internal pricing now had more or less relevance for me. On the one hand, I perceived resources allocated to the university by political monopolists who possessed the ultimate power to create educational havoc by their disdain for academic quality. At this lofty position, economic principles and pricing mechanisms play a minor role, while politics reign supreme. On the other hand, however, given the present budget stringencies, which are getting tighter all the time, there appears to be a great need for some type of rational pricing system that will allocate meager resources among competing uses. And indeed, this is what I hope to obtain from this conference: some hope that economic theory and rational behavior can play a major role in academic resource allocations.

The discussion following the first panel also revealed the presence of disagreement and confusion regarding the interpretation of internal pricing and the relation of prices to costs. A brief digression on these points may therefore be useful. By "internal pricing" the conference organizers meant an organizational control technique for the decentralization of decision-making that determines intra-organizational resource allocation. Scarce resources within a university that are subject to competing demands must be allocated in some manner, and internal pricing would solve this problem by simulating the economic market system within the university. Local decision-makers would be given budgets, university resources would carry prices, and each decision-maker would purchase the most desirable collection of resources attainable within the budget

constraint. Although details of the system will be discussed subsequently, it should be clear that internal pricing is not synonymous with cost accounting. With its stress on allocation, pricing is a future-oriented, decision-making technique, while cost accounting examines the results of past decisions in an attempt to measure the resource absorption of completed activities. Given this difference in orientation, the cost figures generated by accounting studies may be inappropriate if used as prices in an internal pricing system. For example, an accountant performing a cost analysis of a computer center might assess the center with a variety of overhead costs, ranging from janitorial services to a pro-rata share of general university administrative expense. From these cost estimates a unit cost per computer hour could be calculated. However, if we wish to implement internal pricing in order to allocate scarce computer time efficiently, the accountant's unit cost figures may simply be irrelevant as a guide to the proper internal price which will efficiently allocate the fixed supply of computer time among competing claimants. The accountant's figures may be useful if one's goal is to render the computer center self-supporting; however, if revenue generation is separated from the goal of efficient resource allocation, the cost accountant's figures will be inappropriate. This point can be made most persuasively when it is realized that an internal pricing system can be operated with a medium of exchange that is not denominated in dollars, thereby completely separating the allocation problem from the cost recovery problem.[1] An important principle often overlooked in the preparation of university cost and price studies is that the relevant cost (or price) depends critically upon the purpose for which the information is being collected. Allocative efficiency and "full" cost recovery are different goals and may, therefore,

[1]For a detailed discussion of these issues, see Norman R. Nielsen, "The Allocation of Computer Resources - Is Pricing the Answer?", Communications of the ACM, Vol. 13, No. 8, August, 1970, pp. 467-474.

require very different sets of prices.

Panel Session two on the second day dealt with the economic theory of internal pricing. An economist, speaking in the morning session, proposed the following model of an internal pricing system:

(1) The medium of exchange, whether dollars or other accounting unit, must be negotiable for more than one category of university resource, i.e., money used for the rental of space must also be able to purchase equipment or secretarial time or computer time. Note as a special case that if the medium of exchange is limited to a single resource such as space, this requirement can be met by guaranteeing negotiability over time, so that money not spent on space this year can be used to rent it next year.

(2) Prices established for the various resources must be the same for all potential purchasers, and must be perceived as independent of the purchaser's actions.

(3) Prices must be market clearing, i.e., set at a level that equates available supply of each resource with the demand. The price of faculty parking permits was cited as an example of an internal price often set too low, resulting in crowding and a continual pressure to build more parking garages.

(4) Budgets received by the decision-making units must be output determined, directly related to the performance of the units. For example, the academic department must perceive its budget as depending directly upon its own actions, with rewards for good performance and penalties for poor performance.

If these conditions are met, decisions that determine internal resource

allocation can be left to decentralized units, such as academic departments. Note that such a system involves a shift from input to output budgeting, with administrative control exercised through increases or decreases in the monetary budget rather than by directly increasing or decreasing the supply of specific resources.

Several panelists took exception to one or more features of this basic model of internal pricing, indicating that unanimity among economists has not yet been reached on the subject. The following points of contention were raised:

(1) One panelist argued that we were a long way from having useful output or performance measures for academic departments, thereby rendering the link between output measures and budgets impossible in any simple, direct sense. Lacking output measures, this economist suggested that we think of internal pricing as similar to the economic theory of consumer behavior, in which consumers are viewed as maximizing utility subject to a budget constraint. Thus, academic departments would receive a budget, which could be used in an unrestricted manner to purchase those resources which provide maximum departmental utility. This model decentralizes not only the process of resource selection but also the setting of goals to the departmental level, and leaves unresolved the critical problem of determining the size of each department's budget.

(2) A second panelist disagreed with the statement that prices should be the same for all purchasers. He argued that the economic market model was inappropriate, since within universities, those who make resource decisions, those who pay, and those who

benefit, are generally members of three different groups. (The economic model of consumer behavior unites these activities within one person.) Therefore, we were urged to view prices as administrative control variables, which could be adjusted flexibly and consciously in order to affect departmental behavior selectively. This view was criticized by other panel members who urged, on behalf of allocative efficiency, that control be exercised through the budget allotments rather than through price differentiation.

(3) A third panelist provided a radical critique of the entire conference, arguing that the real, underlying issue was power, not efficient resource allocation. He argued that as long as funding flows to the institution rather than to students, faculty members will organize their time and departmental resources to suit themselves, with little regard for the desires and interests of students or society at large, the presumed beneficiaries of higher education.

This theme became one of the major philosophical issues underlying the conference and will be discussed in greater detail subsequently.

In addition to these disagreements regarding the features of an internal pricing system, a number of obstacles to implementation were raised by the economists:

(1) A major problem is the annual budgeting procedure, which forces the decision-making units to plan in one year cycles, with no guarantee that savings generated in year 1 can be applied at a time of greater value in year 3. A multi-year horizon budget is neccessary to provide the flexibility in resource use over

time that an effective internal pricing system requires. Furthermore, new academic programs that require lengthy gestation periods would suffer from annual performance budgeting that rewards rapid outcomes.

(2) Rigidities in the personnel structure, such as tenure, limit flexibility in allocating faculty positions, the major university resource.

(3) The presence of externalities (costs or benefits that spill over to non-contracting third parties) can plague an organization using internal prices just as they plague the market economy. Serious externalities would require offsetting taxes or subsidies.

(4) The presence of resource indivisibilities can prove troublesome, i.e., a department may want only half a secretary but may be forced to acquire the services of a full-time secretary or none at all. High transaction costs pose a related problem; for example, space reallocation involves high moving costs.

(5) Uncertainty and poor information would pose problems within a decentralized organization, just as in the economic marketplace.

In the face of these difficulties and disagreements surrounding the theory of internal pricing, one participant suggested that perhaps the conference report should simply state, "We considered internal prices, and found them wanting." An economist responded by noting that virtually all price systems face many of these same difficulties and yet manage to function effectively. He argued that the critical test was determining whether the benefits of internal pricing would justify the expenditure of time and

energy necessary to design and implement the system. In order to help the reader make that judgment, a summary of the potential benefits, as expressed by several panelists throughout the conference, is now in order.

First, short *run* allocative efficiency should be enhanced, since pricing would allow the units that use the resources to make decisions governing the best mix of resources to acquire. Greater efficiency would result since the decentralized unit is the primary possessor of the information required to make the best local decision regarding resource use. Budgetary saving will not be the direct result, but efficiency is increased since the same stock of resources will yield greater satisfaction to the university members, i.e., allocation has improved.

A second, and closely related, benefit that may produce cost savings will emerge if pricing forces decision makers to be more economical in their use of resources. For example, if a department currently views university space as a free good because it carries a zero price, then we should not be surprised to observe very high levels of demand for space. Faced with a positive price for space in conjunction with a negotiable currency, departments would have an incentive to weigh carefully the value of more space versus more computing time versus another secretary. Furthermore, departments that had acquired excess space would release that space in order to capture the budgetary savings, an incentive that is missing in most current budgeting systems.

The potential savings that might result from improved resource allocation as discussed above are difficult to estimate, and would undoubtedly differ among universities. However, there seemed to be general agreement that the savings would probably be, at most, on the order of 5% of the operating budget. Thus, if increased allocative efficiency

were the sole benefit to be expected, the decision to implement internal pricing might be rejected on the grounds that expected benefits are insufficient. Several economists argued, however, that a benefit of much greater magnitude than improved resource allocation was potentially present, and should serve as the major motivation for use of internal pricing; this benefit has been labeled by economist Harvey Liebenstein as "X-efficiency."[2]

Leibenstein argued in his paper that within large organizations, the structure of incentives within which decision makers act is of crucial importance in determining the quality of the resulting performance. Thus, X-efficiency refers primarily to the type of motivation that an organization environment provides for its members. Leibenstein suggested that variations in industrial performance among firms, such as in output per man hour, could be explained more fully by differences in X-efficiency than by differences in allocative efficiency. The crucial factor is the provision of an environment that is conducive to innovation and experimentation, that brings forth the best efforts of people at all levels in the organization. In such an environment, cost-saving ideas and new techniques emerge spontaneously, as the full potential of the managers and employees is realized. The gains to an organization from increases in X-efficiency, Leibenstein argued, are potentially much greater than gains that can be achieved by increasing allocative efficiency.

Internal pricing within a university fits into the above discussion as one method for increasing X-efficiency. This would occur in several ways. First, with internal pricing academic departments would have positive

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[2] Harvey Leibenstein, "Allocative Efficiency Vs. 'X-Efficiency,'" American Economic Review, June, 1966, pp. 392-415.

incentives to search for cost saving methods of operation, since the savings could be retained by the department for other uses. Secondly, decentralization of decision making would reduce the amount of faculty and administration time spent on committee assignments allocating resources such as space by non-price methods. The time and paper work currently spent preparing special requests to the Dean for budgetary exceptions would also decline markedly. Faculty and administration time saved in the allocation process could then be devoted to creative endeavors more directly related to the goals of the university. Frustrations engendered by the bureaucratization of decision making would be reduced, as would the conflict which non-price rationing methods often produce. In sum, decentralization via pricing should improve the incentives for more rational choice, should reduce the time spent in allocating resources, and should provide an environment in which X-efficiency can flourish. If there is any merit to internal pricing, the justification, in great measure, lies here.

Panel sessions three, four and five and the resulting discussion centered primarily around the possibilities and problems of implementing internal pricing, and will, therefore, be treated as a unit. In a conference not otherwise noted for its high degree of consensus, there was substantial agreement regarding those areas of university activity which offered greatest hope for rapid and successful implementation. Areas suggested included the following:

(1) Space -- particularly departmental space, office space, research space

(2) Computer Time and Computing Services

(3) Building and Grounds

(4) Business Services -- particularly the supply storehouse

(5) Car Pools

(6) Equipment -- typewriters, xerox, calculators, etc.

These areas were singled out for several rather obvious reasons. First, they generally involve physical resources that are not uniquely specialized to a single user; thus, competing claimants exist for their services, and an allocation problem may exist. Secondly, several of the areas involve services which, although provided by the university, are business-like in character, with analogues in the private market. Pricing in such areas seems more natural. A third reason, closely related to the second, is that many universities already employ some form of price or user charge in these areas, making the conversion to internal pricing as a decentralized control technique less difficult. A notable exception in this category seems to be space, where user charges on campus seem to be the exception rather than the rule.

What steps would be required to implement internal pricing in these areas? First, the discussion indicated a clear need for critical evaluation of the procedures currently being followed in those activities that presently make use of pricing, often through a form of recharge system. Typical examples would be supply storehouses and building and grounds departments, operating units that post a series of charges for materials and services rendered to university departments. Several examples were cited that indicate a need for revision in certain recharge systems; the abuses mentioned included the following:

(1) Cases in which the internal price charged by building and grounds or by a storehouse was considerably above the outside market price for the same good or service.

(2) An indication that some managers of self-financing systems were setting prices sufficiently high to run an accounting profit, which could be used for expanding their activities.

(3) Concern that the monopoly power granted by many universities to these units was resulting in the expected abuses of monopoly--prices higher than marginal or average cost, and poor service.

There was considerable sentiment for the view that many of these abuses would be eliminated if university departments were free to purchase services in the outside market whenever the price quoted was below a posted internal price. By depriving the in-house units of their monopoly power, the benefits of competition--lower price and better service--should be achieved. Requiring all internal prices to match or fall below the market price for comparable services is an obvious first step in rationalizing the existing system of user charges.

A second step in implementation would be to "free-up" the budget categories so that funds not spent by a department in Category A could be shifted and spent in Category B, the criterion of negotiability mentioned earlier. This procedure introduces the incentive to economize by forcing each department to calculate resource trade-offs in an attempt to obtain maximum value from the budget. The discussion indicated that certain private universities have moved much further in this direction than have public universities, since line-item budgetary constraints are often imposed upon public institutions by state legislatures. Greater budgetary autonomy in the private schools suggests that these institutions will be the pace-setters in implementing internal pricing, should university management move in that direction.

Space seemed to be the resource that generated the greatest interest

as a candidate for internal pricing. Concern was expressed that most university members currently view this extremely costly resource as a free good, resulting in allocation by a combination of squatters' rights and political arm-twisting, methods that leave room for considerable improvement. One panelist proposed the establishment of a space corporation for property management to be run by the university as an economic enterprise. Departments could then use their budgets to rent space and maintenance service from the corporation at a pre-determined rate, thereby being made fully aware of the value of the space they occupy.

In response to the expressed desire of many participants for a specific proposal involving internal pricing of space, Julian Decyk, a summer research assistant of the Ford Project, prepared a brief paper on the topic, published as Appendix A of this report.

There seemed to be general agreement that implementation of internal pricing in the areas discussed above would not require major new research commitments; instead, a willingness on the part of university administrators to experiment with pricing of such resources as space or computer services is the basic requirement. Although a unique theory of internal pricing does not exist, the general principles and objectives of the technique are sufficiently well known that most universities should have no difficulty in assembling an analytical group to guide the implementation. In fact, the absence of a single "correct" method for pricing should result in a variety of different innovations and techniques, and the differences should prove instructive.

On the other hand, several participants argued that if pricing were ever to play a major role in reducing university costs, the technique would have to be extended to the allocation of personnel, including both

academic and non-academic positions. Since faculty represent the major resource of the university, several panelists expressed the view that more thought and investigation should be given to differential pricing of faculty time to various users. For example, one participant suggested that students be given the option of paying a low fee to attend a large lecture class, or a high fee for attending a seminar with the same professor. It was also suggested that professorial time for individual student consultation be made available, again at a fee. At this point, an administrator from a private university expressed great surprise to hear representatives of public institutions advocating the extension of pricing into virtually every nook and cranny, since he had always thought the purpose of public universities was to provide higher education to students irrespective of financial status. An economist answered that the goal of equal educational opportunity is consistent with extensive differential pricing of educational services, provided the public subsidy is given directly to students and not to institutions. Further discussion made it abundantly clear that implementation of internal pricing for the allocation of academic and non-academic positions and faculty time faced numerous educational, legal, economic, moral and political obstacles that rendered this area a fit subject for further research rather than for immediate action.

Although the above description of the conference proceedings has been rather narrowly focused and technical, it would be a serious failure of reporting to leave the reader with the impression that such was the spirit of the two and one half days. On the contrary, at virtually every turn of the discussion, this seemingly narrow, technical topic gave rise to highly speculative and occasionally philosophical discourse. For example, after listening to a panelist argue for increased contracting of outside services

whenever market prices fall below internal prices, one participant observed that we were really developing a new concept of a university, very different from the ideal of the "total institution" that had been dominant for several decades. To illustrate his point, he referred to a proposal presented years before to a large, urban university that instead of maintaining its own library, the university should contract to use the excellent city library. The proposal was quickly dismissed because the "total institution" concept required a university, by definition, to have its own library. The participant argued that our discussion suggested a new, "modular" concept of a university, with component parts unbundled and separately priced, encouraging substitution of externally provided services whenever the "price is right." This line of reasoning caused us to consider which components of a university are of the essence, in the Platonic sense, i.e., would an institution without its own library, or computer center, or residence halls, or building and grounds department still be a university? In short, how far and in which directions can outside contracting be carried without destroying the social, cultural, and educational unity of the institution? Needless to say, no answers emerged to this question, but explicit recognition of the issue seemed to dampen excessive enthusiasm regarding the widespread applicability of pricing.

A somewhat more mundane aspect of outside contracting arose from this discussion, and will be noted briefly. Several participants urged caution for fear that firms might offer low bids for the provision of services such as maintenance, housing, or food services, only to raise prices once the university has eliminated its in-house units. Cases were cited in which the behavior of private contractors had followed this pattern. Participants seemed to agree that extensive use of outside suppliers might wisely

be limited to universities in urban settings, with competition providing a safeguard against predatory business practices.

University governance was a second philosophical issue that permeated much of the discussion throughout the conference. Thus far, this paper has generally referred to academic departments as the primary decision-making units of an internal pricing system; however, decentralization could be carried further to the level of faculty member, employee, or student. For example, the much-discussed voucher system would give students greater control over the allocation of university resources, and could easily be implemented in conjunction with internal pricing. Universities would offer a broad menu of course offerings, differentially priced, from which the student-consumer would select. Professorial pay could be determined by student enrollments, with the "best" professors charging higher prices. With a little imagination, numerous other scenarios can be developed (and were during the conference), in which internal pricing, by shifting the locus of decision-making, alters control and governance of the university. Much of the spirited debate among participants actually centered upon disagreement regarding which groups within the university ought to make resource decisions, thereby making explicit an issue that is implicit in the design of an internal pricing system. The reader will hardly be surprised to hear that this issue remained unresolved.

Although at various points during the conference skepticism toward pricing seemed to dominate, the mood of the closing session appeared to be much more optimistic and positive. The shift in mood was, undoubtedly, the result of many factors, including, perhaps, the following:

(1) After two days of discussion, participants' understanding of the purpose, method, and limitations of internal pricing

was much greater. Many objections had been considered and possibly resolved in the minds of some; in addition, many participants may not have previously been aware of certain potential benefits that were mentioned during the sessions. In short, as the subject became more familiar, initial skepticism seemed to give way to an interest in pursuing the subject further.

(2) In a period of difficult budgetary retrenchment, a system that involves more university members in the decision-making that allocates increasingly scarce resources seems preferable to more autocratic techniques. One economist argued that the negative response of faculty members to increased centralization of control would only hasten the spread of faculty unionization, while greater use of internal pricing might provide a more positive environment in which the hard decisions could be made.

(3) A general belief that university administrators cannot afford to ignore any promising management control technique, given the difficult period of adjustment currently facing higher education.

The positive attitude was perhaps best expressed in the words of an educator on the final panel:

> Frankly, in the last 24 hours I've made a 180° turn with respect to my attitude toward the continuance of this [internal pricing] project. What I've concluded at this point is that I hope the project will continue, and that Balderston, Weathersby, Breneman, and others will develop this idea and explicate pricing as a theory. Actually, as a theory, I understand it already exists among economists, but the particular applications, or implications

> for higher education, or to be specific, the setting of prices, has yet to be done. I urge you to present applications to the management, with possibilities and constraints, and to develop some models, with well defined usage and application.

Concluding Comment

Attempting to capture and report accurately the dynamics of a lengthy conference on a complex subject, with participants representing many different fields and interests, has been a challenging task. Hopefully, the reader will have gained a sense of the ideas, issues, and disagreements that occupied our time. In the author's judgment, the conference was extremely valuable as a source of new insights and new conceptual approaches to the university; the implications of a nexus of internal price relations for university structure, governance, priorities, and performance were surprisingly far-reaching. Perhaps the stimulus of new ideas for those who shared the experience will prove to be the major benefit of the conference.

IV. AN ANALYTIC CRITIQUE OF INTERNAL PRICING AND AN AGENDA OF ISSUES FOR THE FUTURE

The preceding summary of Conference highlights will have succeeded if it impressed upon the reader an awareness of the widely divergent attitudes toward internal pricing expressed by participants during the Conference. The lack of consensus reflected, in part, different values regarding the goals, structure, and function of universities, but many of the disagreements were a reflection of the relatively underdeveloped state of the subject. A variety of models, techniques, and interpretations of internal pricing were set forth during the two and one half days, and an element of confusion may have entered regarding which techniques require further research and which techniques might be suitable for more immediate implementation. In the present section, an attempt will be made to clarify these issues and also suggest several directions in which further work on the subject might proceed.

A fruitful way to begin our evaluation of the various techniques of internal pricing is to examine critically the most complete model of internal pricing that was presented during the conference. The model, briefly described in the previous section of this paper, treats each academic department as a firm, purchasing resource inputs and producing valued outputs. Each department "earns" a budget based upon the value of its output (measured by a schedule of internal prices), and uses this budget to purchase resources, internally priced at opportunity cost. Each department has an incentive to minimize costs for any level of output, since it seeks to maximize output from available resources in order to increase its budget.

The central administration can influence departmental behavior by altering the valuations placed on outputs, while maintaining the advantages of decentralization in resource use through the system of internal resource prices. This attractive model, deriving much of its intellectual appeal from its similarity to the competitive market ideal, involves the use of internal prices for both inputs and outputs, thereby making the widest possible use of a pricing system. Is this a viable and appropriate model for university resource allocation?

Several problems that would prohibit the current implementation of such a complete pricing system were raised during the conference, and should be noted briefly:

(1) The absence of a complete, well-defined and measurable set of college and university outputs;

(2) The lack of systematic methods for evaluating university outputs;

(3) The prevalence of single year budgeting, which prevents departments from achieving optimal resource use over a multi-year time span;

(4) Lack of knowledge regarding the educational production function, i.e., uncertainty regarding the variation in output associated with different mixes of input;

(5) Inflexibility in staffing created by tenure positions.

In short, most of the difficulties that would prevent current implementation of the complete internal pricing model can be attributed to the technological differences existing between a university and a manufacturing plant, for the model is clearly based upon the rational resource use that a price system forces upon such a business firm. Successful use of the complete pricing model would necessitate the development of detailed knowledge of

university production functions so that rational responses to the internal pricing system could be made. Needless to say, knowledge of this type is not yet available.

Our brief analysis of the complete internal pricing model leads, therefore, to two closely related conclusions. First, since we currently lack the necessary knowledge required to implement a thorough internal pricing system, the complete model is of little use as a guide for pilot projects designed to provide experimental evidence regarding the benefits of internal pricing. In the immediate future, we must be satisfied with less elegant and less comprehensive approaches. Secondly, the gaps in our knowledge that prevent the complete model from being implemented indicate the type of research that must be undertaken if a more rational pattern of university resource allocation is to be achieved. Before turning to an examination of less ambitious internal pricing techniques, a few words regarding this research agenda are in order.

The identification and measurement of inputs and outputs of higher education is the necessary first step in any research program designed to improve the allocation of educational resources. Fortunately, work has begun in this area,[1] and our ability to gather meaningful data that measure resource inputs and educational and other outputs should steadily improve. As measurement techniques develop, the relationships linking inputs to outputs can be explored, increasing our understanding of the technology

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[1] See The Outputs of Higher Education: Their Identification, Measurement, and Evaluation, Western Interstate Commission for Higher Education, Boulder, Colorado, July, 1970; and Robert A. Huff, Inventory of Educational Outcomes and Activities, Technical Report 15, Western Interstate Commission for Higher Education, Boulder, Colorado, January, 1971.

of higher education. Work in this area has already begun,[2] and we can expect more sophisticated results as measurements of inputs and outputs improve. In addition to statistical estimates of the higher education production function, we would also benefit from controlled experiments designed to measure the impact of specific resource inputs upon particular educational outcomes.[3]

A second major research area involves the study of university decision-making processes, the formation of goals, and the response to incentives. Internal pricing is designed to affect the flow of resources through the rational choices of decentralized decision-makers, responding to changes in value of resource inputs and educational outputs. However, our understanding of the decision-making process within the university is incomplete, as is our knowledge of the goals pursued by faculty members and departments. In addition, we need more knowledge of current incentive structures in order to form some estimate of the likely response to the incentives introduced via prices. In short, we need to expand our knowledge of the behavioral features of the university, in order to understand and predict the response to changes introduced by internal pricing.

Finally, in order to overcome the difficulty posed by single year budgets for the full development of internal pricing, continued research, development and application of PPB systems is clearly desirable as a step toward longer range planning. Since the successful application of PPB requires academic departments to forecast resource needs for several years

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[2] See A. W. Astin, "Undergraduate Achievement and Institutional Excellence," Science, Vol. 161, August 16, 1968, pp. 661-68; W. Lee Hansen (ed.), Education, Income, and Human Capital, Columbia University Press, New York, 1970; and David W. Breneman, "The Ph.D. Production Process: A Study of Departmental Behavior," unpublished Ph.D. dissertation, University of California, Berkeley, 1970.

[3] For more detailed discussion of these issues, see the paper by Robert Lamson in the Appendix of this report.

in advance, increased use of PPB should prepare the university environment for the eventual use of internal pricing.

Turning from this substantial research agenda, we must next consider more immediate uses of the internal pricing concept, short of the complete model of decentralized control discussed previously. A few comments regarding the role of prices as value signals, prices as incentive devices, prices as a rationing mechanism, and the relation of prices and accountability may clarify several potential uses of internal pricing capable of more immediate implementation.

As mentioned earlier in this report, internal prices need not be quoted in dollars. In fact, a pricing system exists whenever two or more resources or activities are exchangeable in some fixed relation; in short, a price ratio is nothing more than a ratio of exchange. Adam Smith's famous example of the exchange rate between beaver and deer (one beaver = two deer, based on the assumption that a hunter requires twice the time to kill a beaver as a deer) illustrates the point; the beaver-deer exchange rate establishes a price ratio of 2:1. The hunter is thus equipped with a set of value signals, in the form of the beaver-deer price ratio, with which to direct his activities rationally. Colleges and universities often make use of exchange ratios between resources and activities, perhaps without realizing that such ratios establish a set of internal prices that may be interpreted by decision-makers as value signals. A specific example may clarify this point.

Formula budgeting systems are increasingly being used as a method for determining the allocation of state funds to public universities. Such systems generally involve a weighting scheme applied to students at different academic levels, lower division through Ph.D. candidates. For example,

throughout much of the 1960's, the following formula determined the number of FTE faculty positions that the State of California would fund for the University of California:

$$\text{FTE Faculty} = \frac{1.0\ LD + 1.5\ UD + 2.5\ OG + 3.5\ AD}{28}$$

where

LD = number of FTE lower division students registered,

UD = number of FTE upper division students registered,

OG = number of FTE Master and 1st year Ph.D. students registered,

AD = number of FTE 2nd year + Ph.D. students registered.

In other words, the state had accepted a weighted 28:1 student/faculty ratio. The weights were designed to account for the greater input of faculty time required by doctoral students as compared with lower division students. However, the weights also established exchange ratios or internal prices for different level students; while it took 28 lower division students to "earn" a faculty position, only 8 advanced doctoral students were required. Doctoral students were thus "worth" 3.5 times as much as lower division students, a perfectly explicit internal price ratio. The drive on the part of the University of California campuses to expand graduate enrollment must be attributable, in part, to a rational response to these internal value signals.

The message of the preceding example is simply that many types of internal prices may already exist on university campuses in the form of such exchange ratios. Realization of their presence should alert administrators to the potential use of this form of internal price, and should also prompt a re-examination of existing exchange ratios to make certain that the incentive effects induced by particular ratios are not dysfunctional.

Mention of incentive effects refers to a second use of prices, closely related to their role as value signals. Perhaps the major university resource is faculty time, and the decision regarding the allocation of that time among different university activities is largely made by each individual faculty member. Thus, with regard to the allocation of its major resource, the university is already highly decentralized; explicit use of internal prices as value signals and as incentive devices would seem to be a logical approach to such a highly decentralized system. In particular, attempts to alter the faculty member's allocation of time might be more successfully implemented through changed incentives than through edicts passed down from above.

Consider, for example, the current desire expressed by many state legislators to increase the amount of teaching done by faculty members. One method of securing this change has been to legislate increased teaching loads and increased classroom contact hours. Imposing such directives into a system still operating with incentives that place a much higher value upon research than teaching, is certain to produce numerous ingenious methods of circumventing and frustrating the legislative intent. In other words, an implicit internal pricing system already exists in most universities that places relative values on faculty effort devoted to research and to teaching. Currently, the payoff to research is much higher than the payoff to good teaching; thus, we should not be surprised that rational faculty members have organized their time allocation to favor research. Rather than attempt to legislate a different time allocation from outside, changing the incentive system from inside would seem more likely to succeed. Administrators who want to encourage more and better teaching should simply reward such efforts, this being the most efficient way to communicate the

change in relative values between teaching and research. This shift in relative prices must be accompanied by serious efforts to measure teaching performance, so that faculty effort devoted to effective teaching is visible and capable of earning its reward.

A third, and relatively underutilized, role for internal prices is their use in conveying information regarding the value of resources absorbed by the decision-making units of the university. In particular, one can think of many situations in which members of the university determine resource use in the absence of information regarding the opportunity cost involved in their decision. Too often, resources appear to be free goods to the relevant decision-makers, and we should not be surprised by the resulting irrational use of resources. Such situations reflect nothing more than a defective internal pricing system that incorrectly places a zero value on certain resources. An example may serve to clarify this point.

During the 1950's and 1960's considerable concern was expressed over the "Ph.D. stretch-out," the tendency for the average duration of doctoral studies to increase steadily. Numerous studies were devoted to this phenomenon, and vast resources in the form of fellowship aid were lavished upon universities, partly in the hope that such funds would help to speed students through their programs. And yet, a simple but neglected economic explanation lay at hand; the internal price of graduate student time as seen by professors in academic departments was essentially zero. Hence, the existence of any positive benefit to be gained by keeping a graduate student in residence an additional year was likely to be compelling when compared to the very low cost perceived by the department. In other words, graduate student time, being undervalued, was abused, hardly a surprising result. The solution suggested by this analysis would be to raise the

cost to departments of maintaining graduate students in prolonged attendance, a straightforward application of the internal pricing concept.

The above discussion suggests that internal pricing may also play a valuable role in enhancing the university's accountability, a matter of current concern. Resource use in the "multiversity" clearly cannot be controlled in detail from the top; decentralization of control is a fact of life. Thus, public accountability must be based upon a system of internal accountability, flowing from the decentralized units to the central administration. Internal prices provide an efficient method for conveying information from the central administration to the operating units regarding the relative values of various resource inputs and institutional outputs, and therefore provide a framework in which internal accountability can be made unambiguous. In short, it is unrealistic to expect economically rational behavior from academic units that lack the necessary information for rational choice.

Finally, one can point to several areas of university activity that currently make use of internal pricing or recharge systems, and urge the careful examination of the assumptions underlying current procedures. The areas involved include academic support facilities such as computer centers and libraries, and service facilities that are intrinsically businesslike in nature, such as Buildings and Grounds departments, stores, dormitories, and business services.[4] Conference discussion revealed considerable dissatisfaction with the operation of many of these activities, suggesting that internal prices may have been introduced without sufficient thought devoted to the purpose such prices were to serve. Critical examination of

[4] See the paper by Robert Crandall in the Appendix of this report for a more detailed analysis of internal pricing of service facilities.

sub-systems that currently make use of some form of internal pricing would seem to be a good place for administrators interested in pricing to begin their analysis; determining the strengths and weaknesses of current procedures should provide considerable insight into both the problems and potential of the technique.

Our analysis in this section of the report suggests that many opportunities exist for implementing internal prices within the current university setting. Many of the questions concerning the impact of the technique can only be answered by experimentation and analysis of the results. In a similar vein, proposals for a negative income tax and educational voucher systems are currently being subjected to actual implementation and experimentation. As research continues into the difficult areas of input and output measurement and the educational production function, one would hope to see individual universities experimenting with various uses of internal prices, sharing their experience regarding the outcome. Only a lack of imagination and ingenuity, coupled with an unwillingness to experiment, can prevent us from increasing our knowledge and understanding of internal pricing.

APPENDIX A

PLAN FOR A PILOT PROJECT IN PRICING UNIVERSITY SPACE

Julian Decyk

1. Introduction

During the internal pricing conference, several participants suggested university space as a logical resource area for the early implementation of pricing. At the end of the conference, an educator expressed the hope that some specific projects, combined with theoretical analysis, would be forthcoming. In response to this request, the present paper suggests guidelines for a pilot project in pricing university space, combined with enough analysis to show why the specific proposals were chosen. The project uses data and examples from the most available source, the University of California at Berkeley.

During the conference, the problems associated with such a project seemed insurmountable. Changing administrative structures, establishing prices, and determining budgets in the face of legal and political constraints appeared too costly by comparison with the potential benefits. However, as the data were analyzed and the proposal developed, the costs of implementation proved less than assumed, and the benefits greater. This project has recommended only those changes in institutional structure necessary to put pricing into effect. Additional alterations in administrative structure, while implied, are not explicitly recommended. The result is a consistent plan for a pilot project rather than a definitive proposal. It is left to the manager to adjust the plan to the environment in which he works.

2. Administrative Structure for Space Allocation

Any pilot project seeking to alter methods of decision-making must take into account the current administrative (or decision-making) structure, in order to prevent dysfunctional side effects. That is, one wants to know how the current decision-making apparatus will be affected by the proposal in order to adjust the proposal to that apparatus. Our first step, therefore, is to describe the current method of space allocation at Berkeley.

The discussion must begin with an explanation of "re-study" standards and "capacity" space, as these are used as planning devices, bargaining points, and guidelires in all levels of space allocation. In 1953, in a book called The Needs of California in Higher Education, standards for space use for academic units were developed by Donovan Smith, Specialist in Physical Planning for the University. These standards were based on an *ex post* analysis of 1953 allocations. Several years ago these standards were revised somewhat and are now called "re-study" standards. Re-study standards do not cover all space; rather, they apply to classroom space and space allocated to an academic department's exclusive use. Space standards generate square feet per relevant use per relevant F.T.E., i.e., one faculty F.T.E. generates a specific number of square feet for academic office, administrative office, etc.

Re-study standards apply directly to disciplinary fields (such as mathematical sciences, physical sciences, languages and literature) rather than to academic departments within disciplines (such as French and Italian). Re-study standards attempt to average out the space needs of departments within disciplines. For instance, while the French department may need more space than the Italian department, the average need of all the departments

within a discipline establishes the discipline standard. It should not be assumed that departmental standards were developed and then averaged to create discipline standards. Rather, discipline standards were developed with the expectation that department allocations would vary within a discipline, but that these variations would be counterbalancing, leaving the disciplinary total allocation the same. It is important to note that re-study standards are not sophisticated enough to apply directly to the departmental unit which actually receives the space.

Capacity is defined as that space generated by the re-study standards for an academic budgetary unit. For example, 70% capacity means that the department has been allocated 70% of the amount that the standards, if rigidly applied, would generate for the department; 130% capacity means a department has 130% of the amount the standards would generate. Fluctuations this large are not uncommon on the Berkeley campus.

What, then, is the process, taken on the campus level, of allocating space by department? For Berkeley, the Chancellor has the responsibility for space assignment. He has delegated his authority to the Registrar, naming him the Space Assignment Officer. Assignment of classroom space, also under the jurisdiction of the Registrar, is a separate procedure. The space with which we are concerned is research, office, and lab space. If a particular assignment is a routine matter, such as an office for a new faculty member, then the Registrar handles it. If an allocation raises a question of specific policy, such as competition for the same space, then the Registrar refers the matter to one of several committees.

The Buildings and Campus Development Committee (BCD) advises the Chancellor on policy issues relating to space assignment and major capital improvements. The BCD chairman is appointed by the Chancellor and then

recommends to the Chancellor candidates for Committee membership. At the moment, the Committee has 23 members: 11 faculty, 7 administration, 3 ex-officio, and 2 students. All members, including the students, are appointed by the Chancellor, with the Registrar serving as an *ex-officio* member. Subcommittees to the BCD are appointed by the chairman of the BCD; subcommittee members need not be members of the BCD, although there is about a 50% overlap.

The Space Utilization Subcommittee, with seven members, meets to advise the Registrar, at his request, on questions of policy to solve competing claims. This is a problem-oriented, virtually *ad hoc* committee, which meets when there is an issue and for once a week until the issue is solved. The Registrar is a member of this committee, but not its chairman, and there are no student members.

It is the general policy guideline of these committees that space should be allocated to the claimant that demonstrates greatest need for the highest priority use of that space. A specific decision therefore is based on a two-level screening process. Initially, reference is made to an explicit priority list for space use. De[illegible]for space used for academic programs have a higher priority than demands for faculty office space, which in turn have priority over demands for research space. Secondly, if the remaining claimants have demands for the same, highest-priority uses, then an attempt is made to determine which claimant needs it most. Re-study standards are used as a guideline for determining greatest need. The department with 70% capacity space is favored above the department with 90% capacity space. However, the re-study standards are only guidelines. In fact, the overriding concern of the committees is to find the alternate arrangements that will be the least disruptive. A decision made on that

basis would not necessarily be the same decision as one based on re-study standards, particularly because the "least disruptive" criterion takes into account differential political weights of department heads.

If the Registrar wants further discussion after the Space Utilization Subcommittee has deliberated, he refers the matter to the BCD Committee. All decisions made at a level lower than the Chancellor can be appealed to and/or overruled by the Chancellor.

Now that we are aware of the process, let us try to estimate the costs of this process. First we have the costs of the time spent by the Chancellor, which are very small. Second, the time of the Registrar, which has been estimated as five to ten percent of his time. Third, the time spent by all the members of these committees. Last year these committees each met twice, which is considered abnormally low. Next, the cost of the time of two administrators: an assistant to the Chancellor who is a member of the BCD and spends about a third of his time on matters relating to space allocation; and the Principal Educational Facilities Planner, who as a member of the Space Utilization Subcommittee, and spends about half of his time on matters relating to space allocation. In addition, these administrators employ a secretary, who also does secretarial work for these committees.

Let us see how administrative costs are affected by the amount and type of turnover in space. Last year at Berkeley, 5,000 square feet of departmental space were reallocated. This is about 0.1% of all space on campus, and less than 1% of departmental space on campus. Five thousand square feet is considerably below the norms of the past decade at Berkeley, when new buildings freed a considerably greater amount of space for new occupancy in old buildings.

It should be noted that in the university as a whole, 20,000 out of

80,000 rooms were shifted last year. The discrepancy between a 25% university turnover and a 1% Berkeley turnover is resolved, first, because some campuses are still growing, while Berkeley is not, and second, because rooms rather than square feet were used as a measurement device. The impact of the change in measurement becomes clear when one realizes that the bulk of the cyclotron is one room. The suggestion is that the current situation at Berkeley is typical of a campus that is not growing. Further analysis is based on that assumption.

The major difference in administrative costs between the larger past turnover and current turnover has been that the time spent by the committees has decreased significantly. The time of administrators and secretaries has not changed very much. This suggests that increasing (or decreasing) turnover in space has the major effect of increasing (or decreasing) the time of committee members. The time of administrators and secretaries can be viewed as approximating "fixed" costs; the time of committee members as "variable" costs. The variation in time spent by department chairmen in lobbying for space is unknown.

If, as the panelists proposed, the challenge of the '70's is to maintain innovation by departments in a time of constant budgets and size in the university as a whole, and if such innovation actually occurs, then it is likely that more space will be reallocated in the future than in the last year or two at Berkeley. Why is this increase likely? Most space reallocation in the past decade has been oriented toward occupying space which was freed by a department moving into a new building. But these new buildings are rare now. The past year or two has seen a different type of space reallocation, that of marginal adjustments between departments. But with a zero price on space, there are few incentives to make these marginal adjust-

ments. Consequently, the turnover of space has been very low recently. If, however, innovative approaches to departmental technologies succeed, then it is precisely these marginal adjustments which will increase, as departments will then have an incentive to make the adjustments. The result in administrative costs would primarily be an increase in committee time, and a small increase in administrator's time, under the current procedures.

The preceding, then, is a measure of administrative costs, and the probable impact of innovation on administrative costs, under the current space reallocation procedure. What changes in administrative process and structure would the pricing of space imply?

First, the Chancellor would delegate to the deans authority to include a category for space in departmental budgets. Next, the dean would allow departments to trade between several of the expenditure categories within such constraints as the dean finds reasonable. These constraints would be to ensure market fairness. For instance, a department may try to get space free by refusing to buy space that it clearly needs, such as a department's central office, knowing that no one else will buy it. Then the department would argue that it may as well use this "unused" space. Deans should discourage such strategies.

Although in the proposal detailed later the dean would at first set prices and budgets, once space pricing became a wider phenomenon, the Chancellor's Office (in fact, the same personnel who now are concerned with space allocation) could take over the price-setting function. Once a number of pilot projects indicated price ranges and likely turnover, the task of setting prices would not be so monumental or infeasible as starting a complete campuswide price structure from scratch.

In the case that two departments were vying for the same space, the

administrator (who is the dean in the pilot project) could (1) let the space go to the highest bidder, or (2) that tactic failing to resolve the question, give the space to the current holder at the auction price.

The administrative structure for pricing should not entail more time and people than the current procedure, once prices have been set. (Low cost means of setting prices are discussed later in this paper.) The same administrators who are now heavily involved with space reallocation would set prices. The committees would probably prove superfluous. The time that departments currently spend in lobbying for space would be eliminated. Under the new structure, greater turnover would not result in increases in administrative costs as great as under current procedures: committee time is eliminated, while increased time spent by administrators because of increased turnover is about the same in both cases. As a result, the cost of allocating space by prices appears reasonable when compared with the current procedure.

The pricing structure has two effects. First, it moves the question of individual space allocations away from administrators and committees and focuses attention on budgets. (The criteria for setting budgets is discussed later.) Second, it is an admission that in times of slow or zero growth, a more precise and economic allocation mechanism than the present system is necessary and that departments are in a better position than are central administrators to make those allocation decisions. A pricing system properly conceived should produce more satisfactory resource allocation at no increase in administrative cost, an unambiguous gain in efficiency.

There are several indicators that the allocations or outputs produced by the present administrative process are not optimal. It was mentioned earlier that re-study standards apply to disciplines rather than to depart-

ments, but that it was anticipated that the several departments within a discipline would be above or below the standard for the discipline. That is, while each department may not have "capacity" space, the total amount of space allocated to the departments would be equal to "capacity" space for the entire discipline. In fact, however, the tendency is that if one department has less than capacity space, so do the other departments in that discipline. Variations from capacity space have a tendency to be constant within a discipline and to vary between disciplines, the opposite of what was intended. The process then tends to distort the guidelines rather than to refine them.

3. Types of Space

What types of space are included in that space allocated for a department's exclusive use? How do these types of space vary? The table on the following page shows space allocations for 20 departments at Berkeley, representing a broad disciplinary range.

Three broad categories of space have been employed in the following table. Space category A covers class labs, research labs, research lab offices, lab services, greenhouses and field buildings. Space category B covers academic, graduate and secretarial offices, and office services, conference, commons and storage. Space category C covers exhibit rooms and open library stacks.

Not all space is flexible in use or in department ownership without prohibitive remodeling costs. For instance, in very general terms, a particular faculty office can be used by most departments, and that office can be used by graduate students or secretaries as well as by a faculty member. A lab, however, cannot be made into a faculty office, but can

TABLE I. Distribution of Department Space by Category: 20 Departments

Department	total square feet	Space Category A		Space Category B		Space Category C	
		% of dept. space	square feet	% of dept. space	square feet	% of dept. space	square feet
Natural Sciences							
Agricultural Economics	11,192	10.9	1,222	89.1	9,970		
Biological Control	13,434	82.2	11,043	17.8	2,391		
Chemistry	199,218	74.5	148,474	23.8	47,444	1.7	3,300
Civil Engineering	138,666	62.6	86,771	37.4	51,895		
Computer Science	3,714			100.0	3,714		
Entomology	54,002	70.8	38,242	21.4	11,610	7.7	4,150
Genetics	25,931	83.8	21,776	14.2	3,674	1.9	481
Physics	115,756	57.9	67,072	40.7	47,082	1.4	1,602
Subtotal	561,913	66.7	374,600	31.6	177,780	1.7	9,533
Humanities and Social Sciences							
Anthropology	16,859	29.9	5,037	70.1	11,822		
Art	41,602	66.7	27,784	24.7	10,247	8.6	3,571
Economics	16,792	6.5	1,080	93.5	15,712		
English	24,274	2.3	568	94.0	22,807	3.7	899
French	8,027			92.0	7,383	8.0	644
Geography	8,975	33.5	3,017	61.5	5,525	4.9	433
History	15,484			100.0	15,484		
Italian	2,790			90.9	2,535	9.1	255
Law	27,837	24.0	6,680	76.0	21,157		
Math	27,103	1.5	413	98.6	26,690		
Political Science	15,980	4.5	720	95.5	15,260		
Statistics	11,533	29.4	3,393	70.6	8,140		
Subtotal	217,256	22.4	48,692	74.9	162,762	2.7	5,802
TOTAL	776,169	54.3	423,292	43.7	340,542	2.0	15,335

Key: Space Category A is class labs, research labs, research lab offices, lab services, greenhouses and field buildings.
Space Category B is academic, graduate, and secretarial offices and office services, conference, commons, and storage.
Space Category C is exhibits and open stacks.

Source: D-2 Tables for University of California at Berkeley; Fall, 1970.

potentially be remodeled into a lab for another department, or a graduate lab office. Potentially a graduate lab office can be made into a lab. Therefore, the categories attempt to divide types of space into broad groupings so that the types of space within a group are those most easily transferable in use with other types of space in the same category. These categories are measuring degrees of flexibility in use only, without concern to flexibility of ownership.

This table shows that departmental technologies in space use vary considerably. The percentages of space devoted to research versus offices vary considerably even within divisions, though sciences use more research space than humanities, as would be expected.

Rather than price all space a department uses, which a pilot project might attempt to do, we are adding the limitation that the space priced should be that space most conducive to pricing -- most easily priced and most easily substituted. The categories of space employed in the table suggest the type of space most conducive to pricing. What we are measuring now is the flexibility of departmental ownership over particular categories of space.

First, not all space need be priced. Space for which there is one buyer, or essentially one buyer because remodeling costs are too high, need not be priced. This type of space does not present an allocation problem; there is no reason to create a market where no market potential exists. Space categories A and C appear to have low market potentials because of inflexible department ownership. Space category A includes research labs of all sorts, and services for research labs. Most research labs, particularly in the natural sciences, are not substitutable for other labs in other departments. Likewise, remodeling costs for research labs tend to

be high.[1] Therefore, category A space would be a difficult place to start pricing, although perhaps as one becomes more sophisticated about pricing one could handle more sophisticated problems. Likewise with category C space. Therefore, space category B appears the most conducive to pricing: offices are transferable between departments to a much higher degree, and remodeling costs are lower. This category includes about 40% of the space assigned to departments, so that a project dealing with this type of space is not too limited to produce results.

However, a further refinement is necessary. Even within space category B, not all space is equally substituted. For instance, a history faculty office is more easily substituted with a French faculty office than with a chemistry faculty office. Evidently, there are differences between broad categories of disciplines, humanities versus natural sciences, which indicate that even within space category B there should be several markets. All space labelled faculty office is not equally substitutable, therefore one does not need, and in fact does not want, a common price for all faculty offices. This suggests that a pilot project should confine itself not only to space category B, but also to a particular division.

4. Pricing Space and the Department Budget

How would pricing space affect the departmental budget? Currently, departments at Berkeley receive separate budgets for four categories of expenditures: academic personnel, non-academic personnel, equipment and supplies and expense.[2] To provide an example of distribution of the budget

[1] An interesting way to check on substitution would be to ask the heads of both the department that has the space and the department that wants some of it. Buildings and grounds could give remodeling estimates in the few cases one would want them.

[2] A fifth category, academic support personnel -- Teaching Assistants, Research Assistants, and Readers -- is not part of the departmental budget. Teaching Assistants and Readers are hired and paid by the Graduate School. Research Assistants are hired by professors and paid by the professor's grant money.

among categories, the 1970/71 budget for a Berkeley social science department was as follows:

1.	Academic personnel	$700,000
2.	Non-academic personnel	50,000
3.	Equipment	1,000
4.	Supplies and expense[3]	15,000

At present, budgetary transfers between categories 2, 3, and 4 are not possible without the permission of the dean, which is not always forthcoming. To the extent the law is understood, transfers between categories is not illegal, since the University of California budget is a single line item. However, the expenditures by category which make up the legislative request cannot be changed very much without justifying those changes in detail to the satisfaction of legislators the next time the budget comes under legislative review. This political constraint, not applicable to private universities, appears to be the major obstacle to implementation at the University of California.

For pricing of space to be effective, implementation would require two changes in departmental budgets. First, a fifth category, space, must be added to the departmental budget. Second, money from one category would have to be transferrable to other categories.

What types of budgetary transfer might be expected under present circumstances? According to interviews, departments would give up that resource which was in relative surplus to gain that resource which was relatively scarce, whatever that resource might be. Because at the present time departments have varying scarcities of space relative to other inputs, certain departments might be willing, for instance, to trade off personnel

[3] $14,000 of this category is for telephones.

for space. This conclusion is at first surprising, since space and personnel seem to be complementary -- if one adds a secretary one wants added space to locate that secretary. This is undoubtedly true in new and rapidly expanding departments. However, older departments have already acquired certain combinations of space and secretaries, and increments therefore are the focus. If secretaries are the scarcest resource and space is not, then with appropriate terms of trade, a department might be induced to give up space in return for a secretary. The same is true of other resources. From the departmental point of view, the terms of trade are the most important matter.

Since the terms of trade are in part determined by the price of space, then departmental trade-off decisions deemed wholly inappropriate from the management point of view can be partially controlled by setting space prices in such a way that departmental trade-offs unattractive to management will also be unattractive to departments.

The above *a priori* assumptions of complementarity were used during the conference to limit the type of transfers possible and therefore also to limit the impact of internal pricing. It is apparent that these concepts assume a new or expanding department, which is not now the general case. Therefore, internal pricing appears more useful than was first anticipated.

In addition, our conceptions of complementarity are an example of the degree to which expansion is the common assumption among educational administrators and theorists.

5. Setting Prices and Allocating Budgets for a Pilot Project

Given that one does not know what departments would actually do if space were priced, that one is not sure what prices to set, and that the

prices set affect what the departments do, a pilot project should seek to minimize the amount of information necessary to put it into effect, and on such a scale that if unexpected results occur, those results would not have a catastrophic impact. These considerations suggest that a small number of departments should be involved, a limited amount of space should be priced, and that the experiment should concern itself with only one market of space.

For these reasons, the project should involve only a few departments in several buildings, with the stipulation that these departments occupy all the space in those buildings and be contained only in those buildings. (It is left to the manager to determine the exact number.) As set forth in section 3, the type of space priced would be the academic, graduate and secretarial offices and office services, commons and conference rooms of departments in the same division. Since one is now concerned with specific buildings and specific departments, more precise decisions on which space to price and which space not to price could be made according to the criteria of section 3. Given these limitations on numbers and types of space, setting prices and allocating budgets becomes a more manageable task.

To set prices, a simulation method proposed by an economist during the Internal Pricing Conference is attractive. The budget allocating authority, in this case probably the relevant dean, would (1) talk with the relevant department heads, (2) suggest a combination of prices and additional budget appropriations for space, (3) ask the departments to report the purchase they would make, (4) analyze the result, and (5) repeat the process if he found the result unsatisfactory. With one dean and a limited number of department heads, two or three iterations should be

possible without overloading the participants to an undue degree.

A satisfactory result would be a price that would be market-clearing subject to very general constraints that the dean might impose. For instance, if a department of 40 faculty members purchased more space but left itself only one secretary, the result may be considered unsatisfactory even though the prices were market-clearing.

How does the dean choose prices and budgets for the first iteration, and what numerical adjustments should be made between iterations?

First, the dean should determine a budget objective. The following are two budget objectives which seem reasonable for a pilot project. The first is that a budget should enable the department to buy all the space it currently has at whatever price the dean sets. This is attractive because departments would find this a politically neutral action and would not fight against it as vigorously as they might otherwise, and because, with relatively few changes, a market-clearing price should be relatively easy to determine. The second budget objective would be to enable departments to buy "capacity" space, as defined by space standards, at the price the dean is quoting. This approach has several difficulties. First, it would be politically more difficult. Second, the total amount of space in the chosen buildings may not be equal to the "capacity" space that all the departments in those buildings are entitled to. In this case an equilibrium price would result in a university budget surplus or deficit as outlined in section 6. On the positive side, this approach would reveal experimental results more noticeably and would redress some of the inequities of current allocations. Since the constraint is mostly political, the manager involved should decide which option to choose.

A reasonable price for the first iteration would be the rental charge for the same type of space off campus. Since one is concerned with office

space, this should be easy to establish. Since the budget objective is chosen, the manager will determine departmental budgets in accordance with that objective given the price.

If the reports from the departments indicate that they would buy more space than is available, that is, demand is greater than supply, the manager should raise the price of space for the next iteration. If departments would not buy all the space available, the price of space should be lowered for the next iteration. The iterations cease when the departments buy all the space that is for sale.

6. Pricing Space and the University Budget

How does pricing space affect the university budget?

In order that a department may trade space with other items of expenditure, it is necessary that these types of expenditure have a common numeraire. This numeraire can be anything from accounting units, to yen, to dollars. The only requirement is that the department be faced with the same negotiable currency for all the resources it trades between. For the purposes of this project, dollars have been chosen as the numeraire because all other departmental resources that are priced are at present quoted in dollars. If another numeraire were chosen other departmental resources would have to be converted to the new numeraire. This change was considered unnecessary for a pilot project.

An increase in the dollar value of department budgets does not mean a complementary increase in the university's overall budget, if, as is proposed, academic departments can buy space only on campus. The dollars allocated to departments for space are expenditures for the departments, but are also income to the university. The net effect is zero, provided prices

are market-clearing. If departments as a group are allocated enough money to buy all the space on campus that is being priced, and all the space on campus that is being priced is purchased by the departments as a group, then no change is made in the university's overall budget, as the recharge is total. If, however, not all the space is purchased, then the university budget will show a deficit.

In this case, departments in the aggregate have spent less than the total amount of dollars allocated for space consumption and therefore have spent more than the total amount of dollars allocated for secretaries and office equipment. The income the university expected to get from departments for space use has gone instead to secretaries and office equipment suppliers. The university's income is lower than budgeted, in the aggregate. The result is a deficit. For the same type of reasons, if all the space is purchased, but departments bid up the price of certain space, the budget will show a surplus. If a combination of the two occurs, then the university budget can be in surplus, deficit, or balance.

The actual price set for space need not be a price set either at overhead plus maintenance costs or at a market rental price. Since academic departments in universities have been limited by law (in the case of state universities) or by concepts of the "complete" university, from using off-campus space, the university physical plant has been a market separate from the off-campus market. There is no reason why two separate markets should have the same prices for more or less the same commodity. In addition, there are types of space on campus for which no off-campus substitute is available or is likely to be available. For instance, it is not likely that off-campus cyclotrons will be rented to universities in the near future. Consequently, the university will continue to require special

facilities, and these facilities will be a separate market. The university will always be somewhat divorced from the off-campus market.

The fact that on-campus prices differ from off-campus prices for space, and that on-campus prices are determined under different market conditions does not make them any less real to the departments facing them. It is important only that departments by their own actions have no appreciable way of altering these prices. To make sure departments do not affect prices, price only marketable space.

In sum, space prices that have the properties outlined above do not alter the university budget, only the format of the departmental budget.[4]

7. Planning and Its Relation to Space Allocation

It is difficult to speak of space allocation without at some point speaking of planning.

At the University of California, the university-wide administration is not directly concerned with allocation of existing space, but rather with building new space, through the Vice President--Planning.

The university administration is informed by each campus of the buildings they need and the priorities they set on them. At Berkeley, the BCD Committee prepares a priority list of capital improvements, (which are those improvements with a minimum expenditure of $65,000) and passes it on to University Hall. The university administration then compiles a composite list from all campuses, and then goes down the composite

[4] Some administrators at Berkeley have indicated that a department budget would have to be presented in program budget form to take account of space allocation. While this approach may be a desirable step (the California State Legislature currently required program budgets from the University of California for the next fiscal year), the pilot project proposal does not specifically require it. It is interesting that the disjointed incrementalism of this project should imply to some the necessity of program budgets.

priority list as far as state appropriations allow. (In the last two years these appropriations have been zero.)

Though clearly space standards are only part of the priority decisions at the university level, university administrators emphasize re-study standards to a greater extent than campus administrators. In addition, re-study standards are used in the architects' designs for new buildings.

The university planners are nevertheless faced with several problems in their use of these guidelines.

First, the guidelines only extend to part of the space on campus. They do not cover libraries or administration buildings. Therefore the planners are anxious to spend their time developing standards for more types of space. Second, there is almost no feedback mechanism for them to discover how useful the existing standards are. In interviews, university planners indicated that they see pricing space as such a feedback mechanism. The costs of refining the admittedly crude guidelines would be reduced with a pricing system. By lowering the cost of refining standards, the planners can spend more of their time developing standards for additional types of space. And third, the planners as well as the campuses realize that current procedures do not indicate accurately enough those areas where need for new space is greatest. Current indicators are not hopelessly misleading and worked well when a great deal of building was going on. But these indicators are not accurate enough for the current situation of budget stringencies. University planners see pricing as a useful means to gain that accuracy.

Pricing, then, can be used to supply necessary and missing feedback for the space guidelines which are necessary for planning and to supply more accurate indicators of need.

8. Summary of Proposal for Pilot Project

1. Consider only that type of space which is allocated for a department's exclusive use, excluding classroom space.

2. Consider only that portion of a department's space which has market potential -- essentially space category B.

3. Choose a small number of departments such that:
   a. they are in the same division,
   b. they are under the same dean,
   c. they wholly contain a small number of buildings and are contained solely in those buildings.

4. Choose a departmental budget objective, either
   a. budget allocations should allow a department to buy all the space it presently occupies, or
   b. budget allocations should allow a department to buy "capacity" space.

5. To set prices the dean should conduct a market simulation with department heads with the off-campus rental price as a start for the first iteration.

6. The price should be a market-clearing price, given budget allocations in accord with budget objectives.

APPENDIX B

NOTES ON UNIVERSITY RESOURCE ALLOCATION

Dr. Philip Cartwright

For the past few weeks at the University of Washington, we have been holding budget hearings with each school and college, as well as with each administrative division, to determine the allocation of those resources which the Legislature and the Governor have now appropriated for the University for the next biennium. I am delighted, therefore, to be able to attend this workshop in order to learn how to improve our system of decision-making with respect to the allocation of these resources in a more rational way. I would hasten to say that our present allocative processes involve not just one of the suggested methods in Dr. Breneman's guidelines, but a mixture. Some allocations are based on the economic market price system. For others, the system of allocations are derived from voting procedures of the students. For others, it is frankly a bargaining situation and, I would confess that, in a limited number of cases, allocation is made by fiat or dictatorship in the central administration. As far as I know, we do not allocate by force, fraud, or deceit, but at the same time, one occasionally runs into some mild forms of intimidation. I do not intend to provide any solutions to the problems we face. I recognize the inconsistencies involved in our decision-making processes as well as the inadequacy of information upon which to make rational calculations. I shall try to describe only a few of the myriad of problems requiring decisions, and hope that this conference can provide solutions for us.

The basic allocation of dollar resources from the Legislature and the Governor is based upon a series of formulas. For example, the dollars to

provide for instructional staff are based upon a fairly sophisticated formula reflecting credit hour production, as estimated for a given population of students. The formula, in effect, provides for so many faculty positions in relation to credit hours at different levels of instruction, reflecting the higher cost, in terms of faculty resources, for graduate instruction, as compared with upper division or lower division instruction. It also includes dollars for direct instructional support of the faculty in terms of secretaries, technicians, supplies, equipment, etc. At the present time, our total population of students is fixed, but the mix between levels of instruction, as measured by credit hours, will vary and has to be estimated and accepted by the Legislature. These credit hours are then translated into dollar amounts by calculation of average cost per faculty and the historical cost of supportive services directly involved in instruction for departments of the University as a whole, with no expectation that these would be uniform as among the various disciplines. Allocation of resources thus depends upon a kind of selection on the part of consumers, that is, students, and the courses that they select which produces credit hours as a result of their voting procedures.

Allocation of dollars for maintenance of physical facilities is again based upon a formula calculated on the basis of some historical practice with respect to the amount of square footage to be maintained. Similarly, with the maintenance of grounds, there is a formula reflecting the historic costs of maintaining these facilities. There has been established a formula for library services, again based upon historical patterns at all of the institutions of the state, with some recognition of the difference in library costs at the University as compared to state colleges. Over the past few years, the state has constructed a number of such formulae,

and an increasing number of areas are being subjected to allocations by the formula approach. The state, in turn, applies discretion as to what percentage of the formula is to be achieved by the institution in each of the areas. For example, the state has mandated that we should not exceed 70% of the formula for faculty staffing, which is a substantial reduction from previous staffing positions and reflects the attitude on the part of the Legislature that, given straitened financial circumstances of the state treasury, the instructional staff will have to work harder to produce the same educational services which are measured by credit hour production.

Although the budget request was originated by the University, it was, to some extent, retailored by the Governor before he presented it to the Legislature, and again tailored by the Legislature to meet their set of intentions. While we have a good deal of flexibility with respect to allocation of resources once the appropriation is made to the University, we must pay some attention, of course, to what we describe as "legislative intent" as between the various programs, and subject to formula consideration. Thus, the Governor determined this year that state-supported research activities should be cut more severely than other activities, specifically instruction. Consequently, those parts of the budget which reflected research support were cut more severely than those related to instruction. The Legislature, in turn, determined that the amount of faculty time devoted to contact hours was not sufficient, and mandated an increase in contact hours for the faculty, together with the reduction of a number of faculty per student population. They also mandated certain research and service programs which they felt were relatively more valuable than others, especially those related to what they saw as potential industrial development for the state, and prescribed continuance of present budget levels in

those units.

The University, therefore, is not entirely free to allocate resources in any way that it wishes, but must accept to some extent a pricing pattern established externally by the Governor and the Legislature.

Within the various degree programs and disciplines, the administration is relatively free to allocate or reallocate among them. At the graduate level, we have now begun to control specific enrollment and admissions with quotas that are supposed to reflect department, or interdisciplinary groups' recommendations as to the number of graduate students for whom they can provide satisfactory educational service. Consideration is given, to some extent, to the subsequent market for such certificated products and some recognition of the demand of the students to enter such programs. There is, however, no recognition of the relationship between the values of such products to society as measured, for example, by future income compared to the marginal or average cost of producing such products. There is some recognition on the part of prospective students of the nature of market changes for individuals with different kinds of training, but this is quite imprecise and subject, of course, to substantial lags. Moreover, I am not at all certain that the University does not have an interest, if not a responsibility, to provide training in fields upon which society does not place a very high market value. Thus, for example, we have a long-standing commitment at the University to provide training in the performing arts: music, art, dance, and drama. Such a commitment reflects a decreasing number of private conservatories for such training in the country and a desire on the part of many students to pursue such careers even though they're not very financially rewarding. The feeling on the part of those in the University is that society would be better

off if it is not made up entirely of physicians and lawyers. One might say the University is trying to reshape society and is willing to allocate resources to subsidize such a venture. It is, in fact, not unlike the decision the faculty make when they prescribe the general education requirements for a student at the undergraduate level, because they, the faculty, think the student will be a better educated person through their prescription than through the student's own choice.

At the undergraduate instructional level, the allocation of resources is less likely to reflect the consumer choice in the sense of society, but rather choices by students, within the prescriptions of the faculty, and the requirements for degrees, of those disciplines that interest them. Since training at the baccalaureate level, except for a relatively few fields, is not designed to train people for particular careers whose income is therefore measurable, it is difficult to determine what the benefit of a degree, say, in chemistry is, as compared with, say, a degree in Asian languages and literature. Both degrees have many common elements, of course, but there are enough differences in the programs to create significant differences in the cost for a degree program. Even if we were to establish quota systems for the number of students in each discipline, to try to reflect some equalization at the margin between marginal benefits and marginal costs in each degree program, it is difficult, in fact, to control student registrations in exactly the same way. Students are more or less free to choose courses that will ultimately require specific resources whether they choose majors in the same way or not. The failure to provide courses to meet the student demands, whether these be in ethnic studies, experiential learning, or any of the other more fashionable current fields, creates considerable pressures and, at the very least, some kinds of bargaining and compromise

on the part of the administration.

Another area of difficulty arises because the University is committed in one of its roles to the creation of new knowledge, both as it relates to the training of graduate students who will be future discoverers of knowledge, but also for its own sake. Putting a price on that new knowledge, which becomes a free good, once created, creates serious problems in the allocative process. Allocations of resources to research are further complicated by the fact that both Federal and private foundations which are interested in supporting research and, therefore, make allocations of resources to the University for such purposes, appear to have their own pricing systems as to what kind of research they value most. There is no reason to believe that the National Science Foundation, or the Department of Health, Education and Welfare programs necessarily correspond to the relative prices the University might set on alternative research programs. Allocations of resources from such foundations inevitably require commitment of other funds available to the University in some matching way. The rational consequence of such allocative decisions is to allocate a disproportionate amount of the University's resources toward these areas since the marginal cost, in terms of University funds, is lower. Therefore, if the marginal benefit is a declining function, the rate of marginal benefit will be lower in these areas than in others, but still equal to the lower marginal cost.

While I recognize the difficulty of determining the actual marginal costs of the production of educational services or research, or even community service, especially in view of the increasing proportion of fixed costs, as universities have tended to centralize more and more of the supportive services of education, the calculation of marginal benefits seems to me even more difficult. But, even assuming one could calculate a ra-

tional pricing system, measuring both benefits and costs, the question arises as to whose pricing system are we to select: the pricing system suggested by foundations, which fit their particular values? the pricing system suggested by the Legislature, which reflects its special interests? the pricing system which may be reflected by student choice of courses in the fields which they desire to pursue regardless of future income? the pricing system which might be imposed by society, as measured simply in discounted future economic income? the pricing system which might be suggested by the faculty who have their own special value system? or some kind of compromise proposed by the central administration's value system, which attempts to distribute the misery of a declining budget so that each constituency is equally displeased?

APPENDIX C

STRUCTURAL ANALYSIS OF THE UNIVERSITY RESOURCE ALLOCATION PROBLEM

Dr. Robert Crandall

1. The Inter-University Allocation Problem

It is interesting to think of higher education in a given political jurisdiction (e.g., State or Province) as a single industry, with the individual universities simply being operating units creating outputs (e.g., graduates[1]). The problem is then to find the level of public subsidy (if any) which is needed to energize these operating units to create outputs (the graduates of the various disciplines) and to hold these outputs at the "right" level. Whatever this subsidy plan is, one would hope it would be neutral in the sense that it would leave the operating units free to combine resources in whatever way seemed most efficient in the production of the desired output. Ideally, this allocation scheme to the individual universities would also turn out to be an allocation scheme to the subunits (faculties), so the allocation scheme would be the familiar economic one, based on market forces, right down to at least the major subunits of the individual universities.

One scheme that illustrates what I have in mind is the following:

1. At the beginning of each operating period, the Minister for University Affairs invites the operating units to submit tenders for the production of graduates in each of the various course streams thought to be socially desirable (we need not concern ourselves here how the Minister happens to have the answers to such a subtle issue). The universities are asked to state their total cost for producing, say, engineers at various levels of output thought to be in the relevant range.

[1] "Graduates" is too crude a measure for output, but is used here for simplicity.

2. On receipt of the tenders, the Minister than balances up the marginal cost of the outputs for the same course streams, at the various institutions, and makes some judgement about the marginal benefit to society of the graduates of the various areas. With this cost-effectiveness exercise behind him, he then awards the tenders.

3. The individual universities then know not only what their subsidy will be for the year, but how it ought to be partitioned among the various sub-units that produce saleable products (graduates). The fate of those sub-units that do not produce graduates is something to be dealt with later.

If one is willing to forgive the central role of the Minister in deciding what a "good" mix of student output ought to be, then the rest of the scheme looks reasonably good. In effect, the operating units present to the Minister their cost schedule for each of the products they produce, and he balances up the system to get the lowest marginal costs when he lets the tenders.

Some of the difficulties that come to mind with such a scheme are:

1. Although the universities are asked to bid on the basis of their expected cost schedules, the notions of cost are in reality rather elastic, and there is an opportunity for a thoughtful university administrator to extract from the Minister a rent in those course streams whose enrollments are increasing or even staying steady. This is particularly true in those cases where he knows that existing facilities at competing institutions are at capacity, so that the marginal cost of expanding them is higher than his marginal cost of adding a few more students to existing classes. He would have no difficulty in defeating such crude control devices as post-audits by the Minister to see if his cost was "really" necessary.

2. The plan assumes that there is no quality difference between the output of the various universities, and one would need

a device for ensuring quality control over the outputs, or else it would be possible for a successful tendered to "save" money at the expense of student education.

3. There are, of course, immense institutional rigidities, such as tenure. In this specific instance, however, one might create flexibility by offering system wide tenure instead of institutional tenure.

In the example cited above the universities were asked to quote a price that was just sufficient to bring them to various output levels. Presumably, once the Minister accepted one of the tenders at a given total price, the university would be bound to produce at least the number of graduates contracted for, and would not produce any more because it would suffer a marginal loss (assuming that any fees that might be charged the student are less than his marginal cost). The pricing system is thus both an energizer (driving enrollment up to the "right" amount), and an inhibiter (since it ceases to energize once the "right" amount is reached).

I now propose to describe a second possible inter-university allocation scheme in which the price system is used only to energize, and non-price constraints are used to inhibit. This second model has been more or less inspired by the present experience in Ontario.

Consider a system in which the Minister pays a fixed unit grant per student to a finite number of "approved" operating units. The fixed unit grant varies between course streams, but is everywhere greater than long run marginal cost and, apparently, average cost. We therefore have a system which is energized to grow without limit.

Now consider this same system in the framework of a linear program. The activities are the course streams. It is then possible to identify such constraints in unlimited growth as: (1) the supply of students willing to under-

take a given course of study, (2) the capacity to handle students of each of the operating units in each of the given course streams, (3) total enrollment limits of the various operating units, (4) total governmental funds available for the subsidy plan, and (5) the total output of the various course streams thought to be "right" from a social point of view. The objective function would then be some weighting of the value to society of an output of each of the course streams.

This programming approach is another way to allocate resources to the operating units, although in this case the role of prices is more modest, being simply to energize. The second approach also requires a higher volume of communication with the central authority, since in order to construct a program he needs to know additional information from the operating units, such as their capacity constraints.

Some questions that might be asked of this model are the following:

1. How large a subsidy per student is required to energize the system up to the limits desired? Note that if a uniform fee is paid to all producing units, then some of them will run a surplus because of a more favorable cost structure. One might run a bidding system (similar to the first case) to find this price, but the rules of the system, as described, prevent the Minister from being a discriminatory monopoly purchaser.

2. We assume that the effect of a changing student-staff ratio will have no impact on the quality of the product turned out.

3. We assume that the graduates of a similar course stream from different universities are all homogeneous in quality. This is the quality control problem again.

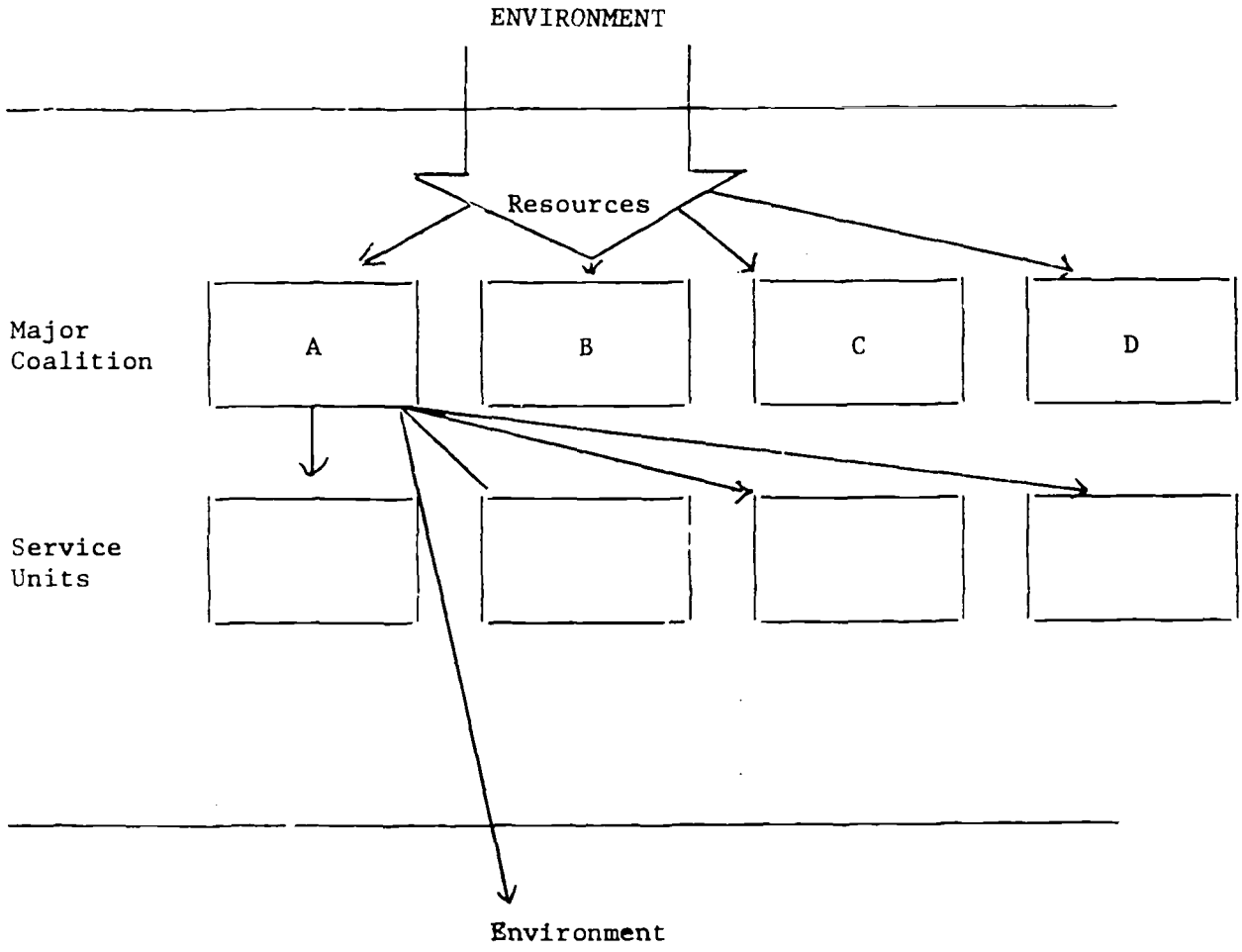
2. The Intra-University Allocation Problem

I begin this section by setting out a simple model for viewing the intra-university relationships. Let us begin at the bottom of the hierarchy by defining service units as those departments that exist by providing a service to the units forming the main coalition of the organization. The simplest kind of service unit would be one producing an identifiable product with a well established market price. A duplicating department would be an example. There are *a priori* reasons for thinking that one could expect such a unit to sell its output internally to the other units of the university, and to generate revenues sufficient to cover its costs. Failure to do so would be evidence that the management of the unit needed to be changed, or that the unit served no useful economic role and should be allowed to wither away.

The role of an internal pricing mechanism is fairly clear in such service units: (1) it provides an automatic system for saying what resources will be made available to that unit (since it must live off the revenue it earns), (2) it provides measures of what the other units of the university want, and encourages the service units to move in that direction, and (3) the test of profitability serves as a combined indicator of both management skills and the economic need for that service. Real life service units are not the smoothly self-adjusting mechanisms to be found in the world of Hirschleifer [1956, 1957], but they are good approximations. Later in the paper I will list over a dozen examples, but at the moment I wish to discuss the second group in this hierarchy.

Consider a flow of resources from the environment outside the university

into the university itself. Let us assume that these resources are divided up (in ways to be discussed later), amongst the members of the major coalition. These members are then free to use these resources to purchase directly from the outside environment, or from the service units. A diagram is given below:



The flow of resources is illustrated for Member A only.

The members of the major coalition are thought of here in the sense put forward by Cyert and March [1963]:

> Let us view the organization as a coalition. It is a coalition of individuals, some of them organized into subcoalitions ...

> Basic to the idea of a coalition is the expectation that the individual participants in the organization may have substantially different preference orderings (i.e., individual goals). (p. 27)

In the diagram above the members of the coalition are thought of, for convenience, as the major political and organizational subdivisions of the institution, such as the faculties. They are the groups with sufficient bargaining power to demand a portion of the incoming resources.

How are the incoming resources allocated among the members of this coalition? I have indicated above how a bidding system might be used to make this allocation. Since the individual faculties would be bidding on the basis of their cost structure, and the central decision maker would be combining the cost information with some notions of social benefit, the system is only partly based on impersonal market forces. The basic form of the evaluation is between the costs of the same course streams at different institutions, however, and this might help to remove the locus of the conflict over the use of scarce resources from the institution-wide level and place it in a discipline-wide setting.

Let us assume, however, that the resource stream into the university has not been partitioned among the members of the coalition in some impersonal manner, and the allocation process must then be based on some non-economic criteria such as those mentioned by Shubik [1969] (e.g., chance, force, fraud, voting). This seems like a reasonable assumption, so it is pertinent to ask whether the internal price mechanism still has a useful role to play even if it is incapable of making the main allocation of resources among the coalition. The supporting role of an internal price mechanism, even in this setting, can be appreciated if one thinks of the budget as the "peace

treaty" among the major members of the coalition. If they agree to use the budget as the allocation device, they need conduct war with each other only, say, once a year when the budget is created. The budget represents agreement in principle on the use of the scarce resources that the organization anticipates receiving. Those agreeing to it cannot know with precision what people and supplies will cost in the year ahead, but they can agree on upper bounds on the dollar amounts that will be made available. As long as the university then maintains an internal price environment for measuring the resources used by the coalition members, and a way of policing to see that the treaty terms are honored, the detailed terms of the treaty can be worked out smoothly until the next annual war.

Once the budget is agreed on, it provides each member of the major coalition with a pool of resources to draw on in a manner consistent with the terms of the "treaty" and the usual standing regulations of the institution. There are several observations to be made about this process:

1. The bidding system proposed earlier provided a means for making resource allocations to those members of the major coalition that produced graduates thought to be desirable. Once one drops the economic method of allocation, however, it then becomes possible for members of the service units to move up to become members of the major coalition. One example of this is the library, which exists to service the needs of the faculties and research groups, and hence could be treated as a service unit. Instead, in the university settings with which I am familiar the library is a member of the major coalition, competing directly with the faculties for budget funds.

   The *prima facie* argument would seem to be that any university unit that could not generate its own revenues under the bidding system outlined earlier would be a candidate to be

considered as a service unit. I will not go into the micro-economic discussion of (1) what price they should charge or (2) how they might be subsidized if the pricing scheme indicates that they should run at an operating loss, since I understand this will be discussed in other sessions.

2. Once one has used the test outline above, then it would be interesting to find out what proportion of the available budget is spent by the major members directly in the market outside the university, and what is spent buying services inside the university. This would provide a test of the importance of internal pricing mechanisms in that institution. If it turns out that most of the budget funds of the major members are spent directly outside the university, then the expected pay-off from internal pricing arrangements is reduced.

3. The analysis presented so far has portrayed a university without students as decision makers. Instead, they are the inert raw material which has been processed to form the desired outputs, graduates. There are not many production processes where the raw material is capable of aiding the process by making helpful production decisions, but this is one of them. One therefore has to add another dimension to this model, and think of adding price mechanisms to permit students to make local decisions about their own educational processes.

In summary, price mechanisms seem to have a useful role in the intra-university processes even if one has to do the allocation among the major coalition members by some process other than the economic one. There is a *prima facie* case for thinking that the price mechanism can usefully be used to direct the affairs of the service units, and the bidding system suggested earlier provides a test for distinguishing between service units and major coalition members.

3. Examples and Research Possibilities

In this section I propose to use the model set out above to categorize the examples I will give. In those cases where I can see possible researchable areas, I will set them out as well.

3.1. The Inter-University Area

Two examples of the use of pricing mechanisms have already been given, so it remains to ask if there are researchable areas.

On the bidding system, it would be interesting to take an existing course stream at several universities in the same jurisdiction (e.g., Ontario) and estimate to what extent the enrollment pattern would have shifted had such a bidding system been in use. This would require estimates of the total cost of that course stream in each of the institutions, but at various levels of enrollment within the relevant range. One would then need to extend it so that it could be adapted to expected shifts in total enrollment in that stream over some planning horizon.

I am <u>not</u> suggesting the common approach of cost allocation between teaching, research, and other activities since I think one must put together a virtually inseparable package of all these components if one intends to mount a program of a given quality level. Instead, this study would make some assumptions about the mix of teaching and research, and go on to examine the relationship between volume and cost, as a part of the examination of the feasibility of a bidding system.

I said that the programming approach was inspired by the current Ontario setting, but so far as I know they have arrived at it intuitively, rather

than formally. Several research possibilities therefore come to mind: (1) seeing if one can express an education system of over 100,000 students in some 17 or so institutions as an activity in which one is trying to maximize something subject to constraints; (2) seeking to find the minimum grant necessary to energize the system to drive it up against the desired constraints. This appears to be an examination of the cost/volume issues similar to the one already described.

3.2. The Intra-University Area

The first task in the university itself is to identify those departments which might be considered as service units. I have already suggested a test for this, and the most interesting potential service units are probably the library and the physical space operations. Some other examples are the following:

1. Animal care and supplies
2. Audio-visual services
3. Computing center
4. Duplicating and printing
5. Telephone services: basic equipment and long distance
6. Student housing
7. Office equipment and supplies
8. Maintenance stores
9. Physical plant renovations
10. Alumni affairs unit
11. Recreation facilities
12. Electronic equipment maintenance
13. Greenhouses
14. University press.

Taking all these service units together, some of the interesting research areas are the following:

1. How price elastic is the demand for these various services? Can we predict ahead of time what it is likely to be? Can we devise methods for encouraging the customers to decide on resource use in the light of relative prices? It is usually assumed that the purchasers of the output of the service units are informed and motivated purchasers, but this may well be wrong.

2. What is the cost behavior in a specific service unit? How does cost change over the relevant volume range? How does one partition the cost amongst the various outputs (if at all) as a guide to pricing? If one could do a thorough job in this area, the study might then be used as a prototype to prepare a guide on pricing and operating analysis for the use of managers of service units.

3. Are generally accepted accounting principles in common use in universities exerting a predictable and counter-productive pressure on the optimal use of resources? I suspect, for instance, that many service units are pricing their output on a "full absorption" costing basis in which they allocate fixed costs to product on some arbitrary basis. It would be interesting to take the methodology proposed by Goldschmidt [1970], and apply it in this setting.

3.3. Additional Comment

There are two other areas that do not fit neatly into the framework set out above, and I intend to comment on them here.

As I indicated above, education is one of the few industries where the raw material (the student) is capable of making decisions for improving the productive process. Consider a situation in which the student is required to reach some prescribed level of competence in an area, and at the end of the learning period he must pass some test of this competence. He is

provided with an endowment of funds, and is then free to purchase his learning in any mix that he thinks appropriate. He might, for example, opt for a large number of (cheap) hours in a large lecture, or instead go for a few (expensive) hours in a small seminar. Instead of either of these, he might opt for the library, audio visual cassettes, or a programmed learning scheme.

I have a colleague who suggests that students do not meet the test of intelligent purchaser, and hence must have their educational diet prescribed for them. I can recall that in my time as a university administrator I felt the same way about many of the professors.

The second area that needs attention is the split between capital and operating decisions found in many universities (including my own). Capital additions tend to be argued "on their merits" without reference to the possible trade-off between capital costs and operating costs. In many ways, capital assets have come to be regarded as free goods subject to some non-price rationing scheme. As a result, one can make the argument that this encourages many institutions to become over capital intensive. Going back to the inter-university setting, one can make the argument that the individual universities should receive only operating grants, and that capital additions should be financed out of operating revenues. This would stop capital additions from being a free good, and encourage a regular evaluation of the relative advantage of capital goods over operating costs.

Finally, I would like to comment on the interaction between student aid and student housing. I have commented elsewhere [1969] on the way in which subsidized student housing is used to provide indirect financial aid to the "right" (usually, married) student, and how the accounting measurement system encourages the development of some types of student housing over others by its failure to measure all the economic costs involved. One could argue

that student housing should be priced at the market, and that student aid should be handled directly as student aid. The companion argument is that the private sector of the housing market should be regarded as part of the student housing system, and that student housing that is uneconomic (although it may still be "profitable" in an accounting sense) should be sold or diverted to other areas.

4. Conclusion

You will have observed that in approaching the question of internal price mechanisms I have found myself looking at the system from the top down, viz., starting with the industry, then going to the individual university, and finally to the organizational sub-unit within the institution. In each case one could use the price mechanism to analyze the process, and to provide an articulation from one stage to the next.

I do not, of course, argue that the internal pricing mechanism is adoptible in each setting at every level. Indeed, there are good economic reasons for suspecting that in many areas the pricing mechanism simply isn't workable. Once this has been said, however, there still remain many areas where its application should promote more thoughtful use of scarce resources.

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APPENDIX D

INTERNAL PRICING AT AN INSTITUTION OF HIGHER EDUCATION: IMPLEMENTATION, PLANNING AND INFORMATION NEEDS

Dr. Robert Lamson

1. Introduction

Much has been said about the conceptual and practical aspects of centralized versus decentralized management at an institution of higher education. It would seem that the conditions for the success of highly centralized management, which might be expected to hold in a relatively small profit maximizing firm, do not hold in a many faceted, not-for-profit institution such as a university, at least in the absence of some sustained crisis. Given the numerous output dimensions and the fact that there are different clients for each, institutions of higher education tend inherently towards decentralization. In the absence of stringent and centrally enforced regulations, therefore, the individual values and the motivations of managers at the department and college level must be influenced through some incentive system which allows their individual goals and activities to be more automatically consistent with the higher order goals of the institution as a whole.

It is in the context of such decentralized management, operating within a financially based incentive system, that internal pricing can, at least conceptually, play an important role. For the ultimate success of an internal pricing system and for the maximum of benefits to be realized, however, certain conditions are necessary:

A. Output Measurement. Ideally output should be quantifiable in specific units and there should exist a means of evaluation so that different dimensions can be aggregated and compared to determine total value added.

B. Input Measurement. Inputs also must be measurable in units, and there should be some mechanism for evaluation in terms of opportunity cost.

C. Specification of the Production Process. The relationship between inputs and outputs must be understood to see how a variation in the level and mix of inputs will lead to a variation in the level and mix of outputs. This problem is complicated by the fact that institutions of higher education produce numerous products jointly (graduate and undergraduate instruction, research, and community or public service). In addition, higher education involves a multi-stage production process. Many outputs which are produced (e.g., from libraries, computer center, student services, etc.) are "intermediate" in nature and become inputs in the next stage in the production process.

D. A Financially Based Incentive Structure and a Minimum of Constraints to Decentralized Action. Ideally, the incentive structure is a substitute for the profit motive in the business community, an incentive structure which will automatically lead decision makers at the departmental and college level to actions which are consistent with the higher order goals of the institution and society. This is perhaps the most important condition in the attempt to implement internal pricing.

Under circumstances in which these conditions existed increased

reliance upon internal pricing and decentralized management at the institution would be feasible and would lead to an efficient allocation of resources in the traditional economic sense. The problem is, of course, that none of the above conditions are readily satisfied.

It would seem logical that one of the goals of long-range planning and the development of information systems at institutions of higher education should be to work towards this end; since the alternative to decentralized management and greater reliance upon an internal pricing and incentive mechanism is a high degree of centralized management. The latter is likely to be both restrictive in the sense of reducing options to students, faculty, and managers at the departmental level and, therefore, less effective in the allocation of resources to meet student and faculty demands.

2. Planning and Information Development to Support Decentralization and the Feasibility of Internal Pricing

It is evident that the necessary conditions for coherent decentralization and reliance upon internal pricing are not likely to be satisfied in the very near future. There are, however, some areas of planning and information development which might assist in moving towards these conditions over the longer run.

A. Output Measurement and Evaluation. Academic research by economists and long-run major research projects by research organizations such as presently underway at the National Center for Higher Education Management Systems may eventually bear fruit in establishing useful quantifiable indicators of output. These efforts

should be continued and supported. Within institutions themselves, however, some effort needs to be dedicated to less precise but more operational and timely indicators.

For example, establishing a "program" framework for the aggregation, analysis and budgeting of activities within the institution results in a critical look at these activities in terms of what is to be accomplished. This leads to the aggregation of similar activities according to "primary intent" and brings both primary and support activities into an output focus. If approached from this point "programming" may greatly improve the chances for subjective evaluation and for setting the foundation for identifying specific quantifiable indicators.

Along with this effort it is possible for institutions to concentrate upon the collection and the provision of certain "quasi-output" indicators, which, while not able to be priced and aggregated, can greatly assist the primary clients of higher education, students, in making their own evaluations of output. Some of the indicators which could be regularly collected, maintained and provided to students in a timely fashion have been suggested by economists:[2]

1. Historical statistics, by discipline, showing the average time needed to achieve the degree, Bachelor, Master's, and Ph.D., as well as the distribution about the average.
2. Historical statistics, by discipline, showing the actual rates

[2] See, for example, David Breneman's work, An Economic Theory of Ph.D. Production, Paper P-8, Ford Foundation Research Program in University Administration, Berkeley, Vice President--Planning, University of California, June 1970.

of success (percentage who ultimately complete their degree) also by level of degree.

3. Reports on recent research accomplishments of the faculty by field and information which shows the degree of student participation in faculty research activity (e.g., number of theses and dissertations derived from faculty research, student participation [by level] as research assistants, and class projects which are tied directly to faculty research activity).
4. Summary information on field work, community service and consulting activity which involves the joint participation of students and faculty.
5. Reports of student assessment of their educational program including advising, program content and teaching quality. This information could quite easily be collected, analyzed and summarized through the careful design and use of student questionnaires.
6. Information on student careers (employment or additional schooling activities) after leaving the institution.

If such information were regularly collected and made available to students and to state and federal funders of higher education, it would go a long way towards moving the decision process, at least on the demand side of the picture, more to an output focus. This should increase the possibility of greater flexibility within the institution and the development and acceptance of decentralized management. Success in this regard, of course, relies upon the institution's ability to maintain, update, and report such statistics.

B. Input Measurement and Evaluation. Here there are basically two problems which need to be resolved; unit measurement of the major inputs and evaluation of these. The three largest factors needing attention are academic labor, student time, and capital.

With respect to academic labor, there exists presently in academic salaries a reasonable market determination of "value of the whole." The problem is that the faculty member performs many activities which do not contribute evenly to the several dimensions of output--research, instruction, and service. Since different outputs involve different "clients" it is necessary to determine a relevant price or financial burden for each. This requires an assessment of the contribution of various faculty activities. Here, over-simplified and speculative as they may be, faculty activity (or assignment) analyses appear to be necessary, at least until that point at which certain operations research tools such as simulation and mathematical programming can better describe the entire joint-input, joint-output production process.

One major cost component which is often ignored during internal management decisions is the cost of student time. Student opportunity costs may range from $2,000 to over $8,000 per year depending upon discipline, student level and the availability of part-time employment. More attention should be devoted to considering the use of shadow prices to reflect such costs in resource allocation decisions. Such opportunity costs might be a factor in assessing the effectiveness of counseling and advising activities, as well as in reviewing major revisions in curriculum, and degree program requirements.

Measuring and evaluating the services of physical capital in institutions of higher education also involves problems. Presently, the approach often taken results in a mis-evaluation of capital service costs. A method frequently used, especially with respect to research-cost studies, is summing the historical capital construction costs over some time period (say up to fifty years), and using the corresponding percentage (2%) of the total as an estimate of the "costs" of capital services for one year. In the economic sense a much more meaningful measure of cost is the opportunity costs of the services provided by capital. A better indicator of this is the potential rental value of capital in its best alternative use. A significant step in the use of internal pricing would be assessment of the costs of capital services according to an estimated opportunity rental value and consideration of such shadow prices in allocating present space and in assessing the desirability of proposed new space.

Related to this problem is the tendency for capital to be treated as a free good by managers within the institution at the departmental and college dean level. Typically, there exists complete separation between capital and operating budgets in an institution of higher education. Few trade-offs are involved for departments or colleges in considering the submission of projects for inclusion in the capital improvement program. Even those operating costs which are highly correlated with capital (light, heat, ventilation or air conditioning, maintenance, etc.) are usually not charged forward to departmental operating budgets. Thus there is a natural tendency to "shoot for the moon" with

respect to requests for capital improvement, since little is to be lost but the time necessary for the request to be moved up on the capital budget priority list. Perhaps a useful pilot project with respect to testing the potential of internal pricing would be in those areas of expenditure which are highly correlated with the size and quality of campus facilities. The information costs necessary to undertake internal pricing experiments here are considerable, both in the sense of measuring the use of such services and in maintaining the relevant accounts. On the other hand, there may be a possibility for the development and use of "formula" chargebacks after an analysis of what factors affect the variance of the total costs of light, heat, and maintenance services. If a formula chargeback system can be developed it would at least cause managers at the departmental and college level to begin to consider the relationship between capital and other resources.

C. The Educational "Production Process." A review of the literature on the costing of research and instruction at institutions of higher education shows that there is little agreement as to the educational production process. Cost studies vary in all possible dimensions: the means by which direct academic salary costs are divided over levels of instruction and between instruction, research and service activities; the means by which departmental overhead costs are apportioned; the general approach taken to the allocation of major indirect cost components (academic and institutional support, student and faculty support services, etc.); and the parameters used for allocation. Frequently, also, little

attention is paid to stating the purposes (external and internal) for which cost estimates are appropriate, which costs can truly be regarded as fixed and which as variable (and over what time dimension such designations are meaningful) and whether the intent is to arrive at estimates of marginal or average costs. In essence, of course, the assumptions which underlie each cost study have particular implications about the educational production process.

This assessment of the present state of the art with respect to costing is not to suggest the abandonment of historical costing exercises. If done carefully and with the intent of understanding better the production process, cost accounting exercises can be valuable. For example, attention might be devoted to determining the fixed or variable nature of various "cost centers," and attempting to analyze what student, faculty, space, or related factors appear to cause the variance in costs. A statistical analysis of each major cost center will shed some light on the nature of the production process.

Further, if cost calculations are made consistently within an institution, comparisons for one department over time or even cross-sectionally for similar departments (e.g., the social sciences) yield some additional understanding of the production process and some idea of the relationship between marginal and average costs.

Also, even the comparison of consistently calculated costs across similar institutions may be useful in identifying the effects of major differences in size or instructional technique.

There is, of course, a danger in relying upon *ex post* information and analyses performed without a carefully reasoned *ex ante*

economic model. However, even in the absence of the latter, the judicious use of cost information can be helpful. Analysis of the results or feedback of decisions based upon *ex post* cost information can over time help lead to the *ex ante* economic model which realistically describes the educational production process.

Another planning tool which may aid considerably in understanding the educational production process is simulation analysis involving the attempt to explicitly specify the dynamics of the educational process. Properly derived simulation models may be useful aids in deriving marginal cost information for final outputs and for those intermediate outputs which are candidates for internal pricing (e.g., library services, computer services, plant operating and maintenance). Simulation analysis, however, is subject to the same problem as historical cost analyses since parameter inputs must be based upon a statistical analysis of *ex post* data. Nevertheless, over time and with proper testing, approximations to marginal effects may be found.

Major problems with respect to both detailed cost studies and simulation analyses revolve around the data requirements. Overcomplexity may destroy the usefulness of either analytical tool. It is probably much better to begin in pieces and to work up to a complete institutional analysis. From the perspective of achieving decentralized management and the use of internal pricing, cost analyses and simulations of particular components of the institution (e.g., the instructional budget, library, student services) are most useful, even if they present only a partial and grossly over-simplified picture.

D. Real World Constraints and the Incentive Structure. The biggest obstacle to rapid progress in decentralized management, facilitated by internal pricing, lies here. Even if all the marginal information with respect to costs, inputs, outputs, and value added were available, internal pricing is not feasible in the absence of management flexibility, and an appropriate incentive structure.

As discussed above, for internal pricing to be useful, an incentive structure must exist which causes the allocation of resources so as to achieve maximum output consistent with the goals of the central administration as well as the managers at the department and college level. Stated another way, an incentive structure which results in decentralization which leads only to the bureaucratic maximization of budgets and/or personnel must be avoided. To achieve this, a financially oriented reward structure must be established which relates directly to accomplishments. It must allow managers the flexibility to accumulate certain "savings" and to spend at least some portion of these discretionately within the department or college, including some "merit" distribution to personnel. By the same token, managers must be expected to bear the consequences of inadequate performance through the removal of previously established savings pools.

The major concern here is that there are many constraints which prevent the needed flexibility, especially for state-supported institutions. Some of the major ones are:

1. A preponderance of input-oriented decision "formulae" relied upon by state funders of public institutions of higher education to determine number of faculty positions, space, library

resources, etc.: Such formulae, generally established with a claim of "equity" across institutions and departments, restrict the flexibility to trade off various academic and non-academic resources.

2. The almost total separation of operating and capital budgets: This again results in little capability to trade capital for other academic and non-academic resources.
3. Increased unionization of non-academic and, in some cases, academic staff.
4. Increasing power and activity of civil service schemes: These usually restrict the possibility of replacing certain presently institutionally provided student and faculty services with those which could be purchased from the outside market.
5. The academic labor system of tenure: This restricts to a considerable degree the ability of trade off among different levels of academic labor.

Planning and information systems do not provide much help in this regard. If decentralization and the extended use of internal pricing is ever to make any real difference the most important role for central administrators is to attempt to reduce the constraints to resource allocation flexibility. In the absence of this, coherent decentralization is a wish at best and centralized control will exist regardless of the state of information. Some of the recently proposed financing schemes for higher education, such as the "voucher" and student loan bank ideas, offer hope for change here, but such ideas have a considerable way to go before they achieve general acceptability.

3. Conclusion

Decentralization and extended use of internal pricing are therefore not likely to progress rapidly and achieve large, visible cost savings in the situations which most institutions find themselves in today. Perhaps over the next decade, however, with planning and development of information along the lines suggested here, coupled with continued developments and implementation of new approaches to financing higher education, and with some changes in structures such as academic tenure, decentralization and internal pricing will become both feasible and successful.

APPENDIX E

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