THE UNIVERSITY AS A NON-PROFIT DISCRETIONARY FUND

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Summary:

This paper develops a managerial discretion model for non-profit public sector institutions and uses it to test for sources of inefficiency in non-instruction expenditures within higher education. Higher student costs can mean higher quality instruction and research, but since they are also associated with declining percentages spent on instruction, it is of interest to know more about whether this extra discretionary revenue is used to improve quality or is used less efficiently. A theoretical solution is presented for a non-profit public sector managerial discretion model that shows that less efficient outcomes can be expected when there is an administrative expense bias. Using USOE data for 68 land grant institutions, and controlling for quality by using quality measures from the Gourman Report and from ACE rankings, lower quality institutions and institutions whose programs lost national ranking are found to exhibit a statistically significant administrative expense bias, whereas higher quality institutions, and institutions whose programs gained national ranking, do not show this tendency.
THE UNIVERSITY AS A NON-PROFIT DISCRETIONARY FIRM

Charles T. Strein and Walter W. McMahon*

This paper develops a managerial discretion model to analyze and test for the existence of an administrative expense bias in institutions of higher education.

Since American universities are facing a continuing financial crisis, identifying sources of inefficiency becomes important for the overall well being of higher education and the survival of individual institutions. This financial crisis has developed partly because of reduced public support compared to the 1960's, and partly because of cultural and demographic changes soon to produce reduced student enrollments in this recently expanded sector of our economy.

The hypothesis tested in this research is that administrative expense in a university system is a function of discretionary revenue. Discretionary revenue is defined as that part of the current operating budget over and above that required to maintain the minimum quantity and quality of activities acceptable to the governing agencies. Hence the funds are accessible to managerial discretion.

The method of analysis involves estimating discretionary revenue, and then entering the estimate of discretionary revenue as an additional explanatory variable in a cost function designed to explain administrative costs. Testing the hypothesis involves testing the sign and statistical significance of the coefficient of discretionary revenue.

The early literature on this subject has its origins in work by O. E. Williamson (1967), who developed a managerial discretion model
for private sector entrepreneurial firms. L. Southwick (1967) and D. Verry and B. Davies (1976) treat the university as a non-profit firm, but assume the goal of the university is to maximize production, the quality of that production, or some acceptable trade off between quality and quantity. A. J. Culyer (1970) suggests introduction of a utility function as a basis of analysis, and Lee (1975) suggests the goal of at least certain universities may be to maximize the quality of the institution and focuses on this as a possible source of waste.¹

A large amount of literature deals with the broader question of efficiency in universities and with "the efficient allocation of resources" as a budgeting problem. But this literature implicitly assumes away any independent "managerial motivation" as a source of inefficiency. The approach in this paper is new in that it relaxes the assumption that the goal of the university is to use its resources so as to maximize quantity and/or quality, and instead postulates "managerial motivation" similar to that found in private firms as a source of resource misallocation. For public institutions which are branches of state government, some of the functions of the chief administrative officer and hence some of the postulated "managerial motivation" are increasingly centralizing in the staff of the multi-campus university system and the staff of the state boards of higher education. This does not imply a priori, that this reduces or increases administrative bias however. It may help to police more localized administrative bias, but simultaneously require a larger administrative staff to do the increased reporting required. The latter is a commonly heard explanation offered for increasing administrative costs by the institution's administrative officers.
The source of expenditure and enrollment data in this study is primarily cross section data from the U.S. Office of Education data for all 68 Land-Grant institutions for the years 1958-59 through 1962-63. This period and these institutions were chosen because the data can be related consistently to several available indices of quality and changes in quality during this period. The sample of 68 institutions also contains wide variations in the characteristics of importance; that is, variation in quality as measured by the indices, in administrative costs per student, and in research expenditure. In addition, the set of 68 institutions provides information on the behavior of administrative expense in the institutions where quality has declined as compared to institutions where quality has improved. The measures of perceived quality used in the study are 1) the Gourman measure of quality (1967) and 2) the National Ranking of Universities (1964, 1969) produced by the American Council on Education.

Following the development of the model and the empirical results, some conclusions are drawn, and some tentative suggestions are offered concerning the reasons for quality improvement.

I. The University as a Firm: The Model

An overview of the model and the research design can be obtained by considering the average cost curve of a university, after which we will turn to the specifics of the full specification and solution of the formal theoretical model.

An Overview

The average total cost curve for an efficient university is shown as $C/Q$ in Figure 1, defining the minimum possible average cost for
each enrollment level at a given level of quality. It is the usual average cost curve assumed by economists, and offers a clear average cost perspective on the problem even though the actual cost functions will be estimated in total cost terms at a later point in this paper. A family of less efficient average cost curves exist lying above and to the right of \( C/Q \), each one of which is associated with a higher level of discretionary spending. This additional discretionary spending may be used to improve the quality of instruction and research at the institution, which is useful. Or it may merely represent inefficiency in a variety of forms.

![Diagram](image)

Figure 1
The Average Cost Function for a University
An econometric estimate of the average cost function for a set of universities of similar types with similar missions will yield the $\hat{C}/Q$ function, and not $C/Q$. Each university system, illustrated by points such as $C_1$, $C_2$, or $C_3$, if it optimizes subject to an objective function that includes quality improvement and/or administrative expense bias lies on a different higher average cost curve in Figure 1 with different levels of discretionary spending. The error term, which can be measured by $(C_i - \hat{C}_i)/Q$ for the $i$th university as measured vertically along the estimated function, provides an estimate of the spending over and above the minimum required per student at each enrollment level. If this spending should range from 0 to 50, for example, the measure $(C_i - \hat{C}_i)/Q$ will range from -25 to +25 and capture on a different scale the magnitude of spending over and above the minimum required.

The hypothesis that administrative expense is a function of discretionary revenue can be tested by entering the resulting estimate of total discretionary revenue (i.e., $(C_i - \hat{C}_i)/Q$ multiplied by $Q$) as an additional explanatory variable in the following cost function designed to explain not total cost, but only administrative costs, where Eq. (1) is the total cost version of the administrative cost function:

(1) $C_A = C_A \{Q, R, r, (C_i - \hat{C}_i), u\}$

where:

$C_A$ = administrative costs,

$Q$ = enrollments as a measure of output,

$R$ = expenditures on organized and sponsored research as a proxy for an additional quantity of output (e.g., a $Q^2$ term) and/or one aspect of quality,

$r$ = a vector of input prices, and
(C\textsubscript{1} - \hat{C}_1) = an estimate of total discretionary spending.

\( u \) = a disturbance term, including measurement errors (since there are not identical accounting procedures and definitions at all institutions).

\( C_A \) in this study is limited to central administrative expense and does not include departmental administration because of limitations in published data. If the coefficient of \( (C\textsubscript{1} - \hat{C}_1) \) is positive and statistically significant, \( (C\textsubscript{1} - \hat{C}_1) \) will help to explain \( C_A \).

With this introduction to the approach, we now turn to the more formal theory of a managerial discretion model and the explanation of behavior in non-profit universities.

The Model

Equation (2) is a possible production function for the university system, where \( K_1 \) is the set of non-administrative academic inputs and \( K_2 \) is the set of administrative inputs.

\[
(2) \quad Q = Q(K_1, K_2)
\]

Two major control variables exist for a university decision maker. The first is the level of production, \( Q \), at a predetermined quality level, and the second is the use of discretionary revenue for quality improvement or for wasteful spending which can include excess administrative costs. The latter administrative expense bias can produce an inefficient resource combination.

Let the objective function of the university be the utility function of the chief administrative officer with an administrative expense bias. The utility function as given by equation (3) includes administrative inputs, \( K_2 \), as well as output, \( Q \), as a source of satisfaction:

\[
(3) \quad U = U(Q, K_2)
\]
With (3) as the utility function to be maximized, the Lagrangian is:

\( L = U(Q, K_2) + \lambda (\bar{R} - r_1 K_1 - r_2 K_2), \quad Q = Q(K_1, K_2) \)

where:

\( \bar{R} \) is a fixed level of revenue,

\( r_1 \) is the price of academic inputs \((K_1)\),

\( r_2 \) is the price of administrative and related inputs \((K_2)\).

and the constraint imposed is a zero profit constraint in the "current fund" budget of the university.

The first order conditions for maximization are:

\[
\frac{\partial L}{\partial K_1} = \frac{\partial U}{\partial Q} \cdot \frac{\partial Q}{\partial K_1} - \lambda r_1 = 0
\]

\[
\frac{\partial L}{\partial K_2} = \frac{\partial U}{\partial Q} \cdot \frac{\partial Q}{\partial K_2} + \frac{\partial U}{\partial K_2} - \lambda r_2 = 0
\]

\[
\frac{\partial L}{\partial \lambda} = \bar{R} - r_1 K_1 - r_2 K_2 = 0
\]

One result is:

\[
\frac{r_2}{r_1} = \frac{\frac{\partial U}{\partial Q} \cdot \frac{\partial Q}{\partial K_2} + \frac{\partial U}{\partial K_2}}{\frac{\partial U}{\partial Q} \cdot \frac{\partial Q}{\partial K_1} + \frac{\partial U}{\partial K_1}} = \frac{\frac{\partial Q}{\partial K_2}}{\frac{\partial Q}{\partial K_1}} + \frac{\frac{\partial U}{\partial K_2}}{\frac{\partial U}{\partial K_1}}
\]

That is, since it is assumed that \( \frac{\partial U}{\partial K_2} > 0 \), the ratio of the price of administrative services, \( r_2 \), to the price of academic teaching and research inputs, \( r_1 \), will be greater than the ratio of the marginal productivities of administrative inputs to the marginal productivity of the other inputs, or \( \frac{\partial Q/\partial K_2}{\partial Q/\partial K_1} \) above. This indicates a resource misallocation.

Figure 2 below illustrates this effect in terms not of the utility function but of the production function and isoquants. With an
The Effects of a $K_2$ Bias

administrative input (expense) bias, a solution like that at point B will result rather than at point A or point C which are cost minimizing solutions. That is, in relation to equation (5), $\frac{\partial Q}{\partial K_2}$, the first term on the right hand side is the slope of the isoquant at point B, and the second term is the difference between the slope of the price line at point B and the isoquant at point B. With the solution at B, the output level will be $Q_1$, and budget costs will be higher than the minimum cost point for output $Q_1$ at point C because of the $K_2$ bias. Furthermore the relative cost of administrative inputs at point B, relative to non-administrative inputs, is greater than the
ratio of their marginal products, and administrative expenses \( r_2 K_2 \) will be higher than necessary.

The problem for society arises when discretionary spending fails to increase quality but instead is used to provide on-the-job satisfaction for the decision maker. If administrative expense is in the objective function as a source of "on-the-job" utility, the amount of discretionary revenue available for increasing quality will be less than what is possible given the total discretionary revenue of the institution.

II. Estimating Discretionary Revenue and Empirical Tests for Administrative Bias

The estimate of discretionary revenue \((C_i - \hat{C}_i)\) is obtained as the residual from a total cost function. Three estimates will be obtained, and then the significance of all three of these estimates of discretionary revenue will be tested separately in a cost function designed to explain only total administrative costs:

\[
(6) \quad C_A = C_A(Q, R, r, (C_i - \hat{C}_i), u),
\]

which is the same as Equation (1).

Three Estimates of Discretionary Revenue

The total cost function estimated uses cross section data for 68 institutions and generates the error term \((C_i - \hat{C}_i)\) for total discretionary revenue (from which average discretionary revenue per student can be calculated if desired). It is:
Here:

\[ C = C(U, G, R, Q, r_1, r_2) \]

- \( C \) = total costs, measured as total current fund expenditures,
- \( U \) = undergraduate student enrollment (FTE),
- \( G \) = graduate student enrollment (FTE),
- \( R \) = organized research expenditure, all from U.S.O.E. (1959-65).
- \( Q \) = quality of the institution as measured by the 1967 Gourman Index, from Gourman (1967),
- \( r_1 \) = average faculty salaries, as given by AAUP data, and
- \( r_2 \) = average clerical and other administrative salaries (an index).

This cost function was estimated first with the results as shown in Eq. (8) at the top of Table 1, and then in a different functional form with the results as shown in Eq. (9) and (10) in Table 1 to obtain three estimates of that discretionary revenue potentially available for administrative costs.

The measures of output \((\overline{U}, R, and Q = G + \overline{U})\) were all quality-weighted in Equation (8), treating \( Q \) and \( r_1 \) as indices of quality. In the results shown, to reduce heteroscedasticity, all of the terms in Eq. (8) were divided by \( \sqrt{Q} \). This step was not necessary however in equations (9) and (10), which are a modified specification of the cost functions estimated by limited information single equation (LISE) and two stage least squares methods. The two stage least squares estimates specify and estimate a demand side, (consisting of a demand for undergraduate enrollments, for graduate enrollments, and for research that are not the focus of this paper and involve detail that will not be reported here). They provide a check against the possibility that the simultaneous nature of the economic relations involved might yield biased estimates of the coefficients in the cost function that could
Table 1: Total and Administrative Costs of Universities

68 Land Grant Institutions, 3 Biennial Surveys from 1958-9 through 1962-3, n = 181; t-statistics in parentheses
Regression coefficients are shown directly above the t-statistics, and standardized regression coefficients for OLS above that.

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Method</th>
<th>( \overline{UQ} )</th>
<th>( \overline{RQ} )</th>
<th>( \overline{Qr_1} )</th>
<th>( \overline{U} )</th>
<th>( G/\overline{U} )</th>
<th>( R )</th>
<th>( \overline{Q} )</th>
<th>Intercept</th>
<th>Goodness of Fit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Total Costs</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>(8) C</td>
<td>OLS</td>
<td>.25</td>
<td>.76</td>
<td>.11</td>
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<td></td>
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<td>0.9593</td>
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<td></td>
<td></td>
<td>(.0045)</td>
<td>(.0019)</td>
<td>(.0817)</td>
<td>(6.4)</td>
<td>(58.2)</td>
<td>(2.8)</td>
<td></td>
<td></td>
<td>(0.1)</td>
</tr>
<tr>
<td>(9) C</td>
<td>TSLS</td>
<td></td>
<td></td>
<td></td>
<td>2739</td>
<td>-2649</td>
<td>1.25</td>
<td>57.5</td>
<td>-24969</td>
<td>.1408</td>
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<td></td>
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<td></td>
<td>(14.5)</td>
</tr>
<tr>
<td>(10) C</td>
<td>LISE</td>
<td></td>
<td></td>
<td></td>
<td>2871</td>
<td>-11362</td>
<td>1.22</td>
<td>64.4</td>
<td>-27558</td>
<td>.1360</td>
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<td></td>
<td>(33.8)</td>
</tr>
<tr>
<td><strong>Total Administrative Costs</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(11) C_A</td>
<td>OLS</td>
<td>.24</td>
<td>.75</td>
<td>.10</td>
<td>-.06</td>
<td>.06</td>
<td></td>
<td></td>
<td></td>
<td>2.21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(.00024)</td>
<td>(.00013)</td>
<td>(.5752)</td>
<td>(.2492)</td>
<td>(.0377)</td>
<td></td>
<td></td>
<td></td>
<td>(.04)</td>
</tr>
<tr>
<td>(12) C_A</td>
<td>OLS</td>
<td>.13</td>
<td>.81</td>
<td>.02</td>
<td>-.15</td>
<td>.15</td>
<td></td>
<td></td>
<td></td>
<td>14.63</td>
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<td></td>
<td></td>
<td>(.00013)</td>
<td>(.00014)</td>
<td>(.1514)</td>
<td>(.5769)</td>
<td>(.056)</td>
<td></td>
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<td>(2.4)</td>
</tr>
<tr>
<td>(13) C_A</td>
<td>OLS</td>
<td>.13</td>
<td>.78</td>
<td>.01</td>
<td>-.15</td>
<td></td>
<td></td>
<td>.17</td>
<td>16.007</td>
<td>.4356</td>
</tr>
<tr>
<td></td>
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<td>(.00013)</td>
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<td>(.507)</td>
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<td>(.065)</td>
<td></td>
<td></td>
<td></td>
<td>(2.7)</td>
</tr>
</tbody>
</table>

*Estimates are presented here for the regressions using the entire sample of 181 observations, but not the many regressions for the fifteen different groupings of institutions for which results are summarized in Table 2.
invalidate the results. The coefficients of the significant variables are all positive as expected. All are highly significant, except for graduate enrollment G/U in Eq. (9) and (10), which is multicollinear with research, R. The goodness of fit measures are satisfactory. The residuals from these three equations provide three estimates of discretionary revenue.

The Administrative Cost Function Containing Discretionary Revenue

These three estimates of discretionary revenue then were inserted one at a time in the total administrative cost function shown in Eqs. (11-13) in Table 1 and repeated here for easy reference as Eq. (14):

\( C_A = b_0 + b_1 \bar{QQ} + b_2 \bar{RQ} + b_3 r_1 + b_4 r_2 + b_5 (C_1 - \hat{C}) + u_{11} \)

Here

- \( C_A \) = administrative costs
- \( \bar{QQ} \) = total graduate and undergraduate enrollment, multiplied by the 1967 Gourman Index of quality,
- \( \bar{RQ} \) = research including a reflection of its quality,
- \( r_1 \) = the average faculty salaries, and
- \( r_2 \) = clerical wages, not including administrative salaries.

The result of these administrative cost function regressions in Table 1 is that all three measures of discretionary revenue are a significant determinant of administrative costs, even after the additional steps shown above have been taken to control for quality.

Next the sample is reorganized into fifteen sub-groups containing more homogeneous types of institutions, with the results shown in Table 2. The more detailed results for all coefficients in the administrative cost function are shown in Table 3. They are ranked in both Tables according to the size of the t-statistic for the coefficient for discre-
<table>
<thead>
<tr>
<th>Rank</th>
<th>Description</th>
<th>Discretionary Revenue, Beta Coefficient in C, function (t-statistic in parentheses)</th>
<th>Goodness of fit: Standard error of the estimate divided by the mean of the dependent variable</th>
<th>Type of Estimate used to generate</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ph.D. Programs lower quality</td>
<td>.35 (5.2)</td>
<td>.162 .300</td>
<td>OLS</td>
<td>98</td>
</tr>
<tr>
<td>2</td>
<td>Ph.D. Program local in scope</td>
<td>.42 (5.1)</td>
<td>.134 .325</td>
<td>LISE</td>
<td>101</td>
</tr>
<tr>
<td>3</td>
<td>Ag Programs, National in Scope</td>
<td>.30 (5.1)</td>
<td>.081 .202</td>
<td>TSLS</td>
<td>46</td>
</tr>
<tr>
<td>4</td>
<td>All Institutions, local in scope</td>
<td>.32 (4.6)</td>
<td>.149 .258</td>
<td>LISE</td>
<td>135</td>
</tr>
<tr>
<td>5</td>
<td>Agricultural Programs, local in scope</td>
<td>.25 (3.5)</td>
<td>.136 .293</td>
<td>LISE</td>
<td>105</td>
</tr>
<tr>
<td>6</td>
<td>Programs lost national ranking</td>
<td>.22 (3.0)</td>
<td>.087 .261</td>
<td>OLS</td>
<td>51</td>
</tr>
<tr>
<td>7</td>
<td>Medical Programs national in scope</td>
<td>.11 (2.6)</td>
<td>.057 .154</td>
<td>TSLS</td>
<td>26</td>
</tr>
<tr>
<td>8</td>
<td>Ph.D. Programs national in scope</td>
<td>.10 (2.2)</td>
<td>.078 .231</td>
<td>OLS</td>
<td>45</td>
</tr>
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</table>
Table 2: (Cont.) Administrative Expense as a Function of Discretionary Revenue

<table>
<thead>
<tr>
<th>Ranked by size of the t-statistic for the unstandardized discretionary revenue coefficient</th>
<th>Description of the category</th>
<th>Discretionary Revenue Beta Coefficient in C_A function, (t-statistic in parentheses)</th>
<th>Goodness of fit: Standard error of the estimate divided by the mean of the dependent variable</th>
<th>Type of Estimate used to generate</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>FULL SAMPLE</td>
<td>.06 (2.1)</td>
<td>.118</td>
<td>.450</td>
<td>OLS</td>
</tr>
<tr>
<td>10</td>
<td>All Institutions national in scope</td>
<td>.09 (2.1)</td>
<td>.079</td>
<td>.234</td>
<td>OLS</td>
</tr>
<tr>
<td>11</td>
<td>Faculty gained national ranking</td>
<td>.09 (1.9)</td>
<td>.090</td>
<td>.446</td>
<td>LISE</td>
</tr>
<tr>
<td>12</td>
<td>Ph.D. Programs, higher quality</td>
<td>.07 (1.6)</td>
<td>.067</td>
<td>.208</td>
<td>OLS</td>
</tr>
<tr>
<td>13</td>
<td>Programs Gained, national ranking</td>
<td>.07 (1.5)</td>
<td>.091</td>
<td>.411</td>
<td>LISE</td>
</tr>
<tr>
<td>14</td>
<td>Medical Programs local in scope</td>
<td>.05 (0.4)</td>
<td>.099</td>
<td>.200</td>
<td>TSLS</td>
</tr>
<tr>
<td>15</td>
<td>Faculty Lost, national ranking</td>
<td>.004 (+0.0)</td>
<td>.094</td>
<td>.219</td>
<td>OLS</td>
</tr>
</tbody>
</table>
tionary revenue. Because of the varying sample size, the t-statistic ranking yields only an approximate ranking of the institutional sets that make up the table. The ranking of the beta coefficients however is almost exactly the same. The discretionary revenue residuals, are utilized in each case from the total cost function that yielded the best measure of goodness of fit as measured by the standard error of the estimate divided by the mean of the dependent variable.

High Variance Low Quality Institutions with Ph.D. Programs

A positive and significant coefficient for discretionary revenue suggests that discretionary revenue is spent for administrative expenses, and is taken as evidence of an administrative expense bias in the university's objective function. The set of lower quality institutions with Ph.D. programs which rank first in Table 2 exhibit the strongest evidence consistent with the hypothesis that an administrative expense bias exists in the utility function of the decision maker. A relevant comparison is the evidence from the set of higher quality institutions with Ph.D. programs, which rank 12th on the list. The t-statistic for this set, 1.6, is not significant at the 5 percent level given the degrees of freedom present. A distinct behavioral difference exists between perceived lower quality and higher quality institutions in this category of Ph.D. producing institutions where the production functions are likely to be similar. This evidence is consistent with the contention that the pursuit of the utility of higher administrative salaries and larger administrative costs draw funds away that could otherwise be used to support research and innovations that contribute to higher quality instruction and research outputs.
In addition to the difference in the power of discretionary revenue to explain administrative costs, the difference in the goodness of fit of the total cost functions shows an interesting contrast. The measure $\frac{\text{SEE}}{\bar{Y}}$ for the total cost function for institutions with Ph.D. programs of lower quality is 0.162, while the same measure for the higher quality set is 0.0669. That is, the cost function appears to explain the behavior of costs for the higher quality set better than for the lower quality set which has a larger unexplained residual. One possible reason for better explanation of cost patterns in the higher quality set is more systematic behavior, i.e., better management of the higher quality institutions. It is reasonable to expect that higher quality institutions attract and retain more able administrators.

Groups 2-5

The set of institutions local in scope rank second and fourth in Table 2, while those institutions with Agricultural programs rank third and fifth. But these groups generate administrative costs for reasons that are not closely related to an administrative expense bias. The local in scope institutions tend to be smaller and therefore fail to fully realize all possible economies of scale. Colleges with Agricultural programs on the other hand have extra administrative costs generated by public service activities through their agricultural extension services that are above and beyond the costs of their instruction and research activities.
Univcrsitics Whose Programs lost National Ranking

Appearing sixth in Table 2 is that set of institutions whose programs lost national ranking between 1964 and 1969. This set and the parallel set whose programs gained national ranking between 1964 and 1969 (ranked thirteenth in the table) provide the most revealing result. The t-statistic is 3.0 for those that lost ranking, and is not statistically significant at the 5 percent level for those that gained national ranking. This is consistent with the hypothesis that there is a choice between spending discretionary funds on additional administrative expense and using them to improve the quality of the instruction and research. It is not consistent with the hypothesis that the quality of the institution is improved by increases in administrative expense.

The change in the national ranking is taken here as an indication of quality change. There may be some weakness in this assumption. The average quality of all institutions probably improved between 1964 and 1969. The result is an institution may have lost national ranking without lowering the quality of its activities. If the university failed to increase its quality at a rate equal to the national average it would lose national ranking. There is nevertheless a significant difference between that set of institutions whose programs gained national ranking and that set whose programs lost national ranking both in the greater importance of research (c = .37) in the former group and in the more limited use of discretionary revenue for administration. This result is consistent with the hypothesis that those that have fallen in
currence have not used discretionary revenues to improve quality but have instead used funds less efficiently on administrative expenses.

Institutions where the Faculty Gained or Lost National Ranking

The reverse order appears for the institutions whose faculty gained in national ranking (Rank 11) and those whose faculty lost national ranking (Rank 15). However both of these groups are well toward the bottom of Table 3 and therefore display evidence of a less significant administrative expense bias. (The t-statistics are 1.9 and .7 respectively and the Betas are small compared to those seen toward the top of the table. The difference between those two groups is that in those institutions whose faculty gained national ranking, there was a closer association of administrative expense with research (in Line 11, Table 3, $\beta = .86$ and $t = 7.9$) than with enrollments ($\beta = .63$ and $t = .7$). Research was relatively less important ($\beta = .41$ in Line 15) and enrollment relatively more important ($\beta = .62$) in those institutions where the faculty fell behind in its national ranking.

Medical Schools

Medical schools are a somewhat different breed, as were agricultural programs as noted above. Medical programs national in scope do show evidence of some administrative expense bias (Line 7, Table 3, where for discretionary revenue $t = 2.8$), whereas those local in scope do not (Line 14). However for the latter group faculty salaries are of overwhelming significance ($\beta = 2.62$, the largest in Table 3 and $t = 3.0$). This is likely to be affected by the need to compete for faculty with the high incomes received by practicing physicians, and the spill-over effect of
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*Note: The table above represents the goodness of fit for different levels of goodness of fit and sample size.
this on the salaries paid administrators in locally-oriented medical schools.

**Overall Averages for the Full Sample**

Results for the full sample, without participating in the various (overlapping) dimensions discussed appear in about the middle at rank number nine in Table 3. Since the t-statistic is 2.1, there is a significant association between discretionary revenue and administrative expense in the entire sample, typical of a more general problem.

**III. Conclusions**

A new theoretical model of the university as a non-profit discretionary firm has been specified, and a solution presented that demonstrates the nature of administrative expense bias. The model suggests an hypothesis useful to the analysis of efficiency. The introduction of administrative inputs into the objective function leads to some implications for administrative costs that have empirical significance.

Lower quality, local in scope, Ph.D. producing institutions show a strong, statistically significant administrative expense problem, for example, while higher quality, national in scope, Ph.D. producing institutions do not. Equally important, that subset of institutions whose programs fell in national ranking display a statistically significant administrative expense bias, while the subset of institutions whose programs gained in national ranking do not.

These institutions whose faculty rose or fell in national ranking did not display significant administrative expense bias in either case,
but those whose status improved did show a closer association of administrative expenses with research than with enrollments. Medical schools displayed a somewhat different pattern, displaying the closest relation of faculty salaries to administrative expense, especially in the more locally-oriented medical schools.

The results overall tend to be inconsistent with the simple argument that more administrative inputs per se will improve the quality of an institution. They are consistent instead with the proposition that there is a tradeoff between quality improvement and administrative expense. This suggests that a monitoring of administrative expense by state boards of higher education can be conducive to greater efficiency, (if the additional reporting requirements added are not too costly), and that it may be appropriate to seek incentives conducive to the establishment of efficiency norms for efficient administrative expenditure decisions by administrators.

References


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1. J. Culyer's (1970) work differs from this analysis in that it merely suggests that the administrator's utility function may include "pretty secretaries and solid walnut desks." It does not specify and solve a specific model, nor present empirical tests.

2. The Gourman index of quality is a survey of "reliable opinions" as described in J. Courman (1967) intended to indicate the relative overall quality of institutions and their programs.

3. When this function was estimated without doing this, the error terms got larger as enrollment got larger. After dividing by \( \sqrt{Q} \), the scatter diagrams were checked again and it did reduce the effect. Heteroscedasticity is no problem in the TSLS and LSE estimates, but a similar procedure was followed for the OLS estimates given in Table 1 for Eq. (14-16). This should be kept in mind when interpreting the results.

4. The demand side estimated simultaneously with Equation (12) for each of the fifteen university groups consists of three parts, comprising a demand for each of the three major outputs, as follows:

- Undergraduate Enrollment Demand: \( \overline{U} = \overline{U}(p_1, p_2, p_3; Y, A, P, C) \)
- Graduate Enrollment Demand: \( \overline{C/U} = C/\overline{U} (p_1, p_2; Y, P, S, C) \)
- Research Demand: \( P = I(C/\overline{U}, Q, \pi_1, \pi_2, C) \)
The exogenous variables in this model are \( \bar{U}, \bar{C}/\bar{U}, R, \) and \( C \). They and \( \bar{C}, r_1, \) and \( r_2 \) are defined above. The other exogenous variables are:

- \( P_1 = \) tuition and fee "price" at each university, (from the institution),
- \( P_2 = \) room and board charge, (both from S. Irwin (1960)),
- \( P_3 = \) foregone earnings, estimated as the wage of high school graduates for the state in which the university is located,
- \( Y = \) real per capita income for the state in which the school is located,
- \( A = \) ability as measured by average ACT test scores for each university,
- \( P = \) proportion of the population in the 20-24 college age bracket by states, from the U.S. Census Bureau (1960),
- \( C = \) total costs of all outputs, including undergraduate enrollments \( (\bar{U}) \), graduate enrollments \( (G) \), and research outputs \( (R) \) measured at cost, and
- \( S = \) the Astin (1971) Selectivity Index for each university.