DATE: January 24, 2011

SUBJECT: Biomedical Research and Development Price Index (BRDPI): Fiscal Year 2010 Update and Projections for FY 2011-FY 2016

Summary

- The Bureau of Economic Analysis (BEA) in the U.S. Department of Commerce estimates a 2.8 percent increase in the BRDPI for Fiscal Year (FY) 2010. The BEA staff also revised last year's preliminary estimate for FY 2009 downward from 3.4 percent to 2.9 percent.
- The following pattern of growth in the BRDPI is projected: 2.9 percent for FY 2011; 3.0 percent for FY 2012; 3.1 percent for FY 2013 and FY 2014; 3.2 percent for FY 2015; and 3.3 percent for FY 2016. These projections presume that the growth in the BRDPI will be two tenths of one percentage point lower than the historical pattern between growth of the BRDPI and growth of the GDP Price Index for FY 2011-FY 2014 and then gradually revert to the historical pattern from FY 2014 through FY 2016.

Definition of the BRDPI

The BRDPI measures changes in the weighted-average of the prices of all the inputs (e.g., personnel services, various supplies, and equipment) purchased with the NIH budget to support research. The weights used to construct the index reflect the actual pattern (or the proportion) of total NIH expenditures on each of the types of inputs purchased. Theoretically, the annual change in the BRDPI indicates how much NIH expenditures would need to increase, without regard to efficiency gains or changes in government priorities, to compensate for the average increase in prices due to inflation and to maintain NIH-funded research activity at the previous year's level.

Background on the BRDPI Estimation Process

The BEA developed the BRDPI in the early 1980s. Under an interagency agreement with the NIH, each December, the BEA provides an estimate of the BRDPI for the most recently completed fiscal year (in December 2010 it was for FY 2010). This estimate is referred to as "preliminary" because the initial data on prices available to the BEA in December are often revised during the following year. Consequently, each December the BEA also provides a revised estimate for the prior fiscal year (e.g., the estimate for FY 2008 was revised in December 2010).

The Office of the Director, NIH projects future year values based on a methodology described below. An updated table of BRDPI annual estimates and future-year projections is posted on the NIH website each year shortly after the release of the President's Budget (PB), typically in early February. See http://officeofbudget.od.nih.gov/gbiPriceIndexes.html, or use the search engine at http://www.nih.gov/ to find "BRDPI."

The FY 2010 Update

As noted above, this year, the BEA estimated a 2.8 percent increase in the BRDPI for FY 2010, which is the lowest annual increase in the BRDPI since the 2.5 percent increase for FY 1997. This estimate is also lower than the 3.1 percent increase originally projected for FY 2010 in January 2010. Some of the difference between the projected and realized increase in the BRDPI for FY 2010 is attributable to a slowdown in the pattern of general inflation. The Gross Domestic Product (GDP) price index is one of the broadest measures of inflation and it drives the BRDPI projection. In December 2009, the OMB projected an increase of 0.9 percent for the GDP price index for FY 2010. The more recently published historical data now indicates the GDP price index grew by only 0.8 percent during FY 2010.

However, BRDPI growth slowed by more than the deceleration in the general rate of inflation. The major cause appears to be slower growth in compensation both for Federal employees and for non-Federal personnel paid from extramural awards.

During FY 2010, the rate of growth of salaries for Federal workers was 3.0 percent compared to the 4.7 percent growth during FY 2009. For academic salaries, the rate of growth slipped to 2.4 percent from 3.4 percent, and non-academic salary growth fell to 2.6 percent from 3.1 percent. The growth in fringe benefits for Federal workers was also lower in FY 2010 (4.7 versus 8.0 percent), though growth in fringe benefits for personnel paid from extramural awards was the same in both years (4.0 percent).

Growth in prices was lower during FY 2010 for many of the non-personnel expenditure categories as well. Notable exceptions were the prices for transportation, automated data processing and other IT equipment, laboratory supplies, equipment rental and utilities where the growth during FY 2009 was exceptionally low, and even negative for some categories.

Revision of FY 2009 BRDPI Growth

The estimate of BRDPI growth for FY 2009 was revised downward from 3.4 percent to 2.9 percent. As a reminder, the estimate for the most recent fiscal year (FY 2009 in December 2009; FY 2010 in December 2010) is referred to as "preliminary" because the initial data on prices available to the BEA each December are often revised during the following months. Consequently, each December the BEA also provides a revised estimate for the prior fiscal year (e.g., the estimate for FY 2009 was revised in December 2010).

The revision of 0.5 percentage points for the FY 2009 growth of the BRDPI is larger than usual. It appears to be due to a confluence of three causes. First, by historical standards for many goods and services the price movements observed during FY 2009 were unusually low and even negative, as the economy dipped into a recession at the end of calendar year 2008 (including the first quarter of FY 2009). Also, price changes seemed to be exceptionally uneven across markets and over time in the same markets. For the fourth quarter of FY 2009, values for some of the price indexes used in the BRDPI and published by BEA and the Bureau of Labor Statistics (BLS) were substantially revised in later months when more comprehensive data were available, but after the BRDPI had been estimated and distributed.

Second, BEA must project values for the growth of extramural salaries (academic and non-academic) for the fourth quarter of the most recently completed fiscal year. Academic salaries are collected on an academic year basis ending on the last day of June. Consequently, the most recently available survey data for academic salaries does not include information for July, August, and September, the last quarter of the fiscal year. BEA projected growth for those months on the basis of the average growth in academic salaries over the previous several years. The actual growth in salaries for the academic year 2009-2010 (running from July 1, 2009 to June 30, 2010) was much lower than the historical average growth rate, contributing to the downward revision. (BEA has adjusted the forecasting methodology. The projection for salary growth for the last quarter of the FY 2010 presumes that the annual growth rate for the previous academic year will continue for the first quarter of the next academic year—corresponding to the last quarter of FY 2010.)

Third and finally, there were minor adjustments to the expenditure weights used to estimate the preliminary value for FY 2009 and incorporated to the estimate of the revised value in December 2010. Together these changes resulted in the downward revision of the FY 2009 estimate from 3.4 percent to 2.9 percent.

Projections for FY 2011-2016

Projections of future annual changes in the BRDPI reflect two considerations. The first is the expected general rate of inflation of prices for the U.S. economy. The second is the expected relationship between the general rate of inflation and changes in the BRDPI. NIH defers judgments on the general rate of inflation to the Office of Management and Budget (OMB). We use the most recently issued OMB projections of the annual rate of growth of the GDP Price Index. While the GDP Price Index increased by only 0.8 percent for FY 2010, OMB projects a slight increase in the rate of inflation over the coming years: 1.3 percent for FY 2011; 1.4 percent for FY 2012; 1.6 percent for FY 2013; and a leveling off at 1.7 percent per year for FY 2014 through FY 2016.

The historical relationship between the BRDPI and the GDP Price Index is summarized by a statistically estimated linear equation (by ordinary least squares regression) that relates the annual percent change in the BRDPI to the annual percent change in the GDP Price Index. Using the data for the most recent ten years (FY 2001 through FY 2010) the estimated equation is:
(Projected annual percent change in the BRDPI)
$$= 2.38 + 0.56 \times \text{(annual percent change in GDP Price Index)}.$$

If we assume that the historical relationship will persist in the future, we simply plug the OMB projected values of the GDP Price Index into the equation and use the predicted growth of the BRDPI as the corresponding out-year projections of the BRDPI.

However, this year there is reason to believe the historical relationship between the BRDPI and the GDP Price Index might not hold over the next few years. Salaries for Federal civilian employees have been frozen for calendar year 2011 and no increase is proposed for calendar year 2012 by the Administration in the forthcoming FY 2012 PB. We used the BEA estimation model to simulate the effect of slower growth in civilian Federal salaries on the estimated rate of

growth of the BRDPI using the FY 2010 estimate as a reference point. We found the Federal salary freeze alone could reduce the rate of growth of the BRDPI by as much as one tenth of a percentage point. Downward pressure on extramural salary growth could account for another tenth of a percentage point decrease in growth (due to slower growth in R&D funding, resistance to tuition increases, and lower endowments and charitable giving to universities).

Consequently, we project the following profile for BRDPI growth: 2.9 percent for FY 2011; 3.0 percent for FY 2012; 3.1 percent for FY 2013 and FY 2014; 3.2 percent for FY 2015; and 3.3 percent for FY 2016. This presumes that the growth in the BRDPI will be two tenths of one percentage point lower than the historical pattern for FY 2011-FY 2014 and then gradually revert to the historical pattern from FY 2014 through FY 2016.

Forecasting the future path of price changes is an inherently imprecise exercise. We cannot expect estimated projections of growth in the GDP Price Index to be realized exactly each year. Likewise, because the complex relationship between the general rate of inflation and the BRDPI increase is approximated with a simple linear equation, year-to-year deviations are inevitable. However, we strive for an unbiased process—i.e., the projections miss high as frequently as they miss low.

Summary Tables
Table A depicts values of the annual percent change in the GDP Price Index and the BRDPI for FY 1980 through FY 2010. Table B includes projected values of the BRDPI and the GDP Price Index for FY 2011 through FY 2016.

For the convenience of the reader, Table C illustrates how to translate annual changes into annual levels of the BRDPI. After designating a reference year, for which the value of the BRDPI is specified as 100, projections of the annual levels of the BRDPI can be constructed using the following recursive relationship:

BRDPI (for year t) = BRDPI (for year t-1) x [1 + {Annual Percent Change (for year t)}]

In Table C, the calculations are presented for FY 1989 through FY 1992 using FY 1989 as the reference year (1989 = 100). To calculate the value for FY 1991, for example, the formula would be: 110.5 = 105.4 x 1.048. In other words, to derive the BRDPI value for FY 1991 (110.5), start with the FY 1990 BRDPI value (105.4) and multiply by one plus the annual change for FY 1991 (1+ [4.8/100] =1.048).

Attachments

ATTACHMENTS

TABLE A

HISTORICAL ANNUAL PERCENT CHANGES

Fiscal Year	GDP Price Index	BRDPI
Col.(1)	Col. (2)	Col. (3)
1980	8.8%	9.8%
1981	9.9%	10.4%
1982	6.8%	8.6%
1983	4.4%	6.2%
1984	3.7%	5.9%
1985	3.2%	5.6%
1986	2.3%	4.2%
1987	2.7%	5.3%
1988	3.2%	5.0%
1989	3.9%	5.2%
1990	3.7%	5.4%
1991	3.8%	4.8%
1992	2.6%	4.4%
1993	2.2%	3.4%
1994	2.1%	3.9%
1995	2.1%	3.5%
1996	1.9%	2.6%
1997	1.8%	2.8%
1998	1.3%	3.4%
1999	1.3%	3.2%
2000	2.0%	3.7%
2001	2.4%	3.3%
2002	1.6%	3.3%
2003	2.1%	3.5%
2004	2.6%	3.7%
2005	3.3%	3.9%
2006	3.4%	4.6%
2007	2.9%	3.8%
2008	2.3%	4.7%
2009	1.3%	2.9%
2010	0.8%	2.8%

TABLE B

PROJECTED ANNUAL PERCENT CHANGES

Fiscal Year	GDP Price Index	BRDPI
Col.(1)	Col.(2)	Col. (3)
2011	1.3%	2.9%
2012	1.4%	3.0%
2013	1.6%	3.1%
2014	1.7%	3.1%
2015	1.7%	3.2%
2016	1.7%	3.3%

TABLE C

Conversion of Annual Changes into Annual Levels

Fiscal Year	Annual Percent Change	[l+(Percent Change/100)l	Previous Year Value			Annual Level BRDPI
Col.(1)	Col.(2)	Col.(3)	Col.(4)			Col.(5)
1989						100.0
1990	5.4%	1.054	*	100.0	=	105.4
1991	4.8%	1.048	*	105.4	=	110.5
1992	4.4%	1.044	*	110.5	=	115.4

References to BEA Price Index Methodology

Robert P. Parker and Eugene P. Seskin, "Annual Revision of the National Income and Product Accounts: Annual Estimates 1993-96, Quarterly Estimates 1993:1-1997:1," Survey of Current Business, 77, No. 8 (August 1997), pp 6-35.

J. Steven Landefeld and Robert P. Parker, "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, 75, No. 7 (July 1995), pp 31-38.

Allan H. Young, "Alternative Measures of Change in Real Output and Prices, Quarterly Estimates for 1959-1992," Survey of Current Business, 73, No.11 (March 1993), pp 31-41.

Allan H. Young, "Alternative Measures of Change in Real Output and Prices," Survey of Current Business, 72, No. 4 (April 1992), pp 32-48.

Jack E. Triplett, "Economic Theory and BEA's Alternative Quantity and Price Indexes," Survey of Current Business, 73, No. 4 (April 1992), pp 49-52.

Modification of the Methodology Used to Estimate the BRDPI

As stated in the memo above, the weights used to construct the BRDPI reflect the actual pattern (or the proportion) of total NIH expenditures spent on each of the types of inputs purchased with the NIH budget (e.g., personnel services, various supplies, and equipment). In fact, the use of weights specific to the NIH budget is what distinguishes the BRDPI from other price indexes designed to reflect different patterns of expenditures.

Until FY 2006, the BEA estimated the BRDPI using a fixed weight (or Laspeyres) index. This type of index compares prices over several years using a fixed set of weights based on the composition of expenditures in a single, specified base year (say 1993 or 2003).

Beginning with the revised estimate for FY 2005 (published in December 2006) the BEA now estimates the BRDPI using a Fisher chain-weighted index methodology. The chain-weighted methodology improves the accuracy of the BRDPI and is consistent with the methodology BEA adopted in 1996 to estimate the Gross Domestic Product and its component series. For the interested reader, five articles in BEA's publication, *Survey of Current Business,* discuss the reasons BEA now uses the chain-weighted methodology. (See the references to BEA Price Index Methodology in the attachment below.)

In less technical terms, the move to chain weighting means primarily that the expenditure weights used to estimate the BRDPI will be updated each year. Also, when estimating the growth of the BRDPI between two consecutive years (say 2005 and 2006) the Fisher Price Index reflects the average experience of two slightly different indexes: the first index uses first year weights (e.g., 2005) to estimate average growth in prices; the second index uses second year weights (e.g., 2006) to develop the estimate. To estimate growth over several years, the consecutive year indexes are multiplied, or chained. (As an analogy, think of calculating compound growth on your retirement portfolio over ten years as the mix of stocks and bonds changes from year to year.)

By contrast, to the chain weighting methodology, the previously used fixed-weight (or Laspeyres) index approach can result in a "substitution bias" that tends to overstate price increases for periods after the base year and understate price increases for periods before the base year. This bias occurs because use of the fixed-weight index implicitly assumes the composition of the items being priced does not change over time. In fact, the mix of items purchased and included in a price index tends to shift over the years. The shift in purchases may be a response to changes in relative prices and to advances in technology which provide new opportunities and new tools for investigation (e.g., more computers and automated test equipment and fewer laboratory assistants).

During periods close to the base year, differences in the composition are usually fairly small, and a fixed-weight index provides a good approximation. Farther away from the base period, however, larger differences in expenditure composition are likely. Consequently, weighting formulas that allow for changes in composition over time provide a better measure of both year-to-year price changes and long-term trends.

In response to BEA recommendations, in past years the expenditure weights used to estimate the BRDPI were updated, or rebased, occasionally to overcome the problem of substitution bias. In the BRDPI Table of Annual Values listed on the NIH website and in the attached Table A, the values of the BRDPI for FY 1999-2004 are constructed using the FY 2003 expenditure weights; the FY 1991-1998 values are based on FY 1993 weights; the FY 1986-1990 values are based on FY 1988 weights; and the FY 1979-1985 values are based on FY 1984 weights. The pre-1979 values of the BRDPI were estimated using a preliminary methodology with a less-detailed set of expenditure weights. As a result of the less precise methodology, the pre-1979 values are not likely to be as accurate as the later year values.