DATE: January 15, 2014
SUBJECT: Biomedical Research and Development Price Index (BRDPI): Fiscal Year 2013
             Update and Projections for FY 2014-FY 2019

Summary

- The estimated growth in the BRDPI for FY 2013 is 1.9 percent.
- The updated growth rate for FY 2012 is 1.3, 0.1 percent lower than the preliminary estimate of 1.4 percent posted last year. The slight decrease is driven primarily by a slower than expected growth in general inflation, especially as manifested in a slower growth in academic salaries.
- The following pattern of growth in the BRDPI is projected: 1.9 percent for FY 2014, 2.2 percent for FY 2015, 2.5 percent for FY 2016, 2.9 percent for FY 2017, 3.2 percent for FY 2018, and 3.3 for FY 2019.
- The modest BRDPI growth rate of 1.9 percent for FY 2013 reflects the effect of the NIH extramural investigator salary limitation ("cap") of $179,700 and the continued freeze on salaries of Federal civilian employees for that year.
- The projected 1.9 percent growth for FY 2014 assumes a one percent increase for Federal salaries and for the limits on extramural investigator salaries starting in January 2014.
- Primarily because of the freeze on Federal civilian employee salaries and the cap on compensation of extramural investigators, the rate of growth of the BRDPI during the years FY 2012 through FY 2014 has been relatively low compared with its historical relationship with general inflation as represented by the growth of the GDP Price Index. The projections for each of the following five years, FY 2015 through FY 2019, assume the growth of the BRDPI will gradually revert to the historical pattern observed from FY 2004 through FY 2013 of faster growth relative to the growth of the GDP Price Index.

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

In the early 1980s, the Bureau of Economic Analysis (BEA) in the U.S. Department of Commerce developed the Biomedical Research and Development Price Index (BRDPI). 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 2013, for example, BEA transmitted information for FY 2013. 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 2012 was revised in December 2013.

The Office of the Director at 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
Beginning with the BRDPI estimate for FY 2011, which was developed in December 2011, NIH began making explicit adjustments for changes in federal policy regarding the cap on salaries on extramural awards.

Every year since 1990, Congress has legislatively mandated a provision limiting the direct salary that an individual may receive under an NIH grant.[1] 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 frozen at the previous year's level. The cap "freeze" has a noticeable effect on the estimated change of the BRDPI for FY 2011.

The limitation on the direct salary that an investigator may receive under an NIH award might not reduce the investigator's effective income. The host institution or another funding source may make up the difference. However, changes in the cap affect what NIH pays for an investigator subject to the salary cap. Given the definition of the BRDPI as an input price index for the NIH budget, the effect of the cap on the price NIH pays for an investigator's effort must be taken into account.

For FY 2012, the level of the cap actually dropped from $199,700 to $179,700. The reduction in the cap on investigator salaries, flat civilian Federal salary levels, and limits on the growth of fellowship and training stipends and related expenses on training awards combined to reduce the estimated BRDPI growth for FY 2012 and the projected growth for subsequent years.

NIH estimated the share of academic salaries subject to each of the two salary caps. Using a sample of successful applications for new competitive NIH awards and competitive renewals, NIH extracted data on salaries from the detailed budget requests submitted as part of each application. Our best estimate is that for NIH awards to academic institutions:
- 12.9% of requested salaries are subject to the original cap of $199,700;
- 14.4% of requested salaries are subject to the lower cap of $179,700;

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[1] http://grants.nih.gov/grants/policy/salcap_summary.htm and http://grants.nih.gov/grants/guide/notice-files/NOT-OD-11-073.html

- -10.7% is the average reduction due to lowering the cap (from $199,700 to $179,700) for the 14.4% of salaries subject to the lower cap.[2]

Revision of FY 2012 BRDPI Growth and the FY 2013 Update

This year, the posted estimate for growth of the BRDPI adjusted for the cap on extramural salaries is 1.3 percent for FY 2012, and the preliminary estimate is 1.9 percent for FY 2013.[3] The revised estimate of 1.3 percent for FY 2012 decreased by 0.1 percent from the 1.4 percent preliminary estimate posted last year.[4]

The 1.3 percent rate of growth for FY 2012 is the lowest annual rate of growth in the history of the BRDPI and the first time that the BRDPI increased at a slower rate than the GDP Price Index (1.8 percent). For FY 2013, the preliminary BRDPI estimate of 1.9 percent is still low by historical standards. However, at least it is once again growing at a higher rate than the GDP Price Index (1.5 percent).

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[2] Information on base salaries and requested salaries for each member of the proposed research staff can be found in the detailed budget tables included as part of the project proposal. The salary information must be extracted from a sample of PDF file copies of applications and placed in Excel files for analysis.

The sample of project budgets was stratified by types of award (e.g., "R01, R21, P01), whether the award was made to a medical school or to a non-medical component of a university, and whether the degree of the corresponding principal investigator (PI) was an MD (including dual MD and PhD degrees) or something else (primarily a PhD).

The results for each cell in the three-dimensional sampling strata were then aggregated to estimate the overall share or requested salaries subject to each cap. The relative weight for each combination of type of award, medical/nonmedical component, type of degree was based on the distribution of all award amounts to academic institutions for FY 2011.

BEA estimated the growth in academic salaries for the BRDPI at 2.82 percent for FY 2011 and 3.24 percent for FY 2012. These estimates were based on the AAMC survey of salaries of medical school faculty and the AAUP survey of university salaries, Adjusting for the freeze on the salary cap for FY 2011 and the reduction of the salary cap for FY 2012, the estimated growth in academic salaries was reduced to 2.46 percent and 1.23 percent respectively.

At the request of the NIH, the BEA re-estimated the BRDPI using the rates of growth of academic salary rates adjusted for the cap freeze and the cap reduction. The revised estimates of BRDPI growth captured the direct effects of reduced growth in academic salaries on the growth of the overall BRDPI. It also captured the indirect effects of academic salary growth through its effects on growth of fringe benefit rates, academic indirect costs and estimates of growth of compensation for consultants and for personnel on awards to non-academic institutions.

[3] As a reminder, the estimate for the most recent fiscal year (e.g., FY 2013 in December 2013) 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 2012 was revised in December 2013).

[4] At the risk of confusion we point out that the BRDPI increase for FY 2012, unadjusted for the drop in the salary cap, was estimated at 2.6 percent last year and was revised downward slightly to 2.5 percent this year. This slight reduction reflects the cumulative effect of revisions in preliminary values of several price series (including the growth of academic salaries) used to develop the estimate of FY 2012 last year. The reported growth in the BRDPI for FY 2012 was adjusted down from 2.5 percent to 1.3 percent. This adjustment reflects the effect of the "reduction" of the NIH investigator salary limitation ("cap") from $199,700 to $179,700 for FY 2012 as well as for the growth of stipends and related expenses on fellowships and training awards. Again this adjusted growth of 1.3 percent is slightly lower than the adjusted growth of 1.4 percent reported last year.

Last January, as is standard practice (see next section) NIH "projected" a growth rate for the (then) out-year FY 2013. The projected value of 2.5 percent turned out to be higher than the 1.9 percent estimated this past December for BRDPI growth during FY 2013. The primary driver for this lower estimate appears to be a slowdown in the general rate of inflation. In December 2012, the OMB projected 2.1 percent growth of the GDP Price Index (a comprehensive measure of price change for all final goods and services produced in the U.S.) in FY 2013. This past December, growth in the GDP Price Index was estimated at only 1.5 percent for FY 2013. This slower growth in the general rate of inflation was reflected in several of the input prices used to calculate the BRDPI. Especially notable was the slowdown in the growth of academic salaries (unadjusted for the salary cap). Academic salaries were estimated to grow at 2.5 percent during FY 2013, compared to growth of 3.0 percent during FY 2012.[5]

Projections for FY 2014-2019
The BRDPI provides the best historical estimate of inflation for the NIH budget for any completed fiscal year. However, development of future NIH budgets benefit from consideration of how prices of the goods and services NIH expects to purchase in future years might change. We could simply project that the rate of change for FY 2013 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. Also, we might wish to adjust future year projections for any anticipated changes in Federal policy that might influence the prices NIH pays for goods and services used to support R&D.

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 1.5 percent for FY 2013. OMB projects an increase of 1.5 percent for FY 2014, 1.7 percent for FY 2015, 1.9 percent for FY 2016, and 2.0 percent per year for FY 2017 through FY 2019.

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 2004 through FY 2013) the estimated equation is:

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[5] Again, risking confusion, we point out that the estimate of BRDPI growth unadjusted for the salary cap was 2.5 percent for FY 2012 and 2.1 percent for FY 2013. After adjusting for the salary cap policy, the posted estimates for FY 2012 and FY 2013 are 1.3 and 1.9 respectively. Notice that the FY 2012 estimate was adjusted downward much more severely, 0.6 percent versus a 0.2 percent reduction for growth during FY 2013. The difference reflects that the salary cap was lowered for FY 2012, while it was held constant during FY 2013. The 14.4 percent of academic salaries subject to the cap experienced an average reduction of 10.7 percent during FY 2012. During FY 2013 they experienced zero growth, rather than a reduction. The effect on average adjusted salary growth is much less severe.

(Projected annual percent change in the BRDPI)
$$= 1.91 + 0.73 \text{ x (annual percent change in GDP Price Index)}.$$

If we assume 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, for FY 2013 the estimated growth of 1.9 percent for the BRDPI, is 1.1 percentage points lower than the 3.0 percent growth predicted with the equation above based on the 1.5 percent growth in the GDP Price Index for FY 2013. Because of all the limits on investigator and trainee compensation on extramural awards and the freeze on Federal salaries, there is reason to believe the BRDPI will grow at a rate lower than predicted by the historical relationship between the BRDPI and the GDP Price Index.

Consequently, we project a 1.9 percent growth in the BRDPI for FY 2014. This projection assumes a one percent growth in Federal salaries, and the cap on investigator salaries remains fixed at the Executive Level II with a one percent increase in 2014 ($181,500). Notice that the fixed cap with a one percent increase does not have as severe an effect on the growth of investigator salaries as the reduction in the cap for FY 2012. Growth for about 14.4 percent of requested salaries is increased by 0.75 percent for FY 2014 rather than a zero percent increase as in FY 2013. The less severe limit leads to a higher projected growth for academic salaries and for the BRDPI.

The projected growth for FY 2014 of 1.9 percent also includes an adjustment for the expected steadying of the general rate of inflation. The GDP Price Index increased by 1.5 percent during FY 2013. OMB projects an increase of 1.5 percent for FY 2014 as well.

At this time (January 2014), there is no indication that the cap on investigator salaries will be raised to its previous level (Executive Level I). While there will potentially be an increase in the growth of compensation for fellowship and training awards during FY 2014, it will not be enough to have a significant impact on the FY 2014 BRDPI estimate. Fellowship and training awards comprise less than two percent of the NIH overall budget.

Primarily because of the freeze and minimal increase in FY 2014 on Federal civilian employee salaries and the cap on compensation of extramural investigators, the rate of growth of the BRDPI during the years FY 2012 through FY 2014 has been relatively low compared with its historical relationship with general inflation as represented by the growth of the GDP Price Index. As the economy improves and the government resolves the various fiscal issues related to balancing overall Federal expenditures with tax revenues, we expect that growth of Federal salaries and the growth of caps on investigator and trainee salaries eventually will return to historical trend rates. Just when this will happen remains uncertain.

Thus, to generate reasonable projections of BRDPI growth to support budget planning, we assume that after FY 2014 the growth of the BRDPI will gradually revert to the historical pattern observed from FY 2004 through FY 2013 of faster growth relative to the growth of the GDP Price Index.

To summarize, the following pattern of growth in the BRDPI is projected: 1.9 percent for FY 2014; 2.2 percent for FY 2015; 2.5 percent for FY 2016; 2.9 percent for FY 2017, 3.2 percent for FY 2018, and 3.3 for FY 2019.

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 precisely 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 roughly 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 2013. Table B includes projected values of the BRDPI and the GDP Price Index for FY 2014 through FY 2019.

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

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

Fiscal Year	GDP Price Index	BRDPI
Col.(1)	Col.(2)	Col.(3)
1980	8.7%	9.8%
1981	9.8%	10.4%
1982	6.9%	8.6%
1983	4.4%	6.2%
1984	3.5%	5.9%
1985	3.3%	5.6%
1986	2.3%	4.2%
1987	2.2%	5.3%
1988	3.2%	5.0%
1989	4.0%	5.2%
1990	3.6%	5.4%
1991	3.5%	4.8%
1992	2.4%	4.4%
1993	2.4%	3.4%
1994	2.2%	3.9%
1995	2.1%	3.5%
1996	1.9%	2.6%
1997	1.8%	2.8%
1998	1.2%	3.4%
1999	1.3%	3.2%
2000	2.1%	3.7%
2001	2.4%	3.3%
2002	1.6%	3.3%
2003	1.9%	3.5%
2004	2.5%	3.7%
2005	3.1%	3.9%
2006	3.3%	4.6%
2007	2.7%	3.8%
2008	2.1%	4.7%
2009	1.2%	2.9%
2010	0.9%	3.0%
2011	2.0%	2.9%
2012	1.8%	1.3%
2013	1.5%	1.9%

TABLE B
PROJECTED ANNUAL PERCENT CHANGES

Fiscal Year	GDP Price Index	BRDPI
Col.(1)	Col.(2)	Col.(3)
2014	1.5%	1.9%
2015	1.7%	2.2%
2016	1.9%	2.5%
2017	2.0%	2.9%
2018	2.0%	3.2%
2019	2.0%	3.3%

TABLE C

Conversion of Annual Changes into Annual Levels

Fiscal Year	Annual Percent Change	[1+(Percent Change/100)]	Previous Year Value		Annual Level BRDPI
Col.(1)	Col.(2)	Col.(2)	Col.(3)		Col.(4)
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," <u>Survey of Current Business</u>, 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," <u>Survey of Current Business</u>, 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," <u>Survey of Current Business</u>, 73, No.11 (March 1993), pp 31-41.

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

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

Modification of the Methodology Used to Estimate the BRDPI (2006)

This section is included for users interested in more of the technical details regarding methods used to estimate annual values of 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 above.)

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 or 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). Or the mix may reflect changes in policy with a larger share of the NIH budget allocated to support of extramural research and less to inside NIH activities, including intramural research and administration of extramural research.

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.