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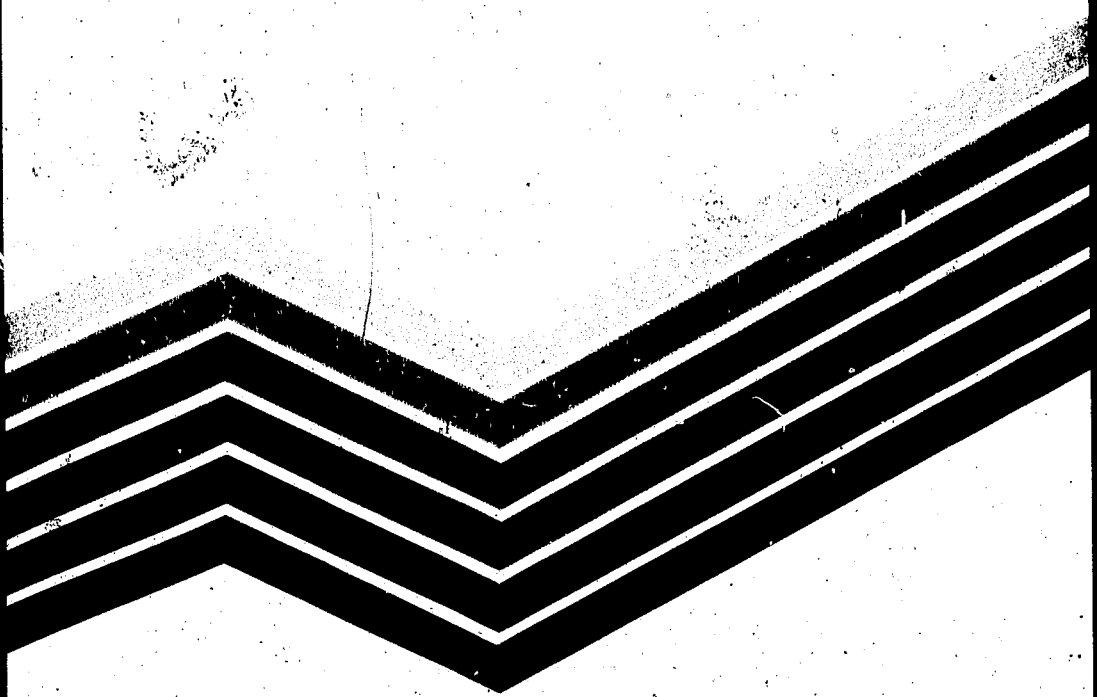
by
D. Kent Halstead



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FOREWORD

The National Commission on the Financing of Postsecondary Education has recommended that indicators be developed for assessing the comparative financial health of educational institutions. Kent Halstead's study belongs to a growing body of literature that is responding to the Commission's recommendations.

The Commission and others have noted that few if any current measures of inflation in higher education exist, and that no single government or private agency maintains the sort of statistical indicators we take for granted in the measurement of economic and business performance. Why are special indicators needed to measure the financial health of colleges and universities? Why must specialized indicators of inflation be developed?

Higher education is a service industry. A key element of service occupations is that they are labor-intensive in their method of production, and as a result, the rate of productivity improvement often is slow or nonexistent. Although the economics of service industries has been given considerable attention, our national economic policy is generally derived from theories or notions that center on manufacturing. Thus, the task of measuring productivity in higher education is a special and relatively untouched problem involving qualitative and quantitative changes in human input and output.

Another special problem is our understanding of what should be the economics of non-profit organizations. Although postsecondary education counts among its members proprietary profit-seeking institutions, higher education as a whole is a nonprofit industry whose objectives to this date have not been defined in generally accepted quantitative terms. Furthermore, there still reigns some confusion and disagreement on what the objectives of education should be.

Finally, the methods of financing higher education differ significantly from those of commercial enterprises. The structure of expenditures also differs markedly from those encountered in industry and business. Thus, the financing of colleges and universities, both on the side of revenues and expenditures, requires specialized nomenclatures.

One key finding of all recent higher education inflation studies is that colleges and universities have experienced considerably more erosion of purchasing power than has the general consumer. Although this is not surpris-

ing to insiders, the public has some difficulty assimilating this fact. The reason lies in the composition of the institutional market basket which differs substantially from the purchases of the average family. The absence of an official and credible measure of inflation in higher education makes it difficult to argue this point convincingly.

Furthermore, the lack of an institutional price index has affected adversely the design of State and Federal policy for higher education. Among other things, the underestimation of inflation has tended to lead to underfinancing. It is only recently that State and Federal agencies have begun to realize that despite ever-increasing appropriations and program expansion, little improvement has been made in the real resources expended per student.

Dr. Halstead refers early in his study to some other path-breaking efforts. If anything, he understates the urgency that has been manifesting itself all around. During the last 2 years alone, a wealth of unpublished work has been done by college administrators in connection with budget and long range planning, and by graduate students in more theoretical studies. State planning and coordinating agencies also have done extensive professional work in trying to come to grips with the problem of inflation in higher education.

Those of us who have toiled in this particular vineyard share a sort of double vision. On the one hand, we are pleased that others around us have taken up the challenge and are pushing forward both the methodology and our understanding of how inflation has been affecting higher education. At the same time, we are struck by a common sense of disappointment at the transient and unofficial character of most of these independent efforts. Some public policymakers have criticized sharply the higher education community for not producing enough useful information that would help to formulate appropriate public policy. Maybe the Halstead study can help convince these individuals that the measurement of higher education inflation is an important enough task for *ongoing, permanent,* and *official monitoring* by a *public agency.* The time for ad hoc studies is surely past—the moment for implementing the recommendations made by the National Commission on the Financing of Postsecondary Education is at hand. If Dr. Halstead's effort can speed this action it will have served higher education well.

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INTRODUCTION

Price changes are important to both producers and consumers in higher education. Producers—colleges and universities—seek to maintain program levels and quality by adjusting their expenditures to keep pace with price changes. Student consumers are concerned with adequately financing their education based on expected tuition and board and room charges. The importance of price changes has long been recognized by educators to the extent that several efforts have been made to compile price data in index form.[1] These compilations were usually made as a one-time effort by individuals with limited resources. Past studies have made little attempt to consistently report price-index information that could be relied upon with confidence by the higher education community. The purpose of this study and its succeeding editions is to report higher education price information on a *continuing* basis until a more formal effort in this direction is initiated by the Federal Government or by interested private organizations.

The author is indebted to a number of organizations that made available data essential to the completion of this study. In particular, I would like to recognize the contributions of the American Association of College and University Professors, the Boeckh Division of the American Appraisal Company, the Bureau of Economic Analysis, the Bureau of Labor Statistics, the National Center for Educational Statistics, the National Science Foundation, and the University of Wisconsin System. The author also wishes to thank Dr. G. Richard Wynn whose careful critique of a draft of this study resulted in many improvements.

[1] For an early survey of price index compilations see William Wasserman, *Education Price and Quantity Indexes,* Syracuse University Press, Syracuse, New York, 1963, pp. 110–127.

For two recent index compilations see June O'Neill, *Resource Use in Higher Education,* Carnegie Commission on Higher Education, Berkeley, Calif., 1971 (Appendix B: "Price Indexes for Instructional Operating Expenditures"), and G. Richard Wynn, *Inflation Indicators in Liberal Arts Colleges,* this is available from Xerox University Microfilms (Order No. 75–1399), P.O. Box 1307, Ann Arbor, Mich. 48106. See also "Inflation in the Higher Education Industry," *Professional File,* Vol. 6, No. 1, January 1975, National Association of College and University Business Officers, One Dupont Circle, Washington, D.C. 20036.

The Bureau of Economic Analysis prepares, but does not publish, a "deflator for private higher education and research."

The Uses and Limitations of Price Indexes

A price index series measures the effects of price change, and price change only, on a fixed group of consumer items. The change in price index values from year to year may be interpreted as the change in resources required to offset the effects of inflation in buying the same kinds and amounts of goods and services previously purchased. For example, if the index series shows a yearly price increase of 6.5 percent, expenditures of $1 million in the first year must be increased by an additional $65,000 in the second year to purchase the *same* resources.

A price index, if compiled and published regularly, serves many useful functions. Most importantly, index values may be projected to estimate the degree of change in *expenditure* levels that will be necessitated by any anticipated price changes. The projected indexes are used to inflate expected "real resource" needs to equal required actual dollar future funding requirements. For example, suppose that on the basis of a trend in price index values, college and university officials conclude that faculty salaries and the cost of supplies, materials, and other education inputs will increase by about 6 percent for the next 3 years. This information permits persuasive argument for across-the-board increases in State appropriations of at least 6 percent per year to provide equivalent (constant dollar) fixed inputs to the educational process. Of course other effects, such as change in enrollment, a need to purchase new types of equipment, and the addition of programs, also would have to be considered in arriving at estimates of total expenditure requirements. However, it is helpful for budget officers to know what increase in education expenditures is necessary merely to offset inflation in buying the resources used in previous years.

Past expenditures may be compared with movements in a price index to ascertain whether expenditures have kept pace with price level changes. For example, suppose that during the past 5 years current operating expenditures per full-time-equivalent (FTE) student in a State public higher education system increased by 4 percent each year, but a relevant education price index increased 6 percent. Since the index is designed to measure the overall price change in representative inputs of fixed quantity and quality, this comparison suggests that a decline has occurred in the ratio of education inputs to students. This may have caused some deterioration in the quality of education being provided, curtailed certain programs, necessitated greater operating efficiency, or caused some combination of these actions which would permit lower unit operating expenditures. In any case the index will have served to indicate a disparity between increases in prices and in expenditures, the significance of which warrants investigation.

Similarly, price indexes may be used to deflate dollar *incomes* to identify trends in funding from different sources in terms of their level of real

purchasing power. For example, tuition charges or State appropriations used for educational and general purposes by colleges and universities may be deflated by the Higher Education Price Index (HEPI) to determine the extent that income from these sources has increased to offset the effects of inflation on institutional buying power.[2] Furthermore, specialized relevant subindexes may be used to deflate either incomes or expenditures used for particular purposes. Thus, endowment income restricted for new library volumes could be converted to constant purchasing power by using the price series for books and periodicals. The new acquisition budget could be deflated in the same manner.

Price indexes are used as devices to provide for automatic adjustment in administrative and contractual transactions. Escalator clauses in union contracts have long been used to provide for automatic adjustments in wage ranges to match changes in the Consumer Price Index (CPI). In a like manner, education price indexes or subindexes could be utilized to account for fluctuations in purchasing power by making automatic adjustments in State appropriations to public colleges and universities or in explaining or justifying increases in tuition at public or private institutions. Similar adjustments might also be made in student-aid grants to offset rising tuition charges.

In each of these uses the employment of a fixed weight index fails to correct for changes in the scope and composition of the expenditures estimate, whatever the cause. The form of the index holds constant *all* factors other than price change that might affect the level of expenditures. The mix of inputs, and implicitly the mix of programs, is held constant by fixed weights corresponding to the various categories of inputs in the base period. To the extent that faculty and researchers from year-to-year use *different* pedagogy, analyses, instruments, equipment, and materials, or employ different mixes of personnel to accomplish objectives, use of a fixed weight index *fails* to price current actual practice. Also, the price index does not account for changes in the mix of students; e.g., an increase over time in the proportion of graduate to undergraduate students and the associated higher overall per-student costs would *not* be reflected by a price index series.

Another characteristic of a price index is that it reflects a pattern of consumption for a group of consumers and not the individual. Also, price indexes are slow to respond to changes in the consumer's pattern of con-

[2] For an example of this type of analysis involving per-student income in actual and constant dollars from five sources (student tuition and fees, Federal Government appropriations, State and local government appropriations, endowment income, and private gifts), by control and type of institution, for academic years 1965–66 through 1971–72, see D. Kent Halstead, *Statewide Planning in Higher Education*, U.S. Department of Health, Education, and Welfare, Office of Education, U.S. Government Printing Office, Washington, D.C. 1974 (Appendix C, "College and University Financial Data").

sumption. These characteristics make price indexes least valuable to individual consumers whose buying patterns differ markedly from the norm and for those consumers who frequently alter what they purchase in response to changing needs and tastes.

To keep these limitations in mind, it is helpful to describe the index series as a "*fixed input* price index." Remembering this description further directs attention away from outputs and productivity changes which are *not* considered unless reflected in production-costs or transaction prices.

The most common misuse of price indexes is to apply them to data or situations they were not designed to cover. The real need in many instances to convert actual or current-dollar figures to a constant-dollar basis and the easy mathematical operation involved tempts many persons unfamiliar with price indexes to select any available index for that purpose. They may rationalize their choice in the mistaken belief that prices of all items move more or less uniformly in the economy. Such is not the case, however, with the many goods and services in our economy showing considerable variability in price patterns. Thus, an index or subindex designed to measure the overall price change in a given grouping of items *cannot* be applied indiscriminately to other groupings. As a case in point, the readily available Consumer Price Index (CPI) is often employed in the field of education without justification to convert per student expenditures from an actual to a constant-dollar basis. The goods and services priced by the CPI are those purchased by families of city wage earners and salaried clerical workers and differ fundamentally from a schedule of inputs for an education price index. The bulk of education purchases is for personnel services of faculty, where price (salary) increases, until recently, have been greater than in classes of commodities represented heavily in the overall Consumer Price Index. Thus, application of the CPI in this totally irrelevant fashion results in erroneous and misleading data.

It is extremely difficult to develop a true price index for any given set of inputs. The persistent and nearly irresolvable problem is that of eliminating the effect on prices of quality changes in the commodities and services purchased. Not only does this conceptual problem exist, but as importantly, for pricing the purchases of academic institutions there are limitations arising from an inadequate data base. In particular, few institutions report expenditures by object classification, data essential for accurate weighting of index item categories. Notwithstanding these difficulties, the price indexes and price trends presented in this study provide useful statistical tools for calculating "constant purchasing power dollars" in the respective areas reported. Specifically designed for higher education, the indexes are far superior to substitute proxy indexes such as the Consumer Price Index or the gross national product (GNP) explicit deflator which are intended for entirely different purposes.

Expenditure Grouping for Pricing Purposes

For institutional purchases, reference to the organization of college and university expenditures shown in the following table assists in understanding how academic activities have been grouped for pricing purposes.

Organization of College and University Expenditures: 1972–73

	(Amount in millions)
CURRENT FUND EXPENDITURES	$27,947
Educational and general	21,071
*General administration and student services	3,711
*Instruction and departmental research	9,241
*Extension and public service	170
*Libraries	841
*Plant maintenance and operation	2,140
*Organized activities of educational departments	791
Sponsored research[1]	2,394
*Government sponsored programs for students	1,283
Student aid	1,322
Major public service programs (hospitals, federally funded R&D centers)	2,217
Auxiliary enterprises	3,337
PLANT FUND EXPENDITURES	4,645
Land	178
Buildings	2,827
Equipment[2]	1,640

*Expenditure categories which in total are priced by the Higher Education Price Index (HEPI).

[1] Includes $555 million spent for separately budgeted research performed by research institutes, bureaus, and agricultural experiment stations.

[2] Includes $679 million current fund expenditures for equipment.

Source: Paul F. Mertins and Norman J. Brandt, **Financial Statistics of Institutions of Higher Education, Current Funds Revenues and Expenditures, 1972–73,** U.S. Department of Health, Education, and Welfare, Office of Education, U.S. Government Printing Office, Washington, D.C., 1975.

The varied nature of these activities and the need for distinctive price information in certain key areas suggest the need for separate pricing in at least three divisions—*educational and general* current operations, *sponsored research* (R&D), and *plant fund* expenditures. The purchasing value over time of *student aid* may be determined by the price indexes for the student consumer. No attempt has been made here to price institutional expenditures for *major public service programs* or for *auxiliary enterprises* because of their secondary role and because they are generally self-supporting; i.e., charges are set equal to costs.

Of greatest importance to institutions are price trends affecting educational and general current operations; i.e., instruction and departmental research, library, general administration, student services, sponsored programs for students, activities of educational departments, and physical

plant operation and maintenance. Goods and services purchased by colleges and universities for these operations—mainly faculty teaching and research, administration, secretarial and clerical services, fringe benefits, supplies and materials, equipment, utilities, books, communication, and data processing—are priced independently and in composite form as a Higher Education Price Index (HEPI). In calculating the index, price changes for the various items are averaged together with weights which represent their relative importance in the spending of all colleges and universities in 1971–72. Index numbers are computed on the base 1966–67 = 100.

A second index reports price trends affecting sponsored research and development activities at universities. Items purchased by academic R&D expenditures and priced by the index include the research services of professional and nonprofessional personnel, fringe benefits, supplies and materials, equipment, data processing, transportation, and other services which can be directly related and charged as current costs to research projects. Overhead charges or indirect costs are excluded from the price index framework because of data limitations.

A third price index for institutions reports prices for building construction and equipment purchased through expenditures of plant funds. The price series for new construction is compiled by the Boeckh Division of the American Appraisal Company and is based on a detailed bill of quantities of material and labor required for constructing apartments, hotels, and office buildings with allowances for contractors' overhead and profit.

For students, price trends for tuition and board and room are reported in total and separately by type and control of institution attended.

Because of considerable confusion regarding the nature and appropriate uses of price indexes, readers are encouraged to review the material in chapter I on price index theory and computation before utilizing the data presented in chapters II through V.

Taxonomy of Higher Education Price Data

This study reports price trends affecting a number of activities of American colleges and universities as well as price trends in institutional charges to students. The taxonomy of price indexes and price trends presented is outlined below. The price data are summarized in table 1 and graphically illustrated in figure 1.

PRICE INDEXES OF PURCHASES BY INSTITUTIONS

- **Price Index of Goods and Services Purchased by Colleges and Universities Through Current Fund Educational and General Expenditures**

(Excluding Sponsored Research) (Abbreviated HEPI for Higher Education Price Index)

- **Price Index of Goods and Services Purchased by Universities Through Current Direct Expenditures for Sponsored Research and Development** (Abbreviated R&DPI for Research and Development Price Index)

HEPI and R&DPI component subindexes:

PERSONNEL COMPENSATION

1.0 Professional salaries
- 1.1 Faculty
- 1.2 Research associates**
- 1.3 Graduate assistants
- 1.4 Other professional, nondoctoral**
- 1.5 Extension and public service personnel*
- 1.6 Administration and institutional services personnel*
- 1.7 Library personnel*

2.0 Nonprofessional wages and salaries
- 2.1 Technicians
- 2.2 Craftsmen
- 2.3 Clerical
- 2.4 Students
- 2.5 Service*
- 2.6 Operators and laborers*

3.0 Fringe benefits

CONTRACTED SERVICES, SUPPLIES, AND EQUIPMENT

4.0 Services
- 4.1 Data processing and equipment rental
- 4.2 Communication
- 4.3 Transportation
- 4.4 Printing and duplication
- 4.5 Miscellaneous services
- 4.6 Consultants and other professional**

5.0 Supplies and materials

6.0 Equipment (current fund expenditures only)

7.0 Books and periodicals*

8.0 Utilities*

*Subindex used for HEPI only.
**Subindex used for R&DPI only.

- **Price Index of Building Construction and Equipment Purchased by Colleges and Universities Through Plant Fund Expenditures**

Subindexes:

New construction

Equipment

PRICE DATA AND PRICE INDEXES OF PURCHASES BY STUDENTS

- **Price Index of Resident Undergraduate Student Tuition—Public/ Private Institutions**

  (Abbreviated TPI for Tuition Price Index)

  Amount and index of student tuition, room and board charges

  Amount and index of resident undergraduate student tuition

  Amount and index of room and board charges (7-day basis)

  NOTE.—These three-price series are presented separately for the three types of institutions—university, 4-year college, and 2-year college—in both the public and private sectors.

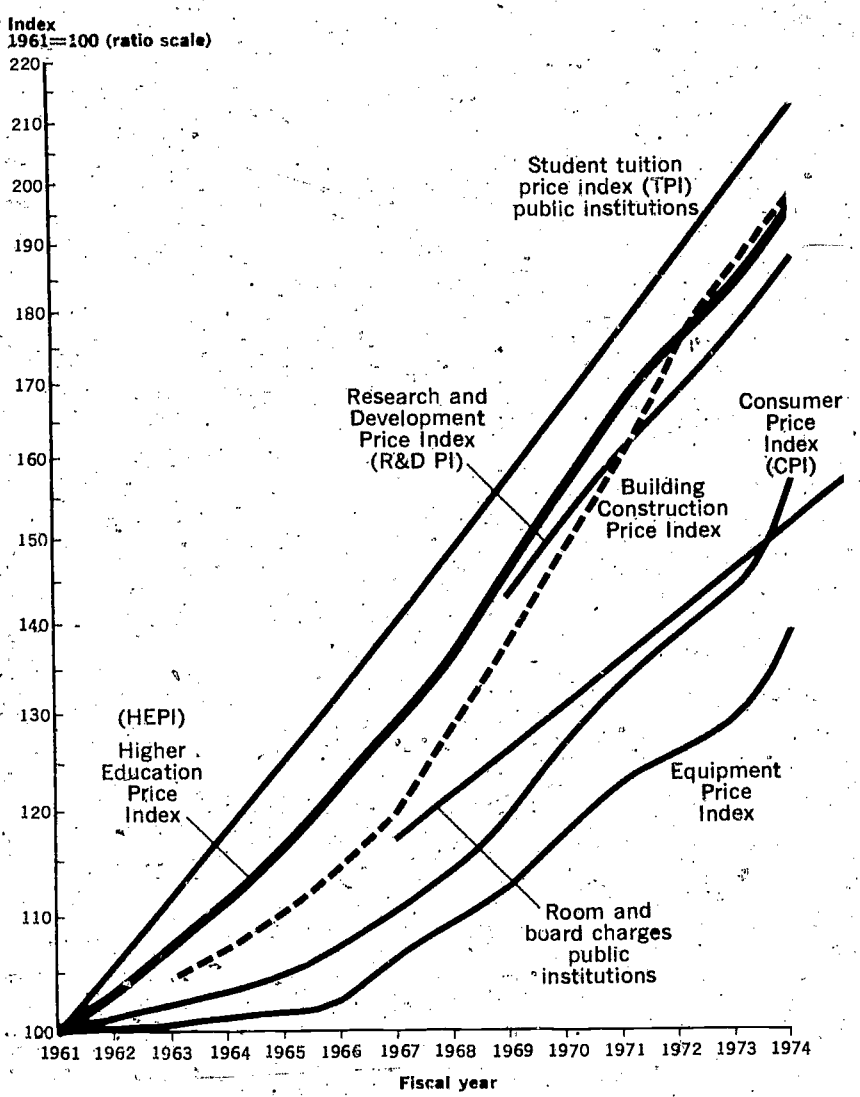
Table 1

Higher education price indexes for current operations, research and development, building construction, equipment, student tuition, and room and board charges, and national indicators of inflation, fiscal years 1961–74.

Fiscal year	Higher education price index (HEPI)	R&D price index (R&DPI)	Physical plant price indexes		Student tuition price index (TPI)		Room and board charges		Consumer price index (CPI)	Wholesale price index (WPI)
			Building construction	Equipment	Public institutions	Private institutions	Public institutions	Private institutions		
1961	77.7	79.1	83.4	94.0	72.8	76.3	85.4	81.5	90.5	94.7
1962	80.5	81.4	85.2	94.0	.....	.....	.....	.....	91.4	94.7
1963	83.6	84.2	87.2	94.5	.....	.....	.....	.....	92.4	94.7
1964	86.8	87.3	89.4	95.1	.....	.....	.....	.....	93.7	94.6
1965	90.5	90.8	92.1	95.3	.....	.....	.....	.....	94.9	95.7
1966	95.0	94.7	95.5	96.3	.....	.....	.....	.....	97.1	98.2
1967	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1968	106.0	105.5	107.3	103.1	.....	.....	.....	.....	103.3	101.1
1969	113.2	112.3	115.5	105.8	.....	.....	.....	.....	108.3	104.3
1970	121.0	119.3	124.0	110.4	.....	.....	.....	.....	114.7	108.7
1971	128.7	126.3	134.7	115.5	.....	.....	.....	.....	120.7	112.0
1972	135.8	133.0	145.7	117.9	.....	.....	.....	.....	125.1	116.2
1973	142.8	139.1	154.8	121.5	.....	.....	.....	.....	130.0	125.4
1974	152.8	148.1	165.3	131.0	153.7	143.8	134.1	131.1	141.6	145.6

Figure 1.

—Comparison of trends in price change in higher education current operations, research and development, building construction, equipment, student tuition, and room and board charges, with the Consumer Price Index, fiscal years 1961–74.



Note.—The vertical axis is expressed on a ratio or logarithmic scale; i.e., equal vertical distances reflect equal proportional (as distinguished from absolute) changes.

CHAPTER I.

INDEX NUMBER THEORY AND COMPUTATION

Prices can be measured either in units fixed at the point at which transactions take place or in terms of the utility or satisfaction the consumer expects to derive from his purchase. The first approach reports the prices of goods and services as per contract between the buyer and seller since this is the only point at which the value of purchases is settled and measureable. A pure *price* index follows this technique in reporting the changes in prices of a *fixed* group of goods and services of *constant quality*. The second approach attempts to report, as a lower price, any increase in consumer *satisfaction* brought about by improvements in product quality. The idea is to substitute a measure of benefit for the item unit in which the transaction was made. Thus, tires, for example, would be priced on a cost-per-mile basis rather than the price per tire. A *cost* index uses this approach in reporting the change in total money expenditure a consumer must make to maintain a *constant* level of *utility* from the purchase of a group of products. Shifts are made in the quantities purchased so as to maintain the constant utility level most economically in each period.

While these abbreviated descriptions appear simple, the concepts involved are not and require explanation. Further, if the measurements are to be used properly, the distinctions between them must be accurately understood. The distinction requiring greatest clarification is that dealing with quality changes—a pervasive problem in measuring economic phenomena.

General Concepts

An *index* number measures changes in prices, wages, employment, et cetera by showing the percentage variation from an arbitrary standard, usually 100, representing the status at some earlier time. A *price* index measures the average change in price of goods and services purchased by a particular group of consumers. The *amount* and *quality* of the selected commodities that comprise the market basket being indexed must remain *con-*

stant so that only the effects of price changes are reflected. Under these restrictive conditions, the price index (in actuality its reciprocal) is a measure of the purchasing value of money.

For consumers, both the quantity and the quality of items purchased, as well as the amount spent on each, tend to change. Goods once included in the budget may no longer be needed. Items not previously in existence may have been added. Some items may be substituted for others. Changes of this kind must have no effect on price index values. When new products are introduced and old ones dropped, the discontinuity is overcome within limits by factoring out the price differences due to the substitution. This procedure called "linking" is explained on pages 18–20 of this chapter. Products are also continually redesigned to modify or improve their quality. A price index reports such changes only if higher producer costs or product prices are involved; improvements that cannot be measured in dollars and cents are ignored. The price differential of a quality improvement is determined by comparing at a common moment in time the relative market prices between the old and the new improved product versions.

It is sometimes difficult to accept the fact that a price index does not take into account changes in product quality and in consumer satisfaction other than those measured as a directly related increase in market price or production cost. But there is no statistically reliable way at present to measure a person's needs or the degree to which these needs are satisfied by particular goods or services. Economic welfare, and in our case educational welfare, as a measurable idea, must currently be restricted to reporting the amount of goods and services purchased per capita, with the implication that the more purchased the better off the individual. Without a means of measuring the value or return on educational purchases, it is impossible to estimate, as is required for pricing, what constitute equivalent educational returns or outputs over time. Consequently, if intangible utility considerations were introduced, it would inject a wide element of subjective judgment that would destroy the useful economic analysis the price index now provides.

There are, of course, certain instances where product value or utility can be measured and taken into consideration by the benefit conscious consumer. Under very limited conditions an attempt may be made to measure the change in money expenditure a consumer must make to maintain a constant level of satisfaction. Such a measurement, generally called a *cost* index, usually involves only a single product or narrow group of products.[1] A cost index for more sophisticated computers, for example, would

[1] An example of a subjectively estimated "cost" type index is the poverty index prepared by the Bureau of the Census. This index, which focuses on the U.S. Department of Agriculture's Economy Food Plan, reflects the different consumption requirements of families based on their size and composition, sex and age of the family head, and farm or nonfarm residency. See U.S. Department of Commerce, Bureau of the Census, *Revision in Poverty Statistics, 1959 to 1968*. Current Population Reports, Special Studies, Series T–23, No. 28, Washington, D.C., Aug. 12, 1969.

report the decrease in unit data processing costs for a series of improved models, whereas a price index would report only changes in price for a given computer. If new insulated jackets are warmer, a cost index measures changes in price for a fixed number of warmth units, while a price index reports the change in price for a specific jacket. While these cost/fixed-benefit ratios are of great value to the consumer, they report only one of many values the consumer seeks and pays for, and for most goods and services even such limited benefit measurements are not possible.

A special circumstance is the pricing of new building construction. The intention is to establish the cost of a *completed* hypothetical structure by pricing a fixed list of labor and material *inputs*. However, new materials and assembly techniques have improved construction efficiency over the years—a type of input quality change. These improvements in productivity are taken into account by pricing inputs per unit of completed or in-place construction. This topic is discussed in some detail in chapter IV, pages 95–97.

More extended treatment of index theory is provided by the bibliographical references. In particular, the Bureau of Labor Statistics' *Handbook of Methods*, Wasserman's *Education Price and Quantity Indexes*, and the very informative articles in the *Monthly Labor Review* are recommended for initial reading.

The Problem of Quality Changes

In the simplest sense, it is possible to obtain an unambiguous measure of true price change only by comparing prices for the *same* goods available in the current year as they existed in the base year. When the quality of some goods has changed, or some new products have been substituted for old ones, these changes should be reflected in a price index only when it results in a price change for the base year goods. It is a fact, however, that any group of goods and services cannot long be kept constant for the quality and design of the products are changed from time to time. Thus, there is a continuing unavoidable problem in computing a pure (fixed input) price index of how to properly account for the changing characteristics of the inputs being priced.

In practice, this accounting is accomplished by application of two rules. The first rule is: **Changes in quality should be measured by the difference in production costs (including profit) from units of unchanged quality; or, if both qualities continue to be produced simultaneously, by the difference in their prices.** This added cost of product improvement is considered an *output* increase and is *not* counted as a price increase. As an example, suppose the single new feature of a given typewriter model is an automatic carriage return. This quality improvement must be assessed

by the additional cost it involves, independently of any change in the posted price of the typewriter. The additional cost is counted as a change in output. If the price in the year in question has changed by a different amount than the cost of the improvement, the difference would constitute a true price change. The price may be lower if typewriter manufacturers are taking the occasion to pass on to the consumer the savings in costs achieved through productivity increases. It may be higher if prices are being affected by inflationary forces.

Products may also be improved in quality in ways that do not involve the producer in higher costs. In these instances the rule for price index compilation is: **Changes in quality or character resulting from a new discovery that does not involve higher production costs are outside the scope of measurement and must be disregarded, like a change in style or taste.** Such cost-free changes must be left out of account for the measurement of both the change in output and the change in prices. As an example, suppose through medical advancement a high-potency aspirin is developed where half the previous dosage at half the price is believed to be just as effective as a former whole pill. For those interested in cost benefits, this improvement in efficiency would likely be considered a cost decline of 50 percent. Such an approach is appealing, as it more clearly corresponds to what most people probably believe is meant by quality. But it is an approach that must be rejected in price-index compilation since it is not consistently measurable. Subjective judgment of consumer satisfaction or the consequences of scientific advancements without related increases in product costs cannot be introduced into price-index compilation. From a pure price-index standpoint, in our example, aspirin production has been cut in half and prices have remained constant.

To illustrate how intangible improvements occurring in higher education are treated in index compilation, consider faculty services. It is evident that over the years the acquisition of more knowledge has increased the level and scope of instructed content. Institutions may well pay faculty more for this improvement in their services, or because more of them hold Ph.D.'s or are, on the average, older and more experienced, or that they are working longer hours.[2] If improvements of this type have occurred and are recognized in contracts for faculty services

[2] The proportion of doctorate degrees among college faculty has recently declined. In 1968–69 the percent of faculty holding a Ph. D., Ed. D., or other doctorate (except medical and other professional) at universities was 56.3 percent; in 1972–73 it was 49.6 percent. At 4-year colleges the decline was from 42.8 percent to 39.9 percent. This modest change has probably had little influence on faculty quality and hence on salary levels. During the same period the amount of time faculty members spend in the classroom has increased with 42.4 percent of university faculty reporting they spent 9 or more hours in class per week in 1972–73 compared to 34.9 percent reporting this amount in 1969. For 4-year colleges the percentages were 67.2 percent in 1972–73 and 64.3 in 1968–69. Source: Alan E. Bayer, *Teaching Faculty in Academe: 1972–73*, Research Report, Vol. 8, No. 2, 1973, and *College and University Faculty: A Statistical Description*, Research Report, Vol. 5, No. 5, 1970, American Council on Education, Washington, D.C.

(e.g., for a given academic rank, requirements for more teaching experience, postdoctoral study, additional instructional load, etc.) with added compensation, such differences in salary represent an additional cost for expected better quality or extended faculty service and must *not* be considered a price increase. However, no significant contractual changes of this nature have been observed.

Changes in price paid for improved faculty quality also cannot be measured by associated increases in production (teacher-education) costs. Tuition and fees charged prospective faculty graduate students are not progressively raised each year to cover the added expenses of improvements in education provided. Each year's education offering is the best available at the time. New faculty are more costly to educate because of rising costs of the education process per se, not because of greater effort to produce better teacher products. Colleges and universities consistently attempt to provide prospective teachers and all students the best education possible within the limits of institutional resources.

We cannot directly measure the satisfaction an institutional consumer gains from the purchase of faculty services of varying quality. Without such a measure, and in the absence of detailed contractual provisions stipulating faculty service expectations, it is impossible to determine what component of salary increases is being paid for expected better services. Colleges have no opportunity to buy "last year's" faculty and compare side-by-side with current "models" for pricing purposes. Each year's new faculty enters the labor market qualified by current education practice and representing the best (and only) available teaching and research service for hire. They are paid according to supply and demand—not improved quality. (Faculty salary increases are generally in response to increases in productivity in other sectors of the economy which force colleges and universities to keep pace in order to remain competitive in the labor market.)

In dealing with faculty services, the nonquantitative aspects of quality change, consumer (institutional) satisfaction, and production costs prevent any measurement of prices for index purposes other than in the unadjusted units in which the transaction takes place; i.e., salary paid for a contracted period of service. While there is no standardized basket of faculty services which is determined solely on educational grounds, faculty services are consistently the best (and only) quality available for hire at any given time and from this standpoint represent a relatively constant state-of-the-art from year to year.

Formulas and Computation

The fixed input index numbers compiled in this study are calculated by a Laspeyres-type formula generally referred to as a weighted average of price relatives. The formula and its application can best be explained in

terms of a simple concrete example. Assume that a price (sub)index is to be constructed for three items—writing paper, pencils, and envelopes. (A price subindex for office supplies could be based on price changes in a sample of three such items or inputs selected to represent all office supplies.) These items and the prices in periods 0, 1, and 2 are as follows:

Items	Unit	Unit price in period		
		0 (base)	1	2
Writing paper	Ream	$2.00	$2.50	$2.80
Pencils	Dozen	.22	.29	.33
Envelopes	100	.70	.77	.84

The price relative of an item is its price during a current or given period expressed as a percent of its price during the base period. If period 0 is taken as the base, the price relatives for writing paper would be 100 for period 0 and 125 for period 1, since $2.50 is 125 percent of $2. The price relatives for all three items are:

Items	Price relatives % in period		
	0	1	2
Writing paper	100	125	140
Pencils	100	130	150
Envelopes	100	110	120

The purpose of a price index is to measure the *average* price change in a group of items. Since these three items do not represent equal importance in the expenditure patterns of the buyer, a weighted average must be used. The weights should reflect the relative importance of each item affecting the overall price change for all items. The importance of an item for price-index purposes is indicated by the dollar expenditure for the item during the base period expressed as a percent of total budget expenditures for all items being priced.[3] In a fixed-weight price index, these relative weights are held constant.

[3] This relative method of weighting is employed in this study rather than weighting by actual quantities, because it is more feasible to determine spending patterns reported by institutions than to collect purchase-quantity data. The index weights are derived by determining stable relationships for selected goods and service items among average institutional expenditures. The assignment of weights in this manner makes it impossible to identify the physical quantities attached to each index item; quantity weights therefore are only implicit in the index structure.

In addition, it is obviously neither feasible nor necessary to include in an index computation *all* items purchased by colleges and universities. As with the Consumer Price Index, judgment and common sense are used to select a *stratified* sample which gives proportional representation to each *class* of items: e.g., supplies and materials, and *random* sampling of "priceable" items *within* each class: e.g., soaps, paints, writing paper, to be representative of all items in the class.

As an example, say that the relevant dollar expenditures during a typical period serving as the base are as follows:

Items	Dollar expenditures	Relative weights (percent distribution)
Writing paper	$3,000	0.75
Pencils	400	.10
Envelopes	600	.15
Total	$4,000	1.00

In combining the price relatives of the three items in a particular year to obtain the subindex value for that year, the first item is given a weight of 0.75, the second item, 0.10, and the third item, 0.15.

The price subindex for office supplies is calculated in the following table. (First, the price relatives are multiplied by their respective weights, and the arithmetic products of all items are added within each period. Then, the index value is obtained for any period by dividing the sum of the weighted price relatives for that period by the sum of the weights. When relative weights are used, this final step is not necessary as these weights sum to 1.0.)

Example calculation of price subindex for office supplies by the method of relative expenditure weights of price relatives:

(Period 0 = 100)

Items	Price relatives in period 1 $\left(\frac{P_{1i}}{P_{0i}}\right) \times 100$	Price relatives in period 2 $\left(\frac{P_{2i}}{P_{0i}}\right) \times 100$	Relative expenditure weights W_i	Price relatives × weight 1	Price relatives × weight 2
Paper	125	140	0.75	93.75	105
Pencils	130	150	.10	13.00	15
Envelopes	110	120	.15	16.50	18
			$\sum_i W_i = 1.00$	123.25	138

Index values: For base period 100
For period 1 123.25
For period 2 138

The formula for a price index calculated by this method of a relative weighted average for price relatives is $\Sigma_i \frac{P_{ni}}{P_{oi}} \times 100 \times W_i$. In this formula, for

an item in general—i.e., item i—the average price in the base period (period 0) is designated at P_{oi}, in period 1 as P_{1i}, and so on. The price relative for period 1 is designated $\frac{P_{1i}}{P_{oi}} \times 100$. The subscripts o and n in the formula are used to designate the base period and any given period, respectively. Thus, a given period price relative for item i would be $\frac{P_{ni}}{P_{oi}} \times 100$.

Adjustments for Quality Changes

Although generally the same goods and services are priced year after year, it is necessary to provide a means for bridging over changes in detailed specifications so that only real price change will be measured. When the specifications of an existing commodity change, the new price series resulting from the change is substituted for the earlier series by direct comparison or by linking. If the specification change is minor and does not involve price setting factors, the substitution is affected by direct comparison and any reported price change between the old and the new specification is reflected in the index. If changes in specifications are major, and neither a price change occurred nor information can be obtained concerning the value of the difference in specification, the substitution is made by linking and *no* change is reflected in the index. When differences are major and the value of the additional features is known, the linking process is used to continue the price series, *excluding* the difference in price known to be a result of the specification change.

These three types of adjustments can best be explained by the following tabulations.[4]

Tabulation of Price-Change Computational Methods

1. Direct comparison:

	Base period	Period of substitution	Later period
Reported price	$1.63	$1.94	$1.70
Price relative	.....	$\frac{\$1.94}{\$1.63} \times 100 = 119.0$	$\frac{\$1.70}{\$1.94} \times 100 = 87.6$
Price index	100.0	119.0	$\frac{119.0 \times 87.6}{100} = 104.2$

[4] Adapted from: Ethel D. Hoover, "The CPI and Problems of Quality Change," *Monthly Labor Review*, Vol. 84, No. 11, November 1961, p. 1178.

2. Linking: (full difference in price between new item substituted for old item due to quality change).

Reported price:				
Old item	$5.00	$5.50		
New item		$6.00	$6.25	
Price relative		$\frac{\$5.50}{\$5.00} \times 100 = 110.0$	$\frac{\$6.25}{\$6.00} \times 100 = 104.2$	
Price index	100.0	110.0		$\frac{110.0 \times 104.2}{100} = 114.6$

3. Linking: (difference in price between new item substituted for old item due to changes in both quality and price).

Reported price:				
Old item	$3.00			
New item		$4.00	$4.50	
Value of quality difference between old and new items		+$0.35		
Price relative		$\frac{(\$4.00-\$0.35)}{\$3.00} \times 100 = 121.7$	$\frac{\$4.50}{\$4.00} \times 100 = 112.5$	
Price index	100.0	121.7		$\frac{121.7 \times 112.5}{100} = 136.9$

When the quality of an item remains relatively constant over time, price changes from one period to the next may be calculated by direct comparison (example 1): dividing the price for an item in the current period by the price in the preceding period. A simple procedure, it has been used, when required, for all subindexes in this report.

Linking is the process whereby the price of a new item is tied to the price of an old item by factoring out the price difference due to the change in quality involved. The full difference (example 2) in price between the two items purchased during the period of substitution is assumed to be due to a quality change.[5] By linking, this price change is not reported as an increase in index value. The price of the new item during a later period divided by its price during the period of substitution is called a link rela-

[5] The value of any product or service is a matter of supply and demand—demand determined in part by human needs, tastes, and judgment. Consumers are often ignorant of changes in product quality and are inconsistent in their evaluation of worth. The price differential between two similar products may, or may not, accurately reflect their difference in quality. In some instances a superior product is introduced at a lower price than the one it replaces. Changes in price due to quality difference can be determined only on the basis of the added producer costs involved, or, in the absence of added costs, by whatever value the open market attaches to such differences. As stated by Gilbert: "Real or imagined quality changes that do not involve a difference in costs for the producer cannot be brought within the scope of index number measurement." (Milton Gilbert, "Quality Changes and Index Numbers: The Reply," *Monthly Labor Review*, LXXXV, May 1962, pp. 544–545.)

tive. The price index for the later period is calculated by multiplying the price index for the period of substitution by the link relative.

When the price difference between the two items is due to changes in both quality and in price, the procedure in example 3 applies. It involves reducing the price of the new item during the period of substitution by the estimated price value of the quality difference involved (as determined, for example, by the added cost of producing the new item), then comparing the adjusted price of the new item with the price of the old item during the previous period.

Estimating the price value of quality changes requires considerable information about both quantities purchased and product specifications. The amount of effort required to secure this data and the amount of improvement that will accrue to index validity are primary factors to consider in determining the extent to which the linking methodology should be employed.

Adjustments for Quantity Changes

As the buying habits of consumers change they may purchase more of certain goods and services and less of others. A price index attempts to hold the *quantity* of all items under consideration *fixed* so that only price changes are reflected in index values. However, over an extended period of time certain adjustments in item weights may be necessary if the index is to accurately reflect the current consumption pattern.[6] When significant changes do occur in the composition of the market basket being priced, linking may be employed to avoid disrupting the continuity of the index series. However, these revisions should be held to an absolute minimum since they result in an inconsistency in the index series; i.e., two different item mixes are presented which prevents their exclusive true price comparison over time.

The most direct method of weighting the different items to be priced for index purposes is by actual physical count. Only by weighting each item by the amount or quantity purchased can the relationship between the *total* cost of buying a given set of goods and services be compared over time. Any other weighting system, such as the use of relative weights based on

[6] It should be noted, however, that in many instances carefully established weights for official indexes may not be varied for many years. For example, the weights adopted in the 1952 and the 1967 revisions of the Consumer Price Index were held essentially constant for more than a decade. The Bureau of Labor Statistics reweights the 52 major item classifications of the CPI every 10 to 15 years, minor item components are changed frequently to include new and modified products and services. As a practical matter, reweighting of the CPI has almost no appreciable effect on index values. Error is primarily caused by inaccuracies in collecting price information, not in index weights.

the budget proportion expended for each item, serves as a proxy for physical counts. Use of the *initial* budget proportion for relative weighting in subsequent years results in an index number series exactly equivalent to using fixed quantity weights. Later period budget proportions must *not* be substituted for the initial relative weights since they reflect changes in *price* as well as quantity changes. (In effect, this results in a double counting type of error.) In the tabulation below, the index of price change from period I to period II based on total budget comparisons and fixed physical quantity count is 1.4375. This accurate relative price change is also obtained by using *fixed* budget proportions (period I) of 0.25 and 0.75. However, when period II budget proportions are substituted, the derived index of 1.4457 is in error. During periods of rising prices, use of *variable* budget proportions in weighting results in an upward bias of index values.

Tabulation of Different Weighting Methods

PRICE CHANGE ONLY

Weighting based on fixed physical quantity count:

	PERIOD I		PERIOD II	
	Price	Quantity	Price	Quantity
Item A.....	$1.00	1	$1.25	1
Item B.....	$1.00	3	$1.50	3

Total budget
$\$1.00 \times 1 + \$1.00 \times 3 = \$4.00$

Total budget
$\$1.25 \times 1 + \$1.50 \times 3 = \$5.75$

$$\text{Total budget ratio period 2/period 1} = \frac{\$5.75}{\$4.00} = 1.4375$$

Weighting based on budget proportions:

	PERIOD I				PERIOD II			
	Price relative	Quantity	Total expenditure	Budget proportion	Price relative	Quantity	Total expenditure	Budget proportion
Item A....	$1.00	1	$1.00	0.25	$1.25	1	$1.25	0.2174
Item B....	$1.00	3	$3.00	.75	$1.50	3	$4.50	.7826
			$4.00	1.00			$5.75	1.0000

Index value (price relative × budget proportion)

$1.00 \times 0.25 + 1.00 \times 0.75 = 1.000$

Index value based on **fixed** (period I) budget proportions

$1.25 \times 0.25 + 1.50 \times 0.75 = 1.4375$

Index value based on **variable** (period II) budget proportions

$1.25 \times 0.2174 + 1.50 \times 0.7826 = 1.4457$ (overstated)

PERIOD II

	Price relative	Quantity	Total expenditure	Budget proportion
Item A....	$1.25	1	$1.25	0.1724
Item B....	$1.50	4	$6.00	.8276
			$7.25	1.0000

	Budget proportion	=	Price relative	×	Unknown quantity	Relative quantity
Item A....	0.1724	=	1.25	×	0.13792	0.20
Item B....	.8276	=	1.50	×	.55193	.80
					.68985	1.00

Index value based on *fixed* (period I) budget proportions
$1.25 \times 0.25 + 1.50 \times 0.75 = 1.4375$ (understated)

Index value based on *variable* (period II) budget proportions
$1.25 \times 0.1724 + 1.50 \times 0.8276 = 1.4569$ (overstated)

Index value based on relative quantity (period II)
$1.25 \times 0.20 + 1.50 \times 0.80 = 1.4500$

The continuous use of initial budget proportions for relative weighting is accurate so long as the physical quantity proportions among items remain relatively constant. When there is a significant change in the buyer's consumption pattern, an adjustment in weighting must be made. If proportionately greater quantities of items with large price increases are being purchased, for example, continued use of initial budget proportions will result in understated index values.[7] This is because index values based on fixed weights do not reflect the increased importance that should be given to price changes of items being bought in larger quantities. In the same circumstances, if new budget proportions are substituted, index values will be overstated because the price change of high inflation items will increase their budget proportions more than the actual change in relative physical count.

To avoid these known errors, reweighting should be based only on recognized changes in the buyer's consumption pattern; i.e., the buying of proportionately greater or smaller quantities of different items. Under this approach, weights are equal to the new quantity mix. If these quantities are not known, they can be calculated by dividing the known new budget proportion by the known price relative for each item. The lower calculations on this page illustrate the procedure. Dividing the known budget propor-

[7] This example is selected because colleges and universities are, in fact, purchasing proportionately more personnel services with highly inflationary rates of salary increase. In most instances the opposite occurs, consumers shift away from high price increase items. A fixed-weight index then tends to overstate the overall price level increase.

tions, 0.1724 for item A and 0.8276 for item B, by the known price relative for each item, $1.25 and $1.50, establishes the unknown quantities as 0.13792 and 0.55193 respectively. These relative quantity percentages of 0.20 and 0.80 (corresponding of course to the purchase of 1 unit of item A and 4 units of item B) result in an index value of 1.4500, intermediate between the understated 1.4375 index value based on fixed initial budget proportions and the overstated 1.4569 index value based on variable budget proportions.

How has the above theory been applied in weighting the indexes in this study? In the case of the Higher Education Price Index (HEPI) the proportion of the educational and general budget expended by institutions for personnel compensation has gradually increased, suggesting the need for weight revisions. In 1964–65, the proportion of the total educational and general budget (less sponsored research) spent for personnel compensation was 74 percent, with 26 percent expended for contracted services, supplies and equipment. In 1971–72, the percentages were 82 and 18 percent, respectively. It would be a simple matter to reweight the index based on the new budget proportions, but, as explained, reweighting should only be performed when the buyer's consumption pattern changes. To determine to what extent the changing budget proportions represent the purchase of additional quantities of personnel services and proportionately smaller quantities of contracted services, supplies, and equipment, it is necessary to calculate the new relative physical quantities as previously explained.

For the 1965–72 period the relative price increase in personnel compensation was 56.1 percent (from an index value of 88.7 to 138.4, see table II–1, page 31). The price of services, supplies, and equipment increased 31.5 percent (from an index value of 95.5 to 125.6). Since the budget proportions for 1965 and 1972 are known, it is a simple matter to calculate the unknown quantity changes as follows:

Index item	Known 1964–65 budget	=	Known price relative	×	Known quantity[1]	Relative quantity[1] (percent)
Personnel compensation	$0.74	=	100.0	×	.7400	74
Services, supplies and equipment	.26	=	100.0	×	.2600	26
	100				1.0000	100
	1971–72 budget				Unknown quantity[1]	
Personnel compensation	$0.82	=	156.0	×	.5256	79.3
Services, supplies and equipment	.18	=	131.5	×	.1369	20.7
					.6625	100.0
	1.00					

[1] The term "quantity" is used here to report change in the physical consumption pattern relative to 1964–65 quantities implied by the 1964–65 expenditure budget.

These calculations show that colleges and universities have been employing relatively more faculty and staff each year and buying proportionately smaller amounts of services, supplies, and equipment.[8] If the relative implied quantities in 1964–65 were 74 percent for personnel compensation and 26 percent for services, supplies, and equipment, then the above computations suggest these percentages have changed to 79.3 percent and 20.7 percent, respectively, in 1971–72.

For purposes of index computation the 1964–65 weights have been used as fixed *average* values for the 1961–67 period, and the 1971–72 weights for the 1967–74 period. The two series are effectively "linked" in 1967 since for this base-year the HEPI value computed using either set of weights is, by definition, equal to 100.0. Although "linked" to establish equivalency, the two series measure price change for two *different* item mixes, and therefore certain discontinuity occurs which prevents the comparison of prior to post-1967 index values from exclusively representing price change. This single weight revision is believed to adequately update the index to account for the changing consumption pattern of colleges and universities while preserving, insofar as practical, the fixed market basket ideal for price index computation.

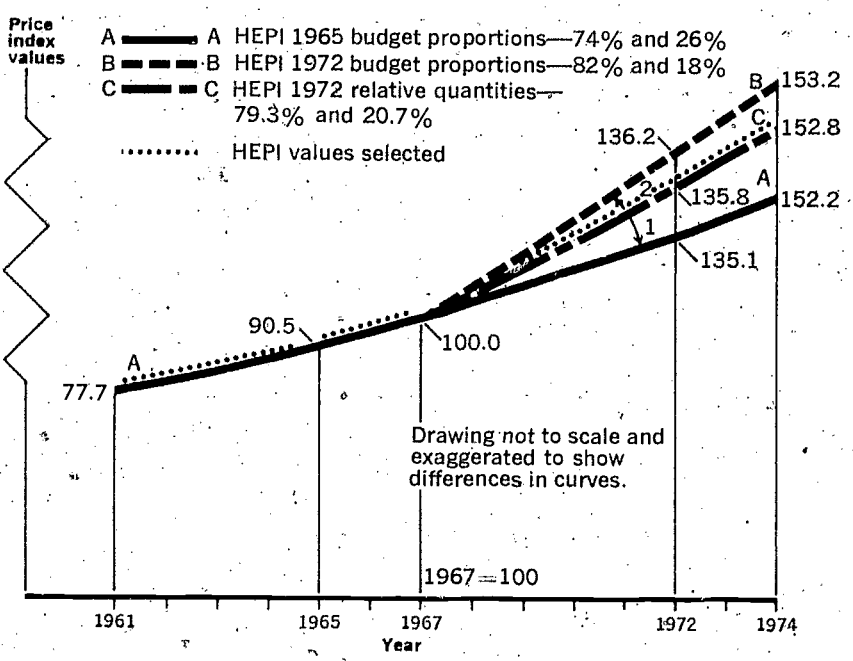
Figure I-1 illustrates the price index series involved. Curve *A* is a plot of HEPI values calculated, using the 1964–65 weights of 74 percent for personnel compensation and 26 percent for contracted services, supplies, and equipment. Curve *B* is HEPI values when 1971–72 weights, based on budget proportions of 82 and 18 percent, are used. Curve *C* is HEPI values calculated, using weights of 79.3 and 20.7 percent based on estimated changes in the physical quantity consumption pattern. The actual HEPI values used (curve *A* from 1961 through 1967, curve *C* from 1967 through 1974) are indicated by the dotted line.

Notice that if curve *A* values were used exclusively for the HEPI, the rate of inflation would be understated for the period 1967–74 compared to the adjusted weights curve *C* values chosen. Similarly, if curve *B* values were used, inflation would be overstated for the period 1967–74 compared to curve *C*. In the absence of actual physical count data, this theoretical approach to adjusting quantity change provides only a means to approximate the reweighting which accounts for changes in institutional consumption patterns. Furthermore, there is considerable debate over the relative merits of a number of theories regarding weighting adjustments. This observer believes that the approach taken here is consistent with the principle of maintaining fixed weights until a revised physical count gives clear evidence of a change in the buyer's consumption pattern.

[8] This change undoubtedly reflects the efforts of colleges and universities to economize by reducing support services, supplies, travel, and other administrative and overhead expenses.

Figure I–1.

—Higher Education Price Index series based on 1965 and 1972 college and university budget proportions, and 1972 relative quantities.



[1] Curve A understates the rate of inflation compared to curve C.
[2] Curve B overstates the rate of inflation compared to curve C.

CHAPTER II.

COLLEGE AND UNIVERSITY CURRENT OPERATIONS PRICES AND INDEXES

Colleges and universities, along with other agencies and businesses in the economy, have had to contend with rising prices for many years. This gradual loss of buying power has not been a real concern to educators as long as their institutions have remained financially healthy. Now, declining enrollment growth and financial difficulties have forced officials to take a hard look at spiraling costs and what can be done to hold the line. With some urgency institutions now seek measures of the impact of inflation on education budgets so that additional income can be sought to meet expected higher unit costs.

A suitable indicator for measuring the effects of inflation on the current operations of colleges and universities is presented in this chapter. The Higher Education Price Index (HEPI), as it is called, reports the change in prices paid by institutions for a fixed group of inputs purchased for educational and general operations less sponsored research. The index and its subcomponents are presented in table II–1, page 31, and are described in detail beginning on page 39. The manner in which the index may be used in the economic analysis of higher education financing trends is illustrated next.

The Effects of Inflation on Current Operations

Price Trends

In the 13-year period from 1961 through 1974, the prices that colleges and universities paid for their educational and general operations (less sponsored research) have nearly doubled. The HEPI for 1961 was 77.7, for 1974, 152.8 (152.8/77.7 = 96.7 percent). Thus, for every $100 spent in 1961 for instruction, administration, libraries, plant operation and maintenance, etc., today nearly $200 is necessary to buy the same goods and

services. Since 1965 the rate of inflation has varied between 5.0 and 7.0 percent yearly, with a compound annual increase rate of 6.0 percent. Based on preliminary AAUP faculty salary data, the estimated HEPI value for fiscal year 1975 is 164, a 8.0 percent increase from 1974.

In comparison with the Consumer Price Index, figure II-1, it is clear that the increases in prices of current operations of colleges and universities over the past decade (96.7 percent) were considerably higher than price increases in the economy at large (56.7 percent). (Comparison of price trends for all indexes reported in this study are presented in table 1 and figure 1, pp. 9 and 10.) Differentials between the HEPI and general price level changes were particularly marked in the first half of the decade. For the 5-year period from 1961 to 1966, the HEPI increased 22.3 percent (95.0/77.7) while the CPI increased only 7.3 percent (97.1/90.5). In the last 4 years the increase in the HEPI and CPI has been about equal—26 percent (152.8/121.0), and 23 percent (141.6/114.7). Between 1973 and 1974 the rate of increase of the CPI (8.9 percent) was greater than that of the HEPI (7.0 percent), and this differential is likely to continue in the immediate future as faculty salary increases lag behind the near runaway inflation of the general economy.[1]

College operating costs in the long run have risen faster than the inflation affecting the general economy because the largest purchase by colleges is faculty and other professional services (about 65 percent of the total including associated fringe benefits). These salaries have increased at a greater rate than the cost of durable commodities which is the major purchase of family consumers. Commodities (less food), comprising 38.6 percent of the CPI market basket, rose only 37 percent in price during the 13-year period 1961–74. Professional salaries, on the other hand, nearly doubled during this time, increasing 98.6 percent. Price increases for the other two major CPI components—services, 68 percent, and food, 73 percent—also showed less of an increase than faculty salaries.

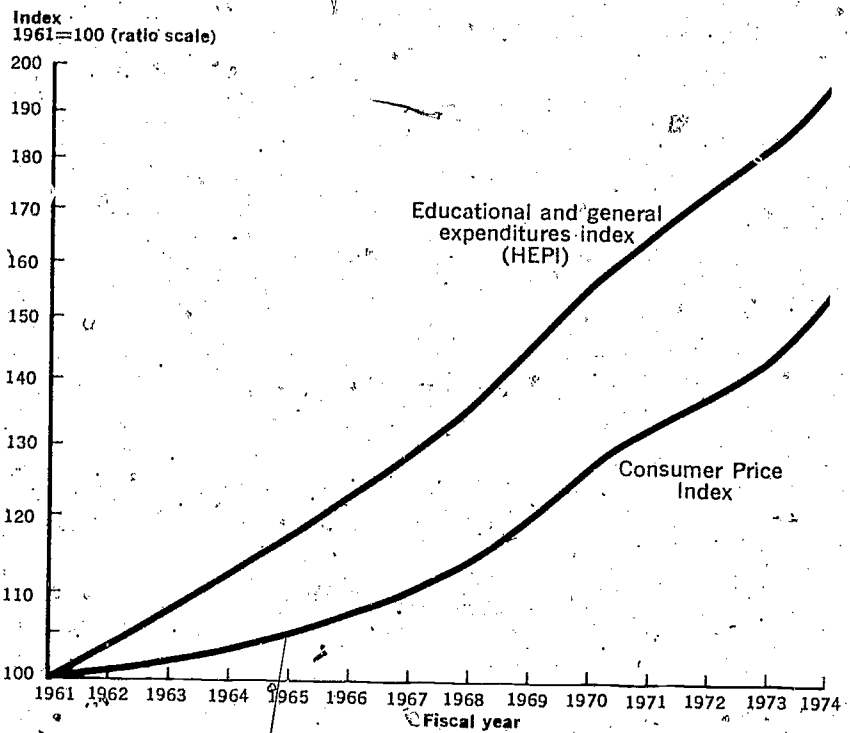
Price increases in the goods and services purchased by colleges and universities have naturally increased institutional operating costs. But, unlike manufacturing industries, there has been little improvement in educational technology and hence no offsetting increase in productivity. The result is increased cost per-service unit, in this instance expenditures per student. These added unit costs must be made up by increased revenues from government, philanthropy, and endowment, and to some degree by the student consumer in paying higher tuition.

This situation arises from growth of our economy as more workers are added to the labor force and technological advancements increase productivity. As workers produce more they receive increases in real salaries and

[1] For an excellent discussion of the implications of inflation in liberal arts colleges and the likely consequences of expected future inflation see G. Richard Wynn, "Inflation in the Higher Education Industry," *Professional File*, Vol. 6, No. 1, January 1975, National Association of College and University Business Officers, Washington, D.C.

Figure II–1.

—Comparison of trends in price change in higher education current operations with the Consumer Price Index, fiscal years 1961–74.



Note.—The vertical axis is expressed on a ratio or logarithmic scale; i.e., equal vertical distances reflect equal proportional (as distinguished from absolute) changes.

wages, not only in sectors where productivity has actually increased but also in sectors where there is no improvement. Education is such a sector, "production" techniques have changed very little. The student-faculty ratio (a rough measure of output to input) has remained between 14 and 15 to 1 for the past decade.[2] Despite this constant technology, if institutions do not raise faculty salaries to keep pace with those in other professions, teachers will be tempted to leave the teaching field to earn higher salaries in other sectors. Furthermore, the rising prices of other inputs to education—supplies and materials, equipment, utilities, etc.—have occurred in most instances without much improvement in efficiency. Thus, year after year the cost of education has and will continue to increase with attenuation possible only through gradual gains in productivity and more economical operation.[3]

Price Trends Within Current Operations

Price trends within the HEPI are presented in table II-1 and illustrated in figure II-2. [NOTE: A description of each index component together with prices and data sources begins on page 44.] Taking the various HEPI components in order of their relative importance, the level of *professional salaries* (weighted 58 percent) paid by colleges and universities nearly doubled between 1961 and 1974, growing steadily at a compound annual increase rate of 5.4 percent. For perspective it should be noted that during this same time period the Consumer Price Index increased only 56.5 percent, a growth rate of 3.5 percent annually. *Nonprofessional wages and salaries* for technicians, craftsmen, clerical, students, services, and operators (weighted 15.0 percent) grew at a slower rate than professional salaries during the first half of the decade, but have since begun to catch up, nearly reaching in 1974 the position they had relative to professional salaries in 1961. Since 1970 nonprofessional salaries have grown at a compound annual increase rate of 7 percent.

Fringe benefit payments by institutions account for 9.0 percent of the educational and general budget and include expenditures for retirement, social security, and various types of insurance and compensation. As de-

[2] In the fall of 1962, 3,455,000 full-time-equivalent degree and nondegree credit students were instructed by 228,000 full-time-equivalent instructional staff, for a student-faculty ratio of 15.15 to 1. In 1967, enrollment was 5,480,000 FTE students instructed by 378,000 FTE faculty for a student-faculty ratio of 14.50 to 1. In 1972, 7,083,000 FTE students were instructed by 471,000 FTE faculty for a 15.04 ratio. Source: U.S. Department of Health, Education, and Welfare, Office of Education, *Projections of Educational Statistics to 1982–83*. U.S. Government Printing Office, Washington, D.C., 1974, pp. 31 and 72.

[3] For a discussion of savings through improved management and economies with special attention to increasing the student-faculty ratio, see D. Kent Halstead, *Statewide Planning in Higher Education*, U.S. Department of Health, Education, and Welfare, Office of Education, U.S. Government Printing Office, Washington, D.C., 1974, pp. 628–644.

Table II–1

Higher Education Price Index and major component subindexes, fiscal years 1961–74.

1967=100

(Number code in parentheses identifies category as outlined in table II–4.)

Fiscal year	Personnel compensation				Contracted services, supplies, and equipment						Higher Education Price Index[3]	Annual percent increase over previous year
	Professional salaries (1.0)	Non-professional wages and salaries (2.0)	Fringe benefits (3.0)	Total[1]	Services (4.0)	Supplies & materials (5.0)	Equipment (6.0)	Books & periodicals (7.0)	Utilities (8.0)	Total[2]		
1961	73.2	85.2	54.9	73.4	86.9	94.7	92.5	69.9	100.3	89.8	77.7	
1962	76.7	87.5	59.6	76.8	88.7	94.5	93.0	73.8	100.9	91.1	80.5	3.6
1963	80.7	89.7	64.9	80.6	90.6	94.5	93.5	78.5	100.7	92.3	83.6	3.9
1964	84.4	91.9	70.8	84.3	92.6	95.0	94.4	84.4	100.1	93.8	86.8	3.8
1965	89.0	94.0	78.1	88.7	94.8	95.6	95.3	90.5	99.8	95.5	90.5	4.3
1966	94.1	96.5	90.2	94.1	96.5	97.8	97.1	96.5	99.9	97.4	95.0	5.0
1967	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	5.3
1968	106.5	105.2	111.1	106.8	103.8	101.9	103.1	104.7	100.5	102.9	106.0	6.0
1969	113.5	110.9	131.7	115.0	108.3	103.6	106.5	113.5	101.6	106.5	113.2	6.8
1970	121.4	117.7	146.2	123.5	113.2	106.4	110.7	131.0	103.7	111.6	121.0	6.9
1971	127.5	126.9	162.0	131.2	119.3	110.3	115.1	152.3	114.6	119.3	128.7	6.4
1972	132.5	136.1	180.2	138.4	126.4	112.6	119.4	163.6	122.4	125.6	135.8	5.5
1973	138.4	144.3	197.7	146.0	131.9	116.3	123.1	167.8	129.0	130.6	142.8	5.2
1974	145.4	153.4	222.0	155.3	138.1	131.6	130.6	181.3	158.3	143.2	152.8	7.0

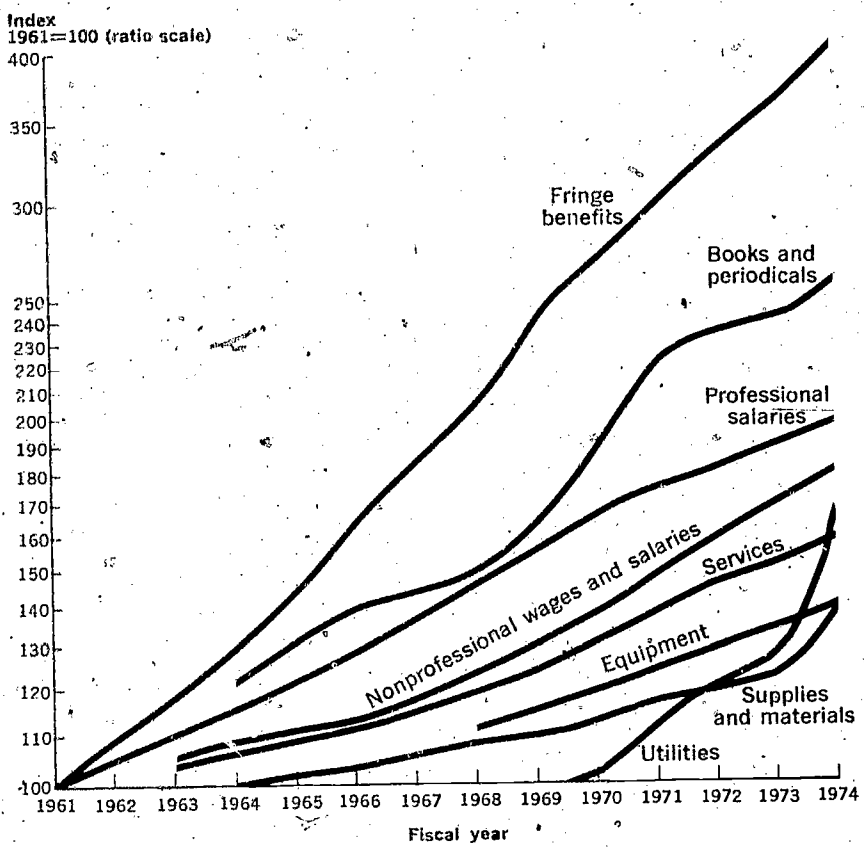
[1] Personnel compensation total index based on weighted average as follows: professional salaries, 70.7 percent; nonprofessional wages and salaries, 18.3 percent; and fringe benefits, 11.0 percent.

[2] Contracted services, supplies, and equipment total index based on weighted average as follows: services, 40.56 percent; supplies and materials, 19.44 percent; equipment, 13.89 percent; books and periodicals, 9.44 percent; and utilities, 16.67 percent.

[3] HEPI based on weighted average as follows: personnel compensation, 79.3 percent; contracted services, supplies, and equipment, 20.7 percent. For fiscal years 1961–67 these weights were 74.0 percent and 26.0 percent, respectively.

Figure II–2.

—Comparison of trends in price change in major component subindexes of the Higher Education Price Index (HEPI), fiscal years 1961–74.



Note.—The vertical axis is expressed on a ratio or logarithmic scale; i.e., equal vertical distances reflect equal proportional (as distinguished from absolute) changes.

scribed on pages 55–56, fringe benefits are regarded as a package preinvestment of employee earnings, the total compensation per employee representing the "price" institutions must pay to secure and hold competent staff. Thus if institutions contribute more to each employee's retirement, this addition is considered like a salary increase necessary to remain competitive in the labor market. Fringe benefits payments have quadrupled in the last 13 years. This spectacular growth is due to a genuine effort on the part of institutions to improve their benefit services and extend coverage to new groups of employees, with some encouragement from the fact that benefits are paid out of pre-tax income rather than after-tax income and that benefit funds may be used for working capital. Other contributing factors include the increase in Federal requirements for social security payments applied to larger salary bases and the imposition of price controls which has had a restrictive influence on salary increases.

Prices for *services* (data processing, communication, transportation, printing, etc.) purchased by colleges and universities (weighted 7.3 percent) along with prices of laboratory-type *equipment* (weighted 2.5 percent) have increased modestly since 1961, a compound annual increase rate of 3½ and 2½ percent, respectively. The prices of *supplies and materials* (weighted 3.5 percent) increased at only 1¾ percent annually until 1973, when in 1 year prices increased 13.2 percent. This sharp upward trend, as part of the current inflation scene, may well continue for some time, necessitating economy in the purchase of supplies and materials.

Prices for *utilities* (weighted 3.0 percent) have jumped dramatically since 1970, increasing 53 percent. Much of this is the result of the price of heating oil doubling between fiscal year 1973 and 1974. For institutions that heat with oil, this price increase is far more important and of greater consequence than indicated by the composite price series for utilities in the HEPI which is tempered by the less severe price increases of natural gas, commercial power, and water and sewer. In other words, depending on the fuel used for heating—oil or gas—the HEPI utilities price series either understates or overstates the inflation affecting an individual institution's utility expenditures.

The prices of *books and periodicals* (weighted 1.7 percent) have increased tremendously and represent a high inflation cost in the college budget. The prices of hardcover books increased 2½ times during the 10-year period 1961–71. Then, unexpectedly, book prices declined during calendar years 1972 and 1973. It is the opinion of Dr. Hugh C. Atkinson, Director of Libraries at Ohio State University, that during this period publishers cutback on the number of expensively bound and printed gift-type volumes which they felt would be viewed as too extravagant by many of today's cost-conscious buyers. As an economy move the effect was short-lived. Book prices in calendar year 1974 exceeded 1973 prices by 15 percent.

The price of periodicals has tripled since 1961. In the 4 years since 1970, price increases have averaged 14 percent, with no letup in sight.

Deflation of Expenditures

The consequence of price changes on expenditures in higher education is shown in table II-2 and figures II-3 and 4. Only actual surveyed data are considered, estimated dollar amounts for fiscal years 1961 and 1974 being subject to possible significant error.

In the public sector, total actual (current) dollar expenditures for educational and general purposes (less sponsored research) increased 5 times in the 11-year period 1962 through 1973.[4] Most of this increase was necessitated by a near tripling (× 2.7) in student enrollment (table II-3)—labeled the "enrollment effect" [5] in figure II-3. When enrollment is taken into account, per-student expenditures in actual dollars increased from $1,275 to $2,415. However, at the same time a near equivalent increase in input costs occurred, the Higher Education Price Index increased from 80.5 to 142.8. The consequence of this "inflation effect" on expenditures was a very gradual growth in "real resources" expended per student. In 1962 public institutions spent $1,584 (in constant 1967 price dollars) per FTE student for current educational and general operations. A little over a decade later (1973) the constant amount had risen to $1,690, a growth rate of approximately 0.4 percent per year. Thus, nearly all the fivefold increase in total expenditures by public colleges and universities was absorbed by rising enrollments and institutional costs.

The private sector fared substantially better, showing significant growth in "real" resources expended per student. Enrollments in the private sector increased only half as much as in the public sector (× 1.4 compared to × 2.7) and when coupled with a × 3.3 increase in total expenditures, the per student increases more than offset the rise in prices. Thus, in terms of constant (deflated) dollar input, unit expenditures in the private sector rose from $1,761 per FTE student in 1962 to $2,258 per FTE student in 1973, an annual increase rate of 2.4 percent.[6]

[4] The fivefold increase in aggregate expenditures for public higher education has been accomplished by shifting more of the Nation's growing resources to meet the needs of expanded enrollments and higher costs. The 1961–62 expenditures for educational and general operations (less sponsored research) were financed by allocating 0.485 percent of the 1961 gross national product (GNP) of $520.1 billion. The 1972–73 expenditures of public institutions were financed by 1.124 percent of the $1,155.2 billion 1972 GNP. In the private sector, less enrollment growth required proportionately less increase in the proportion of GNP allocated. The 1961–62 private expenditures were financed by 0.345 percent of the 1961 GNP. For 1972–73 private expenditures equaled 0.505 percent of the 1972 GNP. (For an analysis of this type, see Halstead, *Statewide Planning in Higher Education*, op. cit., pp. 532–539.

[5] I am indebted to Richard Wynn for the terms "enrollment effect," "inflation effect," and "real resource growth," in graphically labeling changes in expenditures associated with these factors.

[6] Consistent with the limited intent of this report, this brief outline of data serves primarily to illustrate the use and value of price deflators in analyzing higher education expenditures. For extended interpretive studies of college and university financing with consideration given to real resource employment see the following:

In a very thorough study of resource use in higher education, June O'Neill

The implication of a near constant or slight growth in "real resource" input per student in higher education on the *quality* of education provided is not clear. Certainly it is true that both the inputs and outputs of higher education have *not* remained constant, which prevents rigid application of a fixed input price deflator. The education "product" of today is simply not the same as that of 10 years ago. Neither are the inputs. More attention is now being given graduate education and other special training and service which are fundamentally more costly than the standard undergraduate program. More sophisticated and costly equipment is also being used. Thus higher education today is different and inherently more costly than a decade ago, independent of any inflationary factors. Yet, with the exception of a modest increase in the private sector, increased funding in constant dollars per student has not occurred. Possibly the consequence has been a lowering of quality in those programs where resources have been reduced and shifted to expanding more costly academic endeavors.

Hopefully the need for more real resources has been met by improving the effectiveness and efficiency of educational operations. During this current period of financial difficulty, college and university officials have undoubtedly taken many positive steps to curtail extravagance and effect true cost savings to enable fixed resources to be reallocated without serious quality deterioration. However, without accurate measures of the outputs

identifies trends in constant dollar expenditures in the public and private sectors similar to those presented here. Beginning with academic year 1955–56 and extending through 1966–67 (the immediate years prior to 1955–56 exhibited considerable fluctuation) the O'Neill data show expenditures for instructional costs per credit hour in constant dollars in the public sector remaining essentially steady at $33 per credit hour. In the private sector, instructional costs rose from $37 per credit hour in 1955–56 to $44 in 1966–67. (See June O'Neill, *Resource Use in Higher Education*, Carnegie Commission on Higher Education, Berkeley, Calif., p. 41.)

In a series of excellent interpretive studies, Hans Jenny and Richard Wynn trace the pattern in real resource growth for 48 private liberal arts colleges. The general prosperity of the early and middle 1960's is reported in *The Golden Years*, with only a hint in 1967 and 1968 of impending financial problems. Only 2 years later, *The Turning Point* documents the end of the golden years with income unable to keep pace with accelerating expenditure growth. A third report by Wynn reviews the entire period from fiscal year 1964 through 1973 showing educational and general expenses per student in constant dollars peaking in 1971 and then gradually declining. See G. Richard Wynn, *At the Crossroads*, Center for the Study of Higher Education, School of Education, The University of Michigan, Ann Arbor, April 1974, 33 pp. See also Wynn, "Inflation in the Higher Education Industry," op. cit.

In a chapter on the status and issues of financing higher education, I devote 10 pages to an analysis of the patterns and trends of institutional financing. The data, by five student education expenditure categories and five related income sources, are presented separately for public and private universities, 4-year colleges, and 2-year colleges for fiscal years 1969 through 1972. Needless to say, continuous updating of this information is critical to understanding the real investment in higher education among the different types of institutions and the changing roles and relative contribution of the various income sources. See Halstead, *Statewide Planning in Higher Education*, op. cit., pp. 539–548, and appendix C.

Table II–2

Current fund educational and general expenditures[1] in institutions of higher education by institutional control, amount and amount per FTE student in actual and constant dollars, fiscal years 1961–74.

Constant dollars in 1967 prices

Fiscal year	All institutions				Public institutions				Private institutions			
	Amount (in millions)		Per FTE student		Amount (in millions)		Per FTE student		Amount (in millions)		Per FTE student	
	Actual dollars	Constant dollars[2]	Actual dollars	Constant dollars[2]	Actual dollars	Constant dollars[2]	Actual dollars	Constant dollars[2]	Actual dollars	Constant dollars[2]	Actual dollars	Constant dollars[2]
1961[3]	$3,820	$4,916	$1,275	$1,642	$2,240	$2,883	$1,255	$1,615	$1,580	$2,033	$1,306	$1,681
1962	4,317	5,362	1,330	1,652	2,524	3,135	1,225	1,584	1,793	2,228	1,418	1,761
1963[3]	4,850	5,795	1,384	1,654	2,850	3,405	1,310	1,565	2,000	2,389	1,504	1,797
1964	5,483	6,317	1,462	1,684	3,264	3,760	1,368	1,576	2,220	2,557	1,626	1,873
1965[3]	6,370	7,039	1,524	1,684	3,830	4,232	1,412	1,560	2,540	2,807	1,732	1,914
1966	7,551	7,948	1,588	1,672	4,646	4,890	1,472	1,549	2,905	3,058	1,818	1,914
1967	8,889	8,889	1,734	1,734	5,577	5,577	1,622	1,622	3,312	3,312	1,963	1,963
1968	10,554	9,957	1,905	1,797	6,839	6,452	1,798	1,696	3,715	3,505	2,141	2,020
1969	11,873	10,489	1,971	1,741	7,775	6,868	1,817	1,605	4,098	3,620	2,348	2,074
1970	13,737	11,353	2,152	1,779	9,181	7,588	1,989	1,644	4,556	3,765	2,579	2,131
1971	15,516	12,047	2,285	1,774	10,516	8,365	2,108	1,637	5,000	3,882	2,775	2,155
1972	17,059	12,562	2,404	1,770	11,664	8,589	2,206	1,624	5,395	3,973	2,982	2,196
1973	18,825	13,174	2,619	1,833	12,986	9,087	2,415	1,690	5,839	4,086	3,226	2,258
1974[4]	20,480	13,403	2,773	1,815	14,200	9,293	2,551	1,670	6,280	4,110	3,455	2,261

[1] Excludes sponsored research expenditures. For definition of educational and general expenditures see text, pp. 39–40.

[2] Constant dollars in 1967 prices.

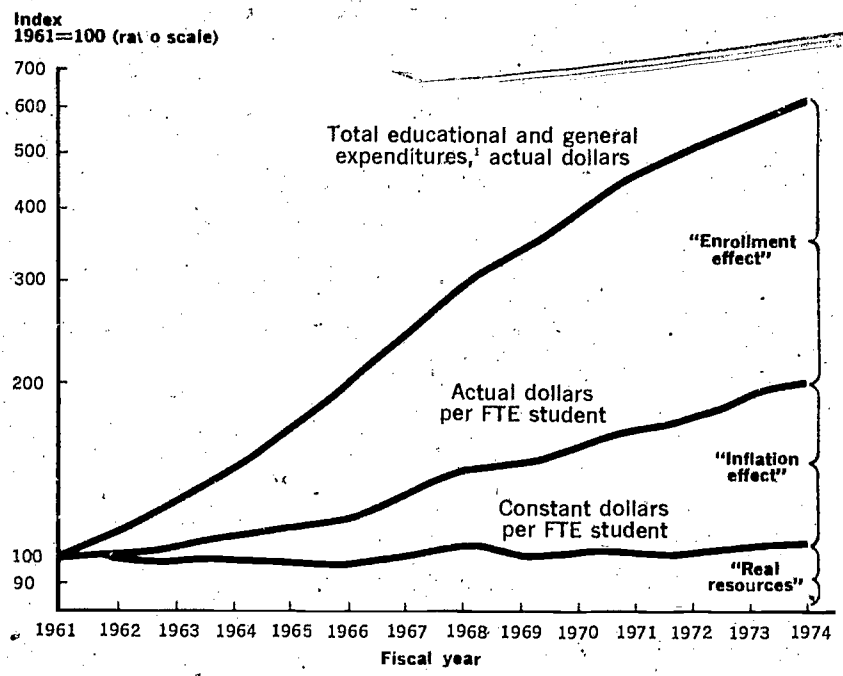
[3] Amounts estimated.

[4] Preliminary data.

Source: U.S. Department of Health, Education, and Welfare, Office of Education, **Financial Statistics of Institutions of Higher Education: Current Funds Revenues and Expenditures,** relevant issues.

Figure II–3.

Trends in current fund educational and general expenditures [1] in public institutions, amount, and amount per FTE student in actual and constant dollars, fiscal years 1961–74.

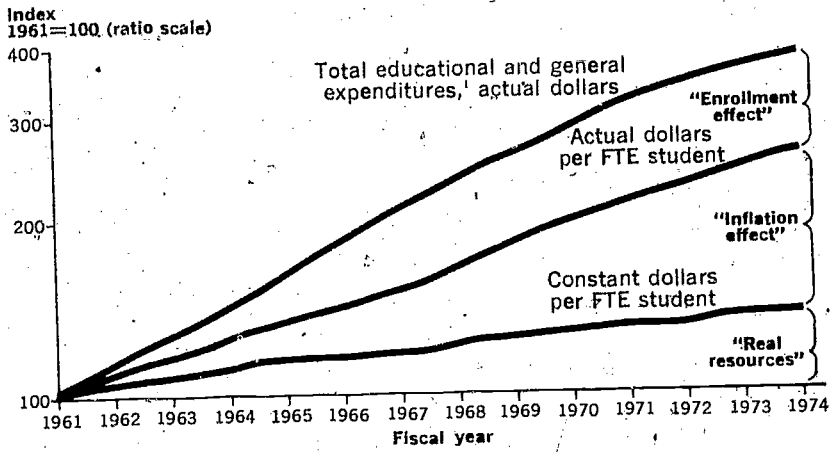


[1] Excludes sponsored research expenditures.

Note.—The vertical axis is expressed on a ratio or logarithmic scale; i.e., equal vertical distances reflect equal proportional (as distinguished from absolute) changes.

Figure II–4.

Trends in current fund educational and general expenditures[1] in private institutions, amount, and amount per FTE student in actual and constant dollars, fiscal years 1961–74.



[1] Excludes sponsored research expenditures.

Note.—The vertical axis is expressed on a ratio or logarithmic scale; i.e., equal vertical distances reflect equal proportional (as distinguished from absolute) changes.

Table II–3

Full-time-equivalent enrollment in institutions of higher education by institutional control, fiscal years 1960–74.

Fiscal year	All institutions	Public	Private
1960	2,810,000	1,665,000	1,145,000
1961	2,995,000	1,785,000	1,210,000
1962	3,245,000	1,980,000	1,265,000
1963	3,505,000	2,175,000	1,330,000
1964	3,750,459	2,385,667	1,364,792
1965	4,178,784	2,712,449	1,466,335
1966	4,753,872	3,155,527	1,598,345
1967	5,126,005	3,438,534	1,687,471
1968	5,539,222	3,804,264	1,734,958
1969	6,024,199	4,279,172	1,745,027
1970	6,382,618	4,615,935	1,766,683
1971	6,790,509	4,988,573	1,801,936
1972	7,096,444	5,287,197	1,809,247
1973	7,186,865	5,377,200	1,809,665
1974	7,384,362	5,566,739	1,817,623

Note— Enrollment includes resident and extension degree and non-degree-credit. Full-time-equivalent (FTE) enrollment equals full-time enrollment plus one-third part-time and extension enrollment.

Source: U.S. Department of Health, Education, and Welfare, Office of Education, **Opening (fall) Enrollment in Higher Education,** relevant issues.

of education, no precise measure may be made of the degree to which cost savings have been effected to offset greater resource requirements. It remains for each individual institution to constantly struggle with and hopefully balance the increasing costs of new programs with cost-saving efficiency so as to avoid any deterioration in quality.

Description of Index and Data Base

The complete title of the index presented in this chapter is: Index of Change in Prices of Goods and Services Purchased by Colleges and Universities Through Current Fund Educational and General Expenditures Excluding Sponsored Research. For the sake of brevity, it is referred to as the Higher Education Price Index (HEPI). The HEPI and its major component subindexes for fiscal years 1961–74 are presented in table II-1, page 31. This index is concerned with price changes involving the salaries of faculty, administrators, and other professional personnel, nonprofessional

salaries and wages, various services, supplies and materials, equipment, books and periodicals, and utilities—all of which represent goods and services purchased by colleges and universities making current fund expenditures for educational and general purposes. (The various items priced by the HEPI and their relative weight or proportion of the total educational and general budget is presented in table II–4, p. 41).

Educational and general operations are classified in the following functional categories: instruction and departmental research, extension and public service, educational programs such as workshops and instructional institutes supported by sponsors outside the institution, student services, general administration and general institutional expenses, staff benefits, libraries, operation and maintenance of physical plant, and organized activities of educational departments designed primarily to provide instructional or laboratory training of students. Sponsored research and other separately budgeted research, although part of educational and general operations, is *excluded* from the index compilation and priced separately by a Research and Development Price Index (R&DPI). The goods and services priced by the HEPI represent those that are purchased to perform all of the above functions.

The Higher Education Price Index is a weighted aggregative index number with "fixed" or "constant" weights, often referred to as a "market basket" index. The procedure is to measure price change by repricing each year and comparing aggregate costs of the goods and services bought by colleges and universities in a selected base period. The quantities of these goods and services have been kept constant based on the 1971–72 buying pattern of colleges and universities. (Prior to 1967 the index weighting is based on the 1964–65 expenditure pattern of institutions.) The quantities represent not only annual consumption of the specific sample items actually priced by the index but also consumption of related items for which prices are not obtained, so that the total cost of the market basket represents total institutional spending for all goods and services.

The index is calculated on the reference base of fiscal year 1967 = 100. This means that current prices are expressed as a percentage of prices for 1967. An index of 110 means that prices have increased 10 percent since the base period; similarly, an index of 90 means a 10-percent decrease. The index can be converted to any desired base period by dividing each index number to be converted by the index for the desired base period.

Index Weighting Structure

The composition of current fund educational and general expenditures (excluding sponsored research) by object classification used for computing the Higher Education Price Index is shown in table II–4. Personnel compensation comprised 82.0 percent of educational and general expenditures of institutions of higher education in the United States in 1971–72. The

largest expenditures for personnel compensation were for faculty salaries (42.2 percent), fringe benefits (9.0 percent), administration and institutional service personnel salaries (8.5 percent), clerical wages and salaries (5.4 percent), and nonprofessional service worker wages (4.0 percent). Contracted services, supplies, and equipment, which accounted for 18.0 percent of the total educational and general budget, consisted primarily of expenditures for services (7.3 percent), supplies and materials (3.5 percent), and utilities (3.0 percent).

The annual consumption pattern represented in the index is based predominantly on the 1971–72 buying patterns of those few colleges and universities in the United States which classify their expenditures by *object* group; i.e., salaries, supplies and material, communication, equipment, et

Table II–4

Composition by object category of current fund educational and general expenditures[1] in colleges and universities, estimate for fiscal year 1972.

Category	Percent of total expenditures		
PERSONNEL COMPENSATION			82.0
1.0 Professional[2] salaries		58.0	
1.1 Faculty	42.2		
1.3 Graduate assistants	2.7		
1.5 Extension and public service personnel	2.6		
1.6 Administration and institutional services personnel	8.5		
1.7 Library personnel	2.0		
2.0 Nonprofessional wages and salaries		15.0	
2.1 Technicians	1.5		
2.2 Craftsmen	1.0		
2.3 Clerical	5.4		
2.4 Students	2.0		
2.5 Service	4.0		
2.6 Operators and laborers	1.1		
3.0 Fringe benefits		9.0	
CONTRACTED SERVICES, SUPPLIES, AND EQUIPMENT			18.0
4.0 Services		7.3	
4.1 Data processing and equipment rental	1.4		
4.2 Communication	1.5		
4.3 Transportation	.7		
4.4 Printing and duplication	.5		
4.5 Miscellaneous services	3.2		
5.0 Supplies and materials		3.5	
6.0 Equipment		2.5	
7.0 Books and periodicals		1.7	
8.0 Utilities		3.0	
		100.0	100.0

[1] Excluding expenditures for sponsored research.

[2] Professional categories 1.2 "research associates" and 1.4 "other professional, nondoctoral" are R&D personnel associated with sponsored research expenditures which are excluded.

cetera. In particular, prime data sources were the expenditure records of the University of Wisconsin System and the Oklahoma State Regents for Higher Education. The extensive object classification of expenditures from these two sources were used to establish the HEPI's detailed subdivision weightings. The breakdown of expenditures for professional salaries by occupational groupings was based on a professional employee count (multiplied by average salaries) obtained from the U.S. Office of Education 1970–71 Higher Education General Information Survey (HEGIS). A similar subdivision of nonprofessional salaries by occupation was computed using a nonprofessional employee count conducted in 1971 by the Office of Institutional Research, State University of New York. In a few instances, U.S. Department of Labor, Bureau of Labor Statistics Wholesale Price Index weights were used within certain object classes when no institutional data were available; e.g., the division between expenditures for telephone and postal charges within the communication category.

The weights for larger divisions were established from data in the annual reports of a number of public and private colleges and universities classifying expenditures by broad object categories. U.S. Office of Education payroll expenditure data were used to set the major division between expenditures for personnel compensation and for contracted services, supplies, and equipment. The relationship between salary and fringe benefit expenditures was determined from the American Association of University Professors' 1971–72 annual survey.

The object category weights shown in table II–1 are estimated national averages based on limited institutional data. The estimates only approximate actual national values. Furthermore, the expenditure patterns of individual institutions will differ markedly from these averages. Such variance in weighting, however, has no great effect on the applicability of the HEPI to any given institutional situation[7] or in the validity of index numbers themselves. Index validity depends primarily on selecting suitable *price* series and holding budget weights constant. Modest differences in the weights attached to expenditure categories have little effect on overall index values. This is because the HEPI is dominated by the trend in faculty salaries (42.2 percent of the total) and because of similarity in the salary trends for other personnel hired by institutions. Even a substantial difference in weighting has not too great an effect on index values. For example, if in 1967 the 1.7 percent weight attached to books and periodicals—where price inflation is a high 7 percent annually—is transferred to equipment—

[7] Individual institutions or groups of institutions may, of course, design their own educational and general expenditure index using the price series provided in this publication and weighting the various items according to their own distinct expenditure pattern. Values for such tailored indexes are unlikely to deviate significantly from those of the national HEPI. However, it is a relatively easy task to construct a special index using prepared price series, and the gain in validity for a given application may make the exercise worthwhile.

where prices have increased only 3.75 percent annually—the 1974 HEPI value of 152.8 would be reduced only 0.6, to 152.2.[8]

A fixed weight index such as the HEPI occasionally requires revision of the weights assigned various items if the index is to accurately reflect *current* goods and services being purchased. Such revisions should be relatively infrequent since even small changes in the composition or quality of the goods and services being purchased prevents unambiguous comparisons of price *alone* without intangible considerations. New weights, when necessary, may be introduced periodically by a process of "linking" (see p. 18–20) without affecting the index level. The linking process has been used in a weight revision for the two major components of the HEPI—personnel compensation and contracted services, supplies, and equipment. For fiscal years 1961 through 1967 these two components are weighted 74 percent and 26 percent, respectively, based on the 1964–65 budget pattern of colleges and universities. For fiscal years 1967 through 1974 the weights are 79.3 and 20.7 percent, respectively, based on an adjustment of the 1971–72 budget pattern.

In 1971–72 the budget of institutions showed an increase in the relative expenditures for personnel compensation to 82 percent and a corresponding decrease in the proportion spent for contracted services, supplies, and equipment to 18 percent. This change was due partly to the fact that salaries and fringe benefits have been increasing at a faster rate than the prices of contracted services, supplies, and equipment. Also, institutions in efforts to economize have cut back on outside purchases to concentrate limited funds on faculty salaries and instruction. This action decreased the amounts of contracted services, supplies, and equipment purchased *relative* to the number of faculty and staff employed. In reweighting index components, only this type of change in consumption is taken into account. The effects of price change must be excluded.

For fiscal years 1967 through 1974 the 1971–72 budget proportions (82 and 18 percent) have been adjusted to index weighting factors of 79.3 for personnel compensation and 20.7 percent for services, supplies, and equipment. This adjustment properly excludes the effects of price change and accounts only for changes in the consumption pattern of colleges and uni-

[8] This example shows how a difference in weighting would result in a divergence in HEPI values of about 0.1 a year; i.e., the 1968 index value would be 105.9 instead of 106.0, the 1969 value would be 113.0 instead of 113.2, . . . the 1974 value would be 152.1 instead of 152.8. If the HEPI were used to adjust for inflation in funding higher education, what would be the financial consequence of a difference in index values of this magnitude? Holding per student expenditures in constant dollars fixed at the 1967 level ($1,734, see table II–2), comparison of total public and private expenditures as adjusted by the two index series results in a difference over the 1968–74 period of $80 million. Thus a divergence of index values by as little as 0.1 per year amounts to a significant dollar difference in funding at the *national* level, a strong argument for accuracy in weighting if the HEPI or similar index is widely employed. For an individual institution, this difference in weighting would have negligible effect on requested funding levels.

versities; i.e., their purchase of different relative physical *quantities* of goods and services. Budget proportions represent not only the relative physical count of items purchased, but also their price. The adjustment made relates the 1972 to the 1965 budget in terms of implied physical quantity changes excluding price factors. If the 1972 budget proportions were used as unadjusted weighting factors, index values after 1967 would tend to overstate the rate of inflation. The theory and calculations involved in this adjustment are presented in an earlier section "Adjustments for Quantity Changes," pages 20–25.

Index Prices and Data Sources

The list of items priced by the HEPI includes the most important services and goods purchased by colleges and universities for educational and general purposes, and a sample of the less important ones. In combination, these represent all items purchased. This section presents a description of the items priced for the index and data sources. It should be kept in mind that the essential objective in pricing is to maintain constant quality in the item being observed or exclude those differences in price attributable to changes in product or service quality.

1.0. Professional salaries

Subindexes for salaries of the various professional personnel categories are shown in table II–5.

1.1. Faculty

The faculty salary subindex consists of a weighted average of individual indexes of the salaries of professors, associate professors, assistant professors, and instructors as shown in table II–6. The weights are based on the proportion of *total* faculty salaries paid to each academic rank in 1971–72 as follows: professors, 34.5 percent; associate professors, 25.2 percent; assistant professors, 30.2 percent; and instructors, 10.1 percent.

The source of all faculty salary data is the American Association of University Professors' (AAUP) annual survey of college and university faculty salaries and benefits directed by Maryse Eymonerie and published in the summer issues of the *AAUP Bulletin*. In 1971–72, 1,244 institutions with professional rank participated in the survey. Their salary schedules represented payment to 263,240 faculty members. In 1960–61 only 452 institutions participated. To infer national averages from this low earlier survey participation is a rather extreme extrapolation, and the validity of index values for this period may be legitimately questioned on this basis.

In 1965–66 the AAUP began publishing salary increases for the *same* institutions reporting comparable data for 1-year periods. While this price

Table II–5

Subindexes of salaries of professional personnel used for the Higher Education Price Index, fiscal years 1961–74.

1967=100 (Number code in parentheses identifies category as outlined in table II–4.)

Fiscal year	Faculty (1.1)	Graduate assistants (1.3)	Extension and public service personnel (1.5)	Administration and institutional services personnel (1.6)	Library personnel (1.7)	Professional salaries total[1] (1.0)
1961	73.5	76.0	73.5	71.9 est.	69.1 est.	73.2
1962	76.8	78.4	76.8	76.3	74.1	76.7
1963	80.8	82.4	80.8	80.1 est.	77.3 est.	80.7
1964	84.5	86.2	84.5	84.5	80.6	84.4
1965	89.0	90.2	89.0	89.1 est.	86.7 est.	89.0
1966	94.1	93.6	94.1	94.6	92.8	94.1
1967	100.0	100.0	100.0	100.0 est.	100.0 est.	100.0
1968	106.4	105.9	106.4	106.9	107.2	106.5
1969	113.3	112.8	113.3	114.6 est.	114.6 est.	113.5
1970	121.3	120.2	121.3	122.3	121.9	121.4
1971	127.2	125.8	127.2	129.2 est.	128.5 est.	127.5
1972	131.7	132.4	131.7	135.8	135.1	132.5
1973	137.4	136.8	137.4	143.3 est.	142.2 est.	138.4
1974	144.4	142.8	144.4	150.8	149.4	145.4

[1] Professional salaries total index based on weighted average as follows: faculty, 72.76 percent; graduate assistants, 4.66 percent; extension and public service personnel, 4.48 percent; administration and institutional services personnel, 14.66 percent; and library personnel, 3.44 percent.

Table II–6

Indexes and dollar amounts of faculty salaries[1] by rank, all institutions, fiscal years 1961–74.

1967=100

(Number code in parentheses identifies category as outlined in table II–4.)

Fiscal year	Professors		Associate professors		Assistant professors		Instructors		Faculty total index[2] (1.1)
	Amount	Index	Amount	Index	Amount	Index	Amount	Index	
1961	$10,344	71.8	$ 7,949	73.4	$ 6,676	74.7	$ 5,428	76.2	73.5
1962	10,858	75.4	8,309	76.7	6,960	77.8	5,647	79.3	76.8
1963	11,399	79.1	8,752	80.8	7,318	81.8	5,934	83.3	80.8
1964	12,017	83.4	9,127	84.3	7,626	85.3	6,165	86.6	84.5
1965	12,715	88.3	9,623	88.9	7,980	89.3	6,442	90.5	89.0
1966	13,505	93.8	10,186	94.1	8,429	94.3	6,737	94.6	94.1
1967	14,402	100.0	10,829	100.0	8,941	100.0	7,122	100.0	100.0
1968	15,341	106.5	11,530	106.5	9,516	106.4	7,548	106.0	106.4
1969	16,312	113.3	12,296	113.5	10,130	113.3	8,010	112.5	113.3
1970	17,374	120.6	13,066	120.7	11,015	123.2	8,541	119.9	121.3
1971	18,314	127.2	13,792	127.4	11,347	126.9	9,084	127.5	127.2
1972	18,913	131.3	14,266	131.7	11,765	131.6	9,520	133.7	131.7
1973	19,751	137.1	14,887	137.5	12,289	137.4	9,873	138.6	137.4
1974	20,798	144.4	15,641	144.4	12,872	144.0	10,344	145.2	144.4

[1] Average salary for full-time faculty based on standard 9-month academic-year.

[2] Weighted average based on the proportion of total faculty salaries paid to each academic rank in 1971–72 as follows: professors, 34.5 percent; associate professors, 25.2 percent; assistant professors, 30.2 percent; and instructors, 10.1 percent.

Source: American Association of University Professors, relevant issues of the **AAUP Bulletin.**

series would provide a better indication of changes in salary than do unadjusted data for the *total* number of institutions reporting, as a practical matter the differentials between the two trends is extremely small (approximately 1.1 percent for the 7-year period 1964–65 to 1971–72), and currently is insignificant because almost all major institutions now consistently report each year.

Comparison of rates of salary change among institutions by type and control reveals differences that might warrant computation of separate price indexes for certain groups of institutions. During the 12 year period from 1961–62 to 1973–74, the percentage increase in professor salaries for all institutions surveyed by AAUP was 92 percent. For the different institutional groups the increases were as follows: public universities, 91 percent; private universities, 82 percent; public 4-year colleges, 102 percent; private 4-year colleges, 89 percent; and public 2-year colleges, 118 percent (there were too few private 2-year colleges surveyed to determine a valid measurement).

As calculated for all institutions, the overall HEPI increased 90 percent from 1962 to 1974. If a separate index were computed for public 2-year colleges based on the above noted differences in faculty salary growth (applied to each academic rank), the resulting index numbers would increase 104 percent during the same 12-year period. This difference is sufficiently significant to warrant attention in later publications to the development of a separate HEPI for public 2-year colleges. For the other type-control institutional groups, the differences in faculty salary growth rates do not appear sufficient at this time to justify separate index calculations. However, during the present period of recession and inflation, index compilers must be particularly alert to the very real possibility of differences in salary growth occurring between the public and private sectors whose funding patterns differ so substantially.

1.3. Graduate assistants

No salary series for graduate student teaching assistants (TA's) and research assistants (RA's) is available, and a suitable proxy to "present" the trend in their salaries is difficult to select. Policy and practice in compensating graduate assistants vary and are dependent on a number of factors and subject to various restraints.[9] Despite this complexity, all institutions recognize the graduate assistant position as a secondary but supportive activity

[9] Some departments with national reputations vie for outstanding graduates by offering top salaries. The latitude required for such open competition is curtailed at other universities which have adopted institution-wide standard salary schedules. In setting graduate assistant salary levels, institutions give varied attention to the tax exemption status of certain assistant earnings which the Internal Revenue Service considers a statutory scholarship if the reimbursement is for work performed in partial fulfillment of a degree. Some institutions, in seeking to discourage lucrative teaching and research assistantships, contribute to what is termed the "Ph. D. stretchout"—lengthening the time spent by students earning their graduate

to the student's principal academic pursuits. Three considerations appear to underlie the setting of assistant salary levels: (1) part-time earnings of graduate students are used primarily to support the individual while attending college and should therefore be adjusted for cost-of-living increases, (2) payment received for research by graduate students which contributes to their academic progress may be regarded as a scholarship or grant and should consequently correspond to tuition charges, and (3) the graduate assistant, as a bonafied and contributing member of the academic community and an adjunct of the faculty, should be compensated proportionate to and consistent with faculty salary schedules.

Based on evidence that the above three considerations are basic to the establishment of graduate assistant salary policy, a proxy salary series was calculated giving equal weight to: (1) cost-of-living as indicated by the Consumer Price Index, (2) tuition charges, and (3) instructor salaries. The price trend for the resulting composite index proved to be, for all practical purposes, equivalent to the trend in instructor salaries alone. As a result, instructor salaries at universities (which employ about 85 percent of all junior faculty) is used as a proxy for the price series for graduate assistants.

1.5. Extension and public service personnel

Extension and public service activities are designed primarily to serve the general public as contrasted with enrolled students. Examples are adult study courses, community development, conferences and institutes, evening schools, correspondence study, radio and TV services, film library, and consultation to State and local government. By far the largest proportion of teachers for extension and continuing education are from an institution's own staff: 80 percent for credit courses, 63 percent for noncredit courses, and 54 percent for conferences, institutes and workshops. Institutional staff teaching extension and continuing education courses are paid generally according to a fixed scale, and to a lesser extent according to individual

degree—by keeping assistant salaries at a minimum. A minimum wage policy may also be employed by institutions seeking to curtail enrollments in fields where a labor surplus is thought to exist.

Graduate student assistant salary levels are also under certain restraints. If the earnings of part-time TA's and RA's approach those of full-time instructors and research associates, faculty and research directors may seek greater employee productivity by substituting instructors for student assistants. Also, since the activities of graduate assistants (particularly RA's) frequently contribute directly to their academic progress, as in thesis preparation, assistant salaries must remain below those of other, less academically supportive positions available to graduate students such as instructor. Thirdly, graduate assistant salaries must be lower than labor market earnings of newly hired bachelor degree holders to discourage a massive increase in assistant applicants who believe they can earn as much continuing their education as working in the economy.

negotiations based on the going rate of the profession, anticipated income of the program, and preparation and travel time of the lecturer.[10]

The National University Extension Association (NUEA) has surveyed and published salary data for extension and continuing education administrative positions for academic years 1971 and 1972. No salary data, however, are available for faculty participating in these programs. In the absence of such data, it is assumed that the fixed scale of payment to an institution's own staff teaching extension and continuing education courses parallels faculty salaries for resident instruction. On this basis, AAUP data for faculty are used as a proxy for the price series for extension and public service.

1.6. Administration and institutional services personnel

This price series for 1971–72 and 1973–74 is based on a mean salary value for 17 administrative positions as reported in both years by 961 institutions responding to the annual *Administrative Compensation Survey* of the College and University Personnel Association. Mean salary for each position is presented in table II–7. Administrative positions normally associated with auxiliary enterprise operations such as director of food services, student housing, student union, athletics, and bookstore manager are excluded.

Administration and institutional services personnel salaries for the period 1960–61 through 1971–72 (and linked to the above series in 1971–72) are based on *median* annual salaries of 10 administrative officer positions in 4-year institutions surveyed by the National Education Association, Research Division. The additional positions and coverage of 2-year institutions by the College and University Personnel Association (CUPA) survey is the reason why CUPA's data are now used in preference to that of NEA's.

At 4-year and 2-year colleges, salary payments for the administrative positions surveyed by CUPA account for a large portion of total expenditures for this subindex item. Even though universities have more nonacademic positions—because of larger staffs in institutional development and student services—it is assumed that the price changes for these additional positions parallel those in the price series for the administrative officers used. It should be noted that the price series trend for faculty and administrative personnel are similar (see table II-5); therefore, any error in weighting between the two items is of little consequence to overall HEPI values.

1.7. Library personnel

Salary data for various library positions do not exist. As a proxy price series for all positions, the salary of head librarians is used—mean values

[10] National University Extension Association, *Annual Survey of Extension and Continuing Education in NUEA Member Institutions, 1969–70: Administration, Financing and Admissions Policies*, Washington, D.C., 1971, pp. 1, 26.

Table II–7

Annual salaries of administrative officers in colleges and universities, fiscal years 1960–74.

Position	1959–60	1961–62	1963–64	1965–66	1967–68	1969–70	1971–72	1973–74
Index number (1966–67 = 100)	68.3	76.3	84.5	94.6	106.9	122.3	135.8	150.8
Mean for all positions	$ 9,117	$10,181	$11,282	$12,624	$14,271	$16,323	$17,215 $18,127	$19,112
Chief executive officer (pres)	13,827	15,375	17,330	19,638	22,203	25,979	29,805 29,750	32,612
Chief academic officer							23,771	26,308
Registrar	6,340	7,312	8,142	9,123	10,366	11,743	14,373 13,108	15,896
Director of admissions	7,680	8,636	9,572	10,364	11,446	12,983	15,178 14,280	16,919
Director, computer center							17,119	19,212
Chief business officer	8,536	9,405	10,512	11,780	14,914	17,615	21,387 19,419	23,862
Purchasing agent							13,119	14,580
Director, personnel services							15,317	17,565
Director, physical plant							15,039	16,840
Comptroller							16,537	18,528
Chief development officer							19,961	21,561
Chief public relations officer	7,194	7,659	8,440	9,596	10,823	12,764	15,892 14,652	17,484
Director, information office							13,211	14,977
Chief student life officer							19,355	21,320
Director, student placement							14,103	15,479

Director, student financial aid							12,447	14,002
Director, student counseling							16,046	17,767
Vice-president	14,154	16,000	17,130	19,012	21,458	23,250	26,313	
Dean of the college	10,723	12,230	13,644	15,703	16,141	19,125	19,975	
Dean of students	8,796	9,592	10,694	12,027	14,086	16,050	17,830	
Dean of men	7,280	8,202	9,144	9,783	10,983	12,319	13,490	
Dean of women	6,638	7,399	8,216	9,209	10,289	11,406	12,448	

Note: Salary data are for full-time employees based on 12 months of service and exclude fringe benefit payments. Individual position salaries are median values in 4-year institutions, 1960–72; mean values for the same 2-year and 4-year institutions reporting comparable data, 1972–74. Excluded are administrative positions for auxiliary enterprise operations; e.g., director of food services, student housing, student union, athletics, and bookstore manager.

Source: 1960–72 data, National Education Association, Research Division (Copyright 1970 and 1972 by the NEA. All rights reserved.) 1972–74 data, College and University Personnel Association, **1973–74 Administrative Compensation Survey,** Washington, D.C., 1974.

reported by the College and University Personnel Association (1971–72 and 1973–74), and median values reported by the National Education Association (1960–61 through 1972–73). The two salary series are linked in 1971–72. These data are presented in table II–5.

There were nearly 22,000 FTE professional library staff in 1970–71. A median of 4.0 were employed per institution; 2.0 at the 25th percentile, 7.0 at the 75th percentile. It is assumed that the trend in salary increases for these small professional staffs parallels that of the head librarian.

2.0. Nonprofessional wages and salaries

For nonprofessional categories the assumption is made that salaries paid by colleges and universities are primarily determined by competition in the open labor market. Although the absolute wage levels paid nonprofessionals by colleges may be lower than paid outside the industry, the relative change from year-to-year is probably the same for all sectors. Hence the price series for the various occupations for all employers is applicable to colleges and universities. The salary subindexes for nonprofessional occupations are presented in table II-8.

2.1. Technicians

Technicians are involved in skilled work at a level requiring knowledge and formal training such as that obtained at technical institutes, 2-year colleges, and technical specialist training programs at universities. Examples of various types of technicians are: engineering, laboratory, medical X-ray, dental, optical, catographic, museum, histology, etc. Also included in the technician category are electronic data processing (edp) personnel. The salary data used for engineering technicians and draftsmen is collected by the Bureau of Labor Statistics, *National Survey of Professional, Administrative, Technical, and Clerical Pay* (PATC). The source of edp personnel salaries is survey data collected by the periodical *Infosystems* (see pp. 57–59 of this text for further discussion of edp salaries).

2.2. Craftsmen

For the craftsmen category a fixed weight composite of average weekly earnings for eight skilled maintenance and toolroom occupations (carpenters, electricians, machinists, mechanics, mechanics-automotive, painters, pipefitters, and tool and die makers) collected by the Bureau of Labor Statistics, *Area Wage Survey,* is used.

2.3. Clerical

The clerical category is priced by a fixed weight composite index of wage trends for eight clerical and clerical supervisory occupations (accounting clerks, file clerks, keypunch operators, keypunch supervisors, messengers, secretaries, stenographers, and typists) collected by the Bureau of Labor Statistics, *National Survey of Professional, Administrative, Technical, and Clerical Pay* (PATC).

Table II–8

Subindexes of wages and salaries of nonprofessional personnel used for the HEPI and R&DPI, fiscal years 1961–74.

1967=100 (Number code in parentheses identifies category as outlined in tables II–4 and III–5.)

Fiscal year	Technicians			Craftsmen (2.2)	Clerical (2.3)	Students (2.4)	Service (2.5) (HEPI only)	Operators and laborers (2.6) (HEPI only)	Nonprofessional wages and salaries total (2.0)	
	Engineering	Draftsmen	Total[1] (2.1)						HEPI[2]	R&DPI[3]
1961	83.5 est.	85.8	82.2	83.2	83.1	82.3	91.9 est.	82.3	85.2	82.5
1962	86.0	88.5	84.4	85.8	85.8	84.9	93.5 est.	84.9	87.5	85.0
1963	88.5	91.7	86.7	88.1	88.0	87.7	95.0	87.7	89.7	87.3
1964	91.7	94.1 est.	89.4	90.5	90.4	90.4	96.3 est.	90.4	91.9	89.9
1965	93.8	95.2	92.2	92.7	92.6	93.0	97.6 est.	93.0	94.0	92.5
1966	96.4	96.6	95.6	96.1	95.4	95.9	98.9 est.	95.9	96.5	95.7
1967	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1968	105.1	105.3	105.3	105.5	105.3	105.4	104.7 est.	105.4	105.2	105.4
1969	111.2	111.4	111.7	112.4	111.1	111.8	109.3	111.8	110.9	111.7
1970	118.2	116.9	118.7	119.0	118.0	118.6	116.0	118.6	117.7	118.6
1971	125.9	123.4	125.5	127.9	125.7	128.1	128.0	128.1	126.9	126.4
1972	132.3	132.3	132.7	137.9	133.4	138.5	138.7	138.5	136.1	134.7
1973	138.5	140.5	140.0	146.6	140.6	147.2	148.0	147.2	144.3	142.5
1974	146.8	149.9	148.2	158.6 est.	149.6	160.1 est.	156.0	160.1 est.	153.9	152.3

[1] Technicians total index based on weighted average as follows: engineering technicians, 50 percent; draftsmen, 25 percent; and electronic data processing personnel (see table II–9 for price series), 25 percent.

[2] HEPI nonprofessional wages and salaries total index based on weighted average as follows: technicians, 10.0 percent; craftsmen, 6.7 percent; clerical, 36.0 percent; students, 13.3 percent; service, 26.7 percent; and operators and laborers, 7.3 percent.

[3] R&DPI nonprofessional wages and salaries total index based on weighted average as follows: technicians, 48.9 percent; craftsmen, 16.8 percent; clerical, 16.8 percent; and students, 17.5 percent.

2.4. Students

The wages paid undergraduate students performing a wide variety of duties at a semiskilled or unskilled level are likely to be at or near minimum wage levels. However, the periodic and somewhat arbitrary setting of minimum wages under the Fair Labor Standards Act [11] results in a wage series which is disrupted, increasing in abrupt increments with long intervals of fixed values. This pattern is inconsistent with the relatively steady growth trend of wages in most occupations. Furthermore, the situation is complicated by the fact that in 1967, institutions of higher education came under the Fair Labor Standards Act for the first time.[12] Beginning at $1 per hour, 40 cents less than the existing minimum wage stipulated for employees engaged in interstate commerce, the minimum wage rate for colleges "caught-up" by rapid increases during the next 4 years. Probably few students were paid as low as $1 an hour in 1967, so this rapid increase did not report the slower growth in wages actually paid. Adding to this complexity are the minimum wage laws in many States which variously affect student wages and which cannot easily be taken into account at the national level. These conditions preclude minimum wage rates from serving as an accurate proxy for student wages.

The proxy used for student wages is a fixed weight composite of wage trends for five unskilled plant occupations (janitors, porters, cleaners, laborers, and material handlers) collected by the Bureau of Labor Statistics, *Area Wage Survey*. To the extent that colleges and universities compete with local business firms for student employees, this wage series is a suitable, and in the absence of actual student-wage data, necessary proxy.

2.5. Service

Service employees perform work in such areas as cleaning service (window washer, maid, janitor), food service (cook, dishwasher, waitress), health service (hospital attendant, nurse's aide, practical nurse), and personal service (locker room attendant, barber, welfare service aide, child-care worker). Also included in the service category are protective workers such as police, firemen, traffic officers, and park patrolmen. Service positions usually require little, if any, formal education. The price series used for the service category are median weekly earnings of cleaning, food,

[11] Minimum wage rates for employees engaged in interstate commerce set by the Fair Labor Standards Act are as follows: Jan. 1, 1960, $1/hr; Sept. 1, 1961, $1.15/hr; Aug. 1, 1963, $1.25/hr; Feb. 1, 1967, $1.40/hr; Feb. 1, 1968, $1.60/hr; May 1, 1974, $2/hr; Jan. 1, 1975, $2.10/hr; and Jan. 1, 1976, $2.30/hr. Source: U.S. Department of Labor, Employment Standards Administration, Wage and Hour Division.

[12] See U.S. Department of Labor, Employment Standards Administration, Wage and Hour Division, *Institutions of Higher Education Under the Fair Labor Standards Act*, U.S. Government Printing Office, Washington, D.C., April 1973, 13 pp.

health, personal, and protective service nonprofessional full-time employees. The source of the series is Bureau of Labor Statistics data derived from the *Current Population Survey*. It should be pointed out that this price series is *not* fixed-weight; i.e., changes in the mix of occupations within the service category do affect series values.

2.6. Operators and laborers

This occupational group includes workers performing a variety of duties at a semiskilled and unskilled level. Examples of positions in this category are chauffeur, truckdriver, janitor, cleaner, material handler, caretaker, maintenance helper, and garage helper. The price series used is average weekly earnings for unskilled plant (men) workers in positions as janitor, porters, cleaners, laborers, and material handlers. The source of this fixed-weight price series is the Bureau of Labor Statistics, *Area Wage Survey*.

3.0. Fringe benefits

The fringe benefit category consists of expenditures by institutions for various services to staff members. The principle benefits and their usual order of importance are: retirement contributions, social security, health insurance, life insurance, unemployment compensation, workmen's compensation, and income continuation insurance. Remissions of tuition and fees granted because of faculty or other staff status are usually also considered a fringe benefit.

The price series used for fringe benefits is a composite index of the difference between AAUP surveyed compensation and salary paid each academic rank. In the absence of benefits data for nonprofessional employees, the benefits price series for faculty is assumed to apply to all institutional personnel. The price index series for fringe benefits is presented in table II–1, page 31.

During the last 13 years, when salaries paid by colleges and universities have doubled, the amounts paid for fringe benefits have quadrupled. As pointed out by AAUP, one reason for this growth is that benefits are paid out of pre-tax income rather than after-tax income and this makes them on the average a bargain to the faculty. Besides a genuine effort by institutions to improve fringe benefits, other factors contributing to their rapid growth have been the increase in Federal requirements for social security payments (3.60 percent in 1965, 5.85 percent in 1974) applied to a larger salary base, price controls which have temporarily restricted salary increases, and the fact that institutions may use benefit funds for working capital.

In the context of a price index, fringe benefits are regarded as a package preinvestment of earnings, which, together with salary, constitute the total across-the-board compensation institutions must pay to attract and hold competent staff. Thus the price series for fringe benefits does *not* price a

fixed package of benefits whose form and quality are kept constant.[13] Rather the price series represents, as it does for salaries, the amount institutions are required to pay faculty and staff in this form to remain competitive in the labor market.

There is some concern that the price series for fringe benefits is inflated due to the early nonreporting by some institutions of retirement contributions not vested in the faculty member within 5 years. An institution must meet this requirement for inclusion of its retirement payments in the AAUP survey. However, a comparison of the trend in fringe benefits for all institutions with that of 41 institutions (all of which had a vested 5-year retirement program in 1963–64 except one), suggests that any possible upward bias is likely to be small.

Contracted Services, Supplies, and Equipment

Services, supplies, and equipment constituted 18.0 percent of the educational and general expenditures (excluding sponsored research) of colleges and universities during the base period 1971–72.[14] The division of these expenditures, shown in table II-4, are services, 7.3 percent; supplies and material, 3.5 percent; equipment, 2.5 percent; books and periodicals, 1.7 percent; and utilities, 3.0 percent.

These services, materials, supplies, equipment, etc., are produced and sold by a wide range of industries. Some purchases are relatively commonplace items typical of the operation of many organizations and commercial businesses; e.g., office supplies and equipment, postage, telephone, utilities, and transportation. Other purchases are more specialized items necessary for instruction and research; e.g., scientific instruments and measuring devices, electronic data processing, chemicals, laboratory glassware, and books and periodicals. Because of the number, diversity, and specialty of these items, any grouping of similar commodities for pricing purposes will necessarily be crude, involving approximate weightings and representative pricing.

[13] A fixed package of fringe benefits may, in fact, be impossible to define, necessitating the interpretation adopted. The principle difficulty is in defining a future *fixed* standard of living and estimating its *future* cost to be partially met by a retirement income established through a uniform series of yearly contributions. Any change in the estimated future retirement income required would result in higher or lower yearly contributions—a price change. While these difficulties may not be insurmountable, this approach is more theoretical than realistic. Retirement contributions by *institutions* are *not* set to provide a future fixed standard of living. Rather, they are set so that in combination with salary the *total* compensation offered is competitive in the labor market. It should be pointed out that *individuals*, as opposed to institutions, are naturally interested in their standard of living on retirement, which accounts for the choice by some faculty to make additional TIAA-CREF payments.

[14] For fiscal years 1961 through 1967, services, supplies, and equipment were weighted 26 percent based on their budget proportion for the 1964–65 base period. See discussion pp. 43–44 and 20–25.

4.0. Services

The price indexes for contracted services are presented in table II-9.

4.1. Data processing and equipment rental

In educational and general operations, the costs of data processing consist of expenditures for outside contracted services of operational and programming personnel, 30 percent, and for equipment purchase and rental, 70 percent. In research and development this division of costs is estimated to be 60 percent and 40 percent respectively. Personnel-services have been priced using data processing salaries reported by the periodical *Infosystems'* nationwide annual survey covering a variety of job classifications. In 1973 the survey reflected the salaries of 36,170 electronic data processing (edp) employees in over 1,500 installations in major metropolitan areas. A fixed weight composite average weekly salary was calculated for 20 edp job classifications consistently reported since 1967. The jobs include managers and supervisors, computer systems analysts, programmers, computer operators, and keypunch and tape operators. From 1960 to 1966 the nationwide annual edp salary survey was published in the periodical *Business Automation*. For this earlier period a composite average weekly salary was calculated for 28 edp positions and "linked" to the 1967–74 salary series by drawing a smooth curve consistent with the trend line of both plots.

The pricing of data processing hardware is based on monthly rental rates of the IBM 360, model 30 computer from 1964 through 1971, linked in 1971 and continuing to the present with the monthly rental rates of the IBM 370, model 135 computer. The technology and capacity of both computers has remained essentially constant during their respective price periods. However, the newer IBM 370 has vastly improved technology over the older IBM 360, having greater capacity, more sophisticated processing capabilities, greater speed, lower cost per operation, and smaller physical size. In 1971 the 370 rental cost was approximately 3½ times the earlier 360. By linking in 1971, this price differential due to a change in product design is *not* reflected in the price index numbers for computer hardware.

The following should be kept in mind. While price increases for fixed model computers have been very modest during the last decade, colleges and universities have been continually upgrading their data processing capabilities by purchasing newer, more expensive computers of advanced design. Thus, total expenditures for data processing and computers has increased greatly, almost all being "real" growth in constant dollars with little erosion of purchasing power because of price increases. And, from a benefit-cost ratio standpoint, recent advances in computer technology are reported to have doubled processing capability at half the cost—a fourfold improvement in return per-dollar investment. Again, this im-

Table II–9
Subindexes of contracted services used for the HEPI and R&DPI, fiscal years 1961–74.

1967=100 (Number code in parentheses identifies category as outlined in tables II–4 and III–5.)

Fiscal year	Data processing and equipment rental				Communication (4.2)	Transportation (4.3)	Printing and duplication (4.4)	Miscellaneous services (4.5)	Consultants and other professional services (4.6) (R&DPI only)	Services total HEPI[2] (4.0)	Services total R&DPI[3] (4.0)
	Edp personnel salaries	Edp hardware	Total[1] HEPI (4.1)	Total[1] R&DPI (4.1)							
1961	76	95.7 est.	89.8	83.9	98.1	84.1	85.6	81.3	70.5	86.9	82.4
1962	77	96.4 est.	90.6	84.8	98.2	87.6	87.7	83.7	73.9	88.7	84.6
1963	78	97.1 est.	91.4	85.6	99.5	89.1	89.4	86.5	77.7	90.6	86.8
1964	80	97.4 est.	92.2	87.0	101.1	90.7	91.3	89.4	83.7	92.6	89.3
1965	86	98.5	94.8	91.0	100.6	92.5	93.7	92.7	88.5	94.8	92.5
1966	93	98.5	96.9	95.2	98.4	93.7	96.8	96.0	93.5	96.5	95.6
1967	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1968	105.8	101.6	102.9	104.1	101.1	104.0	103.4	105.5	107.1	103.8	104.8
1969	113.0	101.6	105.0	108.4	103.5	110.3	108.6	111.6	114.4	108.3	110.5
1970	121.4	99.3	105.9	112.6	104.4	121.7	114.0	118.5	121.6	113.2	117.1
1971	126.8	98.5	107.0	115.5	108.1	135.6	119.7	126.4	128.6	119.3	124.5
1972	133.8	101.9	111.5	121.0	117.4	143.2	126.5	133.4	134.3	126.4	131.3
1973	142.6	105.2	116.4	127.6	120.8	146.3	132.1	140.6	139.2	131.9	137.4
1974	149.4	106.0	119.0	132.0	126.1	148.2	140.1	149.5	147.2	138.1	144.4

[1] Data processing and equipment rental total index based on weighted average as follows: HEPI—edp personnel salaries, 30 percent; edp hardware, 70 percent. R&DPI—edp personnel salaries, 60 percent; edp hardware, 40 percent.

[2] HEPI services index total based on weighted average as follows: data processing and equipment rental, 19.2 percent; communication, 20.55 percent; transportation, 9.6 percent; printing and duplication, 6.85 percent; and miscellaneous services, 43.8 percent.

[3] R&DPI services index total based on weighted average as follows: data processing and equipment rental, 18.1 percent; communication, 5.0 percent; transportation, 12.5 percent; printing and duplication, 5.0 percent; miscellaneous services, 52.5 percent; and consultants and other professional services, 6.9 percent.

provement in utility does *not* in any way alter price index values for computer hardware which report only price changes for products of *constant* quality.

4.2. Communication

This subindex is a fixed weight average of the Bureau of Labor Statistics Consumer Price Index (CPI) series for residential telephone service (82 percent) and postal charges (18 percent).

4.3. Transportation

This subindex is the CPI price series for public transportation which represents fares for local transit, taxicab, railroad (coach), airplane (chiefly coach), and intercity bus. Future development of the price series for this subindex should include the addition of a component reflecting the considerable use of automobile transportation (leasing, rentals, reimbursement for private use, etc.) by college personnel.

4.4. Printing and duplication

The primary expenditures made by colleges and universities in printing and duplication are for production. Associated overhead expenditures for administration, services, utilities, etc., are small and generally included in their own category. In a 1973 survey, the Printing Industry of America determined that the major direct costs of production—paper and worker payroll—were in the ratio of 2 to 3. Using this ratio a fixed weight composite index is used for printing and duplication based on the Bureau of Labor Statistics, Wholesale Price Index price series for book paper #2 plain offset (BLS No. 0913-0122), weighted 40 percent, and the average weekly earnings of production or nonsupervisory workers in the printing and publishing industry, weighted 60 percent, collected by the Bureau of Labor Statistics as part of their *Employment and Earnings* series.

4.5. Miscellaneous services

This category includes contracts for a wide variety of professional, technical, and skilled services provided by consultants, technicians, and craftsmen hired by colleges and universities from outside the institution for particular jobs or projects (payment of legal fees is an example). Also included as miscellaneous services are expenditures for such items as insurance, advertising, dues and memberships, contributions and prizes, taxes, laundry, and trucking. The proxy for pricing this broad service category is a composite index of salaries for professional, administrative, and technical support collected by the Bureau of Labor Statistics, *National Survey of Professional, Administrative, Technical, and Clerical Pay* (PATC). Occupations in this group are accountants, auditors, chief accountants, attorneys, buyers, job analysts, directors of personnel, chemists, engineers, engineering technicians, and drafting. Each of the 11 occupations are given *equal* fixed weight in the composite index.

5.0. *Supplies and materials*

The extensive number, specialization, and variety of supplies and materials used by colleges and universities plus lack of related detailed accounting data permits use of only broad category items and approximate weightings. In particular, the near complete absence of R&D supply and material data and applicable price series reduces the precision of the R&D supplies and materials subindex to a gross and limited estimate. The HEPI supplies and materials subindex series is presented in table II-1, page 31.

Major supply and material categories, separate estimates of their relative weights for educational and general expenditures and for sponsored research, and Wholesale Price Index (WPI) commodity price series used for the supplies and materials subindex are shown below. Because many

Supply and material category	WPI commodity price series	Estimated relative weight[1] HEPI	R&DPI
Chemical and glass supplies	Industrial chemicals; BLS No. 061 Glass containers, BLS No. 138	6	10
Electronic technical supplies	Electronic components and accessories, BLS No. 1178	5	6
Photographic supplies	Photographic supplies, BLS No. 1542	3	4
Drugs and pharmaceuticals[2]	Drug and pharmaceutical materials, BLS No. 0631	2	4
Stationery and office supplies	Office supplies and accessories, BLS No. 0915–06 Writing paper, rag content; BLS No. 0913–0141 Pens and pencils, BLS No. 1595	40	20
Forage and animal supplies[2]	Grains, BLS No. 0122	3	4
Gasoline, oil, and lubricants	Gasoline, BLS No. 0571 Finished lubricants, BLS No. 0576	4	2
Operation and maintenance supplies	Soaps and synthetic detergents, BLS No. 0671 Electric lamps/bulbs, BLS No. 1177 Prepared paints, BLS No. 0621 Mixed fertilizers, BLS No. 0651 Sanitary papers and health products, BLS No. 0915–01 Brushes, BLS No. 1597	12	...
Materials and supplies—general	Intermediate materials, supplies and components, excluding intermediate materials for food manufacturing and manufactured animal feeds	25	50
		100	100

[1] Weight estimates based on limited data provided by the General Financial Reporting Office, the University of Wisconsin System, Madison. Within supply and material categories the various WPI commodity price series used are assigned WPI weights.

[2] The R&D Price Index prices research performed at universities, excluding the research activities of associated medical schools and agricultural stations. The weights assigned to drugs and pharmaceuticals and forage and animal supplies have been reduced accordingly.

of the bulk products purchased by colleges and universities involve transactions in primary rather than retail markets, considerable use is made of WPI product class price series in this expenditure category as well as for equipment and utilities.

6.0. Equipment

Accounting practices for classifying equipment purchases vary among institutions, with no standard definitions commonly applied. However, the type of equipment generally purchased as part of current operations is usually small and easily movable. To be classified "equipment", as opposed to "expendable utensils" or "supplies", an item generally must cost $50 or more and have a useful life of at least 3 years. Examples are projectors, calculators, slide rules, microscopes, fans, cameras, tape recorders, and typewriters. Larger, more expensive permanent equipment is generally purchased with plant funds. Note also that standard accounting practice generally includes equipment *repair* within current fund expenditures for equipment.

Detailed breakdown of current fund expenditures for equipment by type of equipment purchased is not available. This has necessitated selection of a few equipment items, included in the Wholesale Price Index series, as *representative* of the many small types of equipment purchased by colleges and universities. As a result, the surrogate subindex for equipment, as for supplies and materials, is a limited estimate. The HEPI equipment subindex series is present in Table II–1, p. 31.

Major equipment categories, separate estimates of their relative weights for educational and general expenditures and for sponsored research, and Wholesale Price Index (WPI) commodity price series used for the equipment subindex are shown on page 62.

7.0. Books and periodicals

This subindex, presented in table II-10, is a fixed weight average of the price series for selected hardcover trade and technical books (published in *The Bowker Annual of Library and Book Trade Information)* and the U.S. periodicals price series (published annually in the July issue of the *Library Journal)*. The weights of 70 percent for hardcover books and 30 percent for periodicals are based on the expended proportions of the new acquisitions budget of colleges and universities, estimated from fall 1973 library data collected but not tabulated by the U.S. Office of Education.

8.0. Utilities

This subindex is a composite of the Wholesale Price Index series for natural gas (BLS No. 0531-0101), residual fuels (BLS No. 0574), commercial electrical power (BLS No. 0542), and water and sewerage services (CPI). The weights—heating fuel, 30 percent (natural gas, 20 percent;

residual fuels, 10 percent); commercial power, 60 percent; and water and sewerage services, 10 percent—are based on University of Wisconsin System data modified for a central U.S. latitude. The utilities subindex series is presented in Table II–1, p 31.

Equipment category	WPI commodity price series	Relative weight[1] HEPI	Relative weight[1] R&DPI
Rental	Machinery and equipment, BLS No. 11	15	5
Repair	Craftsmen average weekly earnings, BLS *Area Wage Surveys*	20	10
Office	Office and store machines and equipment, BLS No. 1193	15	5
Machinery, tools, and apparatus[2]	Hand tools, BLS No. 1042 Cutting tools and accessories, BLS No. 1135 Electrical machinery and equipment, BLS No. 117 Welding machines and equipment, BLS No. 1133 Fabricated structural metal products, BLS No. 107	40	70
Classroom and laboratory[2]	Scales and balances, BLS No. 1146 Electrical integrating and measuring instruments, BLS No. 1172 Television receivers, BLS No. 1252 Musical instruments, BLS No. 1593 Photographic equipment, BLS No. 1541 Sporting and athletic goods, BLS No. 1512	10	5
Books	Price series for hardcover trade and technical books, *The Bowker Annual of Library and Book Trade Information*	—	5
		100	100

[1] Weight estimates based on limited data provided by the Central Financial Reporting Office, the University of Wisconsin Systems, Madison.

[2] Within equipment categories the various WPI commodity price series used are weighted equally as representative items.

Table II–10

Average prices and indexes for hardcover books and U.S. periodicals, fiscal years 1960–74.

1967=100 (Number code in parentheses identifies category as outlined in table II–4.)

Year	Hardcover books		U.S. periodicals		Total book and periodical index[2] fiscal year (7.0)
	Average price calendar year	Index[1] fiscal year	Average price calendar year	Index[1] fiscal year	
1960	$ 5.24	.....	$ 5.32	.....	.....
1961	5.81	69.4	5.63	70.9	69.9
1962	5.90	73.5	5.92	74.5	73.8
1963	6.55	78.2	6.31	79.2	78.5
1964	6.93	84.6	6.64	83.8	84.4
1965	7.65	91.5	6.95	88.0	90.5
1966	7.94	97.9	7.44	93.1	96.5
1967	7.99	100.0	8.02	100.0	100.0
1968	8.47	103.3	8.65	107.9	104.7
1969	9.37				
	9.50[3]	112.4	9.31	116.2	113.5
1970	11.66	132.4	10.41	127.6	131.0
1971	13.25	156.3	11.66	142.8	152.3
1972	12.99	164.6	13.23	161.1	163.6
1973	12.20	158.1	16.20	190.4	167.8
1974	14.09	164.9	17.71	219.4	181.3

[1] Indexes are not fixed-weight indexes and reflect changes in the type and mix of books and periodicals from year-to-year.

[2] Weighted average of book index and periodical index. The weights used—hardcover books, 70 percent; U.S. periodicals, 30 percent—are based on the estimated proportion of the total acquisition budget expended for each.

[3] Since the new category "travel" was added, prices were linked in 1969.

Source: Prices of hardcover books are based on tabulations recorded in the "Weekly Record" section of **Publishers Weekly** for the years indicated. Not included are mass-market paperbacks, government documents, and certain multivolume encyclopedias. Published in **The Bowker Annual of Library and Book Trade Information**, R. R. Bowker, New York, 1974.

U.S. periodical prices are based on a total group of 2,372 titles published in the July issues of the **Library Journal** since 1964.

CHAPTER III.

UNIVERSITY RESEARCH AND DEVELOPMENT PRICES AND INDEXES

Primarily performed by universities and funded by Federal agencies,[1] sponsored research and development at institutions of higher education was funded at an estimated $2.5 billion in fiscal year 1974. Together with an estimated $.75 billion for associated indirect costs and $.55 billion for departmental research, the $3.8 billion total R&D expenditures at colleges and universities was approximately 12 percent of all R&D sponsored in the United States.[2] As with any large aggregate, it is difficult to gain meaning from dollar amounts of this magnitude. To achieve perspective, it is necessary to relate absolute values to a relevant base, in this instance by dividing by the number of university research scientists and engineers. In unit terms —R&D expenditures per scientist—total dollars are scaled down to a meaningful user unit level. Further insight can be gained by comparing unit expenditures over time to identify relative growth or decline. This operation, to be realistic, must compare dollars of constant purchasing power. In times of rapid inflation, comparison of actual (current) dollars from year-to-year can be extremely misleading, and, at best, a relatively meaningless exercise. The Research and Development Price Index (R&DPI) presented in this

[1] Most research conducted at institutions of higher education is performed by universities through funding by Federal agencies (71.7 percent), by universities funded by nongovernment sources (12.0 percent), and by 4-year colleges funded by the Federal Government (9.5 percent). State and local government funding of sponsored research at all colleges and universities in 1972 amounted to 4.7 percent of the total. Source: Paul F. Mertins and Norman J. Brandt, *Financial Statistics of Institutions of Higher Education, Current Funds Revenues and Expenditures 1972–73*, U.S. Department of Health, Education, and Welfare, Office of Education, U.S. Government Printing Office, Washington, D.C., 1975.

[2] Industry, supported by its own and by Federal funds, performed 67.0 percent of all basic research, applied research, and development. The share performed by other sectors was as follows: Federal Government, 15.0 percent; colleges and universities, 11.9 percent; federally funded R&D centers associated with universities and colleges, 2.6 percent; and other nonprofit institutions, 3.5 percent. U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States: 1974*, U.S. Government Printing Office, Washington, D.C., p. 532.

chapter is designed to remove the effects of inflation from college and university research expenditures by converting actual to constant (deflated) dollars. The index is described beginning on page 74, preceded by a discussion of how the index can be employed to analyze the effects of inflation on R&D expenditures.

The Effects of Inflation on Research and Development

Price Trends

Much of the discussion of price trends affecting the current operations of colleges and universities, pp. 27–30, applies, with slight quantitative differences, to research and development. Shown in figure III–1 (see also table 1 and figure 1, pp. 9 and 10, for comparison with other price indexes) the price of goods and services purchased for research and development increased 88 percent during the 13 year period 1961–74. The trend, as one would suspect, parallels the price changes in current operations as measured by the HEPI. Again, the reason why R&D costs have risen faster than the inflation affecting the general economy is that the largest purchase is faculty and other professional research services where salaries have increased at a greater rate than the price of durable commodities, which are the major purchases of family consumers. Because research and development involves somewhat less personnel compensation than current operations (67.0 percent of the budget compared to 82.0 percent) the rate of increase for the R&DPI has been slightly less than that of the HEPI.

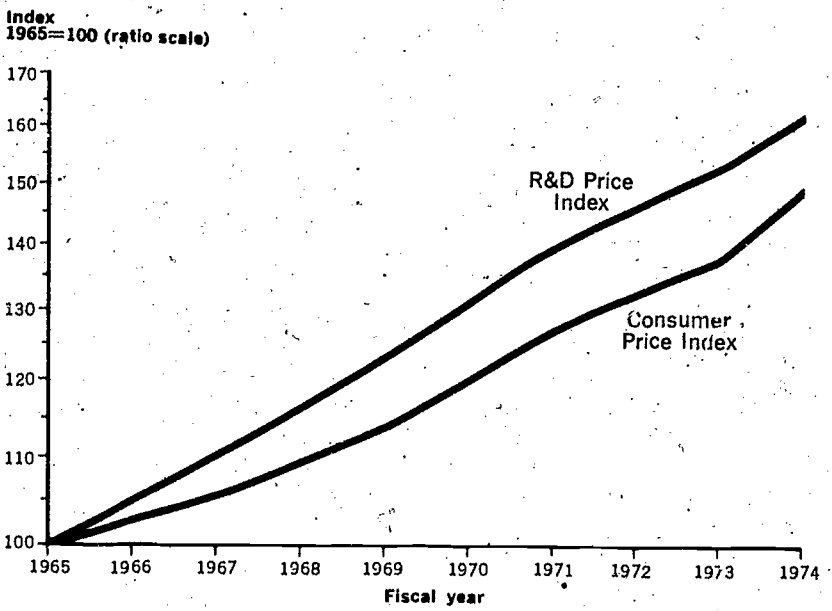
Price trends within the Research and Development Price Index are shown in table III–4, p. 76. Although there are slight quantitative differences between the price series for each of the R&DPI subindexes and their counterparts in the HEPI, the presentation of price trends within the HEPI, pp. 30–33, is relevant to the subindexes of the R&DPI. The reader is therefore referred to this earlier section for discussion of the price trends of each of the R&DPI subindexes (professional salaries, nonprofessional wages and salaries, fringe benefits, services, supplies and materials, and equipment).

Deflation of Expenditures

Perspective on available resources is gained by placing absolute amounts on an appropriate base dimension. Educational and general expenditures are reported per student. Research and development expenditures can also be related to users, in this case college and university scientists and engineers engaged in research. This unit measure reports the *financial resources available per research participant.*

Figure III–1.

—Comparison of trends in price change in higher education sponsored research and development with the Consumer Price Index, fiscal years, 1965–74.



Note.—The vertical axis is expressed on a ratio or logarithmic scale; i.e., equal vertical distances reflect equal proportional (as distinguished from absolute) changes.

The source of research personnel data is the National Science Foundation's "Survey of Scientific Activities of Institutions of Higher Education." This survey reports the number of full-time equivalent scientists and engineers engaged in research and development at colleges and universities including faculty members, postdoctorals, and other professionals working in the sciences and engineering and in research administration. The fields covered include the physical, environmental, mathematical, life, and social sciences, psychology, and engineering. Researchers in the arts, humanities, and law are excluded. Research personnel at medical schools are included; research personnel at Federally Funded Research and Development Centers are excluded. This data is presented in table III–2, page 72.

The consequences of changes in the numbers of research staff and price changes on expenditures for research and development by colleges and universities is shown in table III–1 and figures III–2 and III–3. The analysis can be described with assistance of the summary data presented in table III–3. Since 1969 the number of scientists and engineers engaged in research and development has held steady in both sectors—about 29,000 at public institutions, about 21,000 at private institutions. But public institutions are receiving proportionately more funding and the disparity is increasing. In 1969, public institutions with 57.9 percent of the total number of college and university R&D personnel received about the same proportion of research funding, 59.1 percent. By 1974, with nearly the same share of researchers (58.4 percent), public institutions gathered 66.0 percent of the funding. The opposite relative decline occurred in the private sector with the result that while R&D expenditures per scientist and engineer in the public sector increased substantially from $41,500 in 1969 to $57,370 in 1974, the amount per researcher in the private sector gained only slightly from $39,380 to $41,620.

Both sectors were affected by the same reduction in R&D purchasing power as a result of higher prices. Because total funding had increased so sizeably at public institutions, price increases meant that R&D expenditures per researcher grew from $36,960 to $38,737 (1967 prices). At private institutions the increase in prices reduced funding levels in real resources per scientist and engineer from $35,070 to $28,103.

What explains the fact that researchers at public institutions are receiving an increasing share of R&D funding disproportionate to their relative numbers? A few factors bear on the situation but none appear to provide a conclusive answer. If we identify university senior teaching faculty[3] as an approximate indicator of the *potential* staff to perform research, the amount of R&D funding per potential researcher is substantially higher in the private sector than in the public counterpart ($17,794 compared to $11,605

[3] Since most research (88 percent in 1972–73) is performed at universities, *university* faculty represents the primary source and the most valid base for estimating potential research staff at *all* institutions. University senior teaching faculty are all persons holding ranks of professor through instructor whose primary function is formal classroom instruction and/or related departmental research.

Table III–1

Expenditures for sponsored research and development in institutions of higher education by institutional control, amount and amount per FTE scientist and engineer in actual and constant dollars, fiscal years 1965–74.

Fiscal year	All institutions				Public institutions				Private institutions			
	Amount (in millions)		Per FTE scientist and engineer[1]		Amount (in millions)		Per FTE scientist and engineer[1]		Amount (in millions)		Per FTE scientist and engineer[1]	
	Actual dollars	Constant dollars[2]	Actual dollars	Constant dollars[2]	Actual dollars	Constant dollars[2]	Actual dollars	Constant dollars[2]	Actual dollars	Constant dollars[2]	Actual dollars	Constant dollars[2]
1965	$1,714	$1,888	$32,450	$46,750	$894	$985	$...	$...	$820	$903	$...	$...
1967	1,910	1,910	40,170	40,170	1,012	1,012	...	...	898	898	...	...
1969	2,046	1,822	40,600	36,160	1,210	1,077	41,500	36,960	836	744	39,380	35,070
1971	2,223	1,759	44,680	35,350	1,334	1,055	45,840	36,260	889	703	43,050	34,060
1973	2,408	1,731	50,140	36,050	1,524	1,096	53,500	38,460	883	635	45,190	32,490
1974[3]	2,518	1,700	50,820	34,315	1,661	1,122	57,370	38,737	857	579	41,620	28,103

[1] Full-time-equivalent scientists and engineers engaged in research and development include faculty members, postdoctorals, and other professionals working in the sciences (physical, environmental, mathematical, life, and social sciences, and psychology) and engineering and in research administration at colleges and universities and associated medical schools (Federally Funded Research and Development Center personnel are excluded).

[2] Constant dollars in 1967 prices.

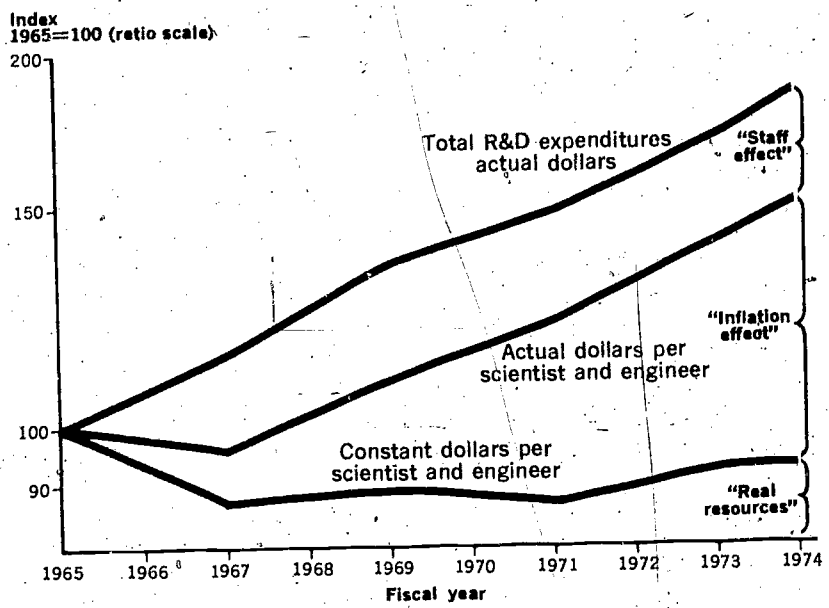
[3] Numbers estimated.

Note: Amounts do **not** include recovery of indirect costs. Also excluded are research expenditures in Federally Funded Research and Development Centers (FFRDC's) administered by universities and consortia. Excluded FFRDC expenditures have been estimated for fiscal years 1965 and 1967.

Source: U.S. Department of Health, Education, and Welfare, Office of Education, **Financial Statistics of Institutions of Higher Education: Current Funds Revenues and Expenditures,** relevant issues.

Figure III–2.

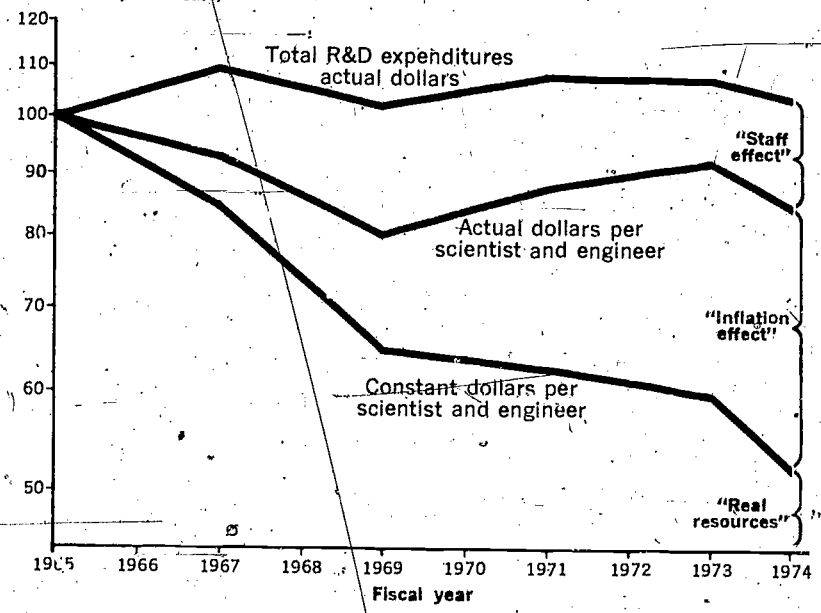
—Trends in expenditures for sponsored research and development in public institutions, amount, and amount per R&D scientist and engineer in actual and constant dollars, fiscal years 1965–74.



Note.—The vertical axis is expressed on a ratio or logarithmic scale; i.e., equal vertical distances reflect equal proportional (as distinguished from absolute) changes.

Figure III–3.

—Trends in expenditures for sponsored research and development in private institutions, amount, and amount per R&D scientist and engineer in actual and constant dollars, fiscal years 1965–74.



Note.—The vertical axis is expressed on a ratio or logarithmic scale; i.e., equal vertical distances reflect equal proportional (as distinguished from absolute) changes.

Table III–2

Full-time-equivalent college and university scientists and engineers primarily employed in R&D, fiscal years 1965–74.

Fiscal year	Total FTE R&D scientists and engineers[1]	Public institutions	Private institutions
1965	40,380	.....	.....
1967	47,540	.....	.....
1969	50,390	29,160	21,230
1971	49,750	29,100[2]	20,650[2]
1973	48,030	28,490	19,540
1974	49,540	28,950	20,590

[1] Full-time-equivalent scientists and engineers engaged in research and development include faculty members, postdoctorals, and other professionals working in the sciences (physical, environmental, mathematical, life, and social sciences, and psychology), and engineering and in research administration at colleges and universities and associated medical schools (Federally Funded Research and Development Center personnel are excluded).

[2] Public and private sectors estimated to be 58.5 and 41.5 percent of total respectively based on average of 1969, 1973, and 1974 proportions.

Source: National Science Foundation, **Manpower Resources for Scientific Activities at Universities and Colleges, January 1974, Detailed Statistical Tables, Appendix B,** NSF 75–300–A, and related earlier publications.

in 1971, see table III–3, columns 9 and 10). And this relative advantage appears to be holding fairly steady. The number of personnel engaged in sponsored research at any institution is dependent, of course, on the amount of R&D funding received. More and larger grants generally involve more research personnel. It may be that with a higher level of funding per potential user, a greater effort is made at private institutions to engage as many faculty in sponsored research as possible. The opposite may occur at some public colleges and universities where a commitment to teaching could restrict and discourage extending faculty involvement in sponsored research. Then again, it may simply be that by having proportionately more of its research sponsored by philanthropic and nongovernmental sources, private institutions obtain relatively more small private grants and fewer large Federal contracts than do public institutions.

There are other plausible reasons dealing with secondary factors which could assist in explaining why research funding per scientist and engineer is growing at public institutions. The gradual dominance of enrollments by the public sector (75 percent of FTE students in 1974, compared to 60 percent in 1961) may have wrought a parallel ascendancy in sponsored research. By sheer number of applicants alone the public sector is at a competitive advantage in securing research grants. Some private institutions, perhaps more sensitive to the negative attitude of students and alumni

Table III–3

Comparison of public and private sector R&D expenditures, scientists and engineers, and university senior teaching faculty, fiscal years 1965–74.

Fiscal year	Share of total R&D expenditures		Share of FTE R&D scientists and engineers		R&D expenditures per scientist and engineer		University senior teaching faculty[1] share in ( )		R&D expenditures per university senior teaching faculty	
	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1965	52.2	47.8	.....	.....	.....	.....	72,600 (63.2%)	42,300 (36.8%)	$12,314	$19,385
1967	53.0	47.0	.....	.....	.....	.....	84,860 (63.8%)	48,070 (36.2%)	11,926	18,681
1969	59.1	40.9	57.9	42.1	$41,500	$39,380	97,550 (67.0%)	48,010 (33.0%)	12,404	17,413
1971	60.0	40.0	.....	.....	.....	.....	114,950 (69.7%)	49,960 (30.3%)	11,605	17,794
1973	63.3	36.7	59.3	40.7	53,500	45,190	.....	.....	.....	.....
1974	66.0	34.0	58.4	41.6	57,370	41,620	.....	.....	.....	.....

Note: Data on R&D expenditures and R&D scientists and engineers are from tables III–1 and III–2 respectively.

[1] University senior teaching faculty are all persons holding ranks of professor through instructor whose primary function is formal classroom instruction and/or related departmental research. Part-time staff are counted one-third to derive FTE's. Source: U.S. Department of Health, Education, and Welfare, Office of Education, **Number and Characteristics of Employees in Institutions of Higher Education**, U.S. Government Printing Office, Washington, D.C., relevant issues.

toward military research, may have intentionally declined continuation of research in this controversial area. Private colleges and universities may also be more hesitant to accept research contracts with restrictive clauses. Finally, and this perhaps is a more important factor, financial difficulties may have forced many private institutions to decline those research grants where funding does not adequately cover associated indirect or overhead costs.

Description of Index and Data Base

The first price index for "deflation of academic R&D expenditures" was developed by Sidney A. Jaffe and published by the National Science Foundation in 1971 and 1972.[4] The index was intended to measure the effects of price change, and price change only, on the kinds and amounts of goods and services purchased (inputs) for research and development activities by universities and colleges. The index presented here employs the same methodology and a weighting pattern similar to that used by Jaffe. However, there are substantial differences in the degree of detail, the weighting of specific items, and the various price series selected. These modifications and refinements, made possible by the availability of more recent and detailed expenditure and price data, result in a higher rate of price change for R&D compared to the Jaffe index series.[5] As with all price indexes, users should bear in mind the appropriate uses and limitations which stem from the approach and the data utilized.

The R&D index prices current *direct* expenditures by universities[6] for *sponsored* research and development excluding expenditures for large expensive scientific equipment and furnishings (generally charged as an indirect cost), and separately budgeted physical plant investment and permanent fixed equipment. The index does not price departmental research done as a part of regular instructional services and budgeted as instruction and departmental research. Also, indirect costs or overhead charges appor-

[4] See National Science Foundation, *A Price Index for Deflation of Academic R&D Expenditures* (NSF 72–310), U.S. Government Printing Office, Washington, D.C., 1972.

[5] The compounded annual increase rate for the two series for the 1961–71 period are: Jaffe, 4.0 percent; R&D Price Index 4.9 percent. This difference is due primarily to the heavier weighting given personnel compensation (67 percent versus 65 percent), and the use of an entirely different set of price series than employed by Jaffe.

[6] Prices for faculty are based exclusively on *university* salary schedules. Expenditure estimates are based on separately organized research activities at institutions of higher education (primarily universities), reporting such information to the National Science Foundation, *excluding* medical schools, agricultural experiment stations, and Federally Funded Research and Development Centers (FFRDC's) administered by universities and consortia.

tioned to research (e.g., expenditures for general administration, operation and maintenance of the physical plant, etc.) are excluded from the price index because of their varied and often arbitrary proportionment to research operations.[7] The index, abbreviated R&DPI for Research and Development Price Index, and its subcomponents are presented in table III–4.

Direct costs of R&D activities include such expenses as wages and salaries and purchases of small or expendable equipment, supplies, and services which can be directly related and charged as current operating costs to research projects. The composition of such costs and their proportion of the research budget are presented in table III–5, page 77. Wages and salaries (including fringe benefits) paid to university employees engaged in and supporting research comprise 65 percent of direct R&D expenditures. The other major expenditure categories and their percentage weights are: services (16.0 percent), supplies and materials (8.4 percent), and small movable equipment charged as direct costs (10.6 percent).

Index Weighting Structure

The composition of university research and development expenditures by object classification used for computing the Research and Development Price Index is shown in table III–5. The R&DPI is constructed in the conventional manner, as previously explained, by applying the pattern of expenditure weights shown to price trend series. The weights are estimated proportions of research and development expenditures at universities during the 1971–72 base year. Thus the index portrays estimated changes in prices of an R&D expenditure aggregate with a fixed composition of inputs or purchases.

The index weights in table III–5 for personnel compensation (67.0 percent) and for the various professional and nonprofessional categories have been estimated from data derived in the National Science Foundation biennial surveys of universities and colleges covering R&D funding for academic years 1965–66 through 1972–73. Research expenditure data by object classification prepared by the University of Wisconsin System [8] were used to estimate the remaining subcategories not reported in the NSF surveys.

Faculty are weighted by rank to correspond to R&D participation as suggested by their primary and secondary assignments in 1963.[9] Out of approximately 125,000 teaching faculty, the 22,797 (18,616 at universities)

[7] National Science Foundation data suggests that indirect costs average roughly 30 percent of direct costs.

[8] Central Financial Reporting Office, *Worksheet*, "Summary of Expenditures by Major & Minor Object Class, 1972–73," The University of Wisconsin System. Madison, 1973.

[9] Ralph E. Dunham, Patricia S. Wright, and Marjorie O. Chandler, *Teaching Faculty in Universities and Four-Year Colleges, Spring 1963*, U.S. Department of Health, Education, and Welfare, Office of Education, U.S. Government Printing Office, Washington, D.C., 1966, pp. 73 and 75.

Table III–4

Research and Development Price Index and major component subindexes, fiscal years 1961–74.

1967=100 (Number code in parentheses identifies category as outlined in table III–5.)

Fiscal year	Personnel compensation				Contracted services, supplies, and equipment				R&D price index[3]	Annual percent increase over previous year
	Professional salaries (1.0)	Non-professional wages and salaries (2.0)	Fringe benefits (3.0)	Total[1]	Services (4.0)	Supplies & materials (5.0)	Equipment (6.0)	Total[2]		
1961	75.0	82.5	54.9	74.5	82.4	96.5	92.3	88.4	79.1	.....
1962	77.8	85.0	59.6	77.4	84.6	95.9	92.6	89.4	81.4	2.9
1963	81.6	87.3	64.9	81.1	86.8	95.6	93.1	90.6	84.2	3.4
1964	85.7	89.9	70.8	85.0	89.3	95.8	94.0	92.1	87.3	3.7
1965	89.9	92.5	78.1	89.2	92.5	96.3	95.1	94.1	90.8	4.0
1966	93.8	95.7	90.2	93.8	95.6	98.2	97.2	96.6	94.7	4.3
1967	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	5.6
1968	106.1	105.4	111.1	106.5	104.8	101.4	103.0	103.5	105.5	5.5
1969	112.8	111.7	131.7	114.5	110.5	103.3	106.8	107.9	112.3	6.5
1970	119.8	118.6	146.2	122.3	117.1	106.1	112.1	113.3	119.3	6.2
1971	125.9	126.4	162.0	129.8	124.5	110.1	116.9	119.1	126.3	5.9
1972	131.6	134.7	180.2	137.3	131.3	112.6	121.4	124.3	133.0	5.3
1973	136.1	142.5	197.7	143.9	137.4	117.3	125.0	129.3	139.1	4.6
1974	142.4	151.7	222.0	152.7	144.4	134.0	133.	138.8	148.1	6.5

[1] Personnel compensation total index based on weighted average as follows: professional salaries, 68.21 percent; nonprofessional wages and salaries, 21.34 percent; and fringe benefits, 10.45 percent.

[2] Contracted services, supplies, and equipment total index based on weighted average as follows: services, 48.5 percent; supplies and materials, 21.2 percent; and equipment, 30.3 percent.

[3] R&D Price Index based on weighted average as follows: personnel compensation, 67.0 percent (professional salaries, 45.7 percent; nonprofessional wages and salaries, 14.3 percent; fringe benefits, 7.0 percent); contracted services, supplies, and equipment, 33.0 percent (services, 16.0 percent; supplies and material, 7.0 percent; and equipment, 10.0 percent).

Table III–5

Composition by object category of current direct expenditures for sponsored research and development in universities, estimate for fiscal year 1972.

Category	Percent of total expenditures		
PERSONNEL COMPENSATION			67.0
1.0 Professional salaries		45.7	
1.1 Faculty (university)	17.3		
1.2 Research associates	15.1		
1.3 Graduate assistants	10.2		
1.4 Other professional, nondoctoral	3.1		
2.0 Nonprofessional wages and salaries		14.3	
2.1 Technicians	7.0		
2.2 Craftsmen	2.4		
2.3 Clerical	2.4		
2.4 Students	2.5		
3.0 Fringe benefits		7.0	
CONTRACTED SERVICES, SUPPLIES, AND EQUIPMENT			33.0
4.0 Services		16.0	
4.1 Data processing and equipment rental	2.9		
4.2 Communication	.8		
4.3 Transportation	2.0		
4.4 Printing and duplication	.8		
4.5 Miscellaneous services	8.4		
4.6 Consultants and other professional	1.1		
5.0 Supplies and materials		7.0	
6.0 Equipment		10.0	
		100.0	100.0

reporting organized research as a primary or secondary assignment were composed by rank as follows: professor, 34.0 percent; associate professor, 30.1 percent; assistant professor, 29.0 percent; and instructor, 6.9 percent. Multiplying these percentages by 1971–72 university salary data results in the relative budget expenditure by rank for teaching faculty involved in research. These budget weights are: professor, 44.3 percent; associate professor, 28.8 percent; assistant professor, 22.7 percent; and instructor, 4.2 percent. The accuracy of this division is not critical since the differentials between salary trends of the various faculty ranks are small.

The weights shown in table III–5 should be interpreted as rough estimates suggestive of general magnitudes rather than of precise dimensions. Because few institutions or State systems report research expenditures by detailed object classification and because there is little standardization in reporting procedure, the distribution of weights among the categories from a sample of institutions can only approximate true national averages. However, the price trends that are associated with many related subcategories are very similar. Therefore, the composite R&D Price Index would be little altered if these weights were to be distributed somewhat differently.

Index Prices and Data Sources

This section, together with relevant material from the HEPI "Index Prices and Data Sources" section, pp. 44–63, presents a description of the items priced for the R&DPI and data sources.

PERSONNEL COMPENSATION

1.0 Professional salaries

Subindexes for salaries of the various professional personnel categories are shown in table III–6.

1.1 Faculty (university)

The university faculty salary subindex consists of a weighted average of individual indexes of the salaries of professors, associate professors, assistant professors, and instructors as shown in table III–7. The weights are based on the proportion of *total* faculty salaries paid to each academic rank in 1971–72.

Faculty play the most important role in academic research as project directors, principal investigators, and associated consultants. The salary data compiled by the American Association of University Professors has been used as representative of the trend of compensation for faculty participants in academic research. With about 88 percent (1972–73) of sponsored R&D expenditures accounted for by universities, trends relating to compensation of *university* faculty, as opposed to all faculty, is most relevant for the R&D price index. For this reason the AAUP Category I salary data for approximately 150 universities is used. Category I "includes institutions which offer the doctorate degree and which conferred in the most recent three years an annual average of fifteen or more earned doctorates covering a minimum of three nonrelated disciplines."

There is some concern as to the validity of using the trend in salaries of *all* university faculty as the appropriate surrogate for faculty engaged in sponsored research who are primarily in the *sciences*. This concern arises because science and engineering departments have been relatively affluent in recent years and may have increased their faculty salaries within rank classifications at a greater rate than for all faculty combined. If this is true, the AAUP salary data would miss part of an additional rise in salaries that may have occurred separately for science and engineering faculty engaged in R&D projects.

1.2 Research associates

Research associates engaged in academic research are a unique factor. These are professional scientists or engineers serving as senior research associates or more often as postdoctorals without faculty rank or perquisites.

Table III–6

Subindexes of salaries of professional personnel used for the R&D Price Index, fiscal years 1961–74.

1967=100 (Number code in parentheses identifies category as outlined in table III–5.)

Fiscal year	Faculty (university) (1.1)	Research associates (1.2)	Graduate assistants (1.3)	Other professional, nondoctoral			Professional salaries total (1.0)
				Chemists	Engineers	Total[1] (1.4)	
1961	72.5	76.0	76.0	79.0	81.3	80.2	75.0
1962	75.9	78.4	78.4	82.1	83.4	82.8	77.8
1963	79.6	82.4	82.4	85.2	87.1	86.2	81.6
1964	84.5	86.2	86.2	88.0	89.6	88.8	85.7
1965	89.1	90.2	90.2	91.4	92.5	92.0	89.9
1966	93.8	93.6	93.6	95.8	95.9	95.9	93.8
1967	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1968	106.6	105.9	105.9	105.1	105.4	105.3	106.1
1969	113.0	112.8	112.8	111.9	111.9	111.9	112.8
1970	119.6	120.2	120.2	118.5	118.1	118.3	119.8
1971	126.1	125.8	125.8	125.0	124.8	124.9	125.9
1972	130.6	132.4	132.4	131.4	131.3	131.4	131.6
1973	134.8	136.8	136.8	136.3	138.0	137.0	136.1
1974	141.2	142.8	142.8	146.0	145.5	145.8	142.4

[1] Other professional, nondoctoral total index based on equally weighted average of chemist and engineer salaries.

[2] Professional salaries total index based on weighted average as follows: faculty, 37.9 percent; research associates, 33.0 percent; graduate assistants, 22.3 percent; and other professional, nondoctoral, 6.8 percent.

Sources: American Association of University Professors; U.S. Department of Commerce, Bureau of Labor Statistics; U.S. Department of Health, Education, and Welfare, Office of Education.

Table III–7

Indexes and dollar amounts of university[1] faculty salaries,[2] by rank, fiscal years 1961–74.

1967=100 (Number code in parentheses identifies category as outlined in table III–5.)

Fiscal year	Professors		Associate professors		Assistant professors		Instructors		Faculty total (universities) index[3] (1.1)
	Amount	Index	Amount	Index	Amount	Index	Amount	Index	
1961	$11,160	71.5	$8,300	73.0	$6,800	73.1	$5,450	76.0	72.5
1962	11,710	75.0	8,660	76.2	7,120	76.6	5,620	78.4	75.3
1963	12,270	78.6	9,090	79.9	7,490	80.5	5,910	82.	79.6
1964	13,140	84.2	9,600	84.4	7,880	84.7	6,180	86.2	84.5
1965	13,880	88.9	10,150	89.3	8,290	89.1	6,470	90.2	89.1
1966	14,640	93.8	10,670	93.8	8,720	93.8	6,710	93.6	93.8
1967	15,610	100.0	11,370	100.0	9,300	100.0	7,170	100.0	100.0
1968	16,640	106.6	12,120	106.6	9,940	106.9	7,590	105.9	106.6
1969	17,600	112.7	12,910	113.5	10,530	113.2	8,090	112.8	113.0
1970	18,660	119.2	13,630	119.9	11,160	120.0	8,620	120.2	119.6
1971	19,600	125.6	14,380	126.5	11,760	126.5	9,020	125.8	126.1
1972	20,250	129.7	14,920	131.2	12,200	131.2	9,490	132.4	130.6
1973	20,900	133.9	15,380	135.3	12,610	135.6	9,810	136.8	134.8
1974	21,900	140.3	16,130	141.9	13,190	141.8	10,240	142.8	141.2

[1] Approximately 150 universities in Category I which "includes institutions which offer the doctorate degree and which conferred in the most recent three years an annual average of fifteen or more earned doctorates covering a minimum of three nonrelated disciplines."

[2] Average salary for full-time faculty based on standard 9-month academic-year.

[3] Weighted average based on the proportion of total faculty salaries paid in 1971–72 to each academic rank engaged in R&D as follows: professors, 44.3 percent; associate professors, 28.8 percent; assistant professors, 22.7 percent; and instructors, 4.2 percent.

Source: American Association of University Professors, relevant issues of the **AAUP Bulletin.**

Their attachment to the university is generally marginal although research appointments may be stepping stones to more permanent affiliations.

With only fragmentary and inconclusive information as guides, the selection of proxy trends to represent compensation of research associates is a difficult problem and one that at this stage must be judgmental. Since research associates are academically oriented and are generally full-time employees, it is reasonable to assume that their compensation is related to the salary and compensation scales of faculty. Such an assumption is particularly cogent with respect to senior research associates working primarily in a professional capacity, less true for postdoctorals whose research participation represents a continuation of their educational training. The stipends of postdoctorals, who make up the bulk of research associates, is considerably less than the salaries of assistant professors.[9] For these reasons, AAUP data for university (Category I) instructors has been selected as the most appropriate proxy for salaries of research associates.

1.3 Graduate assistants

See pp. 47–48 for discussion and table III–6.

1.4. Other professional, nondoctoral

Auxiliary research personnel in this category and also technicians provide backup services to the principal investigators and research associates. Support services are generally outside the professional interests (or training) of the faculty, research associates, and graduate students, and therefore it seems logical to assume that compensation paid to such auxiliary research personnel would be determined by competitive conditions for their specializations in the general labor market. As an approximation of these market conditions, a composite trend of salaries for chemists and engineers published in the BLS reports on its annual *National Survey of Professional Administrative, Technical and Clerical Pay* (PATC) is used as a surrogate for this category (see table III–6).

2.0 Nonprofessional wages and salaries

For nonprofessional categories 2.1 *Technicians,* 2.2 *Craftsmen,* 2.3 *Clerical,* and 2.4 *Students* see pp. 52–54 for discussion and table II–8.

3.0 Fringe benefits

See pp. 55–56 for discussion and table III–4.

[9] See National Academy of Sciences, *The Invisible University: Postdoctoral Education in the United States,* Washington, D.C., 1969, pp. 226–227.

CONTRACTED SERVICES, SUPPLIES, AND EQUIPMENT

4.0 Services

For service components 4.1 *Data processing and equipment rental,* 4.2 *Communication,* 4.3 *Transportation,* 4.4 *Printing and binding,* and 4.5 *Miscellaneous service* see pp. 56–59 for discussion and table II–9.

4.6. Consultants and other professional

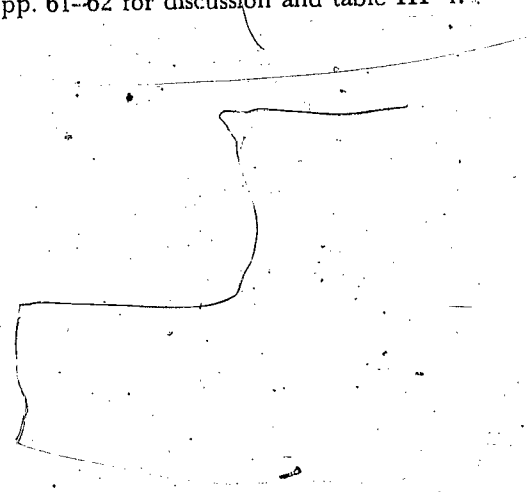
Consultants (mostly faculty from other institutions contracted on a honoraria basis) and experts from business and industry hired to provide professional services to the research activity have been priced by the composite index for university faculty compensation. See table II-9.

5.0 Supplies and materials

See pp. 60–61 for discussion and table III–4.

6.0 Equipment

See pp. 61–62 for discussion and table III–4.



CHAPTER IV.

COLLEGE AND UNIVERSITY PHYSICAL PLANT ADDITIONS PRICE INDEXES

Although currently declining, expenditures for building construction remained relatively steady at $3.2 billion yearly from 1968 through 1972. At first impression this observation suggests a leveling of the building boom in higher education. Nothing could be less true. In terms of real investment per student, new construction at colleges and universities reached its peak in 1967. It has steadily *declined* since then and now in 1974 is less than half the 1967 high. The key to this type of analysis is employment of a suitable price deflator for college and university building construction. The index used for this purpose plus a price index for physical plant equipment are presented in the second section of this chapter. The last section discusses how improvements in construction technology are taken into account in index compilation, and the alternatives considered in selecting an index. The analysis which follows presents price trends in building construction and in equipment, and the impact of this inflation on the expenditures of colleges and universities for physical facilities.

The Effects of Inflation on Physical Plant Additions

The price trends for building construction and for equipment purchased by colleges and universities compared with the Consumer Price Index is shown in figure IV–1. (Comparison may be made of all indexes presented in this study by reference to table 1 and figure 1, pp. 9 and 10). Since 1967, the price of new construction has increased at an annual rate of 7¾ percent, greater than the 6¼ percent annual increase in the price colleges and universities are paying for current operations. On a brighter side, the price of equipment purchased through plant expenditures rose only 4 percent yearly since 1967. In the last year, however, equipment prices jumped 7.8 percent, part of the national inflation phenomenon and a possible portent of the future.

The effects of price increase on expenditures for new construction are shown in table IV–1 and in figures IV–2 and IV–3. The rapid expansion of college and university facilities in the sixties, to accommodate a doubling of enrollment, reached its peak in 1967 with expenditures for new construction equaling $577 per student. In both the public and private sectors this was the most real resources (on a unit basis) ever devoted to new construction and likely will not be exceeded. Since 1967 total expenditures in the public sector have gradually increased, but not as fast as enrollment growth or prices. The result has been a steady decline in per student real investment, from a high of $558 in 1967 to a current low of $240 (in amounts based on 1967 prices). The private sector has fared about the same. While total expenditures have declined, enrollment growth has not been as great, with per-student constant dollar expenditures declining from a high of $617 in 1967 to a 1973–74 low of $269–$272 (1967 prices).

Until 1974, equipment purchases had been a "good buy" relative to the prices of other goods and services, which had been rising more rapidly. The data are presented in table IV–2 and figure IV–4. Since 1966, per-student expenditures in actual (current) dollars have remained remarkably level in the public sector, varying between $133 and $147 per student. In constant dollars, unit expenditures peaked at $139 (1967 prices) in 1968 and slowly declined to the $108–116 level. A similar situation exists in the private sector with steady actual dollar expenditures between $109 and $134 per student, and a gradual decline in constant dollars from a high of $130 (1967 prices) in 1968 to the present $92–103 level.

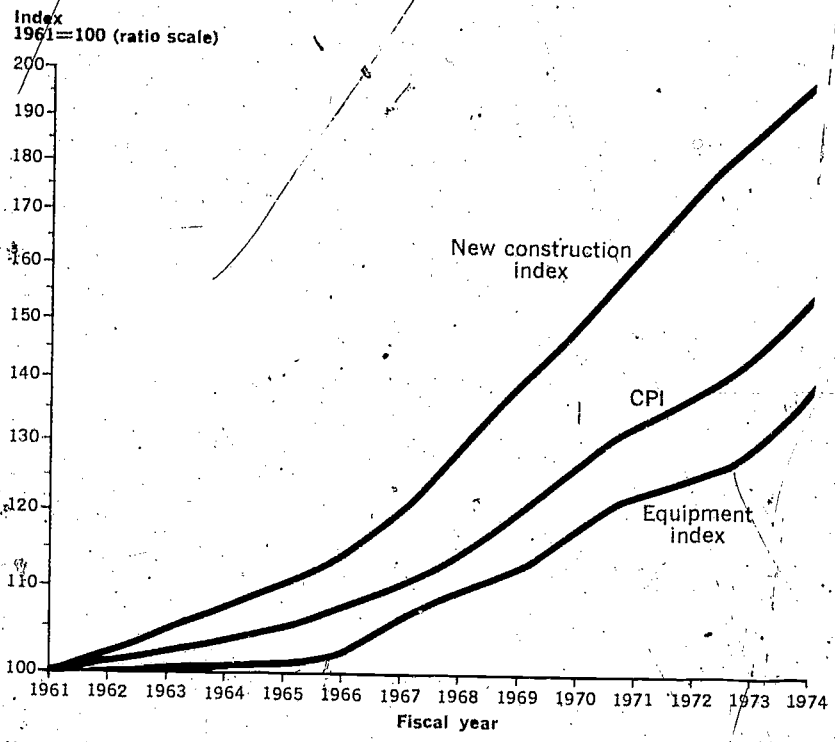
The decline in real investment in equipment has been much less than that in new construction. Education overbuilt facilities in the early 1960's which lessened the need for further new construction while requirements for new equipment and replacements continued steady. Although the same proportion of actual dollars went to each, real investment in equipment relative to new construction increased, due to lower price increases and the intention of planners to emphasize equipment rather than buildings. With the trend in all prices up sharply, future equipment expenditures will buy less than in the past. And the continual purchase of more costly improved equipment compounds the problem. The equipment price index measures price change for a market basket of products fixed in design and quality. Institutions that substitute more expensive advanced equipment must add to their total budget the additional cost involved.

Description of Indexes and Data Base

The price index for physical plant fund expenditures is entitled "Index of Change in Prices of Building Construction and Equipment Purchases by Colleges and Universities Through Plant Fund Expenditures." Expendi-

Figure IV–1.

—Comparison of trends in price change in higher education building construction and equipment with the Consumer Price Index, fiscal years 1961–74.



Note.—The vertical axis is expressed on a ratio or logarithmic scale; i.e., equal vertical distances reflect equal proportional (as distinguished from absolute) changes.

Table IV–1

Plant fund expenditures for buildings, by control of institution, amount and amount per FTE student in actual and constant dollars, fiscal years 1960–74.

Fiscal year	All institutions				Public institutions				Private institutions			
	Amount (in millions)		Per FTE student		Amount (in millions)		Per FTE student		Amount (in millions)		Per FTE student	
	Actual dollars	Constant dollars[1]	Actual dollars	Constant dollars[1]	Actual dollars	Constant dollars[1]	Actual dollars	Constant dollars[1]	Actual dollars	Constant dollars[1]	Actual dollars	Constant dollars[1]
1960	$886	$....	$315	$....	$548	$....	$329	$....	$339	$....	$296	$....
1961[2]	995	1,193	332	398	585	701	328	393	410	492	339	406
1962	1,141	1,340	352	413	661	776	234	392	480	563	379	445
1963[2]	1,360	1,560	388	445	810	929	372	427	550	631	414	474
1964	1,655	1,851	441	493	1,030	1,153	432	483	624	698	457	511
1965[2]	1,975	2,144	473	513	1,230	1,336	454	492	745	809	508	552
1966	2,343	2,454	493	516	1,448	1,516	459	480	895	937	560	587
1967	2,959	2,959	577	577	1,918	1,918	558	558	1,041	1,041	617	617
1968	3,157	2,942	570	531	2,066	1,925	543	506	1,091	1,017	629	586
1969[2]	3,185	2,758	529	458	2,140	1,853	500	433	1,045	905	599	518
1970	3,174	2,560	497	401	2,206	1,779	478	386	967	780	548	442
1971	3,143	2,333	463	344	2,247	1,669	451	334	895	665	497	369
1972	3,179	2,182	448	308	2,316	1,590	438	301	863	592	477	327
1973	2,840	1,835	395	255	2,086	1,348	388	251	754	487	417	269
1974[3]	3,020	1,827	409	247	2,203	1,333	396	240	816	494	449	272

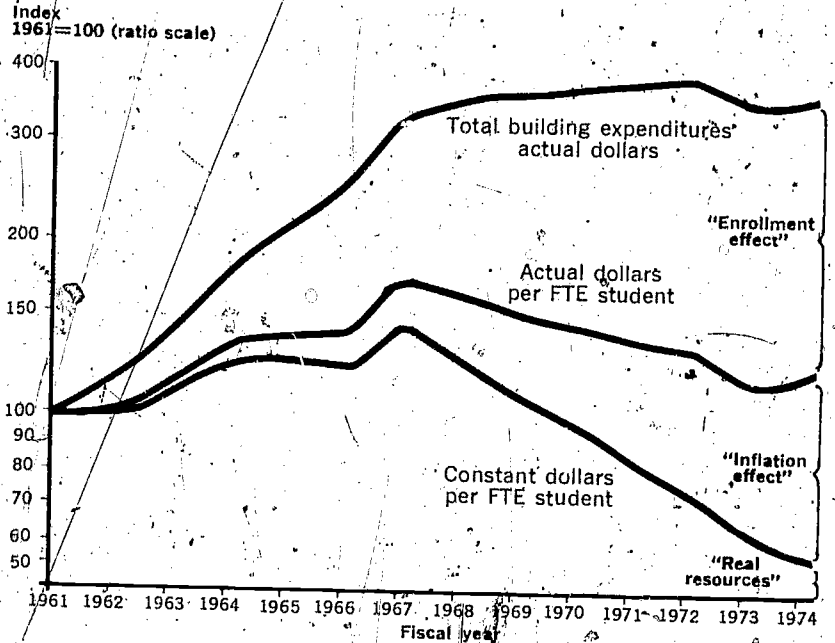
[1] Constant dollars in 1967 prices.
[2] Amounts estimated.
[3] Preliminary data.

Note.—Included with plant fund expenditures for buildings are additions by gift-in-kind from donor and by reappraisal of building value and other additions (these additions are generally less than 10 percent of the total). Included in building expenditures are expenditures for fixed equipment and for other improvements such as utility lines, landscaping, etc.

Source: U.S. Department of Health, Education, and Welfare, Office of Education, **Financial Statistics of Institutions of Higher Education: Property**, relevant issues.

Figure IV–2.

—Trends in plant fund expenditures for buildings in public institutions, amount, and amount per FTE student in actual and constant dollars, fiscal years 1961–74.



Note.—The vertical axis is expressed on a ratio (or logarithmic scale; i.e., equal vertical distances reflect equal proportional (as distinguished from absolute) changes.

						Index						
1961	75.2	73.3	71.0	76.7	65.3	66.0	64.3	72.1	81.5	84.2	79.9	81.0
1967	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1974	151.2	148.5	153.3	145.7	165.6	160.7	169.1	166.2	131.1	130.5	132.0	126.7
1975	160.7	156.1	164.0	158.0	176.3	170.1	181.0	173.0	139.3	135.3	141.1	144.5

[1] Public 4-year colleges with 1966–67 enrollment greater than 2,000 students. California State Colleges and the City University of New York (CUNY) colleges charging nominal tuition "fees", and well above average room and board charges (California) are excluded.

[2] Public 2-year colleges with 1966–67 enrollment greater than 1,000 students. Public 2-year colleges in California and in the City University of New York System charging nominal tuition "fees" are excluded.

[3] Tuition values for all public institutions are fixed weight averages based on full-time-equivalent 1966–67 student enrollments as follows: universities, 1,476,669 (43.0 percent); 4-year colleges, 1,149,198 (33.4 percent); and 2-year colleges, 812,667 (23.6 percent). By 1972–73, shifting student attendance to 2-year colleges had changed the enrollment pattern in the public sector to the following: universities, 2,066,650 FTE students (37.1 percent); 4-year colleges, 1,712,488 (30.8 percent); and 2-year colleges 1,787,600 (32.1 percent). Reweighting and linking will be required for continuation of this price series.

[4] Room and board values for all public institutions are fixed weight averages based on full-time-equivalent 1966–67 student enrollments at public universities, 1,476,669 (56.2 percent); and public 4-year colleges, 1,149,198 (43.8 percent). Few of the 812,667 students attending public 2-year colleges contract for room and board. Income for housing and food services at public 2-year colleges amounted to only 3.8 percent of the total in the public sector in 1966–67. Consequently, excluding 2-year college room and board charges in the calculation of values for all public institutions introduces minimal inaccuracy.

[5] Many public 2-year colleges primarily serving commuting students living at home do not provide room and board services. Charges published by the Beta Club have not been reported with sufficient consistency for the 1961–75 period to establish a valid trend.

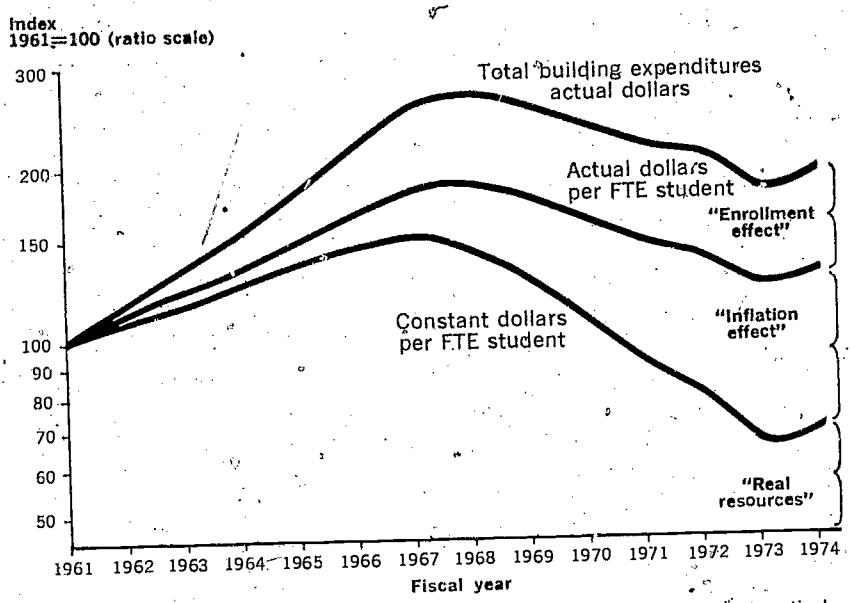
[6] A random sample of private 4-year colleges with 1966–67 enrollment greater than 1,000 students.

[7] Private 2-year colleges with 1966–67 enrollment greater than 200 students.

[8] Values for all private institutions are fixed weight averages based on full-time 1966–67 student enrollments as follows: private universities, 543,351 (32.2 percent); private 4-year colleges, 1,019,915 (60.4 percent); and private 2-year colleges, 124,205 (7.4 percent). Only slight shifts in this attendance pattern have occurred. The 1972–73 FTE student enrollment in the private sector is as follows: universities, 564,115 (31.0 percent); 4-year colleges, 1,147,727 (63.1 percent); and 2-year colleges, 105,780 (5.8 percent).

Figure IV–3.

—Trends in plant fund expenditures for buildings in private institutions, amount, and amount per FTE student in actual and constant dollars, fiscal years 1961–74.



Note.—The vertical axis is expressed on a ratio or logarithmic scale; i.e., equal vertical distances reflect equal proportional (as distinguished from absolute) changes.

Table IV–2

Plant fund expenditures for equipment by control of institution, amount and amount per FTE student in actual and constant dollars, fiscal years 1960–74.

Fiscal year	All institutions				Public institutions				Private institutions			
	Amount (in millions)		Per FTE student		Amount (in millions)		Per FTE student		Amount (in millions)		Per FTE student	
	Actual dollars	Constant dollars[1]	Actual dollars	Constant dollars[1]	Actual dollars	Constant dollars[1]	Actual dollars	Constant dollars[1]	Actual dollars	Constant dollars[1]	Actual dollars	Constant dollars[1]
1960	$ 92	$	$ 33	$	$ 51	$	$ 31	$	$ 41	$	$ 36	$
1961[2]	100	106	33	35	55	59	31	33	45	48	37	39
1962	128	136	39	41	68	72	35	37	59	63	47	50
1963[2]	135	143	39	41	75	79	34	36	60	63	45	48
1964	166	175	44	46	89	94	37	39	77	81	56	59
1965[2]	445	467	106	111	300	315	111	116	145	152	99	104
1966	612	635	129	134	421	437	133	138	191	198	120	125
1967	663	663	129	129	463	463	135	135	201	201	119	119
1968	775	752	140	136	543	527	143	139	232	225	134	130
1969[2]	840	794	139	131	610	577	143	135	230	217	132	125
1970	874	792	137	124	652	591	141	128	222	201	126	114
1971	867	751	128	111	668	578	134	116	198	171	110	95
1972	866	735	122	103	670	568	127	108	196	166	109	92
1973	970	798	135	111	744	612	138	114	226	186	125	103
1974[3]	1,053	804	143	109	817	624	147	112	236	180	130	99

[1] Constant dollars in 1967 prices.

[2] Amounts estimated.

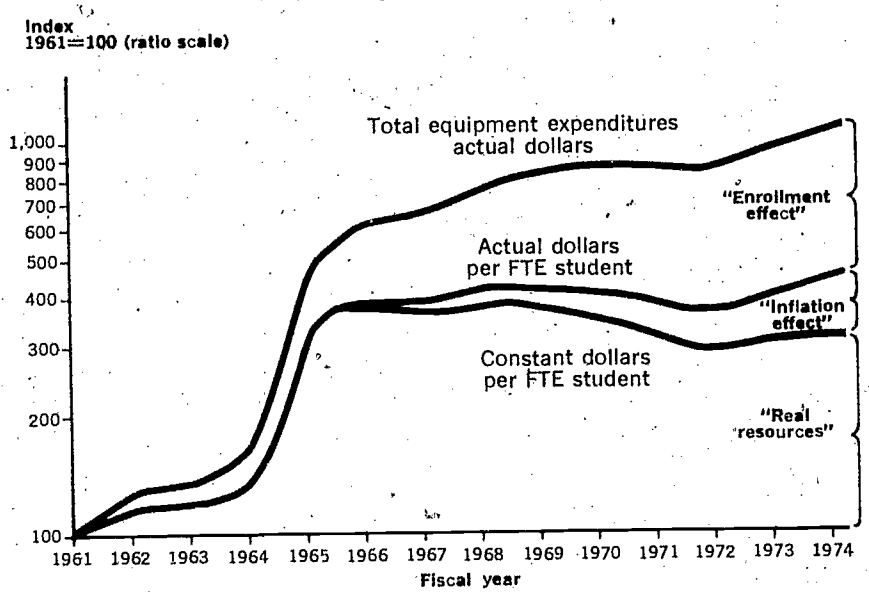
[3] Preliminary data.

Note: Included with plant fund expenditures for equipment are additions by gift-in-kind from donor and by reappraisal of equipment value and other additions (these additions are generally less than 10 percent of the total).

Source: U.S. Department of Health, Education, and Welfare, Office of Education, **Financial Statistics of Institutions of Higher Education: Property**, relevant issues.

Figure IV–4.

—Plant fund expenditures for equipment in institutions of higher education, amount, and amount per FTE student in actual and constant dollars, fiscal years 1961–74.



Note.—The vertical axis is expressed on a ratio or logarithmic scale; i.e., equal vertical distances reflect equal proportional (as distinguished from absolute) changes.

tures for physical plant assets consist primarily of investment in buildings and equipment. Land purchases represent less than 4 percent of the total. Because geographical location plays a critical role in land values, a land expenditure price series based on national averages would have no relevancy either to a particular plot or to a given institution or group of institutions. Therefore, land as an item of expenditure is excluded from the index calculation.

Since 1965–66, total plant fund expenditures have been proportioned between those for new building construction and those for equipment at a remarkably consistent 79 percent—21 percent split. These weights are used in computing the index for physical plant fund expenditures, presented in table IV–3. However, in 1972–73 this ratio changed to construction 75 percent, equipment 25 percent. If 1973–74 data suggest continuation of this ratio or a general trend, the index will be reweighted accordingly.

New Construction

Colleges and universities construct many different types of buildings, but generally they are large steel or concrete structures similar to commercial office buildings. Based on physical facility inventories, about half the floor area of campus buildings is devoted to academic facilities which include classrooms, laboratories, offices, and study areas. Twenty percent of the floor area is for general and supporting use such as museums, hotel-type accommodations, auditoriums, theaters, garages, power and heating plants, and teaching hospitals. Thirty percent is for residential facilities. Although there is no construction price index designed specifically for institutions of higher education, the Boeckh Division of the American Appraisal Company does compute an index for apartments, hotels, and office buildings in the $200,000 to $5 million cost range, which appears particularly applicable to the mix and types of buildings found on college and university campuses.[1] The Boeckh index also appears superior to other alternatives in accounting for improvements in construction productivity. A discussion of this topic and other factors which led to choice of the Boeckh index begins on page 95. Boeckh index values for new construction are presented in table IV–3.

The Boeckh Division's index for apartments, hotels, and office buildings is statistically adequate and consistent and does not exhibit deficiencies which characterize many indexes compiled by private organizations. This index is a fixed weight input index of wage rates and building material prices weighted together in accordance with their importance to the cost of a unit of construction in the 1967 base period. It covers the structural portion of buildings and all plumbing, heating, lighting, and elevators. The

[1] Boeckh has the data and capability to develop a construction price index exclusively for structures built by colleges and universities. Demand for such an index has not been sufficient to warrant its development and maintenance.

Table IV–3

Price index of building construction and equipment purchased by colleges and universities and component subindexes, fiscal years 1961–74.

1967 = 100

Fiscal year	New construction index	Equipment index[1]	Construction and equipment price index[2]
1961	83.4	94.0	85.6
1962	85.2	94.0	87.0
1963	87.2	94.5	88.7
1964	89.4	95.1	90.6
1965	92.1	95.3	92.8
1966	95.5	96.3	95.7
1967	100.0	100.0	100.0
1968	107.3	103.1	106.4
1969	115.5	105.8	113.5
1970	124.0	110.4	121.1
1971	134.7	115.5	130.7
1972	145.7	117.9	139.9
1973	154.8	121.5	147.8
1974	165.3	131.0	158.1

[1] For equipment, a weighted average of the following items from the Wholesale Price Index network: commercial furniture, 40 percent; office and store machines and equipment, 25 percent; general purpose machinery and equipment, 30 percent; and machinery and equipment, 5 percent.

[2] Weighted average as follows: new construction, 79 percent; equipment, 21 percent. Weights are based on the proportionate expenditure for these two items for all colleges and universities since 1966.

Source: For building construction, the Boeckh apartments, hotels, and office buildings index compiled by the Boeckh Division of the American Appraisal Company, Inc., and reported in **Construction Review,** published monthly by the U.S. Department of Commerce.

index measures construction with *fixed* specifications, the bill of 55 material items being extremely thorough and complete.[2] Wage rates are based on detailed job specifications for 19 construction occupations.[3] The weights assigned to the various wage rates and building material prices represent

[2] Major material items in the Boeckh index include brick, concrete block, lumber, ready-mix concrete, galvanized sheet metal, reinforced steel and structural steel, acoustical tile fiber, doors and frames, glass windows, hardware, fiber board, metal lath, Indiana limestone, marble, metal strips, paint, gypsum, roofing asphalt, channels light steel, resilient floor tiling, ceramic wall tile, sash, copper tubing, lavatories, water closets, pipe cast iron and black steel, elevator materials, air conditioners, boilers, furnace forced air, control systems, pipe galvanized steel, radiators, unit heaters, electrical conduit, fixtures, switch gear, transformers, and cable.

[3] Construction occupations priced by the Boeckh index are: bricklayer, carpenter, concrete laborer, concrete formwork laborer, electrician, shovel operating engineer, building laborer B and C, mason tender, painter, plasterer, plumber, ironworker rod man, composition roofer, sheet metal worker, sheet metal duct worker, structural steelworker, structural steel fabricator, and truckdriver.

actual final total building expenditures reported in the "Contractor's Sworn Statement" (CSS). These statements are continually monitored by Boeckh, and as changes occur in construction procedures and material (occasionally with resulting improvements in construction productivity) index component weights are modified, with index values adjusted to eliminate the effects of such changes. The material-labor weights, constant since 1967, are: material, 51.7 percent; labor, including contractor's overhead, profit, and contingency funding, 48.3 percent.

Material and labor costs are computed monthly based on actual transaction prices paid. For basic building materials (brick, concrete block, lumber, ready-mix concrete, galvanized sheet metal, and reinforced and structural steel) local prices are collected by Boeckh. The balance of material items are priced using Wholesale Price Index price series. Local *Blue Book* prices are used for rental of trucks, excavation and erection equipment, and for elevator fabrication. Wage rates including fringe benefits are gathered every other month in 187 U.S. cities and in 19 Canadian cities. Boeckh reports some geographic differentials in *worker* productivity but does not recognize any national trend over time.

Equipment

Equipment purchased through capital investment of plant funds generally consists of all types of *movable* property of a permanent nature much of which is purchased for immediate installation in new buildings. *Permanently affixed* furniture, machinery, appurtenances, and appliances constructed as part of the building are not classified equipment.[4] Current fund, as opposed to plant fund, expenditures for equipment, discussed on page 61, usually involve small items added to the equipment inventory subsequent and apart from the building construction program.

In collecting price data to be used in price indexes, the need for holding constant the quality or utility-determining specifications of all items has already been emphasized. With regard to much equipment, such a practice is especially difficult and perhaps impossible. The utility of most products is continuously being modified and improved, and the improved product usually sold at a higher price to the consumer. Any change in producer costs or sale price that can be attributed to a change in product quality must not be considered a price change. Another problem in developing a price index for equipment is that colleges and universities purchase a wide variety of different products. Individual pricing of these many products is not feasible.

[4] Examples of *building* components and not equipment include: built-in laboratory tables, lockers, bookcases; boilers, furnaces, fixtures, and machinery for heating, lighting, plumbing, air conditioning, and other power plant equipment; elevators; vaults and conduits; signal and clock systems; utility systems; and compressed air systems. American Council on Education, *College and University Business Administration*, Washington, D.C., 1968, p. 108.

The task of pricing many different product items while attempting to account for the effects on price of product innovation and redesign is performed by the Bureau of Labor Statistics in preparing the Wholesale Price Index (WPI). To avoid incorporating price changes influenced by quality or quantity changes, the Bureau of Labor Statistics defines each commodity in the Wholesale Price Index by precise specifications which incorporate their principal price-determining characteristics.[5] So far as possible, prices are f.o.b. producing point and refer to sales in large quantities for immediate delivery.

Although the WPI is based on more than 2,500 commodities and over 8,000 price quotations, this is only a *sample* of all commodities sold in commercial transactions in primary markets. The items priced are thus *representative* of all items in the WPI universe. For the many types of equipment purchased by colleges and universities, a representative sample for pricing must also be used. Many of the major *types* of equipment expenditures made by colleges and universities are subindex components of the WPI. If the WPI sampling for these subindexes is also representative of equipment items purchased by colleges, then the WPI price series may serve as an appropriate proxy. This assumption has been made, and four BLS subindexes that represent the major types of equipment purchased by colleges and universities are listed here. (Values for the resulting price index for equipment are presented in table IV–3, p. 92.)

[5] An example of a commodity specification for steel strip is: "Strip, cold-rolled, carbon steel, coils, No. 4 temper, No. 2 finish, No. 3 edge, base chemistry, 6" x 050", in quantities of 10,000 to 19,999 lb., mill to user, f.o.b. mill, per 100 lb."

Equipment type	Relative weight[1]	WPI subindexes used
	Percent	
Office and classroom furniture	40	Commercial furniture (BLS No. 122—includes chairs, desks, and filing cabinets).
Office machines and equipment	25	Office and store machines and equipment (BLS No. 1193—includes calculators, adding machines, typewriters, safes, duplicating machines, and cash registers).
Laboratory equipment	30	General purpose machinery and equipment (BLS No. 114 — includes pumps, compressors, conveyors, mechanical power transmissions, scales and balances, fans and blowers, valves and fittings, and bearings).
Other	5	Machinery and equipment (BLS No. 11—includes agricultural, construction, metalworking, woodworking, printing, and general purpose machinery and equipment).

[1] The relative weight of each equipment component is based on data obtained from college purchasing officers.

Construction Productivity and Index Selection

The privately compiled price indexes used by the Bureau of the Census and others to deflate figures for new construction have been widely criticized on the grounds that they do not take account of productivity changes and therefore overstate price increases. In January 1961, as part of its overall review of price indexes, the Price Statistics Review Committee of the National Bureau of Economic Research described this and other major deficiencies and further recommended that the development of statistically adequate construction price indexes be given a high priority in the Federal Government's price statistics efforts.[6] Followup activities on the Committee's recommendations have been recently reported in the *Survey of Current Business*.[7] Revised deflators have been selected by the Bureau of Economic Analysis (BEA) and the Bureau of the Census. However, in the opinion of this observer, none of those selected are appropriate as price indexes for college and university construction, and an alternative index has been chosen for this purpose.

Accounting for Increased Productivity

The proper measure of price change in construction is conceptually somewhat different than the approach normally used in preparing price indexes. The essence of price measurement is that a time series of price observations be obtained for goods and services of *fixed* specifications. For homogeneous raw materials of near constant quality (coal, sugar, lumber), quality can be easily controlled by imposing detailed specifications. For the many products that continually change in quality (typewriters, jackets, automobiles), the difference in price because of change in quality (as measured by related higher producer costs or the difference in price between the two qualities produced and sold simultaneously) can be properly excluded by the linking process. However, new construction is one of the most heterogeneous products in the economy, with houses, buildings, and shopping centers almost never built the same. This necessitates the pricing of a fixed *hypothetical* building that accurately represents the type or category of construction being considered. Furthermore, because no "standard" building is repeatedly constructed year-after-year, *inputs* (labor and material) rather than the finished building product must be priced.

[6] The Price Statistics Review Committee was organized by the National Bureau of Economic Research at the request of the Bureau of the Budget. The Committee's report given in: U.S. Congress, Joint Economic Committee, *Government Price Statistics Hearings . . . , January 24, 1961.*

[7] Bureau of Economic Analysis (BEA) and the Bureau of the Census, Social and Economic Statistics Administration, U.S. Department of Commerce, "Revised Deflators for New Construction, 1947–73," *Survey of Current Business,* Vol. 54, No. 8, Part I, August 1974, pp. 18–27.

In pricing inputs, special attention must be directed to those changes in labor and material which result in increased construction productivity. As technology develops new tools, procedures, and materials, construction can be performed at lower unit costs. A construction price index, although based on inputs, must report the cost of a *completed* structure, taking into account all improvements in productivity brought about by changes in inputs and the efficiency of their use.

Changes in productivity are equal to the difference in input costs between old and new methods *measured per unit of the completed or in-place component*. A few examples will illustrate. An early major improvement in construction efficiency occurred when steam shovels were employed in excavating to replace horse drawn scoops. The savings in cost per cubic yard of earth removed (the completed component) were considerable and could be properly accounted for in index calculation by substituting the unit price (dollar cost per cubic yard removed) of shovel operators and gasoline for scoop drivers and horse feed. A second major improvement in construction productivity occurred when ready-mix concrete became available and made self-mixing on the job site noncompetitive and obsolete. Again, the substituting of inputs priced per unit of completed construction (in this case per cubic yard of mixed, ready-to-pour concrete) accounted for the increased productivity. Other examples of potential increases in construction productivity are the possible savings which could accrue from buildings designed with load-bearing exterior walls, and the greater use of factory prefabricated components such as bathrooms. There also have been improvements in material handling through use of tower cranes and motorized "Georgia buggies" for concrete hauling. More recently, the efficiency of interior wall construction has been increased by use of drywall board instead of plaster. The difference in unit costs ($0.40/square foot compared to $0.51/square foot in 1972), would be accounted for in index values by substituting the labor costs per square foot of completed wall of "rockers" and "finishers" for "lathers" and "plasterers"; also the unit costs of sheetrock and finishing compound for gypsum board and brown and finished coat plaster. The fact that a finished plaster wall has certain superior *quality* aspects to that of drywall would have to be taken into account.

The criticism that construction price indexes have not properly accounted for improved productivity is especially true when index values are compared over a considerable period of time when a strong upward bias is noted. In the short recent period that indexes are presented here (since 1961) changes in building materials and construction techniques have largely related to specific components and have *not* had significant effects on overall productivity or total costs. Comparing revised with unrevised indexes of *total* new construction, the BEA and the Bureau of the Census note that since 1965 no overstatement of consequence is observed.[8] Yet

[8] BEA and Bureau of the Census, "Revised Deflators for New Construction, 1947–74," op. cit., p. 20. (For nonresidential buildings, the increase in index values from *1961* to *1973* for the revised and unrevised indexes were 84.1 percent and 86.2 percent, respectively.)

care must be exercised to see that data collected for price index computation adequately account for productivity changes, and it is not clear to this observer, nor do the BEA and the Bureau of the Census claim, that this and other stated objectives have been achieved in their choice of interim revised construction indexes.

Selection of the Boeckh Index

The revised construction deflators selected on an interim basis by the BEA and the Census are based, by necessity, on existing price series with their attendant deficiencies. For educational, hospital and institutional, religious, and other nonfarm nonresidential buildings, the BEA and the Census have selected an unweighted average (one-third weight each) composite of the Turner Construction Company's index, the Census' single-family house index, and the Federal Housing Administration's (FHWA's) structures index. This composite index also serves as a construction deflator for industrial buildings, commercial buildings, and farm nonresidential buildings. The tremendously wide range of building types covered by this single index explains in part why three distinctive price series were selected to form a composite in an effort to represent as many physical specifications and construction skills as would be found in such a broad spectrum of buildings. There is little difference in the overall rate of increase between the BEA's and the Census' revised deflator for nonresidential buildings and the Boeckh index selected for college and university construction (for the 1961–73 period 84.1 percent and 85.6 percent, respectively). Yet, from a theoretical standpoint, the Boeckh index is preferable.

Consider the three components of the BEA-Census index as applied to nonresidential buildings. Both the Census' single-family house index and the FHWA's structures index can be dismissed as irrelevant to most types of *nonresidential* building construction. Single-family houses are typically small, two-story wood-frame constructions with simple electrical, air conditioning, and heating systems. Nonresidential commercial and institutional buildings, on the other hand, are large multistory steel and/or concrete frame structures with complex structural, mechanical, and electrical systems. The architectural and engineering designs are far more extensive, complex, and costly than are those for residential houses. Many workers on large constructions are highly skilled and all are paid union commercial rates which exceed both nonunion wages commonly paid for residential house construction and union residential rates. It is also important to note that since the Census' single-family house index represents the *total* sales price of houses, including site values for use in the value-in-place series, the index must be adjusted for site-value changes. The difficulty of accurately estimating land values casts serious doubts on the validity of resulting structural values.

Bridge construction also is dissimilar to that of commercial buildings. The FHWA's structures index is a weighted average based on the contract

price of fixed physical quantities in place for reinforcing steel, structural steel, and structural concrete. The heavy types of equipment and materials used in bridge construction, particularly if the span is over water, the exceedingly sophisticated structural engineering required in many bridge designs, and the use of prestressed concrete in some instances are among some of the dissimilarities between bridge and building construction. This leads to rejection of the FHWA's structures index as a suitable deflector component for nonresidential buildings.

The more relevant Turner Construction Index by itself would be a better deflator for nonresidental buildings than in combination with the other two components. Yet, this index has certain deficiencies which suggest the superiority of the indexes prepared by Boeckh for purposes intended here. In essence, beginning in 1970, the Turner Construction Company's building-cost index has been based on the estimated cost, plus profit, of constructing a hypothetical 40-story structural steel, finished office building of fixed specifications. The company's cost data are now derived from quarterly reports from the various regional Turner purchasing offices. These reports cover current and projected costs of about 12 categories of materials, supplemented by information on labor costs (from union contracts with Turner) and on other costs (such as interest on construction loans). Quarterly changes in the index are based on estimates of changes in materials, labor, and other costs, weighted according to their estimated relative importance in January 1970—labor, 38 percent; materials, 48 percent; other, 14 percent. Prior to 1969, the Turner index was based on the estimated cost of constructing a hypothetical reinforced-concrete, loft type of industrial building of 10 to 15 stories.

Both the Turner and Boeckh indexes are more similar than dissimilar. Choice of the Boeckh index, more a matter of degree than absolute superiority, rests primarily on its more detailed and comprehensive labor and material specifications, and its broader and more representative collection of data. Equally important, the Boeckh index for apartments, hotels, and office building more closely parallels the types of buildings constructed on college and university campuses, and, therefore, is more relevant. Turner's officials monitor construction operations and adjust costs to take account of the effects of productivity on the basis of informed *judgment* and by incorporating new materials and equipment in index compilation. The Boeckh index makes no value judgments as to changes in productivity, accounting for changes exclusively by altering material and labor inputs as discussed on pages 95 and 97. This latter approach is viewed by this observer as adequate and superior—adequate as indicated by the fact that for the period of this study, 1961–74, the rate of growth of the Boeckh index has been *less* than that of the Turner index (98 percent versus 102 percent), and superior in avoiding subjective inclusions for which there are no standards or controls for consistency.

CHAPTER V.

STUDENT CONSUMER PRICES AND INDEXES

The level of tuition charged is an important factor in a student's decision to attend any given institution. Tuition charged at nearby or peer institutions is important to college administrators in setting rates that meet competition. For many reasons individual school data are useful, and therefore tuition and room and board charges are usually published on an institutional listing basis which permits college-by-college comparisons. Average values are of less general interest, commonly being the purview of economists working on aggregate models of education financing. But average charges are important to individuals, for this information helps policymakers properly define the role of students in meeting the costs of education. How much students and their parents should pay is as important a matter in educational policy as the necessary consumer reimbursement for a purchased service. However decided, defining the role of student payment requires accurate information of existing charges grouped in meaningful aggregates. Surprisingly little effort has been made in this regard, with institutional listings dominating the reporting.

Student Charges and Data Sources

The U.S. Office of Education publishes an institutional listing of undergraduate tuition and fees in its yearly *Education Directory*. Tuition, as well as room and board charges, are also published yearly by the National Beta Club and, beginning in 1966-67, by the College Scholarship Service of the College Entrance Examination Board. The Life Insurance Marketing and Research Association, Hartford, Conn., annually publishes *College Costs*, which presents tuition, room and board, and undergraduate enrollment for most colleges and universities granting the bachelor's degree. None of these organizations calculate a base year, fixed-weight average (Laspeyres-type formula) required for price index purposes.

The Office of Education (OE), in its annual *Projections of Educational Statistics*, reports average student charges actually paid each year. This average is determined by weighting each institution's charges by its *current* enrollment (the Paasche-type formula). Shifts in enrollment, such as the likelihood of proportionately more students attending less expensive institutions, would seriously affect average values weighted in this manner (a downward bias in this case). The student-charge averages calculated by OE thus measure more than pure price change and are therefore unsuitable as values for a price index series.

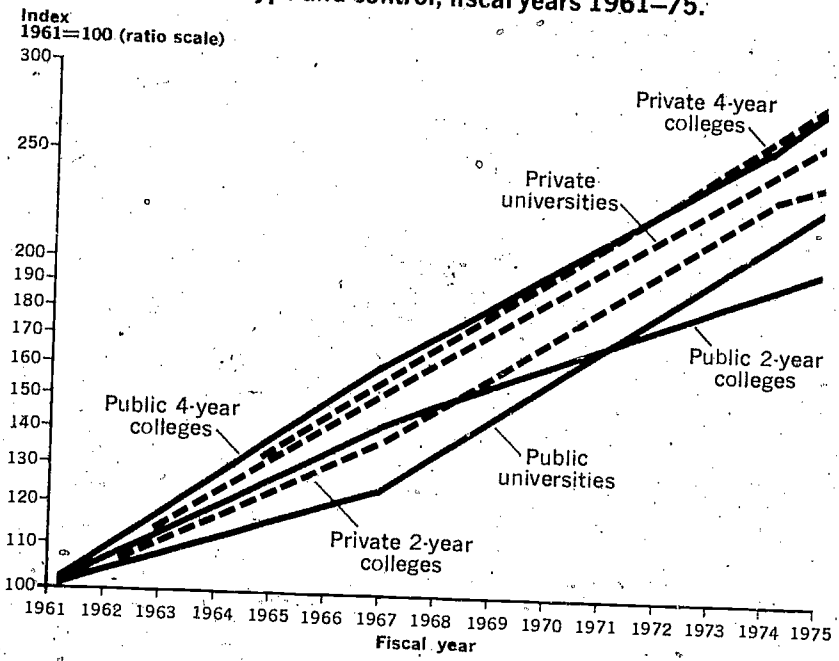
The College Scholarship Service (CSS) calculates an unweighted average of student charges—tuitions are simply added and divided by the total number of reporting institutions. Because there is such a tremendous range of institutional sizes, student charges must be weighted by enrollment if "averages" are intended to be representative of values paid by most students. The 400 smallest private 4-year colleges, for example, have far less total enrollment (95,000 students) than do the 100 largest (190,000 students). A simple average would weight tuition charges at the smallest colleges 4 times that of charges at the largest colleges, when, in reality, the proper weighting based on enrollment would be 2 to 1 in favor of the larger institutions. The simple average of student charges calculated by CSS is thus unacceptable for pricing purposes.

The National Beta Club—a leadership-service organization for high school students—annually reports student charges in its *College Facts Chart*. Beta Club data have been used in preparing the price series for student charges primarily because the organization's publication is the only source that has consistently reported this information for the time period required—since 1960–61—and its reporting is timely. Student-charge data, however, regardless of the publishing agency, are often inconsistently reported by institutions and require careful cross-checking. For this reason, the student-charge series for each institution has been reviewed and compared with data from other sources to reduce reporting errors and maintain continuity. Yet, further efforts are deemed advisable to ensure data reliability.

Using Beta Club data, price series for resident undergraduate tuition and for room and board charges have been prepared for public and private universities, 4-year colleges, and 2-year colleges. Prices for the entire 1961–75 time series are based on charges at the *same* institutions weighted with *fixed* 1967 enrollments. Composite charges for *all* public and *all* private institutions have also been computed, weighted according to the proportional enrollment of each type of institution. Prices have been calculated for fiscal years 1961, 1967, 1974, and 1975. Approximate values for the intervening years can be estimated by extrapolation. Based on sampling, and with some remaining concern for institutional reporting accuracy, the student charges presented in table V-1 and figure V-1 should be viewed as *preliminary* data.

Figure V–1.

—Comparison of trends in price change in fixed weight average undergraduate student tuition in institutions of higher education, by institutional type and control, fiscal years 1961–75.



Note.—The vertical axis is expressed on a ratio or logarithmic scale; i.e., equal vertical distances reflect equal proportional (as distinguished from absolute) changes.

Table V–1

Fixed weight average resident undergraduate student charges and indexes in institutions of higher education, by institutional type and control, fiscal years 1961–75.

PUBLIC INSTITUTIONS

Fiscal year	Total tuition, room and board				Tuition and fees				Room and board			
	All	University	4-year[1]	2-year[2]	All[3]	University	4-year[1]	2-year[2]	All[4]	University	4-year[1]	2-year[2]
	Amount											
1961	$881	$1,004	$759	...[4]	$219	$282	$175	$167	$662	$722	$584	...[5]
1967	1,077	1,184	987	...	302	350	287	237	775	834	700	...
1974	1,517	1,711	1,382	...	478	588	450	319	1,039	1,123	932	...
1975	1,638	1,827	1,517	...	510	621	488	337	1,128	1,206	1,029	...
	Index											
1961	81.8	84.8	76.9	...[4]	72.5	80.6	61.0	70.5	85.4	86.6	83.4	...[5]
1967	100.0	100.0	100.0	...	100.0	100.0	100.0	100.0	100.0	100.0	100.0	...
1974	140.9	144.5	140.0	...	158.3	168.0	156.8	134.6	134.1	134.7	133.1	...
1975	152.1	154.3	153.7	...	168.9	177.4	170.0	142.2	145.5	144.6	147.0	...

PRIVATE INSTITUTIONS

Fiscal year	Total tuition, room and board				Tuition and fees				Room and board			
	All	University	4-year[6]	2-year[7]	All[8]	University	4-year[6]	2-year[7]	All[8]	University	4-year[6]	2-year[7]
	Amount											
1961	$1,637	$1,823	$1,418	$1,268	$804	$983	$737	$574	$733	$840	$681	$694
1967	2,130	2,487	1,998	1,653	1,231	1,489	1,146	796	899	998	852	857
1974	3,218	3,693	3,063	2,409	2,039	2,393	1,938	1,323	1,179	1,302	1,125	1,086
1975	3,422	3,883	3,276	2,612	2,170	2,533	2,074	1,377	1,252	1,350	1,202	1,238

	Index											
1961	75.2	73.3	71.0	76.7	65.3	66.0	64.3	72.1	81.5	84.2	79.9	81.0
1967	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1974	151.2	148.5	153.3	145.7	165.6	160.7	169.1	166.2	131.1	130.5	132.0	126.7
1975	160.7	156.1	164.0	158.0	176.3	170.1	181.0	173.0	139.3	135.3	141.1	144.5

[1] Public 4-year colleges with 1966–67 enrollment greater than 2,000 students. California State Colleges and the City University of New York (CUNY) colleges charging nominal tuition "fees", and well above average room and board charges (California) are excluded.

[2] Public 2-year colleges with 1966–67 enrollment greater than 1,000 students. Public 2-year colleges in California and in the City University of New York System charging nominal tuition "fees" are excluded.

[3] Tuition values for all public institutions are fixed weight averages based on full-time-equivalent 1966–67 student enrollments as follows: universities, 1,476,669 (43.0 percent); 4-year colleges, 1,149,198 (33.4 percent); and 2-year colleges, 812,667 (23.6 percent). By 1972–73, shifting student attendance to 2-year colleges had changed the enrollment pattern in the public sector to the following: universities, 2,066,650 FTE students (37.1 percent); 4-year colleges, 1,712,488 (30.8 percent); and 2-year colleges 1,787,600 (32.1 percent). Reweighting and linking will be required for continuation of this price series.

[4] Room and board values for all public institutions are fixed weight averages based on full-time-equivalent 1966–67 student enrollments at public universities, 1,476,669 (56.2 percent); and public 4-year colleges, 1,149,198 (43.8 percent). Few of the 812,667 students attending public 2-year colleges contract for room and board. Income for housing and food services at public 2-year colleges amounted to only 3.8 percent of the total in the public sector in 1966–67. Consequently, excluding 2-year college room and board charges in the calculation of values for all public institutions introduces minimal inaccuracy.

[5] Many public 2-year colleges primarily serving commuting students living at home do not provide room and board services. Charges published by the Beta Club have not been reported with sufficient consistency for the 1961–75 period to establish a valid trend.

[6] A random sample of private 4-year colleges with 1966–67 enrollment greater than 1,000 students.

[7] Private 2-year colleges with 1966–67 enrollment greater than 200 students.

[8] Values for all private institutions are fixed weight averages based on full-time 1966–67 student enrollments as follows: private universities, 543,351 (32.2 percent); private 4-year colleges, 1,019,915 (60.4 percent); and private 2-year colleges, 124,205 (7.4 percent). Only slight shifts in this attendance pattern have occurred. The 1972–73 FTE student enrollment in the private sector is as follows: universities, 564,115 (31.0 percent); 4-year colleges, 1,147,727 (63.1 percent); and 2-year colleges, 105,780 (5.8 percent).

Two factors dictated the sampling procedure. To be included, institutions must have been in existence in 1960–61 and their student charges listed in the Beta Club's *College Facts Chart*. Secondly, institutions must have met arbitrary minimum 1967 enrollment requirements set to maximize student coverage and to exclude very small schools that, for a variety of reasons including possible high fixed unit costs, may charge atypical tuition rates. The public 4-year and 2-year institutions of California and City University of New York (CUNY), charging little or no tuition or nominal fees only, have been excluded. The resulting sampling data are shown below.

	Number of institutions			Student enrollment		
	1966–67 sample[1]	1966–67 universe	Sample as percent of institutional universe	1966–67 sample[2]	1966–67 universe[3]	Sample as percent of student universe
			Percent			Percent
PUBLIC						
Universities	93	93	100	1,530,000*	1,603,819*	95
4-year colleges[4]	165[5]	289	57	822,900	1,094,374	75
2-year colleges[6]	154[7]	398	39	442,300	650,617	68
PRIVATE						
Universities	65	65	100	644,100*	688,267*	94
4-year colleges	291[8]	1,112	26	606,700	1,176,937	52
2-year colleges	144[9]	276	52	89,300	135,970	66
Total	912	2,233	41	4,135,300	5,349,984	77

*Discrepancy due to difference in survey intent, definitions, and timing between the two collecting agencies—the National Beta Club and the U.S. Office of Education.

[1] Sample institutions existing in 1960–61 and listed in the National Beta Club's 1960–61 and 1966–67 **College Facts Chart.**

[2] Sample student enrollment based on headcount reported in the National Beta Club's 1966–67 **College Facts Chart.**

[3] Universe enrollment are resident students reported in U.S. Department of Health, Education, and Welfare, Office of Education, **Opening Fall Enrollment, Higher Education, 1966**, U.S. Government Printing Office, Washington, D.C. 1967.

[4] Excludes 18 California State Colleges with 1966–67 enrollment of 171,333 students and 6 City University of New York (CUNY) colleges with 1966–67 enrollment of 103,649 students which have no tuition, charging only nominal fees.

[5] Sample consists of most (except California and CUNY) public 4-year colleges with 1966–67 enrollment greater than 2,000 students.

[6] Excludes 75 public 2-year colleges in California with 1966–67 enrollment of 480,413 students and 6 public 2-year colleges of the City University of New York System (CUNY) with 1966–67 enrollment of 30,571 students which have no tuition, charging only nominal fees.

[7] Sample consists of most (except California and CUNY) public 2-year colleges with 1966–67 enrollment greater than 1,000 students.

[8] A random sample of private 4-year colleges with 1966–67 enrollment greater than 1,000 students.

[9] Sample consists of most private 2-year colleges with 1966–67 enrollment greater than 200 students.

Tuition Price Trends

With the exception of public 2-year colleges, tuition increases have averaged between 7 and 8 percent yearly since 1966–67 for all types of institutions in both the public and private sectors. At public 2-year colleges the rate was 4.5 percent. This general uniformity means that tuition charges at private institutions have remained about 4 times greater than at the public counterparts. In 1974–75 the ratios were: universities, 4.08; 4-year colleges, 4.25; and 2-year colleges, 4.09.[1] Further, it suggests that colleges and universities have raised tuition rather evenly out of the common need to respond to inflation and rising costs, not as a matter of individual policy or competitive strategy.

Trends in tuition may be analyzed from a number of standpoints. Absolute values of tuition and its index (table V-1 and table V-2, columns 1 and 2) simply report the average amount of tuition charged by institutions each year and its relationship to the level of tuition in a base year. This aggregate measure is of limited value to students and institutions who are more interested in charges at specific institutions. However, it is interesting to note that tuition increases in the public sector have almost exactly matched increases in median family income. Comparison of column (2) with column (9), table V–2, shows that tuition at public institutions increased 118 percent (158.3/72.5) from 1961 to 1974 while median family income increased 119 percent (161.3/73.6). It is unlikely this parallel relative increase was completely by intent, yet through practice public institutions are setting tuition charges that have been consistently proportional to family ability to pay. Thus, tuition at public institutions has equaled about 3.9 percent of median family income for the last 13 years.

In the private sector tuition increased 154 percent (165.6/65.3) from 1961 to 1974, more than the public sector, but as will be shown, when account is made of real resources expended by institutions, this situation is reversed with the rate of increase for tuition relative to fixed inputs being less in the private than in the public sector.

A Tuition Price Index (TPI)—unlike absolute values of tuition—as with any price index, must report tuition paid for a *fixed* package of educational services received. Such a package would of course be difficult

[1] The National Commission on the Financing of Postsecondary Education calculated somewhat different ratios for selected Carnegie institutional classifications based on average (rather than fixed weight) tuitions charged in 1971–72. Most important, the trend in their ratios for 3 years—1970, 1971, and 1972—also indicated no significant increase in private tuitions relative to charges at public institutions. In fact, for 6 of the 8 institutional classifications the Commission reported the ratio decreased. This suggests the possibility of a slight leveling off in growth of the tuition differential between the private and public sectors; i.e., the differential continues to increase in absolute terms but at a reduced rate. See National Commission on the Financing of Postsecondary Education, *Financing Postsecondary Education in the United States*, U.S. Government Printing Office, Washington, D.C., pp. 202–203.

Table V–2

Trends in the relationship of student tuition charges to institutional educational and general expenditures and to the Consumer Price Index and median family income, fiscal years 1961, 1967, and 1974.

1967=100

Fiscal year	Tuition charged	Index of tuition charged	Educational and general expenditures[1] per student in constant dollars (1967 prices)	Index of educational and general expenditures in constant dollars	Tuition price index (TPI)[2] (2)/(4)	Consumer price index (CPI)	TPI/CPI (5)/(6)	Median family income	Index of median family income
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				Public institutions					
1961	$219	72.5	$1,615	99.6	72.8	90.5	80.4	$5,679	73.6
1967	302	100.0	1,622	100.0	100.0	100.0	100.0	7,717	100.0
1974	478	158.3	1,670	103.0	153.7	141.6	108.5	12,444 est.	161.3
				Private institutions					
1961	$804	65.3	$1,681	85.6	76.3	90.5	84.3	$5,679	73.6
1967	1,231	100.0	1,963	100.0	100.0	100.0	100.0	7,717	100 0
1974	2,039	165.6	2,261	115.2	143.8	141.6	101.6	12,444 est.	161.3

[1] Data from table II–2, p. 36. Expenditures exclude sponsored research. See p. 39 of this study for a discussion of these expenditures.

[2] The Tuition Price Index reports change in average resident undergraduate tuition for a constant-dollar education expenditure input.

Source: Median family income (converted to fiscal year basis), U.S. Bureau of the Census, **Current Population Reports,** series P–60.

to define and almost impossible to quantify adequately for pricing purposes. However, the real resources used in higher education may be held constant and the assumption made that employing fixed inputs with relatively unchanging technology and productivity result in an education service of fairly consistent quality over time.

This approach can certainly be challenged, but it must be employed of necessity, and, if properly interpreted, results in a useful, albeit imperfect, price index. The real resources expended for higher education, shown in column 3 of table V-2, are educational and general expenditures (less sponsored research) per student deflated by the Higher Education Price Index (HEPI). The Tuition Price Index (TPI) column 5 shows index values with 1966–67 as the base year for the ratio of the index of tuition charged (column 2) to the index of constant dollar educational and general expenditures (column 4). The TPI reports change in the average resident undergraduate tuition for a *constant* dollar education expenditure *input*. To clarify the difference, the tuition reported in column 1 is the amount actually charged students with *no* adjustment for related institutional expenditures. TPI values are also presented in table 1 and figure 1, pages 9 and 10, for comparison with trends in other indexes.

The increase in TPI values represents the real loss of student purchasing power. While students still pay far less than the cost of their education, they now pay about twice as much in 1974 as they did in 1961 for the *same* real resources expended by institutions. The fact that TPI values have increased less than the index of tuition charged, especially in the private sector, simply means that over the years more real resources per student are being expended by colleges and universities as shown in column 3 of table V–2. Despite greater increases in tuition charged by private (165.6/65.3 = 154 percent) than by public institutions (158.3/72.5 = 118 percent), in terms of change in student charges for real resources expended in constant dollars, the private sector has the better record. The change from 1961 to 1974 in the private sector Tuition Price Index (TPI) is 143.8/76.3 = 88 percent. In the public sector is 153.7/72.8 = 111 percent. The reason for this difference is that private institutions have been providing greater growth in real resource input per student than their public counterparts, which more than offsets the difference in tuition increase between the two sectors.

Inflation has, of course, affected the whole economy as well as the education sector. Students, along with other consumers who have lost buying power for many goods and services, have lost purchasing power for their education. This overall loss of purchasing power is measured by the Consumer Price Index (CPI). Deflating tuition charges by the CPI converts the price level of this specific purchase to dollars of constant purchasing power for other alternative consumer goods and services. In other words, it

takes into account the general lowering of value of the student's dollars to purchase *any* consumer commodity. The resulting formula[2] is:

$$\frac{TPI}{CPI} \text{ or } \frac{\text{Tuition/CPI}}{\text{Education expenditures/HEPI}}$$

The values for this relationship shown in column 7, table V–2, indicate the degree to which increases in tuition for a fixed education resource input have exceeded the rate of general inflation. In the public sector the TPI/CPI ratio has increased 35 percent (108.5/80.4) in the 13-year period 1961–74. This means that students attending public institutions now pay tuition of $135 in dollars of constant CPI purchasing power whereas in 1961 tuition was $100 for the same real resource education input. In the private sector the increase in values of the TPI/CPI ratio is 21 percent (101.6/84.3).

Room and Board Price Trends

Room and board charges for fiscal years 1961, 1967, 1974, and 1975 are presented in table V–1, and in comparison with other price trends in table 1 and figure 1, pages 9 and 10. Since 1967, room and board charges at colleges and universities have increased 4 percent yearly, substantially less than the 6¼ percent annual increase during the same period in the Higher Education Price Index for institutional current educational and general operations.

The various types of auxiliary enterprises—housing, food service, intercollegiate athletics, student union, bookstore, student activities, etc.—are collectively operated on a break-even basis, with operating income in theory exceeding expenditures by the amount required for retirement of indebtedness and renewal and replacement of equipment. To assist in understanding the trend in room and board charges, therefore, it is useful to study the parallel price trend in housing and food service input costs. Table V–3 shows clearly that the trend in room and board charges by college auxiliary enterprises, at least since 1967, closely parallels the operating costs of transient hotels—a similar business. When more specific cost component comparisons are sought, the shortcomings of not having available *separate* data for room and for board charges are apparent. Office of Education data[3] give evidence that board charges as a percent of total room and board charges have declined from 63.5 percent in 1961–62, to 58.8 percent in 1966–67, to 55.5 percent in 1971–72. This trend indicates that room

[2] This constant dollar approach, using both the CPI and a higher education deflator, was first used by Richard Wynn in an analysis of tuition price inflation. See bibliography.

[3] Kenneth A. Simon and Martin M. Frankel, *Projections of Educational Statistics to 1983–84*, 1974 edition, U.S. Department of Health, Education, and Welfare, Office of Education, U.S. Government Printing Office, Washington, D.C., 1975, pp. 108–109.

Table V–3

Trends in the relationship of student charges for room and board and in housing and food-service input prices, fiscal years 1961, 1967, 1973, and 1974.

1967=100

Fiscal year	Index of room and board charges: Public institutions	Index of room and board charges: Private institutions	Operating costs and expenses per available room, 300 transient hotels[1]	Housing and food-service input prices: Wages and salaries[2]	Food[3]	Furnishings, supplies, and housekeeping operations[4]	Rent[5]	Services[6]	Maintenance, insurance, and taxes[7]	Utilities[8]	Index[9]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1961	85.4	81.5	94.7	91.9 est.	90.3	95.1	93.2	86.9	88.1	97.2	91.9
1967	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1973	128.3 est.	125.4 est.	125.2	148.0	128.4	124.3	122.7	131.9	145.0	123.4	137.7
1974	134.1	131.1	136.6	156.0	153.6	131.9	128.3	138.1	156.4	138.2	148.5

[1] Operating costs and expenses include salaries and wages; cost of food and beverages sold; administration; insurance; advertising; heat, light, and power; repairs and maintenance; and telephone. Source: Harris, Kerr, Forster & Company, **Trends in the Hotel/Motel Business** (1975 edition), New York, p. 11.

[2] Median weekly earnings of cleaning, food, health, personal, and protective service nonprofessional full-time employees, prepared by the Bureau of Labor Statistics from data derived from the **Current Population Survey.**

[3] Consumer Price Index food at home which includes cereals and bakery products; meats, poultry, and fish; dairy products; fruits and vegetables; and other foods such as eggs, fats and oils, sugar and sweets, nonalcoholic beverages, and prepared and partially prepared foods.

[4] Consumer Price Index household furnishings (textiles, furniture and bedding, floor coverings, appliances—excluding radio and TV—dinnerware, flatware, table lamps), housekeeping supplies, and housekeeping services (domestic services, laundry, day-care services, repairs).

[5] Consumer Price Index residential rent.

[6] Services, component 4.0 of the Higher Education Price Index, prices data processing and equipment rental, communication, transportation, printing and duplication, and professional and other miscellaneous services. See pp. 57–59.

[7] Consumer Price Index homeownership which includes mortgage interest rates, property taxes, property insurance premiums, and maintenance and repairs.

[8] Consumer Price Index fuel and utilities includes fuel oil and coal, gas and electricity, and residential telephone services and water and sewerage services.

[9] Composite index of housing and food services input prices based on the following weights: wages and salaries, 48 percent; food, 16 percent; furnishings, supplies, and housekeeping operations, 13 percent; rent, 8 percent; services, 6 percent; maintenance, insurance, and taxes, 5 percent; and utilities, 4 percent

rates have increased faster than board charges. The fairly modest rise in food prices from 1967 to 1973 (4¼ percent annually) supports this possibility. However, the extreme increase in food prices—12 percent from July 1973 to June 1974—should reverse this trend.

One method of identifying the trend in costs associated with total room and board charges is to compute a price index for housing and food service inputs. Because of the heterogeneity of auxiliary enterprise operations among colleges and universities and because of severe data limitations, no attempt is made here to obtain the accuracy or sophistication sought in computing the Higher Education Price Index (HEPI) or the Research and Development Price Index (R&DPI). The index in column (11) of table V–3 is computed on a fixed-weight, Laspeyres-type formula based on seven inputs (expenditure categories) for college and university auxiliary enterprise housing and food-service operations. The expenditure categories and their assigned weights are as follows: wages and salaries, 48 percent; food, 16 percent; furnishings, supplies, and housekeeping operations, 13 percent; rent, 8 percent; services, 6 percent; maintenance, insurance, and taxes, 5 percent; and utilities, 4 percent. Expenditures for the purchase of goods and materials for resale other than food, and expenditures for amortization of principle and interest are excluded. The sources of the associated price series for each expenditure category are identified in footnotes 2 through 9 of table V–3. The weights used are based on financial data for auxiliary enterprises classified by object item provided by the University of Wisconsin System.

The seven components priced constitute the *major* items purchased by colleges to provide student housing and food service. The index lacks detail however. For example, salaries of administrative personnel are not priced. A more serious deficiency arises from presuming national averages from the extremely limited data base. The Wisconsin data report expenditures for *all* auxiliary enterprises (excluding purchases of goods and material other than food, for resale), not just housing and food services, which nationally account for 57 percent of the total. The inclusion of these additional operations distorts the expenditure pattern from what it would be for housing and food service alone. Furthermore, the pattern of expenditures in Wisconsin may possibly include some atypical elements not commonly found at most other colleges and universities. For these reasons, the derived housing and food-service budget used for weighting in index computation should, at best, be considered case data for illustrative purposes only.

With this understanding of its limitations, the housing and food-services' input price index can be compared to student room and board charges. From 1967 to 1974 the index increased 48.5 percent, while the average room and board charges for public and private institutions increased 32.6 percent. How can this difference be explained?

Colleges and universities generally set room and board charges for the entire academic year in the preceding late summer or early fall. The index

of housing and food service operations, on the other hand, is based on average prices for the *entire* fiscal year. Although college administrators set charges based on projected costs, an institution cannot set rates too high in anticipation of future price increases and still remain competitive. It is likely that in most instances the trend in room and board charges lags behind the trend in input costs, and during periods of accelerating price increases this lag increases. This probably occurred when the June 1973 report of 1973–74 room and board charges was evidently based on colleges expecting a continuation of the previously experienced 5.5 percent yearly increase in costs. In actuality, costs for housing and food service rose 7.8 percent between fiscal years 1973 and 1974. The increase in costs last year and perhaps in previous years beyond what was expected, explains in part the differential between the room and food-service price index value of 148.5 for fiscal year 1974 and the index of room and board charges for that year of 132.6.

The differential can also be explained in terms of reduced need to use unrestricted current funds for plant purposes. Provision is generally made in the budgets of auxiliary enterprises to provide for future renewal, replacement, or expansion of buildings and equipment. In 1966–67 the excess of housing and food service operating income over expenditures used for capital purposes was 12.7 percent.[4] This large proportion was required for retirement of indebtedness and establishment of reserves associated with the massive construction programs in the 1960's. Without such building programs in the 1970's the need for such transfer of current income to plant funds has diminished. In 1972–73 housing and food-service-operating income exceeded expenditures by 8.0 percent. This change in need for plant funds permitted institutions to charge students proportionately less for room and board. If colleges and universities had maintained the 12.7 percent excess of income over expenditures in 1974, the index of student room and board charges would have been substantially higher than 132.6.

Finally, the fact that colleges and universities are providing housing and food services more efficiently and economically should be taken into account. In trying to hold the line on charges, institutions may have cut certain services such as room cleaning and passed the savings on to students. High-priced food items are probably no longer on most college cafeteria menus. Most institutions now attempt to operate dormitories at full or near full occupancy. These savings have undoubtedly resulted in a lower growth rate in housing and food service expenditures for the 1967–74 period than rising costs would otherwise have required.

[4] In 1966–67, the last year this data detail was collected by the Office of Education, auxiliary enterprise housing and food services revenues were $1,397,329,000; expenditures were $1,240,329,000. U.S. Department of Health, Education, and Welfare, Office of Education, *Financial Statistics of Institutions of Higher Education: Current Funds Revenues and Expenditures; 1966–67*, U.S. Government Printing Office, Washington, D.C., 1969, p. 13.

Clearly, institutions have not increased room and board charges as rapidly as the rise in associated costs might normally indicate. Although not easily quantified, the factors involved probably have been correctly identified; viz, the inability of institutions to accurately predict recent extreme price increases and set charges accordingly, reduction in the need to transfer current fund income to plant funds for retirement of indebtedness and replacement and renewals, and more economic housing and food service with savings passed on to students in lower charges.

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