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Chapter Title: Costs per Student over Time

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Instructional expenditures in higher education can be linked to the student/faculty ratio in a way that reveals important differences in the structure of costs in higher education. To what extent do costs differ because of differences in the student/faculty ratio or differences in faculty salaries or perhaps differences in other instructional costs? The student/faculty ratio is viewed sometimes as a shortcut measure of educational quality (lower ratios imply better quality) and sometimes as a measure of efficiency (higher ratios imply more efficiency). Changes in the student/faculty ratio over time reveal how higher education responds to a changing environment (O'Neill 1976). The salaries of faculty are the most important cost in higher education, and so a concern for trends in costs must of necessity address trends in student/faculty ratios and in faculty salaries.

Over the last 120 years in higher education in the United States, the aggregate student/faculty ratio has changed substantially. Figure 14.1 shows that, in 1869, the student/faculty ratio for all of higher education was just under 10 and stayed essentially unchanged through 1909, even as the number of colleges nearly doubled, the average size of institutions increased nearly fourfold, and total enrollment increased over sevenfold. As depicted in the accompanying table (Table 14.1), the ratio rose over 20 percent from 1909 to 1919 and showed modest further increase to 1929. It fell nearly to 10 again by 1939 and remained in that vicinity through 1959. In the 1960s, the ratio increased by 86 percent to 17.8. There was a modest decline from the 1969 peak in the succeeding years. Clearly, the 1960s were an era of rapid change in higher education. Enrollment grew by about 120 percent, the number of institutions grew by just over 25 percent, and the number of faculty grew by only 18 percent. This was an era of rapid increase in institutional size and change in production relations. Whether the change reflected a deterioration in quality

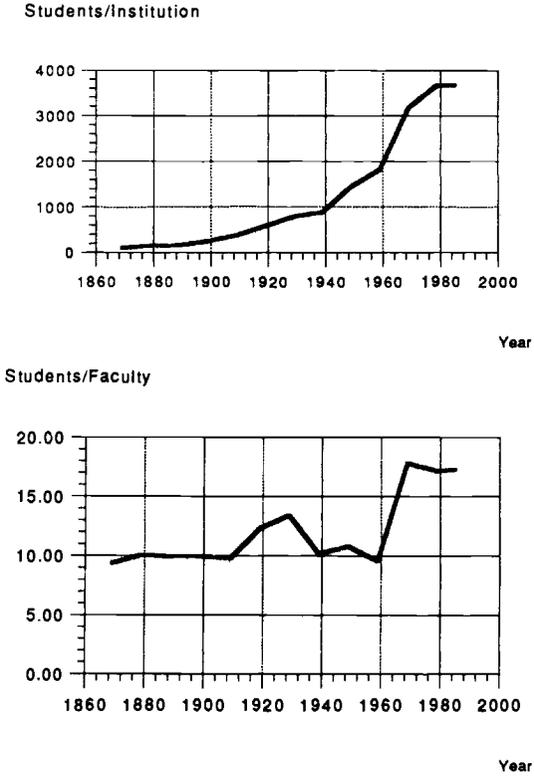


Figure 14.1 Students per institution and student/faculty ratio, 1869–1985.
 Source: U.S. Department of Education (1988, table 116, p. 141).

Table 14.1 Students, Faculty, and Institutions from 1869 to 1985

	Students (in 1,000s)	Faculty (in 1,000s)	Institutions	Students per Institution	Students per Faculty
1869	52	5.6	563	93	9.35
1879	116	11.5	811	143	10.05
1889	157	15.8	998	157	9.92
1899	238	23.9	977	243	9.95
1909	355	36.5	951	374	9.74
1919	598	48.6	1,041	574	12.30
1929	1,101	82.4	1,409	781	13.36
1939	1,494	149.9	1,708	875	10.17
1949	2,659	247.7	1,851	1,437	10.78
1959	3,640	380.6	2,008	1,813	9.56
1969	8,005	450.0	2,525	3,170	17.79
1979	11,570	675.0	3,152	3,671	17.14
1985	12,247	710.0	3,340	3,667	17.25

Source: U.S. Department of Education (1988, table 116, p. 141).

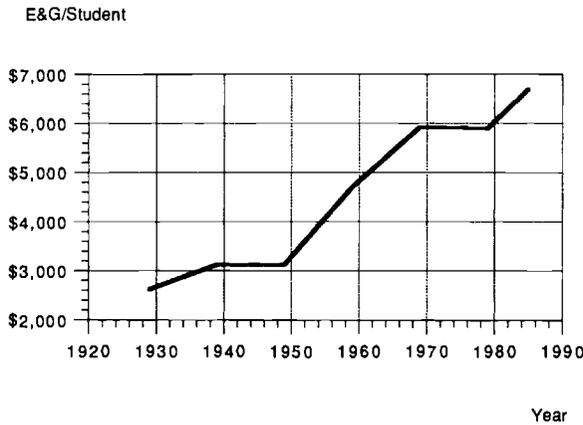


Figure 14.2 E&G expenditures per student, 1929-30 to 1985-86, in 1987-88 dollars.

Sources: U.S. Department of Education (1988, table 116, p. 141); Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1970* (Washington, D.C.: U.S. Government Printing Office, 1975), 197; U.S. Bureau of the Census, *Statistical Abstract of the United States* (Washington, D.C.: U.S. Government Printing Office, various years).

or an increase in productivity requires a more powerful analysis. We can conclude, however, that higher education in the aggregate has been capable of rapid change in its fundamental character.

Information about educational and general (E&G) expenditures is available in the aggregate from 1929-30, as shown in Figure 14.2. Expenditures per student, inflated to dollars of 1987-88 purchasing power by the GNP implicit price deflator over 50 years, have more than doubled. The increase, however, has occurred in episodes of very rapid change interspersed with eras of little change. Expenditure per student in constant dollars changed little from 1929-30 to 1949-50. The 1950s and 1960s were periods of very rapid increase. The stability of the 1970s was followed by another interval of rapid expansion in the 1980s.

This chapter looks in detail at the period 1978-79 to 1987-88 as reported in the HEGIS/IPEDS survey (see Chapter 11, n. 14, above) about expenditures, number of faculty, and enrollment at four points in time. Our sample is limited to 1,804 institutions because some colleges and universities did not report either the number of faculty or faculty salaries in one or more of the surveys used.¹ The institutions in the sample come from all the major sectors

1. This chapter uses data from the HEGIS/IPEDS reports of 1978-79, 1983-84, 1985-86, and 1987-88. The data on the number of faculty are for 1982-83 instead of 1983-84. American Association of University Professors (AAUP) data on faculty salaries are not used because we do not have them for the same set of institutions over time. AAUP data may be individually more accurate both because the AAUP asks institutions to verify the data reported and because the AAUP compares current year with previous year reports in order to identify irregularities.

of higher education. The first half of this chapter decomposes 1987–88 expenditures per student into four parts, one of which is the student/faculty ratio. The second half analyzes changes in the components of expenditure per student over the period 1978–79 to 1987–88, in a search for clues to solve the recent cost inflation mystery.

14.1 Decomposing Expenditures per Student

The linkage between expenditures and the student/faculty ratio is shown in Figure 14.3. The figure reports aggregates for a set of 1,804 institutions for which we have complete data on finances, enrollments, and full-time faculty. At Level I, the total current account expenditures are divided between adjusted educational and general (AE&G) expenditures, research, restricted scholarships, and other expenditures not included in educational and general (E&G). For the 1,804 institutions, the total AE&G was \$54.7 billion in 1987–88. Level II shows that \$26.1 billion of AE&G flowed to instruction, leaving \$28.6 billion to noninstructional functions. The ratio of instructional expenditure (Level II) to AE&G (Level I) is 0.48 (labeled A in Figure 14.3). Level III shows that 44 percent (B in Figure 14.3) of the instructional expenditure, or \$11.3 billion, flowed to the salaries of the full-time faculty. HEGIS/IPEDS reports information only for full-time faculty, so this investigation is limited to a discussion of full-time faculty.² The fringe benefits for the full-time faculty and compensation for all other instructional staff, as well as all noncompensation expenditures in instruction, are excluded from the \$11.3 billion. The \$11.3 billion salary bill was paid to 315,719 full-time faculty members at the 1,804 institutions. Thus, \$35,889 was the average salary per full-time faculty member in 1987–88 (labeled C in Figure 14.3). This average salary figure is slightly lower than that shown in AAUP data reported in Table 6.2 above. The HEGIS/IPEDS data include a larger set of two-year colleges, and they include data for faculty below the rank of assistant professor, for example, instructors and lecturers, categories that the AAUP data exclude. Level V shows that the institutions enrolled 6.6 million full-time-equivalent

2. Counts of full-time and part-time senior instructional faculty are reported in U.S. Department of Education (1989, table 190, p. 212) as follows (in thousands):

	Total	Full-Time	Part-Time	% Part-Time
1970	474	369	104	21.9
1973	527	389	138	26.2
1977	678	448	230	33.9
1983	724	471	254	35.1
1988	741	467	275	37.1

The increase in percentage part-time is consistent with the subsequent evidence reported in this chapter.

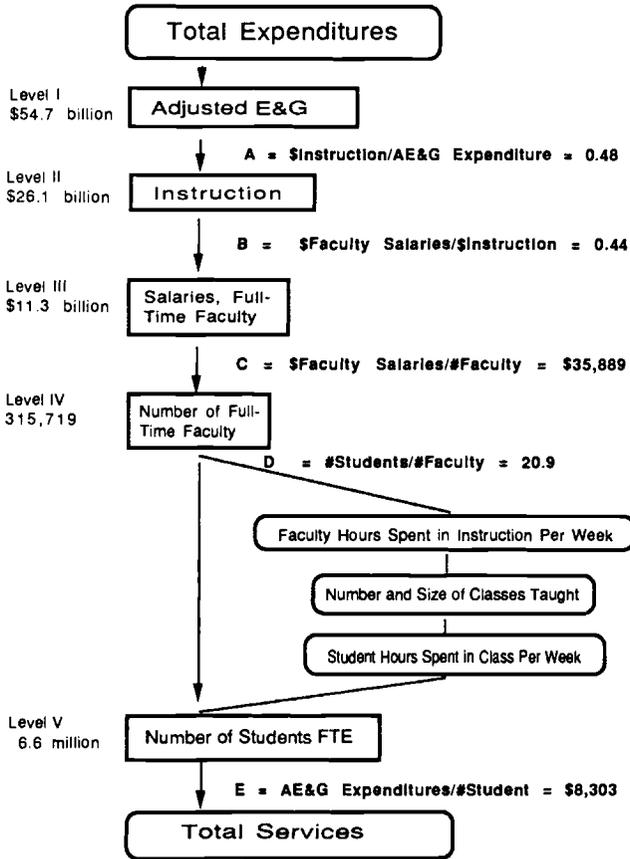


Figure 14.3 Flow from expenditures to services.

Source: Authors' calculation from HEGIS/IPEDS data.

Note: Figures are aggregates for 1,804 institutions, 1987–88.

students. On average, then, these 1,804 colleges and universities had a per-student expenditure (AE&G) of \$8,303 (labeled E in Figure 14.3) and a student to full-time faculty ratio of 20.9 (labeled D in Figure 14.3).³

Figure 14.3 shows three additional connections between faculty and students, links that define the nature of the contact between the two. Faculty members may differ in the number of hours per week devoted to class, lab, and office hours. The faculties may teach different numbers of classes of different sizes. Students may spend different numbers of hours per week in class. The HEGIS/IPEDS surveys do not document these three extra links. How-

3. Rates of flow for the 2,045 institutions used in Chapter 12 are similar to the rates shown here for the 1,804 subset. At level B, 47.6 percent of AE&G flows to instruction. Expenditure per student is \$8,122 for the 2,045 institutions in 1987–88.

ever, they do relate to the intensity of contact between faculty and students. Institutions with identical student/faculty ratios could differ significantly in faculty teaching load, class size, and student course load and, so, could yield quite dissimilar educational experiences.⁴ The extra links should be examined for a more complete understanding of what lies behind the student/faculty ratio.

The five levels of the flow chart in Figure 14.3 connect expenditures to students and suggest a four-part decomposition of those expenditures. The decomposition defines four ratios in columns A–D of Table 14.2 (which match the ratios shown in the aggregate in Figure 14.3), with expenditures per student reported in column E. Column A displays the ratio of instructional expenditure to total AE&G expenditures. Column B shows the full-time faculty salary bill as a ratio of all instructional expenditures. Column C reports the ratio of the full-time faculty salary bill to the number of full-time faculty, so it is the average salary of full-time faculty members. We express this ratio as the salary per faculty member because it is easier to interpret than the number of faculty members per, say, \$100,000 of payroll. Column D is the ratio of full-time-equivalent enrollments to the number of full-time faculty members, a student/faculty ratio. Expressing the ratio as students per faculty is easiest to interpret at this point. The expenditure per student in column E is then equal to the product of the reciprocals of columns A, B, and D times column C:

$$\begin{aligned}
 E &= 1/A \cdot 1/B \\
 \frac{\$AE\&G}{\#STUDENTS} &= \frac{\$AE\&G}{\$INSTRUCTION} \cdot \frac{\$INSTRUCTION}{\$FAC\&SALARIES} \\
 &\cdot C \cdot 1/D \\
 &\cdot \frac{\$FAC\&SALARIES}{\#FACULTY} \cdot \frac{\#FACULTY}{\#STUDENTS}
 \end{aligned}$$

Differences in expenditure per student from one group of institutions to another can be investigated in terms of variation in the four ratios of the de-

4. Tables 8.11, 8.12, and 8.13 above report average student contact hours for faculty members. If the midpoint number of hours in each cell in each table applies to all faculty, faculty members on average spent about 12 hours per week in class and just under five hours per week in office hours. Office hours show some downward trend, but class time does not exhibit a trend.

In the High School and Beyond survey data set used in Part I of this volume, students report the number of hours per week they spend in class, laboratories, and recitations for a single year. The authors accumulated the hours reported by students for each school. On average, students spend about 15.9 hours in contact with faculty each week, with students at private institutions spending somewhat more time (16.2 hours) than those at public institutions (15.7 hours). Because the High School and Beyond survey is for a single point in time, we cannot use it to identify trends in student class hours.

We have no information on class size and know of no survey that gathers this information across a significant number of colleges and universities.

Table 14.2 Ratios of Dollars to Students, 1987–88 Aggregates

Group	(A)	(B)	(C)	(D)	(E)	Sample Size
	$\frac{\$INSTRUCTION}{\$AE\&G}$	$\frac{\$FACSALARIES}{\$INSTRUCTION}$	$\frac{\$FACSALARIES}{\#FACULTY}$	$\frac{\#STUDENTS}{\#FACULTY}$	$\frac{\$AE\&G}{\#STUDENTS}$	
All institutions	.48	.44	35,889	20.9	8,303	1,804
By control:						
All public	.50	.45	36,272	22.0	7,424	1,078
All private	.43	.40	34,703	17.4	11,748	726
By Carnegie classification:						
Research	.49	.36	42,728	19.0	12,816	87
Doctoral	.48	.45	37,501	20.5	8,578	88
Comprehensive	.48	.51	34,471	20.7	6,739	485
Liberal Arts I	.37	.53	35,173	13.9	12,958	122
Other-Four-Year	.35	.53	24,660	16.7	8,068	306
Two-Year	.50	.46	29,875	27.0	4,903	716
By size group*						
Under 1,000	.38	.49	24,625	18.5	7,116	557
1,000 to 2,999	.43	.49	30,330	19.9	7,147	671
3,000 to 9,999	.48	.45	35,192	21.8	7,487	426
10,000 to 19,999	.50	.42	39,619	21.2	8,877	111
20,000 up	.50	.38	42,948	20.6	10,974	39

Source: Authors' calculations from HEGIS/IPEDS data.

Note: For definitions of variables, see the text.

*Size is measured by 1987–88 full-time-equivalent enrollment.

composition. Institutions might have higher costs per student because they spend more on noninstructional functions (A), because they spend more on non-full-time faculty instructional items (B), because they pay higher average full-time faculty salaries (C), or because they have a lower student/faculty ratio (D). A comparison of the four ratios of the decomposition across groups of institutions with different expenditures per student can help us understand why certain institutions have different costs. This decomposition, then, should reveal the role of the student/faculty ratio as a determinant of cost.

14.2 Cost Comparisons across Aggregate Groups

Table 14.2 provides a first look at the decomposition by comparing institutions classified by control, Carnegie group, and size. The last column reports the number of institutions in each group. The cost per student in public institutions was 63 percent of the cost per student in private institutions in 1987–88. The difference arises because student/faculty ratios are 21 percent lower in the privates, because privates devote only 43 percent of their AE&G expenditures to instruction compared to 50 percent for publics, and because only 40 percent of the instructional expenditures in the private institutions goes to full-time faculty salaries compared with 45 percent in the publics. Private institutions employ relatively more noninstructional and nonfaculty inputs than public colleges and universities. These three differences more than overcome the fact that the publics, on average, pay 4 percent higher faculty salaries.

Even stronger contrasts appear in the comparison of the six Carnegie classifications, reported in the middle of Table 14.2. Figure 14.4 shows the expenditures per student in a chart. As might be expected, Liberal Arts I colleges and Research universities show the highest cost per student, \$12,816 and \$12,958, respectively.⁵ The Liberal Arts I colleges' costs are highest primarily because their student/faculty ratios are low (about two-thirds of the others) and because they devote a smaller fraction (37 percent) of AE&G expenditures to instruction than do Research (49 percent), Doctoral (48 percent), or Comprehensive (48 percent) institutions. As we reported in Table 12.5, the selective liberal arts institutions spend more than twice as much per student on student services, institutional support, and internal scholarships as do Research, Doctoral, or Comprehensive universities. These two factors more than overcome the facts that non-full-time faculty instructional expenditures are relatively less and that the average faculty salary at Liberal Arts I colleges is slightly below the national average.

Research universities' costs are high because they pay the highest faculty salaries and because they devote a smaller fraction of instructional expenditures to full-time faculty, by implication employing relatively more non-full-

5. These figures differ from those reported in Table 12.5 above because we are using the 1,804 rather than the 2,045 sample institutions and because the cost per student reported in Table 12.5 for Research universities excludes institutions with on-campus medical schools.

Expenditures per FTE Student, 1987-88

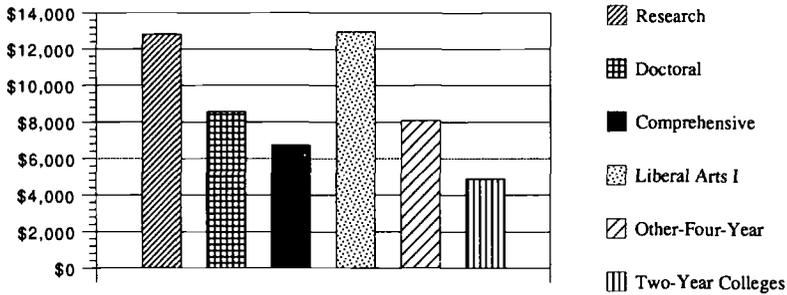


Figure 14.4 AE&G expenditures per student in 1987-88 by Carnegie classification.

Source: Authors' calculation from HEGIS/IPEDS data.

time faculty and other instructional resources. Their student/faculty ratio is only slightly below the national average. At the other extreme, the Two-Year colleges have low expenditures per student, averaging but \$4,903 in 1987-88. The Two-Year schools have low costs primarily because student/faculty ratios are 29 percent higher than the average and because faculty salaries are about 17 percent below the average.

In similar aggregate fashion, we can compare costs across institutions of different size (see Table 14.2). Cost per student is smallest in the under-1,000 size class and rises with enrollment. Faculty salaries increase monotonically with size and the fraction of the instructional budget devoted to full-time faculty salaries falls uniformly with size. These two factors account for most of the strong positive association of cost per student and size. The student/faculty ratio is highest for the 3,000-9,999 size class, where Comprehensives dominate. Non-full-time faculty instructional inputs are relatively more important for larger institutions. The relative importance of noninstructional costs is smaller among the institutions of larger size and so tends to reduce costs at larger institutions, primarily the Research, Doctoral, and Comprehensive institutions. The strong association between size and costs in the aggregate groups primarily reflects the fact that institutions with different missions are clustered at different size levels: liberal arts colleges are small, doctoral universities are large.

14.3 Cost Comparisons across Smaller Groups

The differences in cost patterns among Carnegie classifications, among size classes, and by public/private control, however, may disguise underlying patterns because mission, size, and control often change together. Table 14.3

Table 14.3 Ratios of Dollars to Students, 1987-88, for 24 Groups of Institutions

	Group No.	(A)	(B)	(C)	(D)	(E)	Sample Size
		<u>\$INSTRUCTION</u>	<u>\$FAC SALARIES</u>	<u>\$FAC SALARIES</u>	<u>#STUDENTS</u>	<u>\$AE&G</u>	
		\$AE&G	\$INSTRUCTION	#FACULTY	#FACULTY	#STUDENTS	
Research institutions:							
Public, no medical school	1	.46	.47	41,172	19.6	9,628	36
Public, medical school	2	.50	.33	42,433	19.9	12,865	30
Private, no medical school	3	.46	.41	47,545	13.7	18,264	7
Private, medical school	4	.51	.23	47,500	16.1	24,754	14
Doctoral:							
Public, no medical school	5	.50	.49	36,406	21.0	7,090	47
Public, medical school	6	.48	.36	37,210	21.0	10,229	10
Private, no medical school	7	.44	.45	40,006	19.5	10,272	27
Private, medical school	8	.45	.31	41,067	17.6	16,655	4
Public Comprehensives:							
Under 1,000	9	.45	.50	28,478	18.9	6,778	17
1,000-2,999	10	.46	.54	31,339	19.2	6,537	97

3,000–9,999	11	.49	.56	33,875	20.8	5,980	168
10,000+	12	.56	.53	40,893	22.0	6,320	32
With medical school	13	.55	.27	33,854	22.8	9,975	6
Private four-year:							
Comprehensive under 3,000	14	.40	.49	28,792	19.8	7,527	138
Comprehensive over 3,000	15	.41	.47	34,606	19.8	8,994	49
Comprehensive, medical school	16	.63	.16	36,139	18.0	20,003	2
Liberal Arts I under 1,000	17	.35	.54	30,573	13.2	12,391	35
Liberal Arts I over 1,000	18	.37	.53	35,984	13.9	13,122	85
Other-Four-Year under 1,000	19	.33	.53	23,022	16.5	8,020	227
Other-Four-Year over 1,000	20	.36	.53	26,884	16.5	8,717	57
Public Two-Year:							
Under 1,000	21	.48	.44	25,707	22.1	5,501	198
1,000–2,999	22	.50	.46	27,931	24.4	4,973	288
3,000+	23	.51	.46	33,153	30.6	4,659	149
Private Two-Year:							
All under 3,000	24	.35	.44	22,039	22.5	6,375	81

Source: Authors' calculations from HEGIS/IPEDS data.

Note: Size is measured by 1987–88 full-time-equivalent enrollment. For definitions of variables, see the text.

reports more useful contrasts in costs among groups because it looks at narrower (thus more homogeneous) groups of institutions. The groups here are the same 24 categories described in Table 12.6, here categorizing the sample of 1,804 institutions for which we have faculty and salary data by Carnegie classification, control, size, and presence or absence of a medical school.

The presence of a medical school has a significant effect on cost per student. Among public Research universities, expenditures per student are 34 percent higher for institutions with medical schools compared to those without. Among private Research universities, costs are 36 percent higher where a medical school is present. The difference is even more pronounced among private Doctoral schools, where the presence of a medical school is associated with 62 percent higher costs per student. Costs are higher when medical schools are present primarily because a much smaller fraction of the instructional expenditure goes to full-time faculty salaries, for example, 33 percent with medical versus 47 percent without medical among public Research universities. That is to say, there is a particularly large instructional budget for things *in addition to* full-time faculty at institutions with medical schools. Surprisingly, average faculty salaries, the student/faculty ratio (defined in terms of full-time faculty), and the proportion of AE&G expenditures going to instruction do not differ systematically with the presence or absence of a medical school.

Among Research universities, private institutions have costs per student that average 90 percent higher than their public counterparts without a medical school and 92 percent higher given a medical school. This difference arises because the student/faculty ratio is lower in the privates, because the average faculty salary is higher in the privates, and because the privates use relatively more non-full-time faculty instructional resources. The privates do have a significantly different cost structure than the publics. The public-private cost differences are somewhat less pronounced within the Doctoral category.

Among the public Comprehensive universities, cost is remarkably similar across size classes. Only the six institutions with medical schools have unit costs much above \$7,000 per year. Those with enrollments of 10,000 and over have higher salaries, but they also have somewhat higher student/faculty ratios and devote a significantly higher proportion of AE&G expenditures to instruction, apparently economizing on noninstructional expenditures.

The private four-year colleges divide into three groups. First, the Comprehensives have costs that are somewhat above their public counterparts, \$7,527 for the smaller privates versus \$6,537 for the smaller publics (averaging all the publics under 3,000 students). The privates devote somewhat less of AE&G to instruction and a somewhat smaller fraction of the instructional budget to full-time faculty salaries. Faculty salaries and student/faculty ratios are similar for the private and public Comprehensives. The higher cost of the privates occurs because of the higher use of non-full-time faculty and other instructional resources and relatively more expenditures on student services,

institutional support, and scholarships. Second, the Liberal Arts I group has high costs, averaging \$13,122 per student for those institutions enrolling 1,000 or more students. Liberal Arts I schools have high costs because of their much lower student/faculty ratio, much lower than any other group, and because they commit a larger fraction of AE&G expenditures to student services, institutional support, and internal scholarships (see Table 12.4). Third, the private Other-Four-Year colleges, including less selective liberal arts colleges and small (under 1,500 students) comprehensives, are much lower in cost than are Liberal Arts I institutions, primarily because faculty salaries are about 25 percent lower. Many institutions in the private Other-Four-Year group have strong religious affiliations. For each of the three groups of privates, costs are somewhat lower for the smaller schools because faculty salaries are lower at the smaller schools. The other elements of costs differ little with size within the private four-year school groups.

Among public Two-Year colleges, costs decline moderately with enrollment. The student/faculty ratio rises with enrollment faster than does the average full-time faculty salary. The proportion of AE&G expenditure devoted to instruction rises slightly with enrollment.

Private Two-Year colleges, most of which have enrollments under 1,000 (see Table 12.7), have the lowest faculty salaries of all the groups. The student/faculty ratios are comparable to small, public Two-Year schools. Interestingly, the proportion of AE&G expenditure devoted to instruction is much lower than for the public Two-Year schools. Indeed, the ratio for the private Two-Year colleges is similar to the instruction ratio for the private Liberal Arts I and the private Other-Four-Year groups. The private Two-Year colleges, then, have cost structures that are in some measure like other private institutions and in some measure like public Two-Year schools.

Costs differ remarkably across the different subsectors of higher education in ways that reflect the different missions and markets of the institutions. All four elements of the decomposition are relevant to understanding the differences in costs, but different ratios are important in different comparisons. The broad differences suggest that higher education is not one market but many and, therefore, that different subsectors will likely respond to changing circumstances differently. From the student's point of view, the variety means that consumers have a diverse menu available and can choose higher- or lower-cost institutions offering different levels and combinations of services.

14.4 Behind the Ratios

Decomposing the cost per student into ratios helps explain why costs differ across institutions. The ratios, however, are good guides only when there is little variation in them within the groups, that is, when they truly represent most of the institutions in the group. The usefulness of the ratios can be

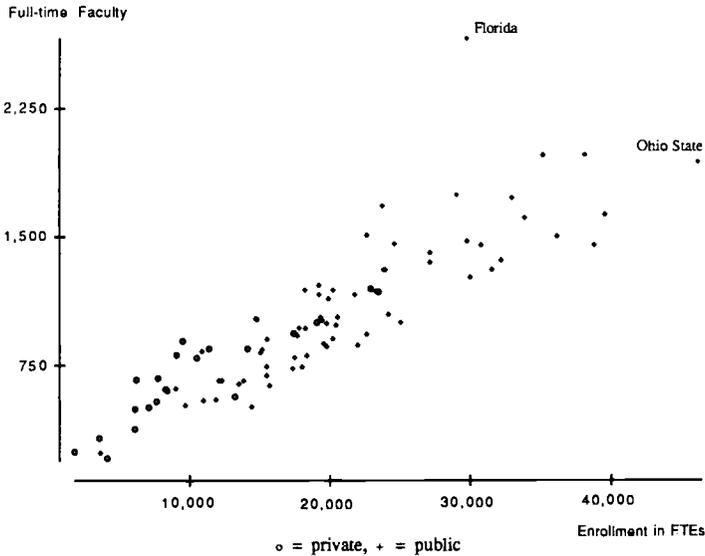


Figure 14.5 Student/faculty scatter for 87 Research universities, 1987–88.

Source: Authors' calculation from HEGIS/IPEDS data.

Note: Each point in the figure represents the number of full-time faculty and the full-time-equivalent enrollment of an individual university. The slope of the ray from the origin to the point is the ratio of faculty to students.

checked by examining scatter plots of the numerators against the denominators of the ratios. Consider first the ratio of full-time faculty to students.

A plot of full-time faculty versus full-time-equivalent enrollment reveals the variation in the ratio of faculty to students across institutions. Figure 14.5 shows the pattern for public and private Research universities. Here we plot faculty on the vertical axis and express the ratio as faculty to students because it makes better sense to view the faculty as the “dependent” variable, faculty being hired to accommodate the number of enrolled students. The ratio of faculty to students is the slope of a ray drawn from the origin to any point. Each point in the diagram represents one of the 87 Research universities among the sample of 1,804 institutions. The circles indicate the private universities. The private universities are generally smaller than the publics. The higher faculty/student ratio for the privates seems to be related to their relatively smaller size. They fit within the overall pattern, which implies that some faculty requirements persist even if enrollment approaches zero.⁶ A sim-

6. Regressing full-time faculty on full-time-equivalent enrollment for Research universities in 1987–88 yields:

$$\text{FACULTY} = 203.17 + 0.041 \text{ ENROLLMENT}$$

(3.91) (17.0)

$R^2 = 0.773$, $df = 85$, and $s = 210.7$. The coefficient implies an incremental student/faculty ratio of 24.4 with a minimum faculty of 203 at zero enrollment. (The numbers in parentheses in this and the following notes are t -ratios. Because only bivariate regressions are reported, the R^2 's are not adjusted for degrees of freedom.)

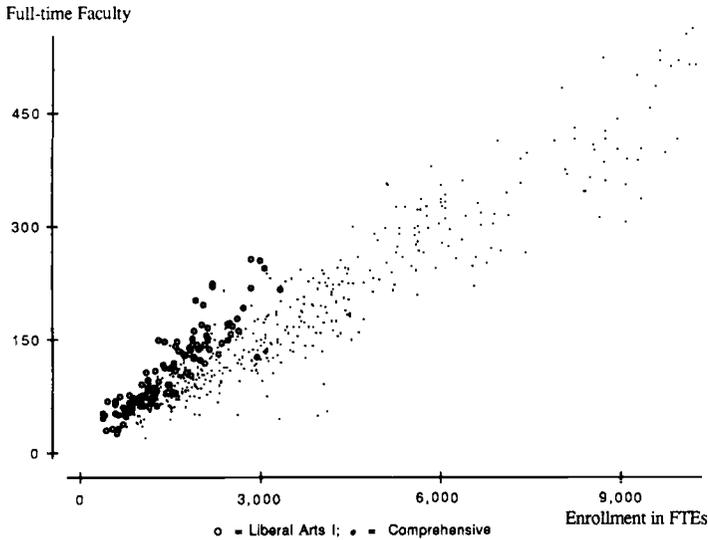


Figure 14.6 Student/faculty scatter for Comprehensive and Liberal Arts I institutions, 1987–88.

Source: Authors' calculation from HEGIS/IPEDS data.

Note: Each point in the figure represents the number of full-time faculty and the full-time-equivalent enrollment of an individual college or university. The slope of a ray from the origin to any point indicates the ratio of faculty to students. The figure is limited to institutions with enrollment under 10,000 for clarity.

ilar scatter for Doctoral institutions (not shown) indicates that private institutions dominate the smaller end of the group and that the privates fit well within the overall pattern.⁷

When private Liberal Arts I colleges are compared with the Comprehensive institutions in Figure 14.6, a significant difference appears.⁸ The diagram is

7. Regressing full-time faculty on full-time-equivalent enrollment for 88 Doctoral universities yields:

$$\text{FACULTY} = 105.154 + 0.0379 \text{ ENROLLMENT}$$

(5.51) (21.4)

$R^2 = 0.842$, $df = 86$, $s = 79.90$. The coefficient implies an incremental student/faculty ratio of 26.4 with 105 faculty members at zero enrollment.

8. Regressing full-time faculty on full-time-equivalent enrollment for 122 Liberal Arts I colleges yields:

$$\text{FACULTY} = 4.435 + 0.0688 \text{ ENROLLMENT}$$

(0.926) (23.4)

$R^2 = 0.820$, $df = 120$, $s = 22.01$. The coefficient implies an incremental student/faculty ratio of 14.5 with four faculty members at zero enrollment. Regressing full-time faculty on full-time-equivalent enrollment for 485 Comprehensive universities yields:

$$\text{FACULTY} = 21.806 + 0.0434 \text{ ENROLLMENT}$$

(6.41) (72.9)

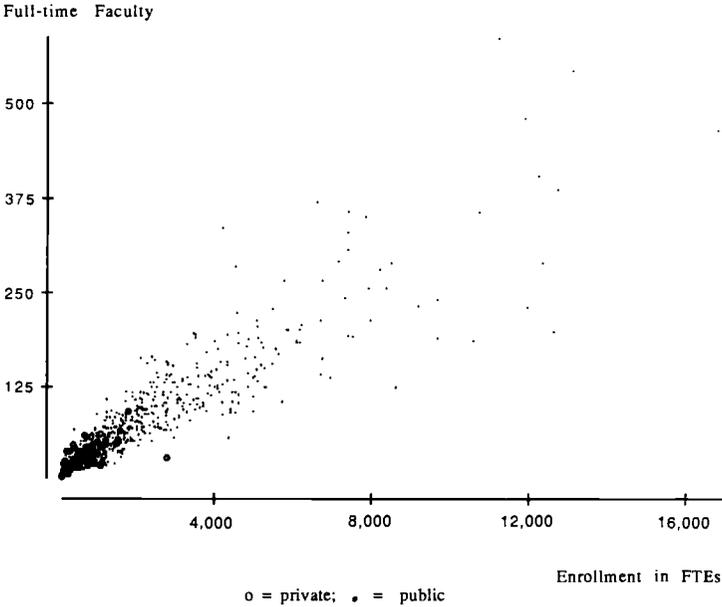


Figure 14.7 Student/faculty scatter for 716 Two-Year colleges, 1987–88.
Source: Authors' calculation from HEGIS/IPEDS data.
Note: Each point in the scatter represents the number of full-time faculty and the full-time-equivalent enrollment of an individual Two-Year college. The slope of a ray from the origin to the point indicates the ratio of faculty to students.

limited to enrollments under 10,000 so that the differences will be clear. The small Liberal Arts I schools have similar enrollments and faculty size as the comparably sized (mostly public) Comprehensives, but, for larger institutions, faculties of the selective liberal arts colleges are proportionately larger than those of Comprehensives.

The scatter for Two-Year colleges in Figure 14.7 tells a different story. The private Two-Year colleges are small and have quite a range of faculty/student ratios. The small public Two-Year colleges have faculty/student ratios that are comparable to the privates; however, the range of the ratio becomes extremely wide for larger-size public Two-Year colleges.⁹ The Milwaukee Area Technical College reported enrollment of 11,227 full-time-equivalent students with

$R^2 = 0.917$, $df = 483$, $s = 47.64$. The coefficient implies an incremental student/faculty ratio of 23 with 22 faculty members at zero enrollment.

9. Regressing full-time faculty on full-time-equivalent enrollment for Two-Year colleges yields:

$$\text{FACULTY} = 15.473 + 0.0297 \text{ ENROLLMENT,}$$

(9.61) (55.4)

$R^2 = 0.811$, $df = 714$, $s = 30.63$. The coefficient implies an incremental student/faculty ratio of 33.6 with a faculty of 15 at zero enrollment.

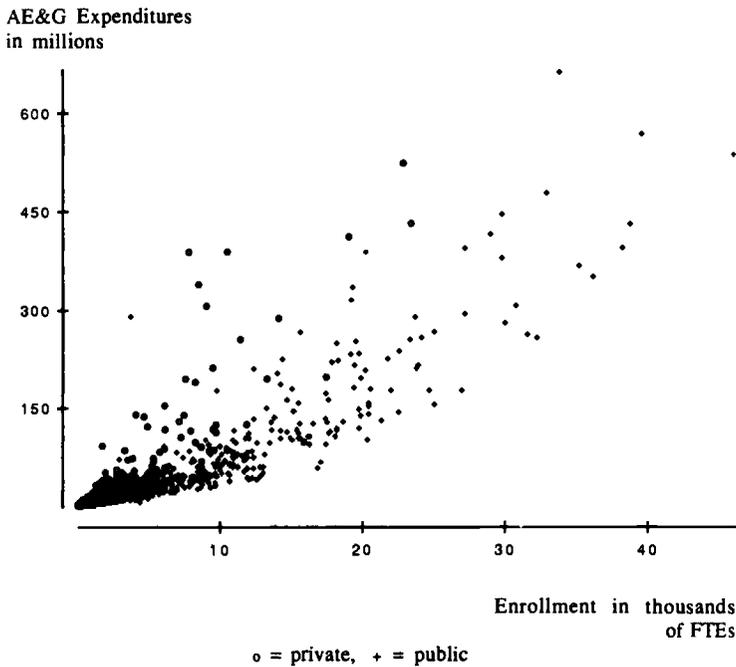


Figure 14.8 AE&G expenditure and enrollment for 1,804 institutions, 1987–88.

Source: Authors' calculation from HEGIS/IPEDS data.

Note: Each point in the figure represents the total expenditure and the full-time-equivalent enrollment at an individual college or university. The slope of a ray from the origin to a point indicates the expenditure per student. Dollar values are in 1987–88 dollars.

586 full-time faculty, while Pima County Community College in Arizona reported 11,977 students with only 231 full-time faculty. The variation in the faculty/student ratio is much wider among Two-Year colleges than in the other groups.

The scatter of faculty against enrollment for all 1,804 schools together (not shown here) also reveals substantial variation.¹⁰ The vast majority of schools are relatively small, and the pattern is linear in the aggregate, with some significant variation. Figures 14.5–14.8 show that private schools generally have lower enrollments and higher faculty/student ratios and that these two facts are linked. The private Liberal Arts I colleges, which seem to have no direct

10. Regressing full-time faculty on full-time-equivalent enrollment for all 1,804 institutions yields:

$$\text{FACULTY} = 1.831 + 0.0474 \text{ ENROLLMENT},$$

$$(0.891) \quad (146.0)$$

$R^2 = 0.922$, $df = 1,802$, $s = 71.22$. The coefficient implies an incremental student/faculty ratio of 21 with two faculty members at zero enrollment.

public counterparts, have a distinct pattern, with higher faculty/student ratios (i.e., lower student/faculty ratios) than any other group. Similarly, the public Two-Year colleges have lower faculty student ratios, although the variation among the Two-Year schools is striking. Note, however, that part-time faculty and graduate teaching assistants, both of which are least prevalent in selective liberal arts colleges, are countervailing forces.

Scatter diagrams also reveal the variation in the other ratios of the decomposition. The total instructional expenditure in each school plotted against AE&G expenditures shows (diagram omitted for brevity) a scatter radiating from the origin clustered tightly along a line.¹¹ The ratio here is a good summary of the relation. In contrast, the aggregate plot of the full-time faculty salary bill against instructional expenditures shows a wide scatter. The ratio here summarizes the relation less well.¹² The plot of total salary bill against the number of faculty shows a tight linear relation.¹³ The salary bill tracks the number of faculty quite well.

The decomposition comes together in Figure 14.8, where AE&G expenditure is plotted against full-time-equivalent enrollment. The slope of a ray from the origin to each point indicates expenditures per student. This scatter shows wide variation.¹⁴ The variation in each of the ratios of the decomposition combines to create substantial dispersion in total expenditure per student. Cost per student varies widely because faculty/student ratios vary and because the faculty salary bill is a widely varying proportion of instructional expenditures. The proportion of AE&G expenditures devoted to instruction shows a degree of constancy over institutions of different sizes and missions, as does the average salary per faculty member. It appears that differences in student/faculty

11. Regressing instructional expenditures on AE&G expenditures for the 1,804 institutions yields:

$$\begin{aligned} \$\text{INSTRUCTION} &= -803,517 + 0.503 \$\text{AE\&G}, \\ &\quad (-7.24) \quad (306.0) \end{aligned}$$

$R^2 = 0.981$, $df = 1,802$, $s = 4,207,652$.

12. Regressing the salary bill for full-time faculty on the total instructional expenditures for the 1,804 institutions yields:

$$\begin{aligned} \$\text{FAC\SALARIES} &= 1,514,842 + 0.333 \$\text{INSTRUCTION}, \\ &\quad (13.9) \quad (103) \end{aligned}$$

$R^2 = 0.854$, $df = 1,802$, $s = 417,664$.

13. Regressing the full-time faculty salary bill on the number of full-time faculty for the 1,804 institutions yields:

$$\begin{aligned} \$\text{FAC\SALARIES} &= -1,134,608 + 42,372.6 \text{ FACULTY}, \\ &\quad (-23.6) \quad (273) \end{aligned}$$

$R^2 = 0.976$, $df = 1,802$, $s = 1,681,320$.

14. Regressing AE&G expenditure on enrollment for the 1,804 institutions yields:

$$\begin{aligned} \$\text{AE\&G} &= -7,044,495 + 10,232.7 \text{ ENROLLMENT}, \\ &\quad (-8.39) \quad (132.9) \end{aligned}$$

$R^2 = 0.767$, $df = 1,802$, $s = 29,093,083$.

ratios and differences in the use of non-full-time faculty and other instructional resources have more to do with differences in the level of expenditure per student than do either faculty salaries or the allocation of resources between instruction and the other functions of colleges and universities. In short, the two main reasons why costs per student differ across categories of institutions are (1) differences in student/faculty ratios and (2) differences in non-full-time faculty and other instructional resources.

The extent of this variation would seem to be consistent with broad, competitive markets. Colleges and universities are differentiated by location, mission, and size and in other ways that induce each of them to develop a different production structure. The wide variation in faculty/student ratio seems inconsistent with the Baumol/Bowen fixed factor proportion theory, at least in its simple formulation. The wide variation in the proportion of instructional expenditure devoted to full-time faculty salaries also suggests that institutions have found different combinations of inputs that meet particular needs. The high degree of variation in the structure of costs might be consistent with institutions fitting themselves into niches, each with a unique demand curve and cost structure. A better understanding, however, will come from examining changes in the elements of cost over time.

14.5 What Caused Costs to Change over the 1980s?

How did the elements of the cost decomposition change over the last decade? Our HEGIS/IPEDS data provide observations on each of the 1,804 institutions at four points in time: 1978–79, 1983–84, 1985–86, and 1987–88. From these data, we compute an average annual growth rate for each of the five elements of the decomposition:¹⁵ AE&G expenditure, instructional expenditures, full-time faculty salary bill, number of full-time faculty, and full-time-equivalent enrollment. The three elements measured in dollars are deflated by the gross national product (GNP) implicit price deflator¹⁶ so that the discussion will be in terms of dollars of constant 1987–88 purchasing power. The average annual rates of change are computed in the aggregate for each group of schools shown in the tables.¹⁷

The average annual rates of change from 1978–79 to 1987–88 for the five aggregates are shown in Table 14.4 by control, Carnegie classification, and enrollment size class. From 1978–79 to 1987–88, AE&G expenditures grew by an average of 3.6 percent per year in real dollars at all institutions, 3.2

15. Estimating the trend growth rates via a semilogarithmic regression uses all four years of survey data we have available. The estimated trend is less dependent on the specific values in the earliest and latest years than if we simply calculated the trend from the end points.

16. In Chapter 12 above, we discuss the selection of GNP implicit price deflator.

17. The aggregate change in a category can be thought of as the geometric mean of the rates of change (more properly, one plus the rate of change) in the individual schools in the category. It weights institutions according to their size; thus, larger schools play a role in the analysis proportional to their size.

Table 14.4 Average Annual Real Growth Rates, 1978-79 to 1987-88^a

Group	(A) \$INSTRUCTION	(B) \$FACSALARIES	(C) #FACULTY	(D) #STUDENTS	(E) \$AE&G	Sample Size
All institutions	3.20	2.10	.53	.89	3.60	1,804
By control:						
All public	2.89	1.89	.36	.92	3.16	1,078
All private	4.11	2.78	1.06	.78	4.78	726
By Carnegie group:						
Research	3.53	2.33	.42	.67	3.76	87
Doctoral	2.91	2.26	.59	.86	3.41	88
Comprehensive	3.06	2.11	.66	1.05	3.42	485
Liberal Arts I	3.75	2.65	.82	.40	5.02	122
Other-Four-Year	2.24	1.25	.65	.74	3.41	306
Two-Year	2.88	1.46	.32	.99	3.32	716
By size group ^b						
Under 1,000	2.89	1.49	.72	1.02	3.69	557
1,000-2,999	3.31	2.13	.79	1.06	3.99	671
3,000-9,999	3.19	1.96	.51	.86	3.56	426
10,000-19,999	3.40	2.35	.58	.97	3.57	111
20,000+	2.95	2.12	.12	.61	3.38	39

Source: Authors' calculations from HEGIS/IPEDS data.

Note: For definitions of variables, see the text.

^aAll dollar values were deflated to 1987-88 with the GNP implicit price deflator.

^bSize is measured by 1987-88 full-time-equivalent enrollment.

percent at public institutions, and 4.8 percent at private institutions. Instructional expenditures grew less quickly than AE&G. Colleges and universities were committing a larger proportion of AE&G to functions other than instruction by the end of the period. The shift was more pronounced among private institutions. The bill for full-time faculty salaries (in real terms) grew more slowly than instructional expenditures. Instructional expenditures other than the salary of full-time faculty took up the slack. The GNP deflator increased by 5.2 percent per year over this period. Faculty salaries grew more slowly at public schools than at privates. The number of faculty grew by 1.1 percent annually at privates and by 0.4 percent per year at public schools, on average. Enrollments, however, grew slightly faster at public institutions: 0.9 versus 0.8 percent per year. The ratio of students to faculty went up at the publics and down at the privates because enrollment grew faster than faculty in the publics but more slowly than faculty in the privates. Table 14.5 reports the rates of change for the 24 detailed groups of institutions.

The rate of change in a ratio is the rate of change of the numerator minus the rate of change of the denominator. Thus, the rates of change of the five elements reported in Table 14.4 can be used directly to compute the rates of change in the associated ratios of the decomposed expenditures per student. Using the rates of change of the components as the starting point makes clear

the sources of change in each ratio. For example, the student/faculty ratio may change because of change in the number of students, change in the number of faculty, or both. Tables 14.6 and 14.7 report the annual rate of change in the ratios used in the decomposition of costs for the various groups of colleges and universities over the period 1978–79 to 1987–88.

Table 14.6 shows the annual rate of change in each of five ratios. The rate of change in the cost per student (AE&G/full-time-equivalent enrollment) is the negative of the sum of the rate of change in the four ratios of the decomposition (counting the rate of change in salary per faculty member negatively). The letters in the equation correspond to the columns of table 14.6 and 14.7, where lower-case letters represent changes:

$$\begin{array}{rcc}
 e & = & c \\
 \% \Delta \left[\frac{\$AE\&G}{STUDENTS} \right] & = & \% \Delta \left[\frac{\$FACSALARIES}{FACULTY} \right] \\
 - & a & - & b & - & d, \\
 - \% \Delta \left[\frac{\$INSTRUCT}{\$AE\&G} \right] & - & \% \Delta \left[\frac{\$FACSALARIES}{\$INSTRUCT} \right] & - & \% \Delta \left[\frac{STUDENTS}{FACULTY} \right],
 \end{array}$$

where $\% \Delta$ refers to the annual percentage rate of change in the ratio.

Overall, AE&G expenditure per student increased on average by 2.7 percent per year over the period for the 1,804 institutions examined here. In the aggregate, the student/faculty ratio increased by 0.4 percent annually, a modest increase that would tend to reduce costs.¹⁸ The average real salary increased by 1.6 percent per year on average in the aggregate, a rate three-fifths of the rate of increase in expenditure per student. The decrease in the proportion of AE&G going to instruction has increased costs somewhat. This represents added noninstructional expenditures and just about balances the cost savings derived from higher student/faculty ratios.

A larger source of cost increases is the decrease in the proportion of instructional expenditures going to the salaries of full-time faculty. This is consistent with the popular belief that institutions began relying more on part-time faculty during the 1980s. Included in this category are fringe benefits, the salaries of part-time faculty,¹⁹ and instructional costs other than the compensation of faculty (e.g., secretarial, technical, and support staff, personal computers, travel, communications, duplicating, and supplies).²⁰ In the aggregate during

18. A detailed investigation of student/faculty ratios in the 1950s and 1960s also found a positive trend at that time (Radner 1976, 415–44).

19. If fringe benefits for faculty are about 20 percent of salaries, fringe benefits of the full-time faculty might account for 15 percent of the instructional expenditures other than the salary of full-time faculty. That part-time faculty have played an important and growing role in instruction is made clear in n. 2 above.

Table 14.5 Average Annual Real Growth Rates, 1978–79 to 1987–88 for 24 Groups of Institutions

	Group No.	(A) \$INSTRUCTION	(B) \$FACSALARIES	(C) #FACULTY	(D) #STUDENTS	(E) \$AE&G	Sample Size
Research institutions:							
Public, no medical school	1	3.11	2.02	.30	.79	3.37	36
Public, medical school	2	3.09	2.42	.39	.42	3.40	30
Private, no medical school	3	4.82	3.09	.50	1.17	5.23	7
Private, medical school	4	4.98	3.35	.93	1.10	4.98	14
Doctoral:							
Public, no medical school	5	2.59	2.01	.51	1.01	2.75	47
Public, medical school	6	2.84	1.89	.36	.98	3.40	10
Private, no medical school	7	3.50	2.99	.95	.32	4.50	27
Private, medical school	8	3.82	3.22	.78	1.13	4.74	4
Public Comprehensives:							
Under 1,000	9	4.03	1.88	1.01	1.55	3.66	17
1,000–2,999	10	2.83	1.55	.36	1.37	2.61	97
3,000–9,999	11	2.41	1.65	.44	1.09	2.50	168

10,000 +	12	2.96	2.44	.32	.86	3.25	32
With medical school	13	4.34	1.94	.29	2.00	5.15	6
Private four-year:							
Comprehensive under 3,000	14	4.08	2.95	1.67	1.36	4.83	138
Comprehensive over 3,000	15	3.94	3.04	1.43	.38	5.18	49
Comprehensive, medical school	16	6.78	4.57	2.89	1.79	6.52	2
Liberal Arts I under 1,000	17	3.15	1.80	.54	-.11	4.21	35
Liberal Arts I over 1,000	18	3.87	2.79	.88	.46	5.22	85
Other-Four-Year under 1,000	19	2.11	1.02	.59	.72	3.29	227
Other-Four-Year over 1,000	20	2.33	1.65	.79	.46	3.89	57
Public Two-Year:							
Under 1,000	21	3.31	1.72	.61	1.41	3.79	198
1,000–2,999	22	2.87	1.61	.48	1.10	3.26	288
3,000 +	23	2.72	1.25	.02	.81	3.14	149
Private Two-Year:							
All under 3,000	24	4.42	2.64	1.67	1.50	4.94	81

Source: Authors' calculation from HEGIS/IPEDS data.

Note: Size is measured by 1987–88 full-time-equivalent enrollment.

*All dollar values were deflated to 1987–88 with the GNP implicit price deflator.

Table 14.6 Average Annual Real Rate of Change in Ratios of Decomposition, 1978-79 to 1987-88*

Group	(a)	(b)	(c)	(d)	(e)
	\$INSTRUCTION \$AE&G	\$FACSALARIES \$INSTRUCTION	\$FACSALARIES #FACULTY	#STUDENTS \$FACULTY	\$AE&G #STUDENTS
All institutions	-.40	-1.10	1.57	.36	2.71
By control:					
All public	-.26	-1.00	1.53	.55	2.24
All private	-.67	-1.33	1.73	-.28	4.00
By Carnegie group:					
Research	-.23	-1.20	1.91	.25	3.08
Doctoral	-.50	-.65	1.67	.27	2.55
Comprehensive	-.36	-.95	1.45	.40	2.37
Liberal Arts I	-1.27	-1.10	1.83	-.42	4.62
Other-Four-					
Year	-1.17	-.99	.60	.09	2.67
Two-Year	-.44	-1.42	1.14	.67	2.33
By size group ^b					
Under 1,000	-.80	-1.41	.77	.30	2.67
1,000-2,999	-.68	-1.18	1.34	.27	2.93
3,000-9,999	-.38	-1.23	1.45	.35	2.71
10,000-19,999	-.18	-1.05	1.77	.39	2.61
20,000+	-.43	-.83	1.99	.48	2.77

Source: Difference in rates calculated from Table 14.4.

Note: Columns here provide the rates of change in the ratios given in equivalent columns in Table 14.2.

*All dollar values were deflated to 1987-88 with the GNP implicit price deflator.

^bSize is measured by 1987-88 full-time-equivalent enrollment.

this period, faculty salaries led the increase in expenditure per student, with instructional costs other than the salaries of full-time faculty second and non-instructional expenditures third.

Rates of growth in expenditure per student by Carnegie group are displayed in Figure 14.9. The highest rate of increase was in the Liberal Arts I colleges, with Research universities being a distant second. There is no systematic association between the rate of change in cost and the size of the institutions (see Table 14.6). Costs increased at the Liberal Arts I colleges in part because of a decrease in the student/faculty ratio, which is consistent with a view that selective liberal arts colleges were attempting to differentiate themselves further during the 1980s by offering more quality (at a higher price). The decline in the student/faculty ratio at selective liberal arts colleges occurred as both the number of students and the number of faculty grew; the number of faculty

20. Hansen and Guidugli (1990, 157) report an increase in the ratio of nonfaculty professional employees to faculty members at colleges and universities from 1975 to 1983. Their data, however, do not distinguish between those nonfaculty professionals counted in instructional expenditures and those who fill other functions such as computer center and library employees.

Average Annual Rate of Growth

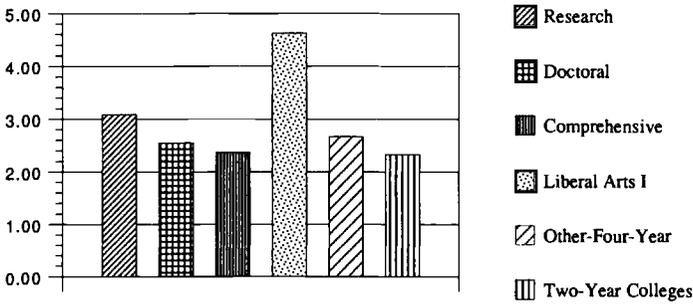


Figure 14.9 Average annual real growth rates in expenditures per full-time-equivalent student, 1978–79 to 1987–88.

Source: Authors' calculation from HEGIS/IPEDS data.

just grew faster. The privates, led by the Research universities and the Liberal Arts I colleges, experienced a large shift toward non-full-time-faculty expenditures in the instructional budget, an important source of increase in costs in all types of institutions. Two-Year colleges experienced the largest rate of increase in the student/faculty ratio, 0.7 percent per year.

The average salary per full-time faculty member grew in all categories even when viewed in constant dollars. Clearly, salaries for full-time faculty have been a significant element in the overall increase in expenditures per student. This result is consistent with the view of universities as clubs, captured and operated for the benefit of the incumbent faculty and administration. However, the outcome is equally consistent with competition in the labor markets for faculty. The growth in real salaries in the 1980s countered the decline in real faculty salaries in the 1970s.²¹ Hansen attributes the decline in real faculty salaries during the 1970s primarily to institutional factors in the public sector. It is not clear how or why those institutional forces may have reversed in the period 1978–79 to 1987–88 (Hansen 1990, 80–112). If the faculty and administrators utility-maximization explanation is to hold up, it must explain both the decline and the increase in real salaries. Viewing salaries as determined

21. Faculty salaries declined in real terms through the 1970s and rose through the 1980s, as reported in U.S. Department of Education (1989, table 192, p. 213). We deflate the average salary of full-time instructional faculty by the GNP implicit price deflator:

	Average Nominal Salary	Salary in 1987–88 Dollars
1972–73	13,850	34,437
1975–76	16,634	32,072
1979–80	21,367	29,757
1984–85	30,447	33,247
1987–88	36,011	36,011

Table 14.7 **Average Annual Real Rates of Change in Ratios of Decomposition, 1978–79 to 1987–88***

Group	No.	(a)	(b)	(c)	(d)	(e)
		\$INSTRUCTION	\$FACSALARIES	\$FACSALARIES	#STUDENTS	\$AE&G
		\$AE&G	\$INSTRUCTION	#FACULTY	\$FACULTY	#STUDENTS
Research institutions:						
Public, no medical school	1	-.26	-1.09	1.72	.49	2.58
Public, medical school	2	-.31	-.67	2.03	.03	2.98
Private, no medical school	3	-.40	-1.74	2.59	.67	4.06
Private, medical school	4	.00	-1.63	2.42	.17	3.88
Doctoral:						
Public, no medical school	5	-.16	-.57	1.50	.50	1.74
Public, medical school	6	-.56	-.95	1.53	.62	2.42
Private, no medical school	7	-1.00	-.50	2.04	-.64	4.18
Private, medical school	8	-.92	-.60	2.43	.35	3.61
Public Comprehensives:						
Under 1,000	9	.37	-2.15	.88	.55	2.11
1,000–2,999	10	.22	-1.29	1.18	1.01	1.24
3,000–9,999	11	-.09	-.76	1.21	.65	1.41

10,000 +	12	-.30	-.52	2.12	.54	2.39
With medical school	13	-.81	-2.39	1.66	1.71	3.15
Private four-year:						
Comprehensive under 3,000	14	-.75	-1.13	1.28	-.32	3.47
Comprehensive over 3,000	15	-1.24	-.90	1.61	-1.05	4.80
Comprehensive, medical school	16	.26	-2.21	1.68	-1.10	4.74
Liberal Arts I under 1,000	17	-1.07	-1.35	1.26	-.66	4.33
Liberal Arts I over 1,000	18	-1.34	-1.09	1.90	-.42	4.76
Other-Four-Year under 1,000	19	-1.18	-1.09	.43	.13	2.57
Other-Four-Year over 1,000	20	-1.57	-.68	.86	-.33	3.44
Public Two-Year:						
Under 1,000	21	-.48	-1.59	1.11	.80	2.38
1,000-2,999	22	-.39	-1.26	1.13	.62	2.16
3,000+	23	-.41	-1.47	1.24	.80	2.32
Private Two-Year:						
All under 3,000	24	-.52	-1.78	.97	-.18	3.45

Source: Differences in rates calculated from Table 14.5.

Note: Size is measured by 1987-88 full-time-equivalent enrollment. Columns here provide the *rates of change* in the ratios given in equivalent columns in Table 14.3.

*All dollar values were deflated to 1987-88 with the GNP implicit price deflator.

by markets can explain both increases and decreases. (See the discussion of the market for faculty in Part II of this volume.) The highest rate of increase in salary per faculty member occurred among the Research universities, a finding consistent with institutions oriented toward prestige, bidding up salaries for "brand name" faculty members. The lowest rate of increase in faculty salaries was among the Other-Four-Year group. These colleges invested relatively more heavily in noninstructional services and held student/faculty ratios nearly steady over the period.

Looking at the more disaggregated groups of institutions reported in Tables 14.5 and 14.7 reveals that enrollment in the private Research universities grew more rapidly than the number of full-time faculty, so the student/faculty ratio increased even in the private Research universities. Student/faculty ratios fell in private Doctoral universities without medical schools, in all but one of the groups of private four-year colleges, and in the private Two-Year schools. The character of instruction at many private schools seems to differ from that in the publics, and the gap is widening.

Although the structure of costs is significantly different in universities with medical schools, the rates of change in costs do not appear to be systematically different. Cost per student increased at about the same rate in institutions with medical schools as in those without.

Cost per student increased least at mid-sized public Comprehensive universities, those with enrollments between 1,000 and 9,999. In those institutions, the student/faculty ratio increased much faster than average, and real salary per faculty member grew relatively more slowly than in many other groups. It appears that, in mid-sized Comprehensives, class sizes grew and faculty salaries lagged behind.

Public Two-Year colleges with enrollments over 1,000 had relatively low rates of increase in costs per student during the period. Student/faculty ratios rose by about 0.7 percent per year, and faculty salaries grew by 1.2 percent annually in real terms, a rate well below average. To a degree, these changes offset the decline in the proportion of the instructional budget going to full-time faculty salaries. Two-Year colleges, like all other groups, shifted expenditures within the instructional category away from salaries for full-time faculty.

Our overall impression of the changes in costs is one of institutions responding to environmental pressures. Faculty salaries grew significantly in real terms but at different rates in different groups of institutions. Student/faculty ratios rose, except in that part of the private sector where they are an important element in the quality that attracts students. Institutions seem to have shifted resources toward instructional expenditures other than full-time faculty. The number of nonfaculty professional employees grew relative to the number of faculty at colleges and universities from 1975 to 1983 (Hansen and Guidugli 1990). Computer professionals and laboratory staff are examples of

categories of employees that increased more quickly than faculty. The number of part-time faculty also grew faster than the number of full-time faculty (see n. 2 above). The substitution of other professional employees and part-time faculty for full-time faculty seems counter to the Baumol/Bowen hypothesis that factor proportions are fixed in service industries like higher education. Expenditures other than instruction increased for most categories of institutions. Colleges and universities displayed a significant degree of flexibility in adapting the production methods over the period 1978–79 to 1987–88.

14.6 Behind the Change in Ratios

A scatter diagram of the rate of growth of the numerator of a ratio against the rate of growth of the denominator reveals how well the aggregate rate of change in the ratio describes the behavior of the individual institutions. Consider first the rate of change in the student/faculty ratio for Research universities shown in Figure 14.10. The average annual rate of growth of the faculty is plotted on the vertical axis, and the average annual rate of growth in enrollment is shown on the horizontal. If the student/faculty ratio remained constant, the scatter of points would fall along an upward-sloping 45-degree line through the origin. (The scales on the two axes are the same for the line of stable change to be literally at 45 degrees; when the scales differ, our reference is to a figurative 45-degree line.) Institutions with rising student/faculty ratios will be below the 45-degree line; those with declining student/faculty ratios will be above. Looking at the scatter diagram of rates of change allows us to see whether institutions collectively exhibit a particular pattern of change in the student/faculty ratio.

The rates of change in student/faculty ratio shown for Research universities in Figure 14.10 do not conform to a single pattern.²² Some of the schools fall along the 45-degree line through the origin, with Wayne State, at the bottom left, having experienced significant declines in both faculty and enrollment; Kansas State had nearly stable faculty and enrollment, and North Carolina State University had significant growth in both enrollment and faculty. These three and many others kept the student/faculty ratio nearly constant. In contrast, Oklahoma State had growth in faculty and declines in enrollment, while Nebraska had growing enrollments and declines in faculty.²³ Taken together, the overall pattern shows a wide variety of experience. Changes in the size of

22. Regressing the average annual growth rate in faculty on the annual growth rate in enrollment for 87 Research universities yields:

$$\text{FACULTY GROWTH RATE} = \underset{(0.248)}{0.000332} + \underset{(6.12)}{0.572} \text{ ENROLLMENT GROWTH RATE,}$$

$R^2 = 0.306$, $df = 35$, $s = 0.0104$.

23. An optimist would say that the quality of instruction has increased at Oklahoma State while Nebraska got more efficient. A pessimist might say that Oklahoma State became less efficient while the quality of instruction at Nebraska deteriorated.

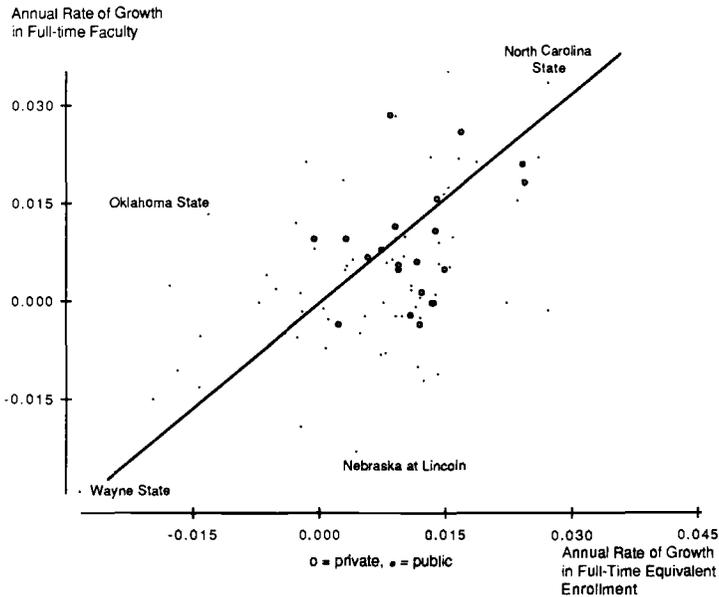


Figure 14.10 Average annual growth rates of faculty and enrollment for 87 Research universities, 1978–79 to 1987–88.

Source: Authors' calculation from HEGIS/IPEDS data.

Note: Each point represents the average annual rate of growth from 1979 to 1988 in number of full-time faculty and in full-time-equivalent enrollment at an individual university. The slope of a ray from the origin to a point indicates the rate of change in the ratio of faculty to students. The 45-degree line indicates those points where the ratio of faculty to students remains constant.

the faculty do not seem to be tightly linked to changes in enrollments among Research universities. Private universities show somewhat less variation than publics. Because Research universities receive so much revenue from federal grant programs, attract so many philanthropic dollars, and generally have significant endowments, the lack of strong association between faculty and enrollment should be expected and may indeed be desirable. These are, generally, not enrollment-driven universities.

The rates of change in the student/faculty ratio for Doctoral institutions (not shown) exhibit little pattern.²⁴ About as many institutions are above the 45-degree line as below. More institutions had growth than decline in both enrollment and faculty, but the association between the growth rates of the two is not strong. In distinct contrast, the rate of change in faculty is closely asso-

24. Regressing the annual growth rate in faculty on the annual growth rate in enrollment for 88 Doctoral universities yields:

$$\text{FACULTY GROWTH RATE} = 0.00374 + 0.473 \text{ ENROLLMENT GROWTH RATE,}$$

(2.38) (5.61)

$$R^2 = 0.268, \text{ df} = 86, s = 0.0136.$$

ciated with the rate of change in enrollments among Comprehensive universities (diagram not shown).²⁵ Except for a few outliers who experienced sharp declines in faculty, the Comprehensives show a relatively compact pattern that sticks close to the 45-degree line. The rate of change in full-time faculty is associated with rates of change in full-time-equivalent enrollments. The Comprehensive universities are enrollment driven, and the funding formulas used by state legislatures likely enforce that characteristic.

The Liberal Arts I group (diagram not shown) exhibits a much more disperse pattern, with little association between growth in enrollment and growth in faculty. More than half the Liberal Arts I colleges are above the 45-degree line, indicating that they generally experienced falling student/faculty ratios.²⁶ The Two-Year colleges also show remarkable variation in the rates of change in enrollments, from schools with enrollments falling at 5 percent per year to institutions with enrollments growing at over 10 percent per year (diagram not shown).²⁷ Because the geographic market for individual Two-Year colleges is small, such colleges may be particularly sensitive to local demographic change, as when a military base closes. The rates of change for faculty also show considerable variation. The number of faculty and students seems to be much more volatile at Two-Year institutions than at the other types.

Having examined the changes in student/faculty ratios in some detail, we use the same approach to examine changes in all the ratios used to decompose costs per student. The rate of change in AE&G expenditures is plotted against the rate of change in enrollments for all 1,804 institutions in Figure 14.11. The scatter is dispersed but generally has a positive slope; total costs have tended to rise where enrollments are rising.²⁸ The slope is less than one, how-

25. Regressing the average annual growth rate in faculty on the average annual growth rate in enrollment for 485 Comprehensive universities yields:

$$\text{FACULTY GROWTH RATE} = 0.00333 + 0.557 \text{ ENROLLMENT GROWTH RATE}$$

(3.70) (19.3)

$R^2 = 0.437$, $df = 483$, $s = 0.0182$.

26. Regressing the average annual growth in faculty on the average annual growth rate in enrollment for 122 Liberal Arts I colleges yields:

$$\text{FACULTY GROWTH RATE} = 0.00706 + 0.353 \text{ ENROLLMENT GROWTH RATE}$$

(4.82) (3.99)

$R^2 = 0.117$, $df = 120$, $s = 0.0158$.

27. Regressing the average annual growth in faculty on the average annual growth rate in enrollment among 716 Two-Year colleges yields:

$$\text{FACULTY GROWTH RATE} = 0.00082 + 0.489 \text{ ENROLLMENT GROWTH RATE}$$

(0.790) (15.7)

$R^2 = 0.256$, $df = 714$, $s = 0.0260$.

28. Regressing the average annual growth rate in AE&G expenditures on the average annual growth rate in enrollment for the 1,804 institutions yields:

$$\text{\$AE\&G GROWTH RATE} = 0.0235 + 0.676 \text{ ENROLLMENT GROWTH RATE}$$

(35.4) (31.4)

$R^2 = 0.354$, $df = 1,802$, $s = 0.0266$.

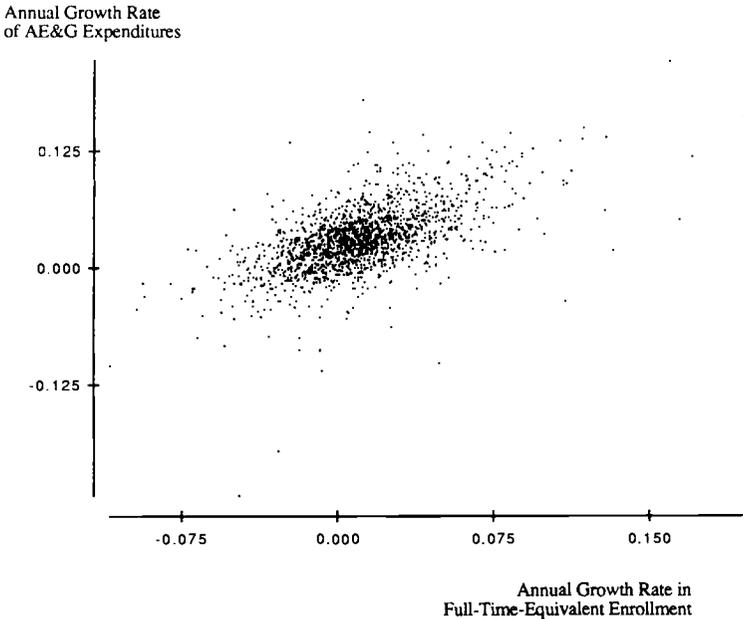


Figure 14.11 Average annual real growth in AE&G expenditure and enrollment in 1,804 institutions, 1978–79 to 1987–88.

Source: Authors' calculation from HEGIS/IPEDS data.

Note: Each point represents the average annual growth rate in AE&G expenditures and in full-time-equivalent enrollment for an individual college or university. The slope of a ray from the origin to the point indicates the rate of change in expenditures per student. Points falling along a 45-degree line indicate no change in the expenditure per full-time-equivalent student. Dollar values are in 1987–88 dollars.

ever, showing that AE&G expenditures per student are increasing less rapidly at the growing institutions and more rapidly at institutions experiencing enrollment declines.²⁹ The relation between the rate of change in instructional expenditures and AE&G expenditures is tighter and more strongly positive (diagram not shown).³⁰ This is consistent with the tighter relation seen in the *levels* of instructional expenditures and the level of AE&G. In contrast, the relation between the rate of change in instructional expenditures and the rate of change in the salary bill for full-time faculty shows no strong pattern (dia-

29. See the discussion of enrollment change in Chapter 13.

30. Regressing the average annual growth rate in instructional expenditures on the average annual growth rate in AE&G expenditures for all 1,804 institutions yields:

$$\text{INSTRUCTION GROWTH RATE} = 0.0164 + 0.665 \text{ \$AE\&G GROWTH RATE}$$

(31.3) (57.2)

$$R^2 = 0.645, df = 1,802, s = 0.0164.$$

gram not shown).³¹ The greatest diversity among colleges and universities is in this cost element, revealing considerable variability in how institutions deliver instructional services.

The growth in the number of full-time faculty and the growth in the total deflated salary bill show a very clear relation. The tight scatter is only slightly steeper than a 45-degree line (diagram not shown).³² The salary bill is growing slightly faster than the number of faculty over the period for all the institutions taken together.

Finally, the rate of change in the student/faculty ratio for all 1,804 institutions appears in Figure 14.12.³³ Although the variation is wide, the pattern shows some significant positive association. The rate of change in enrollments has some association with the rate of change in number of faculty. The relation between enrollment and faculty is much sharper within Carnegie groups than in the aggregate.

14.7 Summary

At the beginning of Part III, we asked why costs in higher education increased so rapidly. We found that costs per student increased by 2.7 percent per year faster than the general price level from 1978–79 to 1987–88, among all the 2,045 colleges and universities examined in Part III, as well as among the 1,804 institutions examined in this chapter. This rate of increase is significant, so our initial question is a compelling one.

We described six among many possible hypotheses about why costs in higher education may increase faster than the general price level. Having reviewed the structure and pattern of change in costs, we return to address this question directly.

Two of the hypotheses concern whether the market for higher education is

31. Regressing the average annual growth rate in the full-time faculty salary bill on the average annual growth rate in instructional expenditures for the 1,804 institutions yields:

$$\begin{aligned} \$\text{FACSALARIES GROWTH RATE} &= -0.0054 + 0.688 \$\text{INSTRUCTION GROWTH RATE} \\ &\quad (-5.46) \quad (32.0) \end{aligned}$$

$R^2 = 0.363$, $df = 1,802$, $s = 0.0251$.

32. Regressing the average annual growth rate in the full-time faculty salary bill on the average annual growth rate in the number of faculty for the 1,804 institutions yields:

$$\begin{aligned} \$\text{FACSALARIES GROWTH RATE} &= 0.0112 + 1.027 \# \text{ FACULTY GROWTH RATE,} \\ &\quad (37.7) \quad (101) \end{aligned}$$

$R^2 = 0.851$, $df = 1,802$, $s = 0.0121$.

33. Regressing the average annual growth rate in faculty on the average annual growth rate in full-time-equivalent enrollment for the 1,804 institutions yields:

$$\begin{aligned} \# \text{ FACULTY GROWTH RATE} &= 0.0028 + 0.545 \text{ ENROLLMENT GROWTH RATE,} \\ &\quad (4.77) \quad (29.0) \end{aligned}$$

$R^2 = 0.318$, $df = 1,802$, $s = 0.0233$.

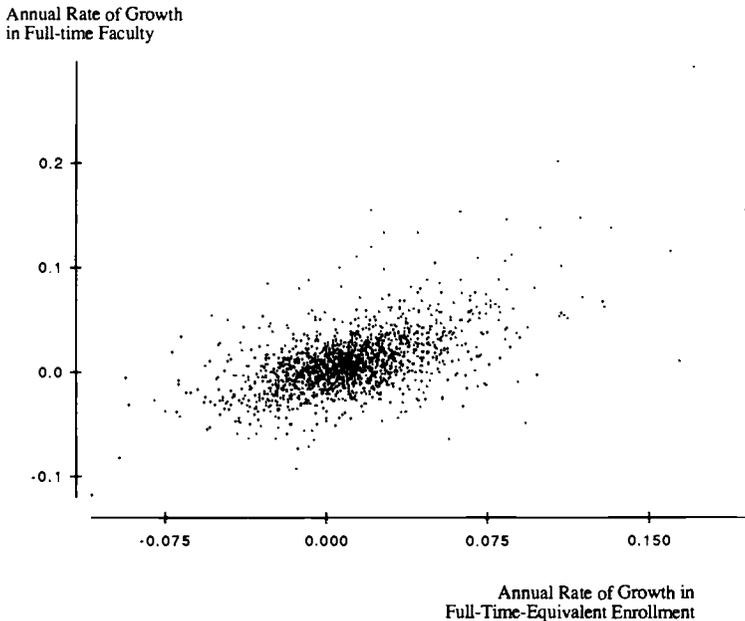


Figure 14.12 Average annual growth in number of faculty and enrollment for 1,804 institutions, 1978–79 to 1987–88.

Source: Authors' calculation from HEGIS/IPEDS data.

Note: Each point represents the rate of growth in full-time faculty and in full-time-equivalent enrollment for an individual college or university. The slope of a ray from the origin to a point indicates the rate of change in the faculty/student ratio. Points along a 45-degree line show no change in the ratio.

competitive, the hypothesis concerning faculty and administrators' quest for salary and status and the hypothesis concerning the quality of management. The most striking finding here is that one-third of the institutions suffered declines in enrollment even as overall enrollment in higher education grew. That so many institutions could lose enrollment gives strong indication that market forces bear heavily on institutions of higher education. Where institutions fall out of favor with their customers, or where demographic shifts lead students elsewhere, institutions face loss of revenues both from tuition and, for public institutions, from state grants, which are often linked by formulas to enrollment level. The marketplace, then, imposes its discipline. Institutions that do not deliver services that a sufficient number of students find attractive must change course or suffer decline. The very evident prospect of enrollment decline limits the opportunity for faculty and administration to capture the institutions or for institutions to tolerate weak management.

Three hypotheses assumed competition. During the 1980s, demand for higher education increased, leading to a larger number of students served and to an increase in the cost per student, as would be expected with a demand

increase in a competitive market with an upwardly sloped supply curve. The supply may slope upward because some important input, like faculty, is relatively scarce. As the demand for higher education increases, the derived demand for the most important input, faculty, also increases, causing a rise in average salaries. The evidence here found that faculty salaries increased by 1.6 percent per year above the rate of increase in the general price level over the period 1978–79 to 1987–88, so the finding is consistent with the supply of higher education having an upward slope because faculty salaries increase to draw more people into the professoriate.³⁴

The supply of higher education might be yet more steeply sloped and cause an increase in demand to push costs still higher because of the difficulty of substituting less expensive for more expensive inputs, the Baumol/Bowen hypothesis. That is to say, if other inputs could be substituted for full-time faculty as their salaries increased, total cost per student need not increase quite as fast as faculty salaries. We find that some substitution away from full-time faculty occurred during the 1980s, as real faculty salaries rose. In the aggregate, the student/faculty ratio increased by 0.4 percent per year. The proportion of the instructional budget devoted to the salaries of full-time faculty declined by 1.1 percent per year. These findings show a degree of substitutability, presumably manifested through changes in class sizes and use of part-time faculty and teaching assistants. We conclude that some substitution for faculty did occur, so the increase in faculty salaries and the cost of higher education were mitigated to a degree.

A final competitive hypothesis suggests that consumers are seeking a higher-quality product and that the extra cost reflects the higher quality. We find that elements of AE&G expenditures other than instruction grew faster than instructional expenditure. These cost elements include institutional support, student services, and academic services. Cost increases in these areas could be associated with efforts to enrich the educational experience and so yield improved product. Of course, increased fund-raising, marketing and recruiting efforts, and self-funded financial aid also affect this ratio, so the proper interpretation is ambiguous. Among the private four-year schools, we see decreases in the student/faculty ratio that contribute to well-above-average rates of increase in costs. These changes are readily interpretable as institutions supplying a demonstrably higher-quality service at a higher cost.

When demand is increasing for both quantity and quality, cost in higher education will be likely to continue to increase. The demand for higher education is considered in detail in Part I of this volume, and a decrease in demand is possible in the 1990s (see Chapter 5). If demand were to decrease, the implication for cost may not be entirely symmetric. We would expect the rate of increase in faculty salaries to be less than the rate of increase in the

34. Table 10.6 above, along with the associated discussion, makes clear the many ways in which the supply of faculty adjusts to changing relative scarcity as reflected in salaries.

general price level, as occurred during the 1970s. The rate of increase in total costs would thus be damped. However, we observed that individual institutions with declining enrollments tend to have higher costs per student than other similar institutions. Colleges and universities have many fixed costs, obligations that persist for some considerable period of time even when enrollments decline. To avoid these fixed costs, institutions must restructure significantly, including, for some, closing down. Such adjustments are slow and difficult, especially in the public sector, where political decisions are involved. Therefore, we expect that a decrease in demand, as might be caused by demographic shifts, recession, or declines in the relative returns to a college education, will cause the rate of growth in higher education costs to be only modestly slower.