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Volume Author/Editor: Charles T. Clotfelter

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Chapter Author: Charles T. Clotfelter

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CHAPTER 5

The Sources of Rising Expenditures

> Universities cannot keep up with the growth of expenses associated with their entire enterprise, and they have to come to terms with the overextension and underinvestment that affect them.
>
> *Hanna Holborn Gray, 1992*[1]

As SHOULD be clear from chapter 4, expenditures increased significantly in many different categories in the sample institutions. In seeking to explain this escalation, the current chapter attempts to attribute portions of these increases to specific factors. This attribution is made on the basis of simple accounting identities. Thus, the decompositions that are presented should be thought of as categorization, rather than as behavioral explanation. The first section of this chapter discusses the contributions of several major items, including faculty compensation, other factor prices, financial aid, and administration. The second section presents a decomposition of the spending increases at the sample institutions in order to obtain an idea of the relative importance of these factors. After attributing to various factors some portions of the increase, a sizable unexplained residual remains. The third section offers several additional possibilities for explaining this residual, including new programs, the cost of scientific equipment, and the slowdown in the growth of federal funding.

KEEPING UP WITH THE MARKET

A search for the sources of rising expenditures in any organization logically begins by focusing on outside forces, particularly the market prices for inputs and other costly activities induced by competition. In the case of universities, the dominant outside influences are faculty compensation and financial aid. This section also addresses the roles of other factor prices and administrative growth.

Payments to Labor: Faculty and Other Employees

Like many other service industries, higher education is quite labor intensive. Given their prominence and unusually high degree of autonomy, faculty undoubtedly comprise the most distinctive class of worker in colleges and universities. Because they also constitute a large share of the workforce, payments to them loom large in the overall financial landscape of higher education. The growth in real faculty salaries during the 1980s further heightens the importance of this factor. It is therefore important to pay special attention to this category of spending.

Trends in Faculty Salaries

Figure 5.1 presents data based on the annual survey of faculty salaries conducted by the AAUP. The figure shows average salaries over the sample period for full professors and assistant professors at the four sample institutions; salaries are expressed in 1991/92 dollars, using the GDP price deflator. An important proviso is that these data include faculty in professional schools as well as in arts and sciences, which certainly affects the average salaries, if not the patterns of growth.

Several features of the figure stand out. First, the average salaries at the three sample universities are higher than those at Carleton. This contrast reflects the difference in general between private colleges and universities and, in particular, the higher salaries that faculty in professional schools receive. A second feature is the pattern of changes over time. For each institution, the first four years of the period, up to 1980/81, were ones of declining real salaries. As noted in chapter 3, the decrease in real faculty salaries during the 1970s was the result of high nominal raises being overwhelmed by even faster price inflation. From 1976/77 to 1981/82, nominal salary increases averaged 7.8 percent per year at private, doctoral-level universities surveyed by the AAUP, whereas price inflation averaged 8.2 percent. During the next 10 years, faculty salaries in nominal terms actually increased at a slower pace, 6.5 percent, but the markedly reduced inflation rate (3.9 percent) meant that real salaries increased over the decade at an impressive 2.6 percent rate.[2] For this 10-year period, the average full professor's salary at Chicago increased by 3.9 percent per year, compared with 3.5 percent at Duke, 2.6 percent at Harvard, and 2.0 percent at Carleton.

What explains the heady increases in real salaries at the sample

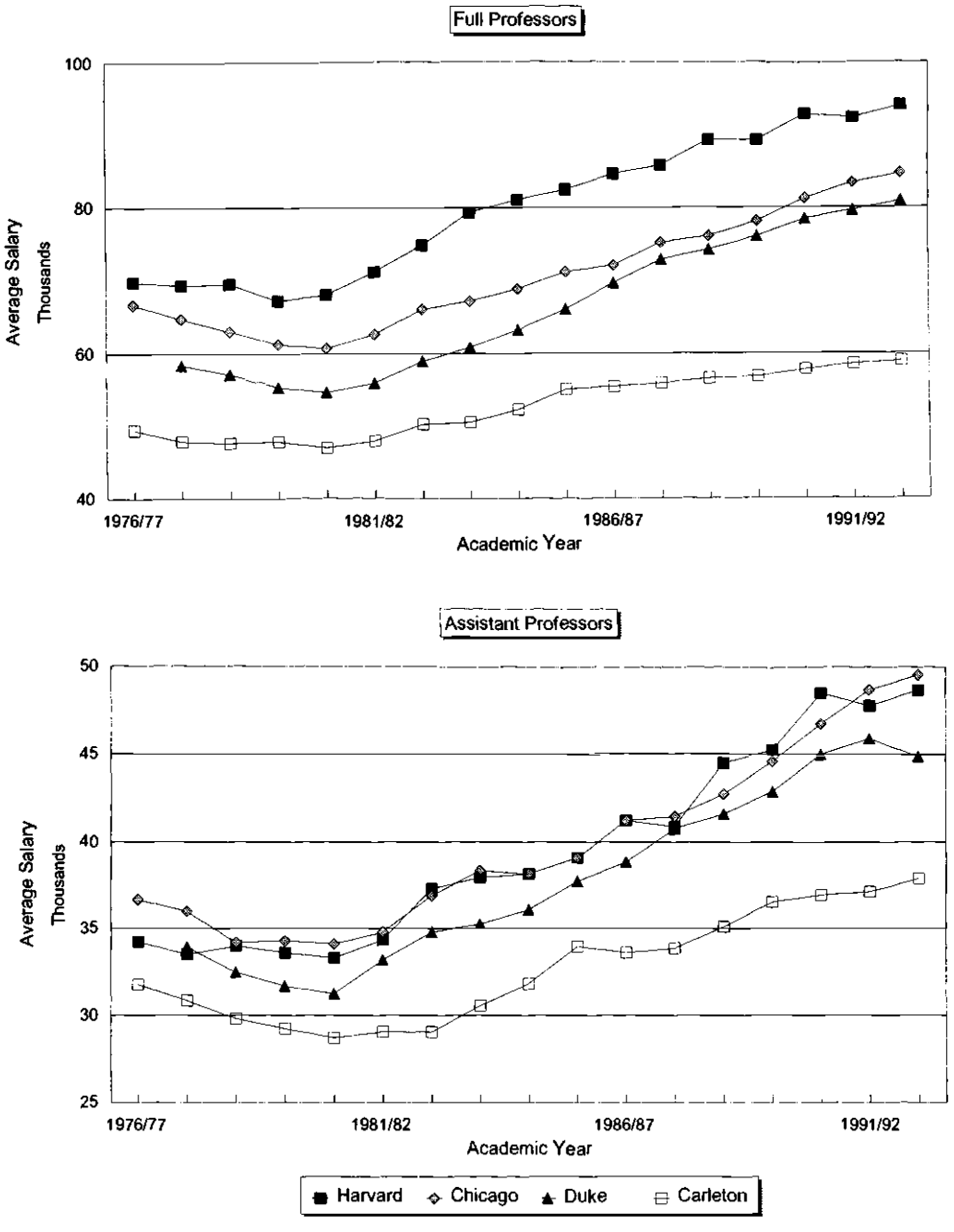

Figure 5.1 Real Salaries, Full and Assistant Professors, Sample Institutions.
Source: Academe, Annual Reports on the Economic Status of the Profession, 1977–1992.

universities during the 1980s? As noted in chapter 3, the earnings of professionals and other highly educated workers rose in relative terms during that decade. Regardless of whether the real increases in faculty salaries were viewed as "catch-up" from the previous decade, during which significant nominal salary increases had been outweighed by rapid inflation, the increases recorded by university faculty as a whole were by no means out of line with increases enjoyed by workers in comparable occupations. The question then turns to why salaries at these institutions did better than the average. One possibility would be changes in the composition of the faculty. If the percentage of the faculty in the sample institutions with tenure and more experience had increased over time, then the normal forces of tradition and the market would be expected to have pushed up real salaries there. Table 5.1 shows the percentage of faculty at the sample institutions who were tenured and the percentage who were full professors, based on AAUP data covering all faculty in its survey. It is evident that no dramatic changes occurred in these percentages. Chicago was the only one of the four institutions at which both of these reported percentages increased over the period; however, Chicago also was the institution showing the most growth in salaries at the full professor level.

To what extent was an institution itself—as opposed to the anonymous forces of the market—responsible for the increase in the salaries that it paid to faculty? Certainly it is part of the job description

TABLE 5.1
Percentage of Faculty with Tenure, with Rank of Full Professor

	1976/77[a]	*1981/82*	*1986/87*	*1991/92*
Percentage with Tenure				
Duke	78	79	74	72
Harvard	59	49	53	60
Carleton	65	71	62	60
Chicago	68	70	73	71
Weighted average	68	64	65	66
Percentage Full Professors				
Duke	49	52	52	51
Harvard	63	55	54	60
Carleton	42	51	51	45
Chicago	50	53	56	58
Weighted average	54	54	54	57

Source: Data are from *Academe* (August) 1977; (July/August) 1982; (March/April) 1987 and 1992.

[a]For Duke, figures refer to 1977/78.

of deans and provosts to search for the best possible candidates to fill faculty vacancies created by retirements and departures. Over time, however, this process should produce salary increases in line with market averages, as long as the average quality of the institution's faculty did not change. If, an institution set out to upgrade the quality of its research and teaching by hiring scholars of higher quality than its existing faculty, then its average salary would be expected to rise faster than the market average. To this extent, therefore, higher expenditures would be the result of deliberate policy, not of externally generated market forces.

During the sample period, all three universities participated actively in the national market for scholars, a market that increasingly featured highly paid "stars." At least one, Duke, made it a deliberate policy to increase the quality of its faculty by extending outside offers to senior faculty. The behavior of other universities, Chicago and Harvard among them, was not dissimilar in many respects. Although it was not possible to obtain data on individual faculty for this study, published information could be used to indicate the effect of this policy at Duke. The annual AAUP survey of institutions collects data on average salary increases for continuing faculty; of the sample institutions, only Duke and Carleton provided this information. By comparing these increases for continuing faculty with the overall percentage increase in salaries, it is possible to make a rough inference about the salaries of faculty hired from the outside and the salaries of continuing faculty. Consider only faculty at the level of full professor. In a steady state, in which retirees continuously are replaced by new faculty, the percentage increase in salaries for continuing faculty would be expected to be greater than the overall increase in salaries, because the salaries of the replacements would be lower than those of the retirees.[3] The overall increase could exceed the increase for continuing faculty only if an institution had begun the practice of hiring faculty from outside at above-average salaries.

Figure 5.2 shows the differential in salary increases for full professors between continuing faculty and all faculty for the years 1978 to 1994 for Carleton, Duke, and all institutions. As shown by the bars for all institutions, the usual pattern is one in which the increase for continuing faculty is higher than that for all faculty. This pattern also characterizes Carleton. For Duke, however, the pattern is reversed in nine of the years shown, suggesting the effect of outside hires at the full-professor level. Interestingly, in the last four years, the pattern at Duke reversed, indicating that the salaries of departing full professors exceeded those of newly appointed ones. Another indication of this pattern of faculty hiring at Duke emerged in a

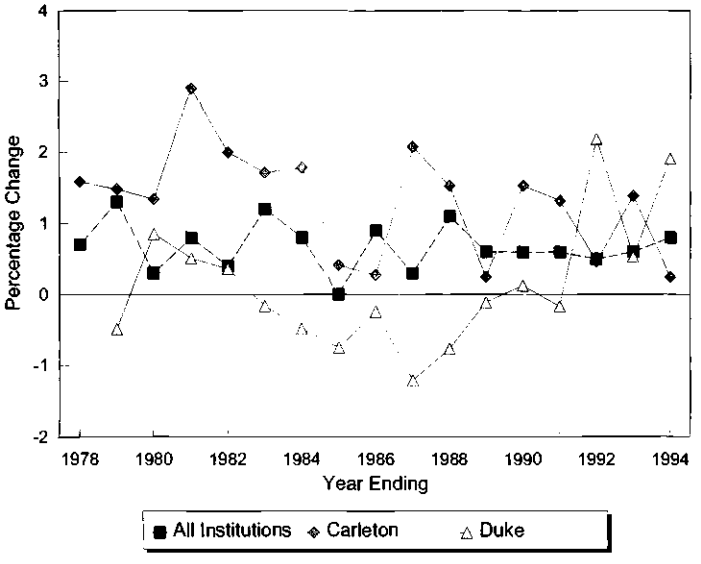

Figure 5.2 Percentage Change in Full Professor Salaries: Continuing Full Professors Minus All Full Professors.
Source: Table 5A.2.

study of faculty salaries in 1993, which found that salaries were related systematically to the number of years spent at Duke[4]; the survey showed the average salary falling by about $1,000 for each year at the university, holding constant highest degree, age, and number of years of experience.

Fringe Benefits

Fringe benefits—encompassing health, retirement, and other nonwage benefits—have grown relatively faster than salaries in higher education, as they have virtually everywhere in the United States in recent decades. Table 5.2 shows, for the sample institutions, the average fringe benefit rates reported on the annual AAUP surveys of faculty compensation. In each case, the rate inches inexorably upward over the period, with the weighted average for the sample institutions increasing from 18 percent in 1976/77 to 23 percent in 1991/92. It seems unlikely that these reported rates are strictly comparable across institutions, and they may not be comparable over time for the same institution, but the general upward trend corresponds to everything else that is known about fringe benefits as a

TABLE 5.2
Fringe Benefit Rates for Faculty

	1976/77[a]	*1981/82*	*1986/87*	*1991/92*
Duke	16	22	22	22
Harvard	20	20	21	23
Carleton	17	19	18	25
Chicago	17	21	22	23
Weighted average	18	21	21	23

Source: Data are from *Academe* (August) 1977; (July/August) 1982; (March/April) 1987 and 1992.

[a]For Duke, figures refer to 1977/78.

broad topic. To illustrate what goes into fringe benefits and into their rise, Table 5.3 details the components of the fringe benefit pool for faculty and staff at Duke for the sample period. Over this 15-year period, fringe benefits increased as a percentage of salaries from 15.3 to 22.7 percent, figures that are close, but not identical, to the comparable AAUP percentages. Duke's overall increase was caused largely by a tripling of the percentage for health insurance and by sizable increases for social security and retirement contributions.[5] By itself, this increase in the fringe benefit rate is responsible for a 0.4 percent average annual growth in faculty and staff compensation.[6]

Other Prices

In the same way that universities were subject to the rigors of market forces in the labor market, they also faced changing prices in other factor markets. Often using the rapid rise in the HEPI as evidence, some defenders of university costs pointed to extraordinary inflation in the cost of important inputs purchased by colleges and universities, including faculty. Just as rapidly increasing utility prices affected the cost structure of universities during the 1970s, the real cost of other items rose during the 1980s. For example, spurred by dramatic hikes in the cost of books and journals, the inflation-adjusted cost of library acquisitions increased 35 percent from 1981/82 to 1991/92.[7] On the other hand, the increase in the price of some items was less than the overall rate of inflation.[8] Because institutions had little choice but to pay the market price of goods and services that they purchased, it is essential in evaluating the escalation in costs to account for the change in these prices.

TABLE 5.3
Faculty and Staff Benefits per $100 of Salaries, by Type of Benefit: Duke

	Fiscal Year			
Benefit Category	*1976/77*	*1981/82*	*1986/87*	*1991/92*
Retirement				
Pensions	6.76	7.23	7.59	8.23
Social Security	4.27	5.80	6.15	6.46
Medical Care	1.53	2.63	3.37	4.90
Educational Assistance	1.57	1.43	1.75	1.55
Group Insurance and Survivors Benefits	0.75	1.03	0.20	0.57
Benefits Administration	—	—	0.18	0.23
Health and Recreation Programs and Subsidies	0.23	0.29	0.36	0.35
Housing Subsidies	—	0.01	0.04	0.03
Child Care Subsidy	—	—	—	0.06
Parking Allowance	—	—	—	0.06
Workman's Compensation	0.10	0.07	0.15	0.15
Other	0.08	0.05	0.10	0.09
Total	15.28	18.53	19.87	22.69

Source: Calculations using unpublished data from the Duke University Accounting Department.
— Benefit not offered or not separately recorded.

Student Financial Aid

Much has been written about the spiraling cost of financial aid at private colleges and universities. Most of the concern has been directed toward need-based aid given to undergraduates. Increases in this item have been presented as reasons why some private institutions have abandoned the policy of "need-blind" admissions policies. Less has been written about the cost of graduate aid, which generally is not based on need, although this support is acknowledged to be a central element in the functioning of graduate training.[9]

As shown in the tables of expenditure changes in chapter 4, financial aid to undergraduates grew faster than any other category of spending, and its increase was on the same order of magnitude as the total increase in faculty compensation. To be sure, some commentators tend to dismiss this category of spending, preferring to

think about financial aid merely as a discount on the "sticker price" of published tuition rates. Certainly, financial aid is a different kind of expenditure than, say, salaries or utility costs, in that almost no aid is "paid out," but rather, is credited against certain revenue streams. The opposing argument is at least as strong, however. In the present environment, particularly among private selective institutions, financial aid is simply one cost of doing business. Its impact on the financial well-being of institutions is much the same as those of other expenditure categories. Moreover, to the extent that the national concern about rising costs has been spurred by the increase in "sticker" tuition rates, it is necessary to pay attention to financial aid as one category of expenditure.

Administrative Services

Another shift that may or may not have been spurred by market forces is the alleged increase in administrative spending. Although some critics, noted in chapter 2, pointed to such increases as evidence of "bloat," the expansion of services, especially student services, that colleges and universities routinely offered over this period suggests that institutions were competing by enhancing the services they provided. One very simple way of assessing the likely importance of growth in administrative expenditures is to focus on the change in the proportion of total spending that is accounted for by administrative functions. In the context of the kind of information presented in chapter 4, this reasoning translates quite directly to measuring the share of spending accounted for by the lines in the tables referring to various administrative units, including arts and sciences administration, admissions and financial aid, alumni and development, general administration, and plant.[10]

DECOMPOSING THE INCREASE

In assessing the various explanations for rising costs, it is useful to step back and attempt to attach an order of magnitude to each possible source of cost increase. This section attempts to break out the effects of four sets of changes, using simple calculations for the sample institutions. The calculations do not analyze behavior or the reasons for the increases, but rather, associate parts of the increases with changes in quantities or shares. The components identified here are based on simple calculations taken one at a time, with inter-

actions ignored. The portion of expenditures that cannot be attributed to one of the changes remains "unexplained" (as will be seen, this portion is large), but it would be incorrect to say that the attributed portions have been "explained" in anything more than an accounting sense. The calculations, summarized in Table 5.4, examine four sets of factors: (1) market prices of factors, (2) institution-specific changes in faculty compensation, (3) financial aid, and (4) administrative costs.

The first generic reason why any entity's expenditure might increase is that the real cost of its purchased inputs might have risen. Using price indices for major components of university purchases, I calculated the increase in expenditures that would have been ex-

TABLE 5.4
Decomposition of Expenditure Increases

	Duke	*Harvard*	*Chicago*	*Carleton*
Base Year	*1983/84*	*1981/82*	*1983/84*	*1981/82*
Ending Year	*1991/92*	*1991/92*	*1991/92*	*1991/92*
1 Percentage Change in Real Expenditures	73%	69%	62%	77%
2 Average Annual Growth Rate	6.8%	5.3%	6.0%	5.7%
Proportion of Increased Spending due to				
3 Market prices	0.122	0.122	0.144	0.141
Regular faculty				
4 Growth	0.047	0.063	0.010	0.078
5 Over-market salary increases	0.035	−0.024	0.017	−0.002
6 Over-market increase in fringe benefits	0.002	0.002	−0.007	0.004
7 Nonregular faculty	0.063	0.013	0.046	0.000
Financial aid				
8 Number of students	0.051	0.033	0.049	−0.003
9 Aid per student	0.259	0.108	0.293	0.217
10 Increased administrative spending	0.046	0.049	0.052	0.008
11 Residual	0.376	0.635	0.398	0.557
12 Total	1.000	1.000	1.000	1.000

Source: Calculations using unpublished data from the sample institutions; Research Associates of Washington (1994); *Academe* (July/August) 1982, p. 17; *Academe* (July/August) 1984, pp. 11, 15; *Academe* (March/April) 1987, p. 9; *Academe* (March/April) 1992, p. 19.

pected on the basis of rising factor prices alone. Data on factor prices were taken from the HEPI and from the AAUP's annual survey of faculty compensation. The index for faculty compensation used for the three universities is a fixed-weight average of salaries plus fringe benefits at three ranks for private independent doctoral institutions; for Carleton, it is a comparable index using private independent four-year colleges.[11] The average nominal faculty salary at private independent doctoral institutions rose 33 percent in real terms and 96 percent in nominal terms between 1981/82 and 1991/92.[12] Thus, an increase of 33 percent of an institution's 1981/82 faculty compensation (expressed in 1991/92 dollars) can be "attributed" to the increase in the market price of faculty, in the sense that an institution's outlay for faculty would have to have increased by that much in the absence of any adjustments in faculty size, just so that the institution could retain faculty of comparable quality.

Similar calculations were made for nine other categories of expenditures, applying in each case the appropriate price index for the period corresponding to the data for each institution. Line 3 in Table 5.4 summarizes all the calculations for each institution, expressing the total of the hypothetical increases due to the price alone as a percentage of the total increase in spending for the institution. What can be seen clearly is that these increases in factor prices do not explain much of the overall increases; in no case do they explain more than 15 percent of the total increase.

Lines 4–6 of the table attribute spending increases to changes in the institution's regular-rank faculty and its compensation, other than increases in line with the marketwide growth in salary and fringes already included in line 3. The first component, shown on line 4, is the increase simply due to growth in numbers.[13] The number of regular faculty increased at all four of the sample institutions over the period of study, ranging from a 3 percent increase at Chicago (over 8 years) to increases of more than 20 percent at Harvard and Carleton (over 10 years).[14] Yet, as the figures in the table show, increases even as large as those at Harvard and Carleton account for less than one-tenth of the total increase in arts and sciences spending. Lines 5 and 6 measure the effects of increases in salaries and fringe benefit rates in excess of the average rates in the market; positive numbers refer to increases above the market increases and negative numbers (representing reductions in expenditures) refer to increases below the market average.[15] Differentials in fringe benefits have little effect, but extraordinary increases in salaries at Duke account for 3.5 percent of the university's total increase.

The next component of increased spending is that attributable to

the increasing use of nonregular faculty, that is, the adjunct professors, lecturers, and other instructors who are neither permanent faculty or graduate students and who have shouldered an increasing share of teaching in American higher education. The figures shown on line 7 refer to the increase in spending on nonregular faculty that is not explained by the increase in real salary rates (which is included in line 3 with the figures on market prices). Separate data on payrolls for nonregular faculty were not available for Carleton. The line shows that the otherwise unexplained increase in spending for nonregular faculty was relatively large at Duke and Chicago, representing 6 and 5 percent of the total increases in spending, respectively.

The fourth component examined in the decomposition, financial aid, accounts for a much larger share of the total increase than does any other. Some of this increase at the three universities is due to the number of students; this is shown on line 8. Because undergraduate enrollments did not increase significantly, virtually all of this increase can be laid to the growth in graduate enrollments.[16] The residual increase in aid is shown in line 9. This component is the largest single attributed element in the table, accounting for 30 percent of the total at Chicago, one-fourth of the total at Duke, and more than one-fifth of the total at Carleton. Increases in the average award to graduate students reflect a strengthening of overall graduate financial support. For undergraduates, the increase in average aid was due largely to the interaction between disproportionate tuition increases and the formula underlying the need-based aid. When tuition increases faster than income and most other items in the standard financial aid formula, both the percentage of students eligible for aid and the percentage of aid in the form of grants (as opposed to loans and self-help) increase, causing a more-than-proportional increase in grants to those receiving aid.[17]

The last item in the decomposition is administrative expenditures, shown on line 10. A way to assess the contribution of administration is suggested by the fact that the percentage of total arts and sciences spending devoted to administration at all four institutions increased over the study period. To determine the portion of the overall increase that one might attribute to the increase in administration, I calculated how much higher administrative spending in the base year would have been if the 1991/92 percentage of total spending on administration had applied rather than the actual percentage. For the three universities, at which the administrative shares increased noticeably, the portions of the total increase so attributed were almost 5 percent each.[18] For Carleton, the portion was less than 1 percent.

The literal bottom line of this decomposition shows a substantial

unexplained residual, ranging from 38 to 64 percent of the total increase in arts and sciences spending. In other words, after attributing all of the increases to changes in other known quantities or shares, a large portion of the growth remains unexplained. The unavoidable conclusion is that a sizable portion of the increase is due to higher quality or new functions, or to increased waste. One of these possibilities can be explored further. The next section discusses that possibility and suggests two additional explanations for the residual.

SOME EXPLANATIONS OF THE RESIDUAL

Three explanations that have been offered for rising expenditures in higher education are worth considering at greater length. They are: (1) universities have added new programs; (2) the cost of science has escalated dramatically; and (3) the federal government has scaled back its support of universities, forcing institutions to take up the slack.

New Programs

To what extent are rising expenditures due simply to an increase in the number of things that universities are doing? We know that knowledge grows, probably at an accelerating rate. We also know that the universities in our sample have added academic programs faster than they have eliminated them. Therefore, one simple way of thinking about increasing expenditures is to focus on the impact of new programs, or to separate the increase that arises from any excess of new programs over discontinued programs.

By definition, the increase in spending in any component of the university can be written in terms of the following identity:

Expenditures in newly established programs
− Expenditures in discontinued programs
+ Changes in expenditures in continuing programs
= Change in total expenditures

Within limits, this kind of decomposition of the overall increase can indicate the relative contribution of new activities. One must recognize, however, that this division depends on someone's determination of what constitutes a "program"—the unit of accounting—which muddies the interpretation of any empirical application of

this decomposition. Continuing programs may institute new activities, and new programs may well be composed largely of previously existing parts.

With this inherent drawback in mind, I applied this reasoning to the detailed expenditure data for Duke, allowing the accountants' definition of a fund code to determine what constitutes a "program." Fund codes differ enormously in size, from academic departments with budgets in the hundreds of thousands of dollars to individual faculty members with very small amounts of research funds, measured in the hundreds of dollars. They are good indicators of continuity, however, because they tend to remain on the books as long as an activity continues to exist and because they have money to spend or receive. Fund codes with expenditures of at least $100 in absolute value in constant dollars were taken to signify existing programs; those existing in both years were counted as continuing programs.[19]

For each of the four major academic departmental groupings, the components of the change in spending shown in the identity above were calculated. In the case of Duke, the beginning year was 1983/84, the first year for which detailed financial information was available. Table 5.5 shows this decomposition separately for internally funded and externally funded expenditures. Among the internally funded programs, the growth in continuing programs was far more important than new programs in explaining expenditure growth. The difference between new and discontinued programs, $7.4 million, accounted for only about one-fifth of the total $38.8 million increase in spending. During this period, the three largest new programs were new departments; two of the three (the Institute of Statistics and Decision Sciences and Asian and African Languages and Literature) were created out of whole cloth, albeit using some faculty who previously had been members of other departments. The third was merely the result of splitting a large department (Psychology) into two parts. As these examples illustrate, it is uncommon to find large, internally financed, genuinely "new" programs.

Not surprisingly, the story was quite different for externally financed expenditures, for which continuing programs had virtually no importance. By their nature, individual grants and contracts do not have long lives. All the growth in external funding can be attributed to the difference between new and discontinued fund codes.

Science Costs

One hypothesis that has been offered for the rapid increases in expenditures in research universities is the escalating cost of scientific

TABLE 5.5
The Importance of New Programs in Explaining Growth in Expenditures
(In Millions of 1991/92 Dollars)

	Departmental Groups				
	Humanities	*Social Sciences*	*Natural Sciences*	*Engineering*	*Total*
Internally Financed					
New accounts, 1991/92	2.6	2.9	3.8	1.1	10.3
− Discontinued accounts, 1983/84	0.8	0.3	1.4	0.3	2.9
Continuing accounts					
+ 1991/92	18.2	13.4	18.8	6.7	57.1
− 1983/84	10.3	10.1	1.2	4.1	25.7
= Change in expenditures	9.7	6.0	19.9	3.3	38.8
Externally Financed	0.0	0.0	0.0	0.0	0.0
New accounts, 1991/92	2.3	8.9	18.1	3.8	33.2
− Discontinued accounts, 1983/84	1.1	2.6	14.3	1.8	19.7
Continuing accounts					
+ 1991/92	0.0	0.0	0.1	0.0	0.1
− 1983/84	0.0	0.0	0.1	0.0	0.1
= Change in expenditures	1.2	6.3	3.9	2.0	13.5

Source: Calculations using unpublished data from Duke.
Note: Figures give expenditures in new, discontinued, and continuing accounts, using data from the 1983/84 and 1991/92 academic years.

research. In principle, the components of the HEPI should reflect these increases. However, the special scientific requirements of research universities, especially the need for new and expensive equipment, may not be reflected fully in those indices. Although the operating costs of science may be a major source of rising costs, it seems more likely that people have capital costs in mind when they cite the high cost of science. It is certainly worth looking at both costs. Symbolic of the capital costs of science are the large commitments in start-up costs that have become a routine part of recruiting new faculty in the sciences. These start-up costs typically cover such items as scientific equipment, computers, and the renovation of laboratories and are negotiated as a part of financial packages for newly hired faculty.

At Duke, a calculation for 36 appointments in the early 1980s showed an average commitment of $149,000 for appointments in botany, chemistry, geology, physics, and zoology, and an average commitment of $50,000 for appointments in biological anthropology, mathematics, and psychology.[20] Are costs such as these a major factor in the rise in total spending by research universities? The tab-

ulations in chapter 4 on expenditures at Duke suggest that increases in capital spending for research were dwarfed by changes in salaries and other spending. Although the accounting system used at Duke does not lend itself to the identification of such costs, most capital spending for scientific research is reflected in the two columns in Table 4.1 corresponding to computers and capital expenditures. The breakdown by department group gives an indication of the relative importance of capital costs at Duke in 1991/92. Relative to the overall size of each departmental grouping, the natural sciences far outspent the humanities and social sciences in both computers and capital expenditures. The natural sciences accounted for some 40 percent of all internally funded expenditures for computers and other capital.

Harvard's accounting structure makes it simpler to track start-up costs, and the story that the numbers tell is one of rapid increases during the 1980s. As at Duke, these costs almost always arise from commitments made to newly hired faculty to be used at the faculty member's discretion for such items as computers, laboratory renovation, or laboratory equipment. At Harvard, the practice was to establish a fund at the time of the appointment, out of which subsequent expenditures would be made. Table 5.6 presents a summary of start-up costs at Harvard, covering the three major divisions of arts and sciences plus two additional categories. Although the figures are reasonably comparable, they differ in the matter of timing. The totals listed in the three columns of the table for the three academic divisions and administration represent expenditures made during the designated years from the start-up accounts, many of which were established in previous years. In contrast, the general expense category is the sum of allocations made in those years to academic units

TABLE 5.6
Research Start-Up Costs: Harvard Arts and Sciences, 1982, 1987, and 1992
(In Thousands of 1991/92 Dollars)

	1981/82	*1986/87*	*1991/92*
General Expenses[a]	172.9	96.4	258.3
Humanities	10.8	205.9	300.7
Natural Sciences	27.3	1,468.6	1,476.5
Social Sciences	27.1	200.1	906.4
Administration	0.0	97.4	92.6
Total	238.1	2,068.4	3,034.5

Source: Calculations based on unpublished data from Harvard.
[a]Transfers out of Faculty of Arts and Sciences and unspecified.

outside the Faculty of Arts and Sciences but within our definition of "arts and sciences."[21] If these aggregates are taken as a rough indication of total start-up spending, it is clear that this category of expenditure has risen markedly over the period 1982–1992. Because most of the general expense costs probably were directed to an affiliate unit that we classify as natural sciences, Table 5.6 strongly suggests that, despite rapid growth in start-up costs in the social sciences during this period, the bulk of the start-up costs was directed toward the natural sciences.

Stagnant Federal Funding

Federal support for research increased modestly in real terms during the 1980s, but its share of total university support for research declined.[22] This trend is evident among the three universities studied here as well; as a percentage of total arts and sciences expenditures, federally funded spending fell from 21 to 15 percent at Harvard, from 20 to 19 percent at Duke, and from 27 to 19 percent at Chicago. The important question in this study is, How did this changing pattern affect universities' internally funded spending? Because virtually all federal support was tied to specific expenditures, in principle, any decline in support could have been matched by corresponding spending cuts. However, universities could have continued some of these programs, choosing to replace lost federal support with their own institutional funds. This choice is most explicit when funding agencies ask institutions to bear a larger share of the cost of sponsored grants and contracts. By means of matching and other cost-sharing requirements, this shifting of the burden onto institutions appears to have become more common during the 1980s.[23]

It is impossible to determine the precise impact of these changes in funding, as doing so would require knowledge of what would have happened if no change had occurred. However, it is both possible and helpful to make some assessment of that impact through the use of a counterfactual calculation giving a "what-if" level of federal support. The calculation represents what might have occurred if the relative importance of federal support had not decreased and allows comparison of the actual and hypothetical patterns, to give one measure of the possible impact. One reasonable benchmark is the amount of federal support that universities would have received had federal support remained a fixed percentage of total expenditures. If universities used internal funds to make up the difference between this hypothetical amount and what they actually received in federal sup-

port, then the additional expenditure of internal funds can be calculated.

Tables 5.7 and 5.8 show these calculations for Duke and Harvard, respectively. The first two columns show the percentage of total arts and sciences spending funded by federal grants and contracts, by departmental group. To illustrate the calculation, consider the largest item in Table 5.8, on the line for natural sciences. If federal funds had continued to account for the 47 percent of natural sciences spending in 1991/92 that it had 10 years earlier, Harvard would have received some $8 million more in federal support than it actually did. If Harvard had used internal funds to make up this shortfall, the impact on internal funds clearly would be $8 million, or about 12 percent of all the internally funded spending in the natural sciences. To commit this amount without reducing other

TABLE 5.7
Hypothetical Impact of Decline in Federal Share of Expenditures: Duke

Departmental Group	*Federal Grants as Percentage of Total Expenditures*		*Hypothetical Loss (Gain) in Federal Funding*[a]	*As Percentage of Internally Funded Spending*	*Required Growth in Internally Funded Spending*
	1983/84	*1991/92*	*($ Thousands)*		
Humanities	4	5	(239)	−1.1	−0.1
Social Sciences	14	26	(3,187)	−18.1	−2.5
Natural Sciences	41	39	880	3.4	0.4
Engineering	20	23	(348)	−4.5	−0.6
Library	0	2	(234)	−2.1	−0.3
Student Services	0	0	0	0.0	0.0
Plant	0	0	0	0.0	0.0
Admissions and Financial Aid	30	12	3,923	20.8	2.4
Arts and Sciences Administration	25	23	566	2.8	0.3
Provost	0	2	(78)	−2.1	−0.3
Alumni and Development	0	0	0	0.0	0.0
General Administration	1	0	1,282	30.3	3.3
Total	20	19	2,565	1.7	0.2

Source: Calculations using unpublished data from Duke.

[a]Difference between hypothetical federally funded expenditures and actual federally funded expenditures, where the hypothetical is calculated as the percentage of total expenditures that was federally financed in the initial year multipled by actual total expenditures in 1991/92.

TABLE 5.8
Hypothetical Impact of Decline in Federal Share of Expenditures: Harvard

Departmental Group	*Federal Grants as Percentage of Total Expenditures*		*Hypothetical Loss (Gain) in Federal Funding*[a] *($ Thousands)*	*As Percentage of Internally Funded Spending*	*Required Growth in Internally Funded Spending*
	1981/82	*1991/92*			
General Academic	1	7	(1,496)	−6.1	−0.6
Humanities	7	4	1,690	3.4	0.3
Social Sciences	16	10	2,387	7.6	0.7
Natural Sciences	47	41	8,344	12.0	1.1
Museums	31	11	2,853	22.6	2.0
Library	2	1	348	1.0	0.1
Student Services	2	0	714	2.0	0.2
Admissions and Financial Aid	10	5	1,851	5.3	0.5
Administration	4	1	1,749	3.0	0.3
Plant	0	0	0	0.0	0.0
Athletics	2	0	237	2.0	0.2
Total	21	15	18,675	4.9	0.5

Source: Calculations using unpublished data from Harvard.

[a]Difference between hypothetical federally funded expenditures and actual federally funded expenditures, where the hypothetical is calculated as the percentage of total expenditures that was federally financed in the initial year multipled by actual total expenditures in 1991/92.

spending would have required a real growth rate in internal funds of 1.1 percent per year. For the university's total arts and sciences operation, this calculation suggests that the burden of sluggish growth in federal funding could have accounted for more than $18 million in internally funded spending in 1991/92. For Duke, the implied burden is less, owing to the more modest decline in the share of its arts and sciences spending supported by federal funds.

Although these calculations are suggestive, they are by no means definitive. In fact, they would appear to represent an upper bound to the impact of the slowdown in the growth of federal funding. These calculations would represent the true cost of the change in funding patterns only if universities had decided to continue all the projects and expenditures that formerly had been supported by federal money. Universities could have avoided at least some portion of this burden by deciding not to undertake certain activities. However, to the extent that the federal government's cuts occurred in categories that universities felt were central, such as the support of graduate students, or in expenditures for infrastructure deemed essential

to the projects themselves, a certain shifting of the burden from federal to institutional funds was inevitable.

CONCLUSION

The aim of this chapter is to seek reasonable explanations for the increases in expenditures documented in chapter 4. When the increases are decomposed into identifiable components associated with other documented changes or trends, roughly half the total increases can be "explained." The largest of these identifiable components are increases associated with financial aid per student, rising real factor prices (including faculty compensation), and growth in faculty size. Some increase also can be attributed to growth in the number of graduate students and in the portion of the arts and sciences budget taken up by administration. At the end of the exercise, however, there remains a sizable share of the increase that cannot be attributed to any of these factors. It seems most likely that the bulk of this residual reflects attempts to provide higher-quality service or to undertake new activities, all within existing departmental and administrative structures. Another strong possibility, especially for the research universities, is that part of the increase represents the institutions taking responsibility for some kinds of expenditures that might formerly have been covered by federal grants and contracts, some of which is in the form of start-up costs for newly hired faculty.

Appendix 5

Supplementary Tables for Chapter 5

TABLE 5A.1
Average Faculty Salaries, by Rank, 1991/92 Dollars

	1976/77	*1981/82*	*1986/87*	*1991/92*	*Growth Rate 1982–92*
Duke[a]					
Professor	58,504	56,007	69,454	79,600	3.5
Associate professor	42,024	40,866	48,642	56,000	
Assistant professor	33,990	33,222	38,720	45,900	
Instructor	—	—	38,357	—	
All	47,929	47,040	57,112	65,700	3.3
Harvard					
Professor	69,836	71,295	84,337	92,200	2.6
Associate professor	43,979	39,690	44,649	52,000	
Assistant professor	34,255	34,398	41,140	47,800	
Instructor	—	—	23,958	46,600	
All	57,681	55,566	63,283	71,400	2.5
Carleton					
Professor	49,504	48,069	55,297	58,500	2.0
Associate professor	37,349	35,574	44,286	45,500	
Assistant professor	31,824	29,106	33,517	37,100	
Instructor	28,288	23,961	28,556	—	
All	40,210	39,837	45,738	48,100	1.9
Chicago					
Professor	66,742	62,769	71,874	83,300	2.8
Associate professor	45,747	41,454	47,190	54,400	
Assistant professor	36,686	34,839	41,140	48,700	
Instructor	31,161	26,754	29,645	34,800	
All	53,587	50,715	59,169	69,000	3.1
Private Independent, Doctoral Level[b]					
Professor	61,460	59,123	68,849	76,890	2.6
Associate professor	42,764	41,072	46,972	51,700	
Assistant professor	34,189	33,075	38,768	43,630	
Instructor	27,647	26,901	30,117	33,220	
Lecturer	—	26,078	32,247	34,090	

TABLE 5A.1 (*cont.*)

	1976/77	*1981/82*	*1986/87*	*1991/92*	*Growth Rate 1982–92*
No rank	—	—	—	37,480	
All	47,073	46,246	53,990	60,260	2.6
All Faculty (Doctoral Level)					
Professor	56,731	53,655	61,105	65,190	1.9
Associate professor	41,747	39,264	43,814	46,290	
Assistant professor	34,034	32,208	36,736	39,120	
Instructor	26,852	24,431	26,777	27,670	
Lecturer	—	28,209	31,569	32,510	
No rank	—	—	—	33,150	
All	43,382	41,924	48,158	51,080	2.0
All Faculty[c]					
Professor	52,885	49,216	55,091	58,220	1.7
Associate professor	40,001	37,059	40,922	43,260	
Assistant professor	32,752	30,326	33,783	36,060	
Lecturer	26,343	23,976	25,809	27,170	
No rank	—	27,239	30,165	30,470	
Instructor	—	—	—	33,560	
All	39,625	37,853	42,919	45,360	1.8

Source: Data are from *Academe* (August) 1977, Table 3, p. 154; (July/August) 1982, Table 6, p. 18; (March/April) 1987, Table 3, p. 9; (March/April) 1992, Table 4, p. 19.

Note: The GDP price deflator was used to convert to constant dollars.

— No data available owing to small number of observations.

[a]Figures are for 1977/78; 1976/77 not published.

[b]Category I, covering institutions conferring an average of 15 or more doctorates in a minimum of three nonrelated disciplines.

[c]All four-year and two-year institutions, with ranks.

TABLE 5A.2

Percentage Change in Full Professor Salaries: Continuing Full Professors Minus All Full Professors, All Institutions, Carleton, and Duke

Year	*All*	*Carleton*	*Duke*
1977/78	0.7	1.6	—
1978/79	1.3	1.5	−0.5
1979/80	0.3	1.3	0.9
1980/81	0.8	2.9	0.5
1981/82	0.4	2.0	0.4
1982/83	1.2	1.7	−0.2
1983/84	0.8	1.8	−0.5
1984/85	0.0	0.4	−0.7
1985/86	0.9	0.3	−0.2
1986/87	0.3	2.1	−1.2
1987/88	1.1	1.5	−0.8
1988/89	0.6	0.2	−0.1
1989/90	0.6	1.5	0.1
1990/91	0.6	1.3	−0.2
1991/92	0.5	0.5	2.2
1992/93	0.6	1.4	0.5
1993/94	0.8	0.2	1.9

Source: Academe (March/April), 1978–1994.

Note: Numbers are the difference between the percentage change in the average salary of full professors who continued to work at the same institution and the percentage change in the average salary of all full professors.

— No information reported.