GDP components' contributions to U.S. economic growth

Rebasing GDP and its components on chained 2001 dollars enhances the role of services as a contributor to economic growth, while diminishing the significance of private investment; only minor effects are seen on the contributions of net foreign trade and government expenditures

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Recently, the Bureau of Labor Statistics projected that U.S. real gross domestic product (GDP) will exceed $8.5 trillion by 2006, an increase of more than $1.6 trillion during the 1996–2006 period.[1] In the BLS economic projection, real GDP and its components were stated in chained 1992 dollars, as is typically done for real output measures.[2] However, the BLS projection employs a terminal year 14 years from the 1992 base year used for the chained dollars, and because relative prices in the economy can change substantially over 14 years, the question arises as to whether some other base year would be more appropriate. This article explores the issue by rebasing from chained 1992 dollars to chained 2001 dollars. While this rebasing does not change calculated growth rates, it does affect calculations of how the various GDP components contribute to overall GDP growth.

Economic growth can be analyzed from several vantage points, such as the growth rates of the various GDP components or their contributions to growth. Each measure has advantages, and certain weaknesses as well. Growth rates, for example, highlight the dynamic sectors of the economy. But often the fastest growing components of GDP are the smaller ones. These components will contribute proportionately less to the overall increase in GDP because their growth rates apply to small initial values.

Conversely, the *contributions* to growth of the GDP components—defined for each component as the ratio of the change in that component over the projection period to the total change in GDP over the period, expressed as a percentage—pinpoint those components most responsible for additions to GDP. However, with this approach, some imprecision results: upon aggregation of the component percentages, a residual amount remains.

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Analysis in chained 1992 dollars

Table 1 compares the 1996–2006 projected growth rate, the expected percent distributions of GDP, and the projected contributions of various components of GDP to its growth. According to the table, those components of GDP with the fastest projected growth rates involve foreign trade. Exports of goods are expected to advance 8.0 percent annually over the projection period, while overall exports are anticipated to grow 7.4 percent annually. Countering the growth of exports, the Bureau projects imports of goods to expand at a 6.9-percent annual rate from 1996 to 2006. Total imports would register a 6.4-percent annual advance for the period.

Growth rates for international trade describe a U.S. economy progressively integrating with the world economy. Nonetheless, on net, the foreign sector does not significantly contribute to the additional GDP produced for the projection period, because imports, more or less, offset exports.[3] Only 3.1 percent of the projected contribution to total GDP growth for 1996–2006 is related to net exports.

Table 1. Major components of real GDP, 1996 and projected to 2006, in chained 1992 dollars

Component	Billions of chained 1992 dollars			Growth rate		Percent distribution			Contribution to GDP growth			
									Change		Percent distribution	
	1986	1996	2006	1986–96	1996–2006	1986	1996	2006	1986–96	1996-2006	1986–96	1996–2006
GDP	5,489.9	6,911.0	8,539.1	2.3	2.1	100.0	100.0	100.0	1,421.1	1,628.1	100.0	100.0
Personal consumption	3,708.7	4,690.6	5,772.9	2.4	2.1	67.6	67.9	67.6	982.0	1,082.3	69.1	66.5
Durables	448.4	611.5	867.3	3.2	3.6	8.2	8.8	10.2	163.1	255.8	11.5	15.7
Nondurables	1,215.9	1,441.9	1,683.8	1.7	1.6	22.1	20.9	19.7	226.0	242.0	15.9	14.9
Services	2,041.4	2,638.2	3,239.8	2.6	2.1	37.2	38.2	37.9	596.8	601.6	42.0	36.9
Private investment	813.7	1,060.2	1,469.7	2.7	3.3	14.8	15.3	17.2	246.5	409.6	17.3	25.2
Nonresidential	548.5	766.2	1,132.0	3.4	4.0	10.0	11.1	13.3	217.7	365.8	15.3	22.5
Structures	203.3	189.6	210.8	–.7	1.1	3.7	2.7	2.5	–13.6	21.2	–1.0	1.3
Producers' durables	345.9	578.3	935.6	5.3	4.9	6.3	8.4	11.0	232.5	357.2	16.4	21.9
Residential	257.0	276.8	302.7	.7	.9	4.7	4.0	3.5	19.8	25.9	1.4	1.6
Exports	362.2	826.1	1,686.0	8.6	7.4	6.6	12.0	19.7	463.9	859.9	32.6	52.8
Goods	243.6	609.3	1,313.2	9.6	8.0	4.4	8.8	15.4	365.7	703.9	25.7	43.2
Services	120.3	218.0	389.7	6.1	6.0	2.2	3.2	4.6	97.7	171.7	6.9	10.5
Imports	526.1	940.3	1,749.8	6.0	6.4	–9.6	–13.6	–20.5	414.2	809.5	–29.1	–49.7
Goods	425.5	796.8	1,550.3	6.5	6.9	–7.8	–11.5	–18.2	371.3	753.5	–26.1	–46.3
Services	100.2	144.1	211.5	3.7	3.9	–1.8	–2.1	–2.5	43.9	67.4	–3.1	–4.1
Net exports	–163.9	–114.2	–63.8	–3.5	–5.7	–3.0	–1.7	–.7	49.7	50.4	3.5	3.1
Government expenditures	1,135.0	1,271.8	1,400.6	1.1	1.0	20.7	18.4	16.4	136.8	128.8	9.6	7.9
Federal	518.4	468.2	399.4	–1.0	–1.6	9.4	6.8	4.7	–50.2	–68.8	–3.5	–4.2
Defense	393.4	314.9	257.3	–2.2	–2.0	7.2	4.6	3.0	–78.5	–57.6	–5.5	–3.5
Nondefense	125.2	152.8	141.5	2.0	–.8	2.3	2.2	1.7	27.7	–11.4	1.9	–.7
State and local	617.0	804.5	1,005.9	2.7	2.3	11.2	11.6	11.8	187.5	201.5	13.2	12.4
Residual	–	–	–	–	–	–	–	–	–	–	–	–
Sector level[1]	–	–	–	–	–	–.1	.0	–.5	–	–	.4	–2.6
Detailed level[2]	–	–	–	–	–	.1	.2	–.5	–	–	.8	–3.9

[1] GDP – (personal consumption expenditures + private investment + net exports + government expenditures).

[2] GDP – (durables + nondurables + services + nonresidential structures + producers' durable equipment + exports (goods + services) + imports (goods + services) + defense + nondefense + State & local government expenditures).

In fact, the trade in goods is not expected to contribute to growth for the period. Although the 8.0-percent growth rate of goods exports is projected to exceed that of imports (6.9 percent), the lower growth rate for imports applies to a larger base ($1,550.3 billion) than that for exports ($1,313.2 billion). If, despite rapidly expanding exports and imports, net exports will not significantly augment projected GDP, from where will the additions to GDP come?

The answer is that traditional sources are expected to continue to dominate the economy's growth over the 1996–2006 period. Personal consumption expenditures are projected to contribute two-thirds of the growth of GDP for the period. Historically, consumption expenditures have composed about two-thirds of GDP itself. Within personal consumption, a shift in emphasis appears to be in progress, at least for expenditures on goods.

Under the BLS projection, personal expenditures on durable goods are anticipated to account for 15.7 percent of the increment to total GDP for the 1996–2006 period. By comparison, the contribution to growth of personal expenditures on nondurable goods is expected to amount to 14.9 percent. Here, the relatively rapid growth (3.6 percent annually) of durable goods, as opposed to nondurables (1.6 percent annually), underlies the shift. Within the durable goods component, the Bureau projects that technology-laden purchases, such as computers, will grow the fastest over the projection period.

While durable goods are expected to grow faster from 1996 to 2006 than are other components of personal consumption, spending on durables will not supply the largest contribution to growth in this category. Personal spending on services is anticipated to contribute 36.9 percent of the growth in GDP for the 1996–2006 period, only slightly less than its percentage of GDP (37.9 percent in 2006). Although the services component is projected to grow at the same rate as overall GDP (2.1 percent annually), this moderate growth rate applies to the single most significant component of GDP.

In sum, then, the contribution to growth of personal consumption is expected to be dominated by expenditures on services. Because spending on nondurables includes several subsistence-type purchases, such as food and clothing, this component's contribution to growth is anticipated to be constrained by a deceleration in population growth during the

projection period. Spending on durables, however, would compensate for a portion of the tepid expenditure growth of nondurables.

Private investment is projected to follow personal consumption as a leading source of growth for the 1996–2006 period, providing about one-quarter (25.2 percent) of the addition to GDP. The most rapidly expanding component of private investment is expected to be expenditures on producers' durable equipment, which is anticipated to grow 4.9 percent annually from 1996 to 2006. With that growth rate, this component will contribute 21.9 percent of the addition to GDP for 1996–2006. Not only is producers' durable equipment's share of private investment large, having made up more than one-half of private investment each year since 1986, but also, it includes such briskly evolving technologies as computers and communications equipment.

The remainder of private investment involves expenditures on nonresidential structures and residential investment.[4] With a 1.3-percent and a 1.6-percent contribution, respectively, neither component is expected to contribute substantially to the projected growth of GDP. To a degree, investment in nonresidential structures is still recovering from a period of overbuilding in the 1980s. As for residential investment, demographic factors are anticipated to operate to retard the growth of this component.

Expenditures by the three levels of government—Federal, State, and local—account for the remainder of GDP. Much of the Federal Government's spending involves transfer payments. Because the National Income and Product Accounts do not record transfers as expenditures for purposes of calculating GDP, the overall contribution to growth of the Federal government is projected to be comparatively small. Moreover, the Federal Government has been undergoing a period of retrenchment in the recent past. The Bureau projects Federal defense spending to decline 2.0 percent annually from 1996 to 2006, while nondefense spending will decline 0.8 percent annually. Accordingly, for the projection period, the Federal Government has a negative contribution of –4.2 percent to the increment of GDP.

Unlike the Federal Government, State and local government is expected to contribute positively to GDP growth for the projection period. The Bureau projects that expenditures by State and local governments will grow 2.3 percent annually from 1996 to 2006. At this rate, the sector will contribute 12.4 percent of the growth of overall GDP for the period.

Analysis in chained 2001 dollars

Nominal, or current-dollar, GDP represents the aggregate of expenditures on currently produced final goods and services, as determined by applying current prices to output. From one year to the next, current-dollar GDP changes because the amount of output changes or the price of output changes (or both). At least in principle, a change in current-dollar GDP can be directly measured. Difficulties arise, however, when an attempt is made to separate out that portion of the change in current-dollar GDP which represents just the change in the quantity of output, so-called real GDP.

A quantity index must be employed to evaluate changes in real GDP. In determining this quantity index, appropriate price weights must be selected for weighting together (that is, aggregating) the detailed pieces of output that compose GDP or one of its components. Formerly, a base year was chosen, and base-year prices were employed as weights. But that weighting method led to a substitution bias in the index.

When faced with a relative decline in the price of a commodity, consumers will tend to substitute that commodity for other, more expensive ones. As a consequence, those components of GDP with the fastest output growth tend to have the lowest (or even negative) price growth over time. Conversely, components with slow output growth tend to have faster price growth. This bargain hunting, then, is the source of the substitution bias. Subsequent to the base year, aggregation using base-year price weights, instead of more current prices, places their relatively heavier earlier price weight on those components whose output grows the most rapidly. Aggregation with base-year prices tends, therefore, to overstate growth subsequent to the base year. For analogous reasons, fixed base-year price weights tend to understate growth prior to the base year. So simply updating the base year does not resolve the problem.

Currently, the quantity index employs a chain weighting method.[5] The chained quantity index utilizes as weights a geometric average of annual prices between the base year and the terminal year. This technique incorporates the pattern of price changes over time into the price-weighting scheme and so alleviates the substitution bias.

The chained quantity index is just a number, while contributions to growth require component values denominated in dollars. The real value of GDP and its components, in chained 1992 dollars, can be derived by multiplying the component's chained quantity index for a particular year by its 1992 current-dollar value. However, aggregating the resultant chained dollar components leads to a residual, especially with long-term forecasts. Basically, as noted, the underlying chained quantity index employs average annual prices throughout the projection period as weights, while chained 1992 dollars utilize both these average prices and 1992 prices as weights.[6] Close to the base year, average annual prices closely approximate 1992 prices, but over time, they will diverge from 1992 prices as the structure of the economy evolves. Accordingly, the components of GDP will become progressively more nonadditive, and a growing residual will appear when they are summed to form GDP.

The period for the most recent BLS projection spans 1996 to 2006. Accordingly, the terminal year is 14 years from the

base year used when GDP components are specified in chained 1992 dollars. Presumably, a base year somewhere in the middle of the period would provide base-year prices more consistent with average annual prices for the entire period.

To accomplish this result, projected values of GDP and its components for 2001 were obtained in current dollars and in chained 1992 dollars. The projected quantity index for 2001 was then obtained by dividing a component's 2001 value in chained 1992 dollars by its current-dollar value for 1992. Next, the resultant implied quantity indexes for 1996 and 2006 were rebased by setting the 2001 implied quantity indexes equal to 1.00. Finally, the rebased quantity indexes were multiplied by the projected 2001 current-dollar values of the components to derive approximate chained 2001 dollar values for the 1996 and 2006 components.[7] Contributions to growth could then be calculated. (See table 2.)

As expected, the use of a more contemporaneous base year reduces the residual resulting from subtracting the sum of the components of GDP from GDP itself. At the sector level, the residual got closer to zero, moving from –2.6 percentage points (with 1992 as base year) to –0.9 percentage point (with 2001 as base year.)[8] At the most detailed component level, the residual also got closer to zero, going from –3.9 percentage points to 1.5 percentage points.[9]

Rebasing to chained 2001 dollars yields results similar to, if less dramatic than, the earlier analysis in chained 1992 dollars. Personal consumption expenditures still provide the largest contribution to growth, 67.8 percent. Prior to rebasing, the contribution to growth of personal consumption declined 2.6 percentage points for the 1996–2006 period, compared with the 1986–96 period (66.5 percent versus 69.1 percent for the respective periods). Rebasing lessens the decline to 1.3 percentage points (67.8 percent in chained 1992 dollars for 1996–2006 versus 69.1 percent in chained 2001 dollars for 1986–96).

More noteworthy, the relative contributions to growth of the various components of personal consumption do not display as significant a shift when rebased to chained (2001) dollars. For example, without rebasing, durable goods contribute 15.7 percent to GDP growth for the projection period, while rebased durables contribute 13.4 percent. Accordingly, the rebased figure more closely accords with the 11.5-percent contribution to growth of consumer durables for the

Table 2. Major components of real GDP, 1996 and projected to 2006 in chained 2001 dollars

Component	Billions of chained 2001 dollars		Projected growth rate	Percent distribution		Contribution to GDP growth	
						Change	Percent distribution
	1996	2006	1996–2006	1996	2006	1996–2006	1996–2006
GDP	8466.3	10460.8	2.1	100.0	100.0	1994.5	100.0
Personal consumption	5856.9	7208.3	2.1	69.2	68.9	1351.4	67.8
Durables	637.9	904.7	3.6	7.5	8.6	266.8	13.4
Nondurables	1726.8	2016.6	1.6	20.4	19.3	289.8	14.5
Services	3494.1	4290.9	2.1	41.3	41.0	796.7	39.9
Private investment	1156.9	1603.8	3.3	13.7	15.3	446.9	22.4
Nonresidential	795.8	1175.8	4.0	9.4	11.2	379.9	19.0
Structures	235.5	261.8	1.1	2.8	2.5	26.3	1.3
Producers' durables	564.6	913.4	4.9	6.7	8.7	348.8	17.5
Residential	344.7	376.9	.9	4.1	3.6	32.2	1.6
Exports	854.3	1743.5	7.4	10.1	16.7	889.2	44.6
Goods	585.2	1261.2	8.0	6.9	12.1	676.0	33.9
Services	271.0	484.5	6.0	3.2	4.6	213.5	10.7
Imports	978.2	1820.3	6.4	–11.6	–17.4	842.1	–42.2
Goods	802.8	1562.0	6.9	–9.5	–14.9	759.2	–38.1
Services	177.2	260.2	3.9	–2.1	–2.5	83.0	–4.2
Net exports	–124.6	–69.6	–5.7	–1.5	–.7	55.0	2.8
Government expenditures	1579.4	1739.3	1.0	18.7	16.6	159.9	8.0
Federal	601.8	513.4	–1.6	7.1	4.9	–88.4	–4.4
Defense	403.0	329.3	–2.0	4.8	3.1	–73.7	–3.7
Nondefense	198.9	184.1	–.8	2.3	1.8	–14.8	–.7
State and local	980.7	1226.3	2.3	11.6	11.7	245.6	12.3
Residual							
Sector level	–	–	–	.0	–.2	–	–.9
Detailed level	–	–	–	.0	.3	–	1.5

[1] GDP – (personal consumption expenditures + private investment + net exports + government expenditures).

[2] GDP – (durables + nondurables + services + nonresidential structures + producers' durable equipment + exports (goods + services) + imports (goods + services) + defense + nondefense + State & local government expenditures).

1986–96 period. Conversely, rebasing has a less pronounced effect on nondurable goods, with the contribution of nondurables to growth for 1996–2006 in chained 2001 dollars being only 0.4 percentage point lower than the contribution in chained 1992 dollars.

By contrast, rebasing from chained 1992 to chained 2001 dollars enhances the significance of the services component's contribution to growth. When calculated using chained 1992 dollars, the contribution to growth of services falls 5.1 percentage points (from 42.0 percent to 36.9 percent) for 1996–2006, compared with the preceding 10 years. Rebasing the projection period to chained 2001 dollars reduces this decline to 2.1 percentage points (from 42.0 percent for 1986 to 1996 in chained 1992 dollars to 39.9 percent for 1996–2006 in chained 2001 dollars) and so accords more closely with the prominent role played by the services sector as a source of GDP growth in recent decades.

Unlike the situation with personal consumption, rebasing diminishes the contribution of private investment to GDP growth. As noted earlier, before rebasing, private investment contributed 25.2 percent of the growth in GDP for the projection period. After rebasing, the contribution of private investment stands at 22.4 percent. The source of this reduction can be isolated in producers' durable equipment: the contribution of this component to GDP growth for the period 1996–2006 declines from 21.9 percent to 17.5 percent under a rebasing to chained 2001 dollars. In contradistinction, neither investment in nonresidential structures (1.3 percent) nor residential investment (1.6 percent) shows any change in contribution to growth for the projection period due to rebasing.

Rebasing from chained 1992 to chained 2001 dollars has only minor effects on the contributions to growth of net foreign trade and government expenditures for the 1996–2006 period. The contribution of net exports declines by only 0.3 percentage point as a result of rebasing, while the contribution of government declines only 0.1 percentage point. In sum, then, rebasing to 2001 chained dollars modestly reemphasizes the importance of personal consumption, especially the role of services. By contrast, while private investment remains a major contributor to growth, rebasing diminishes its significance somewhat. □

Footnotes

[1] See Thomas Boustead, "The U.S. Economy to 2006," *Monthly Labor Review*, November 1997, pp. 6–22.

[2] See, for example, "BEA Current and Historical Data" (Table 1.2), *Survey of Current Business*, April 1998, p. D2.

[3] Percent distributions show imports as a negative value, because these amounts displace expenditures on U.S. output and so reduce GDP.

[4] Private investment also includes changes in business inventories. This component will not be examined, however, as it is generally a small fraction of private investment and does not lend itself to the rebasing technique discussed subsequently.

[5] See "Preview of the Comprehensive Revision of the National Income and Product Accounts: BEA's New Featured Measures of Output and Prices," *Survey of Current Business*, July 1995, pp. 31–38.

[6] For a discussion of chain weighting and the rebasing technique employed in this article, see "BEA's Chain Indexes, Time Series and Measures of Long-Term Economic Growth," *Survey of Current Business*, May 1997, pp. 58–68.

[7] *Ibid.*

[8] The residual is equal to GDP, less the sum of personal consumption expenditures, private investment, net exports, and government expenditures.

[9] The residual in this case is equal to GDP, less the sum of durables, nondurables, services, nonresidential structures, producers' durable equipment, exports of goods and services, imports of goods and services, defense spending, nondefense spending, and State and local government expenditures.