

## Alternative Measures of Real GNP

THIS article reports on work underway at BEA to develop alternative measures of real GNP for presentation in the comprehensive revision scheduled for November 1990. It also shows the present measure of real GNP, in which output is valued in 1982 prices, recalculated in terms of 1987 prices for the period 1982–88. BEA is developing alternative measures because, for the reasons set forth in this article, a single measure of real GNP cannot be considered sufficient for all analytical applications that require a measure of aggregate output.

In general, a measure of real GNP based on the prices of a more recent year increases less than a measure based on prices of an earlier year. This characteristic, which has often been observed in index number construction, exists because the commodities for which output grows rapidly tend to be those that register the smallest increases in prices. Thus, when real GNP is recalculated using more recent prices, the commodities with strong output growth receive less weight, and growth in the aggregate measure is reduced.

This characteristic has always been recognized as a problem in long-term comparisons of GNP. However, until recently, the difference in the effect of using one set of prices rather than another had generally been considered small enough to be safely ignored in measuring real GNP in the United States. The simplicity of a single output measure in which the prices of a given year were used to value real GNP in all years was considered to outweigh

any advantage provided either by presenting alternative measures based on prices of other years or by using more complex approaches to weighting.

Two situations have contributed to a change in this view. First, beginning in the 1970's, changes in the prices and quantities of the energy and food components of GNP have been large enough in certain periods for the choice of price weights to affect the measurement of the change in real GNP. However, some of these price and quantity movements over time have reversed direction.

Second, with the introduction of BEA's price index for computers in the comprehensive revision in 1985, changes in the prices and quantities of computers have been large enough to make the measurement of real GNP quite sensitive to the choice of price weights. Because of the rapid decline in the price of computers—about 15 percent per year from 1982 to 1988—real GNP growth using 1987 price weights is about 0.3 percent per year lower than real GNP growth using 1982 price weights.<sup>1</sup>

When the sensitivity of the measurement of real GNP to the choice of price weights is large, a single measure is not appropriate for comparisons over all periods. For example, the present measure of real GNP in 1982 dollars imposes the relative price structure of 1982 on all years. Thus, the mea-

sure is appropriate for comparisons of GNP among those years that have relative price structures that do not differ greatly from that of 1982, and it may also be of use in making longer term comparisons in which 1 of the 2 years being compared is either 1982 or a year immediately around 1982. When the relative price structure of neither of the years being compared resembles that of 1982, it is more appropriate to use a measure in which the weights are representative of one or both of the years being compared. A similar statement applies to a measure of real GNP in 1987 dollars and to any other measure of real GNP based on the prices of a given year.

In the comprehensive revision scheduled for November 1990, BEA is planning to continue featuring real GNP calculated in the prices of a given year—the revision will be the occasion for replacing the 1982 prices currently used with 1987 prices. BEA is also planning to present alternative measures of real GNP in the comprehensive revision so that the user can select the type of measure most appropriate for a particular application.

The first part of this article describes the present approach to calculating real GNP and various approaches that are being considered for calculating alternative measures. The second part shows the present measure of real GNP recalculated in 1987 dollars. This recalculated measure, which is presented for the period 1982–88, provides a preview of one important element in the revision that will be made in 1990. Improvements in deflation procedures and revisions in current-dollar estimates will also contribute to the revision of the present measure. If past experience is a guide, there are likely to be offsets among these various sources of revision.

NOTE.—Carol S. Carson, Frank de Leeuw, Shelby A. Herman, Robert P. Parker, and Jack E. Triplett contributed to the development and preparation of the article. Teresa A. Williams provided secretarial assistance.

1. Two recent studies that have examined the sensitivity of real GNP to the prices in which it is valued are Edward F. Denison, *Estimates of Productivity Change by Industry*, (Washington: The Brookings Institution, 1989), and "The Effect of Computer and Petroleum Prices in NIPA Measures of Real Growth," *The Economic and Budget Outlook: An Update*, A Report to the Senate and House Committees on the Budget, (Washington: Congressional Budget Office, 1988): 75-78. See also "Revised Estimates of the National Income and Product Accounts of the United States, 1929-85: An Introduction," *SURVEY OF CURRENT BUSINESS* 65 (December 1985): 1-19.

# Considerations for the Comprehensive Revision

## Alternative weighting formulas

This section describes three types of index number formulas that can be used in calculating real GNP; these formulas are further explained by the example in the note that accompanies this article.

**Fixed weighting.**—The real GNP measure presently calculated by BEA values output in terms of 1982 prices—that is, in 1982 dollars. This is accomplished by expressing the output of each commodity in each period in 1982 prices. Use of the same price weights throughout—that is, fixed weights—provides a set of estimates that are expressed in constant dollars and that are additive; that is, total GNP in 1982 dollars is the sum of the components of GNP in 1982 dollars.

In this respect, real GNP and its components differ from the Index of Industrial Production and its components and the Consumer Price Index and its components. In these two sets of indexes, the weights are changed over time, and the indexes are, in general, not additive.

Many users consider the additive property of real GNP and its components to be quite useful. This property is a major reason why BEA has used fixed weights in calculating real GNP and why BEA will feature a fixed-weighted measure for the foreseeable future. However, as in all index number calculations, a desired property is obtained only at a cost. In this instance, the cost is that the real GNP measure is sensitive to the choice of the year for price weights.

**Short-term chain weighting.**—A chain-weighted measure is not calculated initially in terms of levels, but

in terms of period-to-period percent changes. For each change, output is expressed in terms of the prices of a given period. However, the same set of prices is not used over time; as the calculation moves forward, more recent prices are used. The resulting period-to-period changes can be linked together into an index.

For measuring changes in real GNP over short timespans, it is likely that some form of a chain index will prove to be useful. BEA began to present a quarterly chain index measure of real GNP change in the "Business Situation" in the August 1988 SURVEY OF CURRENT BUSINESS; in this measure the change in output from the previous quarter to the current quarter is expressed in terms of the prices of the current quarter. The August 1989 SURVEY showed how this chain index can be derived from the quarterly changes in current-dollar GNP and in the GNP chain price index.

## A Note on Alternative Measures of Real GNP

Alternative measures of real GNP—based on fixed weighting, chain weighting, or other weighting alternatives—can perhaps best be explained in terms of a hypothetical two-commodity economy. Exhibit 1 shows prices, quantities, and the current-dollar values—that is, price times quantity—for two commodities (A and B) in years 1 to 4. An important feature of the example is that the price of A grows more than the price of B while the quantity of A grows less than the quantity of B. Exhibit 2 shows three types of real GNP measures calculated from the data on commodities A and B.

**Fixed weighting.**—Using the entries in exhibit 1, fixed-weighted measures of real GNP are obtained by multiplying quantities in each year by prices in a designated base period. Thus, with year 1 as the base period, real GNP in year 1 is  $(6 \times 5) + (5 \times 4) = 50$ , and in year 2,  $(7 \times 5) + (7 \times 4) = 63$ , and so on. Likewise, with year 2 as the base period, real GNP in year 1 is  $(6 \times 6) + (5 \times 4) = 56$ , and in year 2,  $(7 \times 6) + (7 \times 4) = 70$ , and so on. Similarly, real GNP can be calculated using year 3 or year 4 as the base period.<sup>1</sup>

Thus, there are in principle as many measures of fixed-weighted real GNP as there are years that could be used as the base period. Exhibit 2 shows a matrix of real GNP measures calculated from exhibit 1, using each of the 4 years as the base period. The first four rows in the exhibit show the real GNP measures in constant dollars; the next four rows show period-to-period growth rates in the measures.<sup>2</sup>

In this example, selecting a later year as the base period produces a lower growth rate than selecting an earlier year because of the feature mentioned earlier—that the price of commodity A grows more than the

price of commodity B while the quantity of A grows less than the quantity of B. Therefore, commodity A receives more weight (and commodity B less) when a later year is the base period. *It is true generally*, as in this example, that a later base period produces lower growth in real GNP, because slow-

Exhibit 1.—Hypothetical Two-Commodity Economy

	Year				Ratio: Year 4 to Year 1
	1	2	3	4	
<b>Price (dollars):</b>					
A .....	5	6	8	9	1.80
B .....	4	4	5	5	1.25
<b>Quantity (units):</b>					
A .....	6	7	7	8	1.33
B .....	5	7	8	10	2.00
<b>Value (dollars):</b>					
A .....	30	42	56	72	2.40
B .....	20	28	40	50	2.50
Total .....	50	70	96	122	2.44

Exhibit 2.—Alternative Measures of Real GNP

	Year				Ratio: Year 4 to Year 1
	1	2	3	4	
<b>Fixed weighting</b>					
Real GNP in dollars, based on prices in:					
Year 1.....	50	63	67	80	1.60
Year 2.....	56	70	74	88	1.57
Year 3.....	73	91	96	114	1.56
Year 4.....	79	98	103	122	1.54
Percent change in real GNP, based on prices in:					
Year 1.....	n.a.	26.0	6.3	19.4	1.60
Year 2.....	n.a.	25.0	5.7	18.9	1.57
Year 3.....	n.a.	24.7	5.5	18.8	1.56
Year 4.....	n.a.	24.1	5.1	18.4	1.54
<b>Chain weighting</b>					
Percent change in real GNP, based on prices in:					
Previous year.....	n.a.	26.0	5.7	18.8	1.58
Current year.....	n.a.	25.0	5.5	18.4	1.56
<b>Other weighting alternatives:</b>					
Percent change in real GNP, based on:					
Fisher ideal index.....	n.a.	25.5	5.6	18.6	1.57
TGFI index.....	n.a.	25.3	5.9	18.6	1.57

n.a. Not applicable.

1. In reality, quantity data are not available for most components of real GNP. Real GNP is obtained by deflating current-dollar values by price indexes that express the price of each period relative to that of the base period. This procedure yields results identical to those obtained directly from prices and quantities. For example, using prices and quantities directly with year 1 as the base year, commodity A in real terms in year 2 is  $(7 \times 5) = 35$ . The identical result is obtained by deflating the current-dollar value of 42 for commodity A in year 2 by the price index with year 1 as the base year for commodity A in year 2. The price index is  $(6 \div 5) = 1.20$ . Thus, commodity A in real terms is  $(42 \div 1.20) = 35$ . Algebraically, the two procedures can be shown to be identical as follows. Using prices and quantities directly, real GNP is  $\sum q_t p_o$ , where  $q_t$  is the quantity in year  $t$  and  $p_o$  is the price in the base period. Deflating current-dollar values, the fixed-weighted measure of real GNP is  $\sum (q_t p_t / (p_t / p_o)) = \sum q_t p_o$ .

2. As shown in footnote 1, the fixed-weighted measure of real GNP in year  $t$  is  $\sum q_t p_o$ , where  $q_t$  is the quantity in year  $t$  and  $p_o$  is the price in base year  $o$ . The growth rate in this measure from year  $t-1$  to year  $t$  is

$$100 \left( \frac{\sum q_t p_o}{\sum q_{t-1} p_o} - 1.0 \right)$$

Experience may show that it is desirable to maintain a greater degree of stability in weighting than that in such a quarterly chain index. Therefore, for the comprehensive revision in 1990, BEA is also considering a quarterly chain index in which the price weights are held constant within a year. In this index, the prices of the previous year would be used in calculating the quarterly changes of a given year.

A disadvantage of a chain output index is that it lacks the additive property inherent in a fixed-weighted index. The lack of this property may prove troublesome for some users who now take advantage of the property in their analyses.

*Other weighting alternatives.*—BEA is experimenting with the Fisher ideal index number formula and with derivatives of it. The Fisher ideal index is

a geometric mean of a Laspeyres and a Paasche index. One promising index form, designated the time-series generalized Fisher ideal (TGFI) index, uses the Fisher ideal formula to calculate growth between adjacent benchmark years and uses fixed-weighted real GNP measures to interpolate the intervening years. The TGFI index may prove to be useful in economic growth studies that involve long-term comparisons. Preliminary results of research on the TGFI index were presented at a recent workshop sponsored by the National Bureau of Economic Research.<sup>2</sup>The Tornqvist index is an

other candidate; its properties are similar to the Fisher ideal.

*Evaluating the alternative measures*

While the presentation of alternative measures of GNP will provide useful information, it will complicate users' tasks. To the extent possible, BEA will, in the SURVEY and elsewhere, evaluate the characteristics of the alternative measures so that users can decide when to use one in place of the fixed-weighted measure. Also, it will be helpful to keep the following in mind.

- An important function of the analytical system represented by real GNP and its components is to distinguish the quarters and years in which aggregate economic activity is either much stronger or much weaker. It is likely that all of the alternative measures of

2. Jack E. Triplett, "Superlative and Quasi-Superlative Indexes of Price and Output for Investment Goods: Office, Computer and Accounting Machinery," BEA Discussion Paper No. 40 (presented at a National Bureau of Economic Research Summer Workshop, Boston, Massachusetts, July 1988.) Copies may be obtained from the author at BEA.

growth quantities tend to be associated with relatively fast-growing prices and fast-growing quantities with relatively slow-growing prices.

Over long timespans, such inverse relationships in the growth of prices and quantities tend to be the rule. One explanation for such relationships is that as changes in technology or in market structure lower some relative prices and raise others, buyers respond by demanding relatively more of the low-priced goods and relatively less of the high-priced ones and that these responses outweigh any contrary effects arising from changes in taste or in income levels.

*Chain weighting.*—Chain-weighted measures of the change in real GNP may be obtained using selected changes in the fixed-weighted measures. Thus, a chain index can be constructed in which prices of the previous year are used as weights; in this case, the growth rate for year 2 is the year 2 change in the fixed-weighted measure with year 1 as the base period, and the growth rate for year 3 is the year 3 change in the tied-weighted measure with year 2 as the base period, and so on. Similarly, a chain index can be constructed in which prices of the current year are used as weights; in this case, the growth rate for year 2 is the year 2 change in the fixed-weighted measure with year 2 as the base period, and so on. The growth rates for these two chain-weighted measures are shown in exhibit 2; it can readily be seen that, for each of these chain indexes, the changes correspond to changes along a diagonal of the matrix of growth rates for the fixed-weighted measures.<sup>3</sup>

Because a chain-weighted measure represents a series of changes taken from different fixed-weighted indexes, a change over a period of years can only be established by cumulating the period-to-period changes. In exhibit 2, the cumulated changes in the chain indexes fall in the middle of the range of growth in the fixed-weighted indexes from year 1 to year 4. (These are not the only possible chain-weighted measures; instead of using one set of weights for only one link in the chain, one set of weights could be used for two or more links before switching to a new set of weights.)

*Other weighting alternatives.*—The Fisher ideal index is the geometric mean of a Laspeyres and Paasche index. In terms of the example, the year 2 index value of the fixed-weighted measure with year 1 as the base period is a Laspeyres quantity index, while the year 2 index value of the fixed-

weighted measure with year 2 as the base period is a Paasche quantity index. The geometric mean of these two index numbers is the Fisher ideal index for year 2; that is, the Fisher ideal index is  $\sqrt{1.260 \times 1.250} = 1.255$ , and the growth rate from year 1 to year 2 is 25.5 percent. Likewise, the Fisher ideal index for year 3 is  $\sqrt{1.057 \times 1.055} = 1.056$ , and the growth rate is 5.6 percent.

The time-series generalized Fisher ideal (TGFI) index uses geometric means of fixed-weighted measures to calculate the year-to-year changes in real GNP between adjacent benchmark years. In the example, years 1 and 3 are taken as benchmark years, and the tied-weighted real GNP measures with year 1 and year 3 as the base period are used to calculate the growth rates in real GNP from year 1 to year 2 and from year 2 to year 3. To calculate the growth rate from year 1 to year 2, an index value for year 2 is obtained as the geometric mean of the year 2 values of the two fixed-weighted measures; that is, for year 2 the index value is  $\sqrt{1.260 \times 1.247} = 1.253$  (where  $63 \div 50 = 1.26$  and  $91 \div 73 = 1.247$ ), and the growth rate is 25.3 percent. Similarly, the index for year 3 is  $\sqrt{1.063 \times 1.055} = 1.059$ , and the growth rate is 5.9 percent. The cumulated change from year 1 to year 3 of 32.7 percent is identical to the growth rate calculated with the Fisher ideal index directly from year 1 to year 3—that is,  $\sqrt{1.340 \times 1.315} = 1.327$  (where  $67 + 50 = 1.340$  and  $96 + 73 = 1.315$ ).<sup>4</sup>

Beyond the most recent benchmark, only one set of benchmark weights is available, and the TGFI index requires two. In the exhibit, the annual Fisher ideal value is entered as the year 4 TGFI value; other procedures are possible.

4. The Fisher ideal index measure of real GNP growth from year  $t - 1$  to year  $t$  is

$$100 \left( \sqrt{\frac{\sum q_t p_{t-1}}{\sum q_{t-1} p_{t-1}} \times \frac{\sum q_t p_t}{\sum q_{t-1} p_t}} - 1.0 \right)$$

The TGFI measure of real GNP growth from year  $t - 1$  to year  $t$  is

$$100 \left( \sqrt{\frac{\sum q_t p_A}{\sum q_{t-1} p_A} \times \frac{\sum q_t p_B}{\sum q_{t-1} p_B}} - 1.0 \right),$$

where  $A$  and  $B$  are benchmark years and  $t = A + 1, A + 2, \dots, B$ . The cumulation of the TGFI index values for the years between  $A$  and  $B$  is equal to the Fisher ideal index value calculated directly from year  $A$  to year  $B$ :

$$\begin{aligned} & \sqrt{\frac{\sum q_{A+1} p_A}{\sum q_A p_A} \times \frac{\sum q_{A+1} p_B}{\sum q_A p_B}} \times \sqrt{\frac{\sum q_{A+2} p_A}{\sum q_{A+1} p_A} \times \frac{\sum q_{A+2} p_B}{\sum q_{A+1} p_B}} \times \dots \\ & \times \sqrt{\frac{\sum q_B p_A}{\sum q_{B-1} p_A} \times \frac{\sum q_B p_B}{\sum q_{B-1} p_B}} = \sqrt{\frac{\sum q_B p_A}{\sum q_A p_A} \times \frac{\sum q_B p_B}{\sum q_A p_B}} \end{aligned}$$

3. The chain-weighted measure of real GNP growth from year  $t - 1$  to year  $t$ , using prices of the previous year as weights, is

$$100 \left( \frac{\sum q_t p_{t-1}}{\sum q_{t-1} p_{t-1}} - 1.0 \right)$$

The chain-weighted measure using prices of the current year as weights is

$$100 \left( \frac{\sum q_t p_t}{\sum q_{t-1} p_t} - 1.0 \right)$$

Table 1.—Gross National Product

Line	1982	1983	1984	1985	1986	1987	1988	Seasonally adjusted at annual rates								
								1982				1983				
								I	II	III	IV	I	II	III	IV	
1	GNP .....	3,768.8	3,900.3	4,135.4	4,258.6	4,385.0	4,526.7	4,683.7	3,766.4	3,780.1	3,762.0	3,766.9	3,788.1	3,878.5	3,934.7	3,999.7
2	Personal consumption expenditures .....	2,469.2	2,579.0	2,698.0	2,820.5	2,933.3	3,012.1	3,096.7	2,445.5	2,457.5	2,471.7	2,502.1	2,520.5	2,566.1	2,598.1	2,631.1
3	Durable goods .....	276.6	309.6	353.0	386.8	417.5	421.9	440.8	271.7	272.6	275.4	286.7	287.9	306.4	315.5	328.8
4	Nondurable goods .....	868.0	899.6	928.3	952.0	986.0	997.9	1,006.9	859.6	864.6	870.8	877.0	885.4	894.6	905.8	912.8
5	Services .....	1,324.6	1,369.7	1,416.7	1,481.6	1,529.8	1,529.3	1,649.0	1,314.1	1,320.4	1,325.5	1,338.4	1,347.2	1,365.1	1,376.9	1,389.5
6	Gross private domestic investment .....	489.0	550.8	704.3	677.2	684.7	712.9	747.6	502.9	510.0	490.9	452.1	469.5	534.5	572.2	627.2
7	Fixed investment .....	514.4	553.8	638.2	665.4	669.2	673.7	704.0	528.5	515.9	500.5	512.7	511.0	539.8	569.5	595.1
8	Nonresidential .....	392.6	380.5	439.7	462.9	442.6	446.8	481.1	411.2	396.1	384.5	378.4	362.7	368.6	381.5	409.4
9	Structures .....	150.6	134.2	151.5	160.5	143.2	139.5	138.8	156.7	151.9	147.2	146.6	135.3	130.6	132.6	138.3
10	Producers' durable equipment .....	242.0	246.3	288.3	302.4	299.4	307.3	342.3	254.5	244.2	237.3	231.8	227.4	238.0	248.9	271.1
11	Residential .....	121.8	173.3	198.5	202.5	226.7	226.9	222.9	117.3	119.8	116.0	134.3	148.3	171.2	188.0	185.7
12	Change in business inventories .....	-25.4	-3.0	66.1	11.8	15.4	39.2	43.6	-25.6	-5.9	-60.6	-41.5	-41.5	-5.3	2.8	32.1
13	Net exports of goods and services .....	42.9	-7.9	-78.1	-104.3	-131.7	-123.0	-92.7	58.5	54.5	30.8	27.8	23.0	-1.1	-18.0	-35.6
14	Exports .....	383.4	365.4	386.8	377.1	384.9	428.0	497.2	396.7	401.0	381.4	354.4	360.2	358.7	370.3	372.3
15	Imports .....	340.5	373.3	464.9	481.5	516.6	551.1	589.9	338.2	346.5	350.6	326.6	337.1	359.8	388.3	407.9
16	Government purchases of goods and services .....	767.8	778.4	811.1	865.3	898.7	924.8	932.1	759.6	758.0	768.6	784.9	775.1	779.0	782.3	777.0
17	Federal .....	309.8	315.0	332.7	365.3	372.8	382.0	374.6	303.0	299.7	311.2	325.3	315.0	317.3	316.5	311.0
18	National defense .....	221.4	234.9	248.8	266.9	281.7	295.3	290.8	212.0	219.9	224.8	228.7	230.5	234.4	234.0	240.9
19	Nondefense .....	88.4	80.0	83.9	98.3	91.1	86.7	83.7	91.0	79.8	86.3	96.6	84.6	82.9	82.5	70.1
20	State and local .....	458.0	463.4	478.4	500.0	525.9	542.8	557.6	456.5	458.3	457.4	459.5	460.1	461.7	465.8	466.0
<b>Addenda:</b>																
21	Gross domestic purchases .....	3,725.9	3,908.2	4,213.5	4,362.9	4,516.7	4,649.7	4,776.4	3,707.9	3,725.6	3,731.1	3,739.1	3,765.1	3,879.6	3,952.7	4,035.3
22	Final sales .....	3,794.3	3,903.3	4,069.3	4,246.8	4,369.6	4,487.5	4,640.1	3,792.0	3,786.0	3,771.6	3,827.6	3,829.6	3,883.8	3,931.9	3,967.6
23	GNP price index (fixed weighted), 1987=100 .....	85.0	88.4	91.8	94.6	96.8	100.0	103.8	83.6	84.5	85.7	86.5	87.3	88.0	88.8	89.6

real GNP that will be presented will, for the purposes of short-term analysis, identify the same periods as being much stronger or weaker.

• A difference between two measures of real GNP is not evidence that one is wrong. Real GNP is not composed of actual transactions that reflect market prices and that could, at least in principle, be added up from information obtained from transactors to obtain a single, correct total. A measure of real GNP is a construct in which transactions are valued by the compiler in terms of a set of prices that is chosen, at least in part, arbitrarily. The worth of such a measure lies in whether or not it proves useful in analysis. Viewed in this way, there can be more than one useful measure.

## Real GNP in 1987 Dollars

This part describes the present measure of real GNP recalculated in 1987 dollars. Annual and quarterly estimates of real GNP in 1987 dollars are shown for 1982-88 in table 1. Percent changes in the measure of real GNP in 1987 dollars are compared with those in the measure of real GNP in 1982 dollars in table 2 and in chart 8. Estimates in 1987 dollars for the first quarter of 1989 will be presented next month and for each quarter thereafter in the "Reconciliation and Other Special Tables" section of the SURVEY.

## Aggregate GNP

From 1982 to 1988, the growth in the 1987-dollar measure is 1.9 percentage points less than that in the 1982-dollar measure—24.3 percent, compared with 26.2 percent. As shown in table 2, the annual percent changes in the 1987-dollar measure are smaller than those in the 1982-dollar measure in 5 of the 6 years. The largest difference—0.8 percentage point—occurs in 1984, when the 1987-dollar measure increased 6.0 percent and the 1982-dollar measure increased 6.8 percent. In 1986, the change in the 1987-dollar measure is larger than that in the 1982-dollar measure—3.0 percent, compared with 2.8 percent.

The quarterly percent changes in the 1987-dollar measure are smaller than those in the 1982-dollar measure in 16 of 27 quarters; the changes in the two measures are the same size in two quarters; and the changes in the 1987-dollar measure are larger in nine quarters. The differences between the two measures are greater than 1.0 percentage point in one-third of the quarters. The largest difference—1.5 percentage points—occurs in the first quarter of 1984, when the 1987-dollar measure increased 9.2 percent and the 1982-dollar measure increased 10.7 percent. Seven of the nine quarters in which the changes in the 1987-dollar measure are larger than those in the 1982-dollar measure are concentrated in 3 years—

three quarters in 1988 and two each in 1982 and 1986.

The differences in quarterly changes do not lead to substantially different cyclical patterns in the two measures. In both measures, periods of weak growth or decline occur in 1982 and in 1986, and the strongest growth occurs in 1983 and early 1984 and in 1987.

The difference in the growth from 1982 to 1988 in the two measures of real GNP can be traced primarily to the smaller price weight assigned to computer output in the 1987-dollar measure. Business expenditures on computers, which account for most of the output of computers, can be readily isolated in the presently available data base. Excluding this component of business fixed investment almost eliminates the 1.9-percentage point difference in the growth of the two measures from 1982 to 1988. The 1987-dollar measure increased 23.5 percent, compared with 23.7 percent in the 1982-dollar measure.

Table 3 illustrates the contribution of business expenditures on computers to the differences in the annual percent changes in the two measures of real GNP. Annual percent changes in the two measures of real GNP are shown in columns 1 and 2, and the differences in column 3. Columns 4-6 show the same information for real GNP excluding business expenditures on computers. Excluding business expenditures on computers reduces the average difference from -0.3 percentage

in 1987 Dollars, 1982-88

Seasonally adjusted at annual rates																				Line
1984				1985				1986				1987				1988				
I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	
4,089.0	4,131.9	4,151.3	4,169.1	4,208.4	4,233.2	4,283.3	4,309.2	4,366.3	4,370.7	4,396.1	4,406.7	4,453.5	4,502.5	4,547.8	4,602.8	4,625.6	4,671.4	4,701.8	4,735.8	1
2,654.7	2,695.2	2,707.4	2,734.9	2,778.2	2,800.7	2,845.6	2,857.2	2,888.2	2,916.7	2,959.6	2,968.8	2,975.7	3,005.9	3,040.7	3,025.8	3,058.4	3,081.1	3,110.8	3,136.6	2
341.8	352.8	354.0	363.2	376.1	381.7	403.0	386.5	394.3	405.4	440.4	430.0	407.7	422.5	439.6	417.6	431.8	441.8	441.4	448.3	3
915.2	931.2	932.6	934.4	941.5	947.5	954.9	964.0	976.6	988.2	987.3	991.8	997.9	996.6	999.8	997.4	999.5	1,000.4	1,012.5	1,015.0	4
1,397.7	1,411.2	1,420.7	1,437.2	1,460.6	1,471.5	1,487.7	1,506.7	1,517.4	1,523.0	1,531.9	1,546.9	1,570.1	1,586.8	1,601.3	1,610.9	1,627.1	1,638.9	1,656.8	1,673.3	5
706.2	704.6	707.9	698.6	675.6	684.8	662.4	686.0	714.6	690.4	669.9	663.8	691.5	701.4	700.4	758.3	748.0	741.2	750.8	750.3	6
616.8	639.3	644.1	652.6	658.3	668.1	658.9	676.3	668.9	669.5	669.2	669.4	654.6	668.3	685.3	686.7	688.2	702.4	709.4	715.8	7
418.7	438.2	446.4	455.6	460.5	467.4	455.7	468.0	453.4	441.9	437.8	437.2	423.8	438.6	462.1	462.7	467.9	482.1	486.8	487.3	8
144.9	151.7	153.4	155.8	161.3	163.2	155.8	161.7	157.1	141.0	136.4	138.2	134.8	135.0	142.0	146.0	137.2	138.9	139.4	139.5	9
273.8	286.4	292.9	299.8	299.2	304.2	299.8	306.3	296.2	300.9	301.3	299.1	289.0	303.5	320.1	316.7	330.7	343.2	347.4	347.8	10
198.1	201.1	197.8	197.0	197.9	200.7	203.2	208.3	215.6	227.6	231.5	232.2	230.7	229.7	223.2	224.0	220.3	220.3	222.6	228.4	11
89.4	65.3	63.7	46.0	17.2	16.7	3.5	9.7	45.7	21.0	.7	-5.5	37.0	33.1	15.1	71.6	59.8	38.8	41.3	34.5	12
-60.6	-80.2	-80.6	-91.1	-85.2	-101.9	-108.0	-122.2	-115.2	-134.0	-140.6	-136.7	-129.2	-123.1	-121.5	-118.5	-105.1	-84.5	-84.2	-97.0	13
379.3	384.9	393.7	389.3	381.7	377.8	372.3	376.8	383.0	380.3	384.8	391.6	398.9	418.0	439.1	456.1	477.8	489.1	506.7	515.4	14
439.9	465.1	474.2	480.3	466.9	479.7	480.3	499.0	498.2	514.4	525.5	528.4	528.1	541.1	560.5	574.6	574.6	573.6	590.9	612.4	15
788.8	812.3	816.7	826.7	839.8	849.6	883.4	888.3	878.7	897.7	907.3	910.9	915.4	918.2	928.1	937.2	924.4	933.7	924.5	945.9	16
316.6	336.5	336.0	341.7	350.2	351.7	379.0	380.1	362.2	374.2	377.8	376.9	375.5	376.8	385.7	390.0	372.6	377.7	367.1	380.8	17
243.6	248.6	247.2	255.7	259.7	261.6	273.7	272.7	271.1	281.1	292.1	282.3	288.1	295.2	300.3	297.8	293.4	292.6	286.3	291.0	18
73.1	88.0	88.7	85.9	90.5	90.1	105.3	107.4	91.1	93.0	85.7	94.5	87.4	81.6	85.4	92.2	79.2	85.1	80.8	89.9	19
472.2	475.7	480.7	485.0	489.6	497.9	504.3	508.2	516.5	523.5	529.4	534.0	539.9	541.5	542.4	547.2	551.7	555.9	557.4	565.1	20
4,149.7	4,212.0	4,231.9	4,260.2	4,293.6	4,335.1	4,391.4	4,431.4	4,481.6	4,504.8	4,536.8	4,543.5	4,582.7	4,625.5	4,669.2	4,721.3	4,730.8	4,755.9	4,786.1	4,832.8	21
3,999.6	4,066.6	4,087.6	4,123.1	4,191.2	4,216.5	4,279.8	4,299.5	4,320.6	4,349.8	4,395.4	4,412.3	4,416.5	4,469.4	4,532.7	4,531.3	4,565.8	4,632.6	4,660.5	4,701.3	22
90.5	91.4	92.1	93.2	93.9	94.3	94.9	95.5	95.9	96.5	97.2	97.7	98.7	99.6	100.4	101.3	102.0	103.3	104.5	105.5	23

point to -0.1 percentage point; the average computed without regard to sign is reduced from 0.4 percentage point to 0.2 percentage point. In 5 of the 6 years, excluding the computer component reduces the difference. The only year in which the remaining difference is more than 0.2 percentage point is 1984. In that year a large accumulation of business inventories, which included a variety of goods that registered smaller than average increases

in price from 1982 to 1987, also contributed to the difference.

Excluding the computer component reduces the average differences in the quarterly percent changes in the same manner as in the annual percent changes. However, the quarterly variation in the differences is largely due to other components. Sharp changes in energy quantities are the most important contributor to the differences in the quarterly changes. Reflecting

the drop in energy prices from 1982 to 1987, the weights assigned to the energy components of GNP in the 1987-dollar measure are smaller than those assigned to these components in the 1982-dollar measure. Consequently, both increases and decreases in energy quantities affect the 1987-dollar measure less than the 1982-dollar measure. Changes in the food components of GNP also contribute substantially to the differences in the quarterly

Text continues on page 33

**CHART 8**  
**GNP in 1982 and 1987 Dollars: Annual and Quarterly Percent Changes, 1982-88**

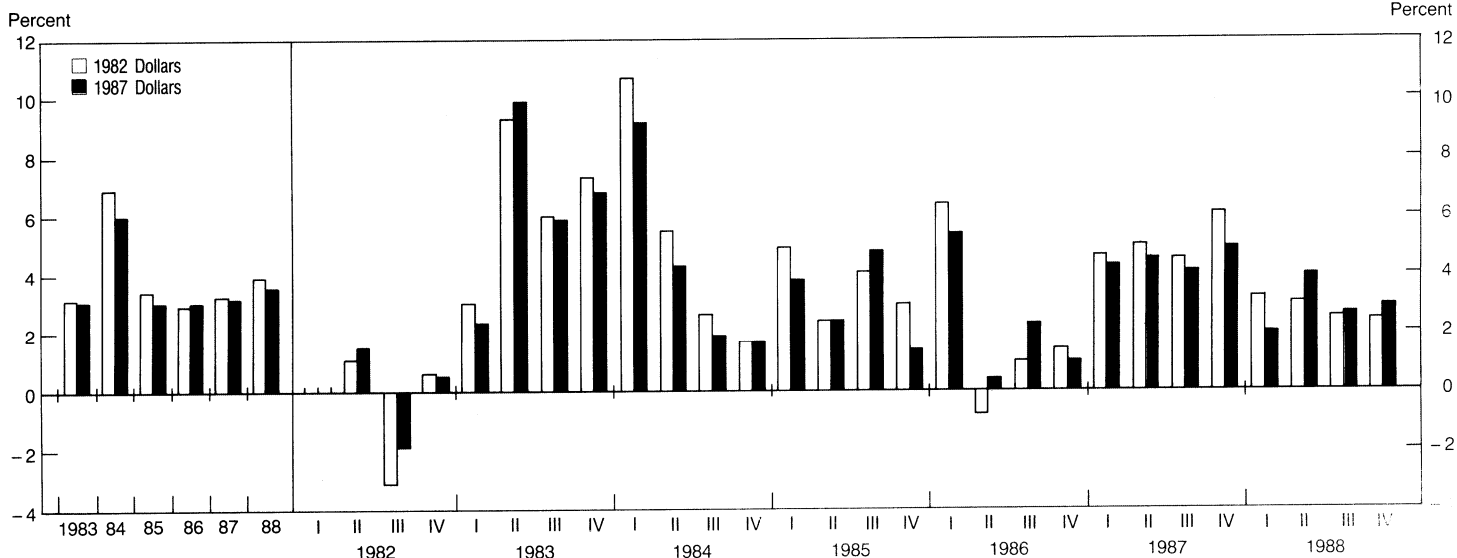


Table 2.—Gross National Product in 1982 and 1987 Dollars:

Line		1983	1984	1985	1986	1987	1988	Seasonally adjusted at annual rates							
								1982			1983				
								II	III	IV	I	II	III	IV	
1	GNP:														
2	1987 dollars .....	3.5	6.0	3.0	3.0	3.2	3.5	1.5	-1.9	.5	2.3	9.9	5.9	6.8	
	1982 dollars .....	3.6	6.8	3.4	2.8	3.4	3.9	1.2	-3.2	.6	3.5	9.3	6.0	7.3	
	<b>Personal consumption expenditures:</b>														
3	1987 dollars .....	4.4	4.6	4.5	4.0	2.7	2.8	2.0	2.3	5.0	3.0	7.4	5.1	5.2	
4	1982 dollars .....	4.6	4.8	4.7	4.3	2.7	2.8	1.9	2.1	5.3	3.0	8.0	5.3	5.5	
	<b>Durable goods:</b>														
5	1987 dollars .....	11.9	14.0	9.6	7.9	1.1	4.5	1.3	4.2	17.5	1.7	28.3	12.4	18.0	
6	1982 dollars .....	12.0	14.1	9.9	8.4	1.5	4.8	2.3	4.4	17.2	2.0	27.9	12.7	17.7	
	<b>Nondurable goods:</b>														
7	1987 dollars .....	3.6	3.2	2.6	3.6	1.2	.9	2.3	2.9	2.9	3.9	4.2	5.1	3.1	
8	1982 dollars .....	3.8	3.2	2.6	3.8	1.3	1.0	2.2	2.4	3.0	4.0	4.9	5.4	3.3	
	<b>Services:</b>														
9	1987 dollars .....	3.4	3.4	4.6	3.3	4.1	3.6	1.9	1.6	4.0	2.7	5.4	3.5	3.7	
10	1982 dollars .....	3.5	3.5	4.7	3.3	4.1	3.5	1.7	1.5	4.3	2.5	5.8	3.4	3.9	
	<b>Gross private domestic investment:</b>														
11	1987 dollars .....	12.6	27.9	-3.8	1.1	4.1	4.9	5.8	-14.2	-28.1	16.3	68.0	31.3	44.4	
12	1982 dollars .....	12.7	30.6	-3.3	1.0	4.9	7.0	2.9	-15.2	-31.0	19.1	68.9	35.0	46.3	
	<b>Fixed investment:</b>														
13	1987 dollars .....	7.7	15.2	4.3	.6	.7	4.5	-9.2	-11.4	10.1	-1.3	24.5	23.9	19.2	
14	1982 dollars .....	8.2	16.8	5.3	0	2.0	6.1	-11.9	-12.0	9.0	1.1	24.9	26.1	20.0	
	<b>Nonresidential:</b>														
15	1987 dollars .....	-3.1	15.6	5.3	-4.4	.9	7.7	-13.9	-11.2	-6.2	-15.6	6.7	14.8	32.6	
16	1982 dollars .....	-1.5	17.7	6.7	-4.5	2.8	9.5	-16.9	-11.9	-6.2	-11.6	8.7	18.5	32.5	
	<b>Structures:</b>														
17	1987 dollars .....	-10.9	12.9	5.9	-10.8	-2.6	-5	-11.7	-11.8	-1.6	-27.4	-13.2	6.3	18.3	
18	1982 dollars .....	-11.2	13.1	4.0	-13.5	-2.9	-3	-15.7	-14.1	-2.8	-26.2	-14.4	8.4	19.8	
	<b>Producers' durable equipment:</b>														
19	1987 dollars .....	1.8	17.1	4.9	-1.0	2.6	11.4	-15.2	-10.8	-9.0	-7.4	20.0	19.6	40.7	
20	1982 dollars .....	4.7	20.3	8.0	-1	5.2	13.4	-17.4	-10.6	-8.2	-1.3	24.7	24.3	39.6	
	<b>Residential:</b>														
21	1987 dollars .....	42.3	14.5	2.0	12.0	.1	-1.8	8.8	-12.1	79.7	48.7	77.6	45.4	-4.8	
22	1982 dollars .....	42.1	14.5	2.0	11.8	.1	-1.7	9.0	-12.2	79.1	48.4	77.0	45.5	-4.9	
	<b>Change in business inventories:</b>														
23	1987 dollars .....														
24	1982 dollars .....														
	<b>Net exports of goods and services:</b>														
25	1987 dollars .....														
26	1982 dollars .....														
	<b>Exports:</b>														
27	1987 dollars .....	-4.7	5.9	-2.5	2.1	11.2	16.2	4.4	-18.2	-25.4	6.7	-1.7	13.6	2.2	
28	1982 dollars .....	-3.8	6.8	-1.2	3.1	13.1	18.0	4.8	-18.6	-23.7	8.0	-9	13.6	3.1	
	<b>Imports:</b>														
29	1987 dollars .....	9.6	24.5	3.6	7.3	6.7	7.0	10.2	4.8	-24.7	13.5	29.8	35.7	21.8	
30	1982 dollars .....	9.7	23.8	3.4	9.4	7.9	8.7	3.8	13.7	-24.4	2.6	42.0	40.3	15.0	
	<b>Government purchases of goods and services:</b>														
31	1987 dollars .....	1.4	4.2	6.7	3.9	2.9	.8	-.8	5.7	8.8	-4.9	2.0	1.7	-2.7	
32	1982 dollars .....	1.1	4.4	7.9	4.0	2.6	.3	-3.1	8.4	11.4	-6.4	1.1	1.7	-6.8	
	<b>Federal:</b>														
33	1987 dollars .....	1.7	5.6	9.8	2.1	2.5	-1.9	-4.3	16.3	19.4	-12.1	3.0	-1.0	-6.8	
34	1982 dollars .....	.9	5.7	12.1	2.3	1.7	-3.0	-9.4	22.0	25.0	-14.7	.4	-1.3	-15.7	
	<b>National defense:</b>														
35	1987 dollars .....	6.1	5.9	7.3	5.5	4.8	-1.5	15.8	9.2	7.1	3.2	6.9	-.7	12.3	
36	1982 dollars .....	6.8	5.6	8.6	6.0	5.4	-1.2	14.1	11.8	9.2	3.6	6.2	.4	10.3	
	<b>Nondefense:</b>														
37	1987 dollars .....	-9.5	4.9	17.2	-7.3	-4.8	-3.5	-40.9	36.8	57.0	-41.2	-7.8	-1.9	-47.9	
38	1982 dollars .....	-13.6	6.0	22.8	-7.7	-9.6	-9.7	-49.2	55.2	73.0	-47.4	-14.6	-6.0	-65.7	
	<b>State and local:</b>														
39	1987 dollars .....	1.2	3.2	4.5	5.2	3.2	2.7	1.6	-.8	1.8	.5	1.4	3.6	.2	
40	1982 dollars .....	1.3	3.5	4.7	5.4	3.3	2.8	1.6	-.6	2.2	.4	1.5	3.9	.2	
	<b>Addenda:</b>														
	<b>Gross domestic purchases:</b>														
41	1987 dollars .....	4.9	7.8	3.5	3.5	2.9	2.7	1.9	.6	.9	2.8	12.7	7.8	8.6	
42	1982 dollars .....	5.1	8.7	3.8	3.7	3.0	3.0	1.1	.6	.6	2.9	13.6	8.6	8.6	
	<b>Final sales:</b>														
43	1987 dollars .....	2.9	4.3	4.4	2.9	2.7	3.4	-.6	-1.5	6.1	.2	5.8	5.0	3.7	
44	1982 dollars .....	3.0	4.7	5.0	2.7	2.9	3.7	-1.1	-2.6	7.1	1.3	4.9	5.0	3.8	
	<b>GNP price index (fixed weights):</b>														
45	1987=100 .....	3.9	3.8	3.1	2.3	3.3	3.8	4.4	5.7	3.8	3.9	3.1	4.0	3.3	
46	1982=100 .....	4.1	4.0	3.4	2.8	3.6	4.2	4.7	5.5	4.0	3.6	3.8	4.2	4.0	

Annual and Quarterly Percent Changes, 1982-88

Seasonally adjusted at annual rates																					Line
1984				1985				1986				1987				1988					
I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV		
9.2	4.3	1.9	1.7	3.8	2.4	4.8	2.4	5.4	.4	2.3	1.0	4.3	4.5	4.1	4.9	2.0	4.0	2.6	2.9	1	
10.7	5.5	2.6	1.7	4.9	2.4	4.1	3.0	6.4	-8	1.0	1.4	4.6	5.0	4.5	6.1	3.4	3.0	2.5	2.4	2	
3.6	6.2	1.8	4.1	6.5	3.3	6.6	1.6	4.4	4.0	6.0	1.2	.9	4.1	4.7	-1.9	4.4	3.0	3.9	3.4	3	
3.7	6.4	1.9	4.3	6.8	3.2	6.8	1.9	4.8	4.3	6.3	1.2	.6	4.3	4.6	-2.1	4.5	3.0	3.9	3.5	4	
16.8	13.5	1.4	10.8	15.0	6.1	24.3	-15.4	8.3	11.7	39.3	-9.1	-19.2	15.3	17.2	-18.6	14.3	9.6	-4	6.4	5	
17.1	13.3	2.3	11.3	14.8	6.5	23.3	-13.1	8.0	12.6	37.4	-7.5	-17.8	14.5	16.5	-17.3	14.7	9.8	-2	6.1	6	
1.1	7.2	.6	.8	3.1	2.6	3.2	3.9	5.3	4.8	-4	1.8	2.5	-5	1.3	-1.0	.8	.4	4.9	1.0	7	
.9	6.9	.7	.8	3.4	2.3	3.4	4.0	5.8	4.9	.2	1.8	2.1	0	.9	-6	1.0	.4	5.0	1.3	8	
2.4	3.9	2.7	4.7	6.7	3.0	4.5	5.2	2.9	1.5	2.4	4.0	6.1	4.3	3.7	2.4	4.1	2.9	4.4	4.0	9	
2.4	4.2	2.7	4.9	7.1	2.8	4.5	5.4	3.2	1.5	2.1	3.9	6.3	4.5	3.7	2.2	4.0	2.8	4.5	4.2	10	
60.7	-9	1.9	-5.2	-12.5	5.6	-12.5	15.0	17.7	-12.9	-11.4	-3.6	17.8	5.9	-6	37.4	-5.3	-3.6	5.3	-3	11	
66.0	2.0	3.6	-5.0	-12.4	8.6	-17.0	20.8	19.8	-14.4	-14.2	-6.9	20.9	8.8	4.8	38.6	2.3	-7.4	6.3	-4.9	12	
15.4	15.4	3.0	5.4	3.5	6.1	-5.4	11.0	-4.3	.4	-2	.1	-8.6	8.6	10.6	.8	.9	8.5	4.0	3.7	13	
16.6	17.3	5.6	7.3	3.0	8.0	-5.3	12.3	-4.9	-2.4	-2.5	1.5	-6.5	10.6	15.1	1.7	3.3	10.5	4.1	.8	14	
9.4	20.0	7.7	8.5	4.4	6.1	-9.6	11.2	-11.9	-9.8	-3.7	-5	-11.7	14.7	23.2	.5	4.6	12.7	4.0	.4	15	
11.6	22.3	10.8	11.0	3.5	8.8	-9.0	12.9	-11.7	-12.0	-6.5	1.6	-8.3	16.8	28.4	1.7	7.6	15.0	4.0	-2.9	16	
20.5	20.1	4.6	6.4	14.9	4.8	-16.9	16.0	-10.9	-35.1	-12.4	5.4	-9.5	.6	22.4	11.8	-22.0	5.0	1.4	.3	17	
19.9	20.6	4.2	3.6	11.3	.8	-14.5	12.3	-12.2	-41.9	-14.9	7.1	-8.7	-3	25.6	13.4	-22.4	3.3	2.6	-1.0	18	
4.0	19.7	9.4	9.8	-8	6.9	-5.7	9.0	-12.6	6.5	.5	-2.9	-12.8	21.6	23.7	-4.2	18.9	16.0	5.0	.5	19	
7.5	23.4	14.4	14.8	-3	13.1	-6.2	13.4	-11.5	6.0	-2.8	-5	-8.0	24.3	29.4	-2.4	21.6	19.2	4.6	-3.5	20	
29.5	6.2	-6.4	-1.6	1.8	5.8	5.1	10.4	14.8	24.2	7.0	1.2	-2.6	-1.7	-10.8	1.4	-6.4	0	4.2	10.8	21	
29.3	6.2	-6.3	-1.6	1.7	6.2	4.9	10.4	14.3	23.9	6.9	1.4	-2.6	-1.6	-10.7	1.3	-6.5	.2	4.3	10.9	22	
																					23
																					24
																					25
																					26
7.7	6.0	9.5	-4.4	-7.6	-4.0	-5.7	4.9	6.7	-2.8	4.8	7.3	7.7	20.6	21.8	16.4	20.4	9.8	15.2	7.0	27	
8.4	7.2	10.8	-2.2	-5.6	-3.8	-5.3	5.4	8.0	-2.5	7.7	9.5	7.5	23.6	25.7	17.7	25.7	9.1	14.5	6.5	28	
35.3	25.0	8.1	5.2	-10.7	11.4	.5	16.5	-6	13.7	8.9	2.2	-2	10.2	15.1	10.4	5.9	-6.2	12.6	15.4	29	
33.0	25.5	6.8	6.4	-15.0	16.3	.4	20.2	-1.9	19.4	15.2	-5	-1.9	11.5	23.4	9.9	6.9	-3.7	13.1	13.5	30	
6.2	12.5	2.2	5.0	6.5	4.8	16.9	2.2	-4.3	8.9	4.3	1.6	2.0	1.2	4.4	4.0	-5.4	4.1	-3.9	9.6	31	
6.9	17.7	2.6	5.2	7.3	6.5	19.8	1.6	-5.7	9.5	4.3	4.0	-8	-4	5.7	5.0	-7.9	3.9	-5.2	11.9	32	
7.4	27.6	-6	7.0	10.3	1.7	34.9	1.2	-17.5	13.9	3.9	-9	-1.5	1.4	9.8	4.5	-16.7	5.6	-10.8	15.8	33	
8.5	40.5	-1	6.9	11.8	5.7	40.2	-4	-19.4	14.2	3.8	4.6	-7.4	-2.3	12.6	6.7	-21.0	4.7	-13.2	20.7	34	
4.6	8.5	-2.2	14.5	6.4	3.0	19.8	-1.5	-2.3	15.6	16.6	-12.8	8.5	10.2	7.1	-3.3	-5.8	-1.1	-8.3	6.7	35	
4.8	7.1	-1.5	16.2	8.6	6.0	19.4	-4.2	-5	17.1	16.7	-11.2	6.3	12.7	7.3	-1.9	-5.3	-1.5	-10.5	9.9	36	
18.2	110.0	3.2	-12.0	23.2	-1.8	86.6	8.2	-48.2	8.6	-27.9	47.8	-26.8	-24.0	20.0	35.9	-45.6	33.3	-18.7	52.6	37	
24.0	237.5	4.2	-16.2	21.8	4.6	116.3	9.8	-54.2	6.0	-29.0	74.9	-39.8	-41.6	35.4	43.8	-60.1	33.2	-22.5	71.5	38	
5.4	3.0	4.3	3.6	3.8	7.0	5.2	3.1	6.7	5.5	4.6	3.5	4.5	1.2	.7	3.6	3.3	3.1	1.1	5.6	39	
5.9	3.3	4.4	4.0	3.8	7.3	5.6	3.2	7.0	6.0	4.8	3.6	4.6	1.1	.6	3.8	3.5	3.2	1.1	6.0	40	
11.8	6.1	1.9	2.7	3.2	3.9	5.3	3.7	4.6	2.1	2.9	.6	3.5	3.8	3.8	4.5	.8	2.1	2.6	4.0	41	
13.4	7.6	2.3	2.7	3.2	4.8	4.6	4.8	5.1	1.8	2.2	.4	3.4	4.1	4.8	5.4	1.6	1.3	2.5	3.5	42	
3.3	6.9	2.1	3.5	6.8	2.4	6.1	1.9	2.0	2.7	4.3	1.5	.4	4.9	5.8	-1	3.1	6.0	2.4	3.5	43	
3.7	8.1	2.9	4.0	8.0	2.3	6.6	1.6	2.1	1.6	3.3	2.9	.2	5.3	6.1	.4	3.6	6.3	2.0	3.5	44	
4.3	3.8	3.3	4.7	3.0	1.8	2.4	2.6	1.7	2.4	2.9	2.5	3.8	3.7	3.5	3.4	3.0	4.8	4.8	4.2	45	
4.5	3.8	3.4	3.2	3.8	3.3	2.8	3.3	2.2	2.4	3.0	2.8	4.2	4.2	3.7	3.8	3.5	5.0	5.3	4.2	46	

**Table 3.—Difference in Annual Percent Change in Real GNP and in Real GNP Excluding Business Expenditures in Computers, 1983-88**

	GNP			GNP excluding business expenditures on computers		
	1982 dollars	1987 dollars	Difference	1982 dollars	1987 dollars	Difference
	(1)	(2)	(3)	(4)	(5)	(6)
1983.....	3.6	3.5	-0.1	3.2	3.4	0.2
1984.....	6.8	6.0	-0.8	6.3	5.9	-0.4
1985.....	3.4	3.0	-0.4	2.9	2.8	-0.1
1986.....	2.8	3.0	0.2	2.8	2.9	0.1
1987.....	3.4	3.2	-0.2	3.1	3.1	0
1988.....	3.9	3.5	-0.4	3.4	3.3	-0.1
Average difference:						
With regard to sign.....			-0.3			-0.1
Without regard to sign.....			0.4			0.2

changes, reflecting smaller weights assigned to these components in the 1987-dollar measure than in the 1982-dollar measure.<sup>3</sup>

In each of the last three quarters of 1988, the 1987-dollar measure increased more rapidly than the 1982-dollar measure. The sources of the difference between these two measures vary by quarter. In the second quarter, most of the difference can be traced to the decumulation of inventories—largely inventories of food and energy. In the third quarter, most of the difference reflects food components that registered declines. In the fourth quarter, the difference is largely due to declines in computers and in energy components. (It is likely that the pattern of the previous three quarters will be reversed in the first quarter of 1989, and the 1982-dollar measure will increase more than the 1987-dollar measure.)

### GNP components

Table 4 shows the effect of restating the components of real GNP in 1987 dollars. For the major components, the tendency is widespread for the growth in the 1987-dollar measures to be less than the growth in the 1982-dollar measures. The exceptions are nonresidential structures and residential fixed investment, change in business inventories, and Federal nondefense purchases. Much the same pat-

3. The energy components and food components of GNP refer to all the components for which separate estimates are prepared. The major energy components that are not included are (1) exports of energy, (2) the gasoline and motor oil portions of inventories of gasoline service stations, and (3) the energy portions of inventories of businesses that do not produce energy for sale. The major food component that is not included is purchases of food by the Federal Government other than transactions by the Commodity Credit Corporation that are treated like purchases.

**Table 4.—Difference in Average Annual Rate of Change in Real GNP and Its Major Components, 1982-88**

	1987 dollars	1982 dollars	Difference
GNP.....	3.7	4.0	-0.3
Personal consumption expenditures.....	3.8	4.0	-0.2
Durable goods.....	8.1	8.4	-0.3
Nondurable goods.....	2.5	2.6	-0.1
Services.....	3.7	3.8	-0.1
Gross private domestic investment.....	7.3	8.3	-1.0
Fixed investment.....	5.4	6.2	-0.9
Nonresidential.....	3.4	4.5	-1.5
Structures.....	-1.4	-2.2	0.8
Producers' durable equipment.....	5.5	8.4	-2.5
Residential.....	10.6	10.4	0.2
Change in business inventories.....			
Net exports of goods and services.....	4.4	5.7	-1.3
Exports.....	9.6	10.3	-0.7
Imports.....			
Government purchases of goods and services.....	3.3	3.4	-0.1
Federal.....	3.2	3.2	0
National defense.....	4.6	5.1	-0.5
Nondefense.....	-0.9	-2.7	1.8
State and local.....	3.3	3.5	-0.2
Addenda:			
Gross domestic purchases.....	4.2	4.5	-0.3
Final sales.....	3.4	3.6	-0.2
GNP price index (fixed weights).....	3.4	3.7	-0.3

tern occurred in the comprehensive revision in 1985, when real GNP was restated from 1972 dollars to 1982 dollars.

The more rapid growth in nonresidential structures in 1987 dollars reflects the depressed level of oil and gas drilling in the 1980's. In terms of both quantities and prices, oil and gas drilling increased less than other types of construction. Thus, the smaller-than-average growth of this type of construction was assigned less weight in the 1987-dollar measure than in the 1982-dollar measure. The more rapid growth in Federal nondefense purchases is largely due to purchases by the Commodity Credit Corporation, which increased more slowly than other components in terms of both quantities and prices.

As expected, growth in producers' durable equipment (PDE) in 1987 dollars is substantially less than in 1982 dollars. Because of the smaller price weight assigned to business expenditures on computers, growth in PDE is reduced from 8.4 percent in the 1982-dollar measure to 5.9 percent in the 1987-dollar measure.

The slower growth in exports and in imports in the 1987-dollar measure reflects the smaller weights assigned to computers in that measure. For Federal defense purchases, the slower growth in the 1987-dollar measure is due partly to computers and partly to compensation of employees; the latter

**Table 5.—The Number of Detailed Components Used in Calculating Real GNP**

	1982 dollars	1987 dollars
GNP.....	17,811	1,211
Personal consumption expenditures.....	186	186
Durable goods.....	38	38
Nondurable goods.....	52	52
Services.....	96	96
Gross private domestic investment.....	349	191
Fixed investment.....	224	66
Nonresidential.....	206	51
Structures.....	17	17
Producers' durable equipment.....	189	34
Residential.....	18	15
Change in business inventories.....	125	125
Net exports of goods and services.....	181	39
Exports.....	82	19
Imports.....	89	20
Government purchases of goods and services.....	17,095	795
Federal.....	17,000	700
National defense.....	15,000	500
Nondefense.....	2,000	200
State and local.....	95	95
Addenda:		
GNP excluding Federal Government purchases of goods and services.....	811	511

component increased less in quantity and more in price than the other types of purchases.

### How the estimates were computed

For most of the major components of GNP, the 1987-dollar estimates were obtained by deflating the current-dollar estimates at the same level of detail used for the 1982-dollar estimates (see table 5). For some components, however, it was not practical to carry out the computations at this level of detail; less detail was used for producers' durable equipment, exports, imports, and Federal Government purchases. For Federal defense purchases, BEA uses information from the Department of Defense on the prices paid for 15,000 commodities in the deflation of current-dollar expenditures. In calculating the 1987-dollar estimates) it was necessary to summarize this information into 500 categories. For Federal nondefense purchases, it was necessary to summarize 2,000 categories into 200 categories. Excluding Federal Government purchases, about 500 components were used to derive the 1987-dollar measure of real GNP, compared with about 800 for the 1982-dollar measure. The net effect of carrying out the deflation of the 1987-dollar estimates in less detail is judged to be very small for total GNP. For each of the major components, it is likely that the net effect is small relative to the difference in the change between the 1987- and 1982-dollar measures.