



DATE: January 25, 2012  
SUBJECT: Biomedical Research and Development Price Index (BRDPI): Fiscal Year 2011 Update and Projections for FY 2012-FY 2017

## Summary

- The estimated growth in the BRDPI for FY 2011 is 2.8 percent. The revised estimate for FY 2010 is 2.9 percent, up slightly from the 2.8 percent preliminary estimate posted last year.
- The following pattern of growth in the BRDPI is projected: 2.2 percent for FY 2012; 2.8 percent for FY 2013; 2.9 percent for FY 2014; and 3.1 percent for FY 2015, FY 2016, and FY 2017, respectively.
- The estimated growth of the BRDPI for FY 2011 reflects the effect of the freeze on the NIH investigator salary limitation (“cap”) for that year. The projected change for FY 2012 adjusts for the reduction (\$20,000) in the NIH salary cap and anticipates the continued freeze on salaries of Federal civilian employees for calendar year 2012. Forecasted growth for FY 2013 assumes the salary cap will remain fixed at the FY 2012 level. The projections for each of the years FY 2014 through FY 2017 assume the growth of the BRDPI will gradually revert to the historical pattern between growth of the BRDPI and growth of the GDP Price Index observed from FY 2002 through FY 2011.

## 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 maintain NIH-funded research activity at the previous year’s level.

## Background on the BRDPI Estimation Process

The Bureau of Economic Analysis (BEA) in the U.S. Department of Commerce 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 2011, for example, BEA transmitted information for FY 2011. This estimate is referred to as “preliminary” because the initial data on prices available to the BEA in December are typically revised during the following year. Consequently, each December the BEA also provides a revised estimate for the prior fiscal year, i.e., the estimate for FY 2010 was revised in December 2011.

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. Please refer to the following link <http://officeofbudget.od.nih.gov/gbiPriceIndexes.html>, or use the search engine at <http://www.nih.gov/> to find “BRDPI.”

## **Adjusting the BRDPI for Changes in Federal Policies**

This is an unusual year for developing estimates of the BRDPI for the past year and projections for future years. Every year since 1990, Congress has legislatively mandated a provision limiting the direct salary that an individual may receive under an NIH grant.<sup>1</sup> The cap has been increased most years at a moderate rate. Although the increase is generally somewhat below the average growth in academic salaries, in past years the impact of the salary cap on the estimated growth of the BRDPI was negligible.

However, for FY 2011 the NIH salary cap was maintained at the previous year's level. For FY 2012, the level of the cap was actually dropped from \$199,700 to \$179,700. The cap "freeze" has a noticeable effect on the estimated change of the BRDPI for FY 2011. The reduction in the salary cap, flat civilian Federal salary levels, and limits on the growth of training stipends and some related expenses on training awards combined to reduce the projected BRDPI growth for FY 2012 and subsequent years, compared to projections that would have been made without the changes in Federal policies.

NIH estimated the share of academic salaries subject to the cap using information from the detailed budget requests submitted as part of the applications for new competitive NIH awards or for competitive renewals. The detailed budget information is not recorded electronically in NIH administrative records. Therefore, the salary information was extracted from a sample of scanned hard copies of successful applications ultimately funded by NIH.

BEA estimates the BRDPI using a series of interrelated spreadsheets to pull together information on price changes and weights for the 45 major expenditure categories that form the basis of the index. NIH augmented the BEA estimation model to examine the effects of salary cap limitations on the effective average growth of academic salaries and for estimates and projections of the overall BRDPI for FY 2011 through FY 2013. The augmented BEA model was also used to capture the effect of the continued freeze on salaries of Federal civilian employees for calendar year 2012 on the projected BRDPI for FY 2012.

## **Revision of FY 2010 BRDPI Growth and the FY 2011 Update**

This year, the BEA revised the estimate of BRDPI growth for FY 2010 upward slightly from 2.8 percent to 2.9 percent. As a reminder, the estimate for the most recent fiscal year (e.g., FY 2011 in December 2011) 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 2010 was revised in December 2011). The small revision of +0.1 percentage points is the net result of slight increases and decreases in the price changes for several of the expenditure categories of the BRDPI. The most notable change was the revised estimate of the growth in academic salaries from 2.4 to 2.6 percent during FY 2010.

For FY 2011 the published (preliminary) estimate for BRDPI growth is 2.8 percent. This estimate is the net result of adjusting the 3.0 percent estimate of growth submitted by BEA for the freeze on the NIH cap on academic salaries in effect during FY 2011. For the record, both the BEA estimate of 3.0 percent and the adjusted estimate of 2.8 percent are very close to the 2.9 percent rate of growth NIH projected for FY 2011 last January.

<sup>1</sup> [http://grants.nih.gov/grants/policy/salcap\\_summary.htm](http://grants.nih.gov/grants/policy/salcap_summary.htm) ; and <http://grants.nih.gov/grants/guide/notice-files/NOT-OD-11-073.html>

## Projections for FY 2012-2017

The BRDPI provides the best estimate of inflation for the NIH budget for the last completed fiscal year (FY 2011) and for previous years. However, informed development of future NIH budgets benefits from consideration of how prices might change for the inputs NIH expects to purchase to support research in future years. We could simply project that the rate of change for FY 2011 will hold for the next few years. However, it would be unrealistic to assume the BRDPI will change at a fixed rate when the general rate of economic activity and the average growth of prices is expected to change from year to year.

A more sophisticated but still simple projection methodology for future annual changes in the BRDPI embodies 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. The GDP Price Index increased by 2.0 percent for FY 2011. However, OMB projects a slightly slower increase in prices over the coming years: 1.8 percent for FY 2012; 1.7 percent for FY 2013; 1.6 percent for FY 2014; and 1.8 percent per year for FY 2015 through FY 2017.

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 2002 through FY 2011) the estimated equation is:

$$\begin{aligned} & \text{(Projected annual percent change in the BRDPI)} \\ & = 2.25 + 0.61 \times \text{(annual percent change in GDP Price Index)}. \end{aligned}$$

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, as mentioned above, there is reason to believe the historical relationship between the BRDPI and the GDP Price Index might shift over the next few years. Salaries for Federal civilian employees were held flat for calendar year 2011 to previous year levels and have been frozen again for 2012 (at the 2010 level). Zero growth in Federal civilian salaries for FY 2012 will reduce the estimated BRDPI slightly. More significantly, the 10 percent of salaries on NIH awards subject to the NIH cap for FY 2011 will experience a reduction of 10.2 percent for FY 2012 as a result of the NIH salary cap falling from \$199,700 per year to \$179,700 per year. Together, those two restrictions yield a projection of 2.2 percent growth in the BRDPI for FY 2012. The projected change for FY 2012 is noticeably lower than the estimated 2.8 percent growth for FY 2011 when the cap on academic salaries was merely frozen rather than reduced by 10.2 percent.

For FY 2013, the projected change bounces back to 2.8 percent. This projection reflects the assumption that for FY 2013 the salary cap will remain fixed at the FY 2012 level and that Federal civilian salaries might be raised sufficiently to match the 0.6 percent growth realized during FY 2011. If the cap is held fixed, then salaries subject to the cap will experience no growth, similar to the experience during FY 2011, but not the negative growth due to the 10.2 percent reduction in the cap experienced in FY 2012.

The projections for the years FY 2014 through FY 2017 assume that the growth of the BRDPI for out years will gradually revert to the historical relationship between the annual rates of change for the BRDPI and the GDP Price Index observed from FY 2002 through FY 2011.

To summarize, the following profile for BRDPI growth is projected: 2.2 percent for FY 2012; 2.8 percent for FY 2013; 2.9 percent for FY 2014; and 3.1 percent for FY 2015, FY 2016, and FY2017 respectively.

Forecasting the future path of price changes is an inherently imprecise exercise. We cannot expect OMB projections of growth in the GDP Price Index to be realized exactly each year. Likewise, the complex relationship between the general rate of inflation and the BRDPI can change from year to year. 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 2011. Table B includes projected values of the BRDPI and the GDP Price Index for FY 2012 through FY 2017.

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:

$$\text{BRDPI (for year t)} = \text{BRDPI (for year t-1)} \times [1 + \{\text{Annual Percent Change (for year t)}\}]$$

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:  $110.5 = 105.4 \times 1.048$ . 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

1. **Supplementary Tables**
2. **References to BEA Price Index Methodology**
3. **Modification of the Methodology Used to Estimate the BRDPI**

**TABLE A****HISTORICAL ANNUAL PERCENT CHANGES**

<b>Fiscal Year</b>	<b>GDP Price Index</b>	<b>BRDPI</b>
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	1.7%	3.3%
2003	2.0%	3.5%
2004	2.5%	3.7%
2005	3.2%	3.9%
2006	3.4%	4.6%
2007	3.0%	3.8%
2008	2.3%	4.7%
2009	1.4%	2.9%
2010	0.9%	2.9%
2011	2.0%	2.8%

**TABLE B**  
**PROJECTED ANNUAL PERCENT CHANGES**

<b>Fiscal Year</b>	<b>GDP Price Index</b>	<b>BRDPI</b>
Col.(1)	Col.(2)	Col.(3)
2012	1.8%	2.2%
2013	1.7%	2.8%
2014	1.6%	2.9%
2015	1.8%	3.1%
2016	1.8%	3.1%
2017	1.8%	3.1%
2014	1.6%	2.9%
2015	1.8%	3.1%

**TABLE C**  
**Conversion of Annual Changes into Annual Levels**

<b>Fiscal Year</b>	<b>Annual Percent Change</b>	<b>[1+(Percent Change/100)]</b>	<b>Previous Year Value</b>	<b>Annual Level BRDPI</b>
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.