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A Price Index for Biomedical Research and Development

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Synopsis

Price changes of goods and services used in biomedical research and development have impor-

tant effects on the costs of conducting research. We summarize the trends suggested by a recently constructed biomedical research and development price index, which measures the effects of price changes on the inputs to biomedical research from 1979 to 1986. The fixed-weighted index uses fiscal year 1984 National Institutes of Health expenditure patterns in developing the weights.

The rate of increase shown in the price index peaked in 1981 and slowed in following years. However, in most years, the rate of increase in the price index has exceeded the rate of increase in other major price indexes, such as the consumer price index, the producer price index, and the Gross National Product fixed-weighted price index.

A RECENTLY CONSTRUCTED price index measures the effects of price changes on the inputs to biomedical research from 1979 to 1986.

The Biomedical Research and Development Price Index (BRDPI) shows, for most years, a rate of increase that exceeds the rate of increase of other major price indexes, such as the consumer price index (CPI), the producer price index (PPI), and the Gross National Product (GNP) fixed-weighted price index.

BRDPI is a fixed-weighted index (Laspeyres formulation) that uses patterns of expenditures by the National Institutes of Health (NIH) to determine the weights. A Laspeyres index holds quantities fixed over time and is essentially the type of

index used by the Bureau of Labor Statistics in estimating the CPI and the PPI. Its formulation is

$$I = \frac{\sum P_{i2}q_{i1}}{\sum P_{i1}q_{i1}} \quad (1)$$

where: I = Laspeyres index; P_{i1} = price of item i in period 1; P_{i2} = price of item i in period 2; q_{i1} = quantity of item i in period 1. Quantities are held fixed at period 1 levels. The product of quantity times the items' price is summed across items to determine the index. An algebraically equivalent way to express the index is

$$I = \sum R_i w_i \quad (2)$$

Table 1. National Institutes of Health biomedical research and development price index, by fiscal year (fiscal year 1984 = 100)

Component	1979	1980	1981	1982	1983	1984	1985	1986 ¹
All performers.....	67.5	74.1	81.8	88.9	94.4	100.0	105.6	110.3
Intramural activities.....	76.9	82.4	88.7	93.7	97.3	100.0	103.0	104.6
Personnel.....	74.6	79.8	86.8	92.4	96.7	100.0	103.7	104.6
Nonpersonnel.....	79.1	85.0	90.6	95.1	97.8	100.0	102.3	104.5
Research function.....	76.9	82.4	88.8	93.8	97.3	100.0	102.6	104.4
Support function.....	76.8	82.3	88.5	93.6	97.1	100.0	103.6	104.8
Extramural activities.....	65.3	72.2	80.2	87.7	93.7	100.0	106.2	111.6
Academic grants and contracts.....	64.5	71.4	79.5	87.2	93.4	100.0	106.5	112.0
Personnel.....	67.5	72.7	80.2	88.5	94.2	100.0	107.8	113.3
Nonpersonnel.....	68.8	79.2	88.5	93.4	96.3	100.0	101.6	105.4
Indirect costs.....	56.7	64.5	73.1	81.2	90.3	100.0	106.9	113.6
Nonacademic grants and contracts.....	68.7	75.5	83.2	90.2	95.1	100.0	105.3	109.7

¹ Preliminary.
SOURCE: Bureau of Economic Analysis.

Table 2. Percent change in the National Institutes of Health biomedical research and development price index, by fiscal year

Component	1980	1981	1982	1983	1984	1985	1986 ¹
All performers.....	9.8	10.4	8.6	6.2	5.9	5.6	4.4
Intramural activities.....	7.2	7.7	5.7	3.7	2.8	3.0	1.5
Personnel.....	7.0	8.8	6.4	4.7	3.4	3.7	0.9
Nonpersonnel.....	7.4	6.7	5.0	2.8	2.3	2.3	2.1
Research function.....	7.2	7.8	5.7	3.7	2.8	2.6	1.7
Support function.....	7.2	7.6	5.7	3.8	2.9	3.6	1.2
Extramural activities.....	10.5	11.1	9.4	6.8	6.7	6.2	5.0
Academic grants and contracts.....	10.6	11.4	9.6	7.2	7.1	6.5	5.2
Personnel.....	7.7	10.3	10.3	6.5	6.1	7.8	5.1
Nonpersonnel.....	15.1	11.8	5.6	3.1	3.8	1.6	3.7
Indirect costs.....	13.7	13.4	11.1	11.2	10.7	6.9	6.2
Nonacademic grants and contracts.....	10.0	10.1	8.4	5.5	5.1	5.3	4.2

¹ Preliminary.
SOURCE: Bureau of Economic Analysis.

In equation (2), R_i is referred to as a price relative; it is the ratio of the price of an item in some period to its price in a base period. In the equation, w_i is the weight of an item in the same base period. For a discussion of index numbers, see reference 1.

BRDPI weights are based on fiscal year 1984 NIH obligations. Detailed NIH accounting records permitted the calculation of these weights for a large number of subcomponents.

The price relatives of the index use fiscal year 1984 as the base period and come from a variety of sources. Some are direct price relatives constructed from NIH data, while others are proxies. Like price relatives for all price indexes, controlling for quality change to isolate only price change is an important concern. For the index, some of the

price relatives are based on subcomponents of the CPI and the PPI. To the extent that CPI and PPI subcomponents control for quality changes—as they purport to do—they contribute to BRDPI's control for quality change. Further, BRDPI price relatives for personnel components control for quality change by isolating salary changes by faculty rank (such as assistant professor or full professor), and by Federal personnel classifications (such as GS-11, step 2). To the extent that these types of rankings and classifications reflect differences in employee quality, they contribute to BRDPI's control for quality change. A report submitted to the National Institutes of Health (2) provides a detailed discussion of the weights and price relatives.

Because NIH expenditures constitute an important share of funding for biomedical research in the United States, and because they cover a wide range of types of biomedical research, BRDPI provides a better measure of overall biomedical research price changes than other available price measures or their individual components.

Tables 1 and 2 summarize the trends shown by the index and some of its major components. Table 1 shows the index values, with 1984 equaling 100. Table 2 expresses annual index values as year-to-year percent changes. The three main components are intramural activities, extramural academic activities, and extramural nonacademic activities. Intramural activities reflect research conducted at NIH; extramural academic activities reflect research conducted at medical schools and universities; extramural nonacademic activities reflect research conducted outside of NIH and the academic community. The shares of these main components of total NIH obligations, and therefore their relative importance in the base period to the value of the index are as follows: intramural, 19 percent; extramural academic, 65 percent; and extramural nonacademic, 16 percent. To focus on the largest component (extramural academic activities), a sample of 140 institutions was used to derive detailed data on weights and prices.

Tables 1 and 2 show that, in general, the rate of increase in the index and its components slowed noticeably in recent years. The peak year-to-year increases occurred in fiscal year 1981, and then decelerated sharply. The pattern of deceleration reflected the general deceleration of inflation in the economy. The fiscal year 1986 index was 110.3, which was a 4.4 percent increase from fiscal year 1985. Extramural components consistently increased more rapidly than intramural components. A major reason was the relatively rapid increase in the personnel and indirect costs subcomponents of the extramural academic component. The personnel subcomponent of intramural activities rose slowly, however. Slow increases in the mid-1980s reflect the relatively small Federal pay raises in recent years. The fiscal year 1986 index for the extramural academic component was 112.0, which was a 5.2 percent increase from fiscal year 1985. The fiscal year 1986 index for the extramural nonacademic component was 109.7, a 4.2 percent increase. The fiscal year 1986 index for the intramural component was 104.6, a 1.5 percent increase from fiscal year 1985.

Table 3 compares the index with several well-known broad measures of price changes. The broad

Table 3. Comparison of the biomedical research and development price index with other price indexes, by fiscal year (percent change from preceding year)

Fiscal year	Biomedical research and development price index	Consumer price index, all items	Producer price index, all commodities	Gross National Product fixed-weighted price index
1980	9.8	13.6	14.6	9.0
1981	10.4	11.1	10.9	9.7
1982	8.6	7.4	3.1	7.1
1983	6.2	3.5	1.2	4.4
1984	5.9	4.1	2.5	4.0
1985	5.6	3.7	-.1	3.7
1986 ¹	4.4	2.5	-2.1	3.0

¹ Preliminary.

SOURCE: Bureau of Labor Statistics and Bureau of Economic Analysis.

measures are the "all items" measure of the CPI, the "all commodities" measure of the PPI, and the GNP fixed-weighted price index. In most years, the rate of increase in the index was more rapid than the rates of increase in the broader measures. The rates of increase in all the indexes (including BRDPI) were higher in the early 1980s than in the mid-1980s. In fiscal year 1986, BRDPI increased 4.4 percent. This increase was larger than the increase in the GNP fixed-weighted price index and nearly twice the increase in the CPI; the PPI declined.

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