

(Box 1) The Revision to the Output Gap and the Potential Growth Rate

Reflecting (1) the retroactive revision of Japan's GDP statistics in December 2016, incorporating a revision of the benchmark year, as well as a switch to the 2008SNA and the regular annual revision, and (2) the newly available capital stock data (Quarterly Estimates of Net Capital Stocks of Fixed Assets) in line with the new 2008SNA guidelines and adjusted for economic depreciation, the Research and Statistics Department of the Bank of Japan recently re-estimated Japan's output gap and potential growth rate and revised the estimation method.³³

However, the basic approach employed by the Bank of calculating the output gap based on the slack in the utilization of capital and labor is unchanged through this revision. Specifically, the output gap is calculated based on the following formula:

Output gap = Capital input gap + Labor input gap

Capital input gap = Utilization gap in manufacturing + Utilization gap in nonmanufacturing

Labor input gap = Labor force participation rate gap + Employment rate gap + Hours worked gap

In the formula above, the following three items were subject to the revision: (1) the utilization gap in manufacturing, (2) the labor force participation rate gap, and (3) the hours worked gap.³⁴

(1) Revision to the utilization gap in manufacturing (Box Chart 1 [3])

Although the indices of production capacity for industrial production, which are used for measuring the utilization rate in manufacturing, reflect the disposal of physical equipment such as the retirement of equipment, the economic depreciation (obsolescence) of equipment is hardly taken into account. When this is taken into account, potential production capacity in

³³ For details, see the forthcoming Bank's research paper "Methodology for Estimating Output Gap and Potential Growth Rate: An Update."

³⁴ The estimation methods for the utilization gap in nonmanufacturing and the employment rate gap were not revised in essence (Box Chart 1 [1] and [2]).

manufacturing will be assessed lower, and thus the utilization rate will be higher.³⁵ In the revised estimates, the downward deviation in the utilization rate in manufacturing was adjusted by using the newly available information from the Quarterly Estimates of Net Capital Stocks of Fixed Assets and by referring to the estimation method of the utilization rate developed and published by the Federal Reserve.³⁶

(2) Revision to the labor force participation rate gap (Box Chart 2 [1])

The labor force participation rate has been rising clearly since the end of 2012, reflecting (1) the increasing numbers of dual-income households and (2) the elderly working until an older age. So far, the trend of the labor force participation rate had been estimated using the Hodrick-Prescott (HP) filter. However, doing so meant that, in order to identify breakpoints such as that observed around 2012 as turning points in the trend, it was necessary to wait until a considerable amount of time-series data had become available. Therefore, the approach was revised and, following the methodology of the Congressional Budget Office of the United States, a piecewise linear regression was adopted, which allows sharp breakpoints in the trend for each business cycle. This makes it possible to identify structural changes in a more timely manner as turning points in the trend.

(3) Revision to the hours worked gap (Box Chart 2 [2])

Until the revision, the measurement of trends in working hours took into account major working time regulations (such as the introduction of the five-day work week) and population aging as factors exerting downward pressure on the trends; however, the structural decline in working hours in recent years, due to the increase in married women who work only part-time and the redressing of long working hours through work-style reforms, was not sufficiently captured. Therefore, as part of the revision, the way in which trends in working hours are derived was modified in order to capture the decline in actual working hours over the past few years as a structural rather than a cyclical decline.

³⁵ Moreover, this trend appears to have become more pronounced in recent years, as the pace of obsolescence of capital has increased with the advances in information and communications technology.

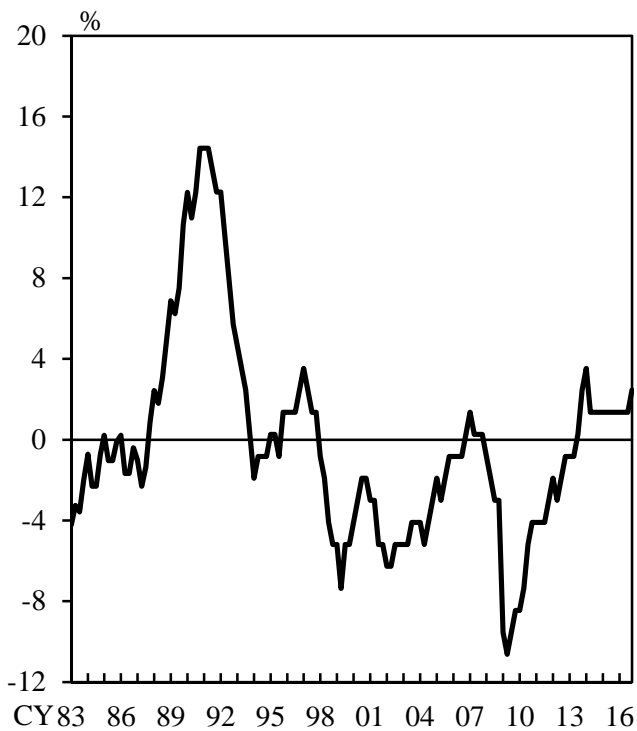
³⁶ Charles Gilbert, Norman Morin, and Richard Raddock, "Industrial Production and Capacity Utilization: Recent Developments and the 1999 Revision," *Federal Reserve Bulletin*, Vol. 86, 2000, pp. 188-205.

A look at the revised output gap shows that, for the first half of the 2000s, these changes result in a slight downward revision of the output gap, while for the period following the global financial crisis they result in a slight upward revision, mainly due to the upward revision of the capital input gap and the hours worked gap (Box Chart 3). However, the upward revision for the last two years or so is relatively small, due in part to the downward revision of the labor force participation rate gap, and the overall picture for the most recent period is unchanged in that the output gap, after having been more or less flat at around 0 percent, has been improving for two consecutive quarters. Next, comparing the revised output gap estimates with those of other institutions shows that, while they are quite similar, some differences can be observed for some periods (Box Chart 4 [1]). This indicates that there are discrepancies in the measurement of the output gap that reflect differences in the data used and the estimation method. The chart also shows that, for recent years, the Bank's output gap estimate is close to the estimate made by the Organisation for Economic Co-operation and Development (OECD), which is on a 1993SNA basis.

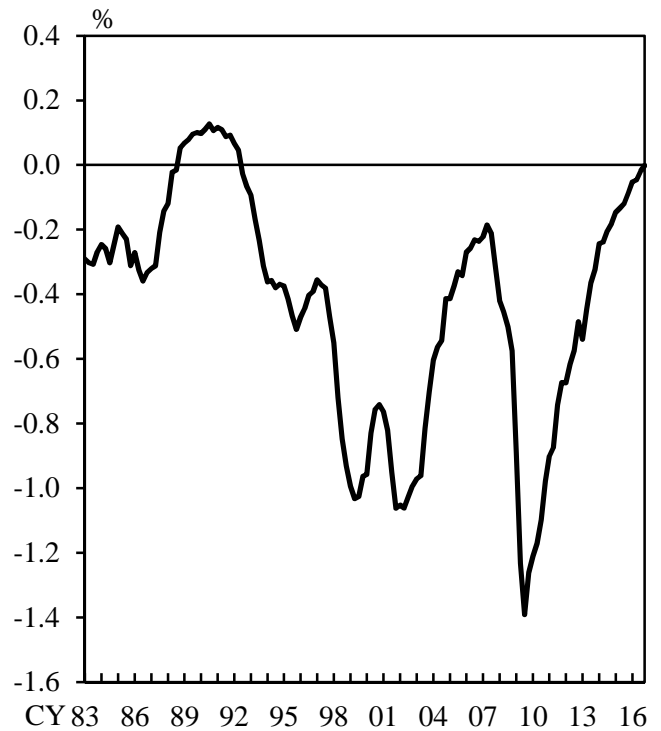
Looking at the revised potential growth rate shows that, immediately after the global financial crisis, it temporarily dropped to about 0 percent, due mainly to the drop in capital input (Box Chart 5). However, it subsequently improved, mainly due to the increase in the capital stock including research and development as the economy recovered, as well as to the increase in the number of potential workers, particularly among the elderly and women. As a result, the potential growth rate in recent years has been estimated to be in the range of 0.5-1.0 percent, which is comparable to that in the first half of the 2000s, before the global financial crisis. Comparing the potential growth rates before and after the revision shows that, whereas for the period after the global financial crisis the changes result in a downward revision of the potential growth rate due mainly to the downward revision of the capital stock, they result in a rather large upward revision for the last few years, mainly reflecting a rise in the TFP growth rate associated with the comprehensive revision to GDP statistics (see Box 2 on developments in Japan's TFP in recent years). Comparing the revised estimates of the potential growth rate with the estimates of other institutions, the estimates by the Bank of Japan, the Cabinet Office, and the IMF, which already incorporate the effects of the SNA revision, are higher than the estimate by the OECD, which is based on the previous standard (Box Chart 4 [2]).

Labor and Capital Input Gap (1)

(1) Utilization Gap in Nonmanufacturing (Unrevised)

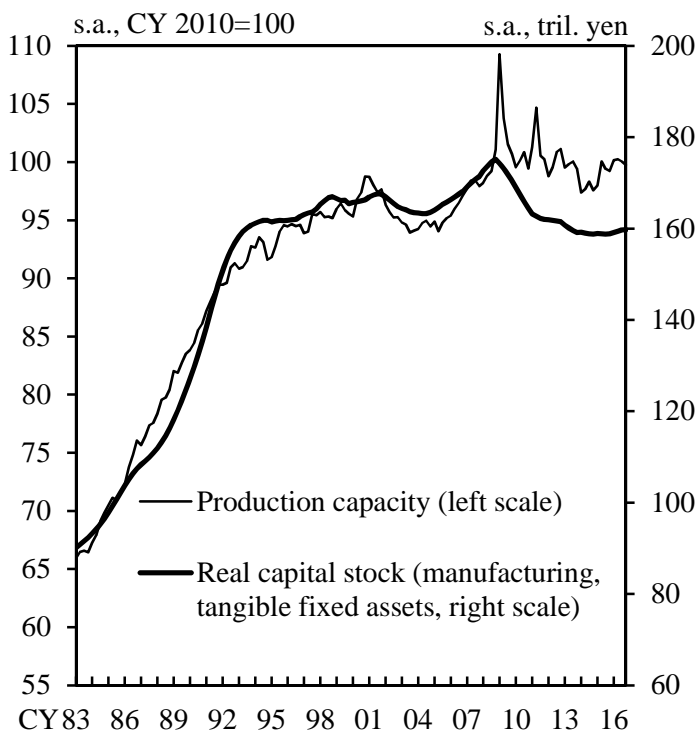


(2) Employment Rate Gap (Unrevised)

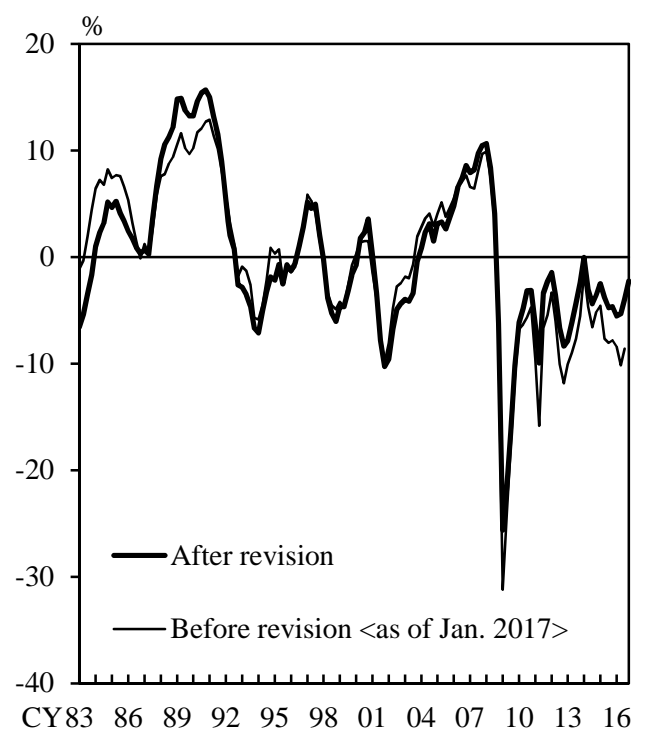


(3) Revision of Utilization Gap in Manufacturing

(a) Production Capacity and Capital Stock



(b) Utilization Gap in Manufacturing



Notes: 1. Production capacity in (3) is obtained by dividing the production index by the operating ratio index.

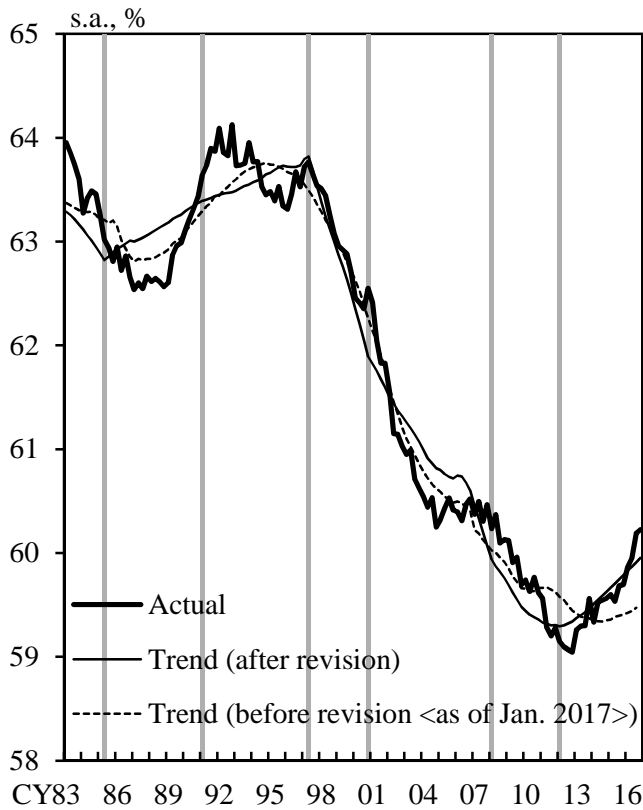
2. Real capital stock is estimated by the Research and Statistics Department, Bank of Japan using the "Quarterly Estimates of Net Capital Stocks of Fixed Assets" and the "Net Capital Stocks of Fixed Assets classified by Institutional Sectors and Economic Activities."

Sources: Cabinet Office; Bank of Japan; Ministry of Internal Affairs and Communications; Ministry of Economy, Trade and Industry; Research Institute of Economy, Trade and Industry.

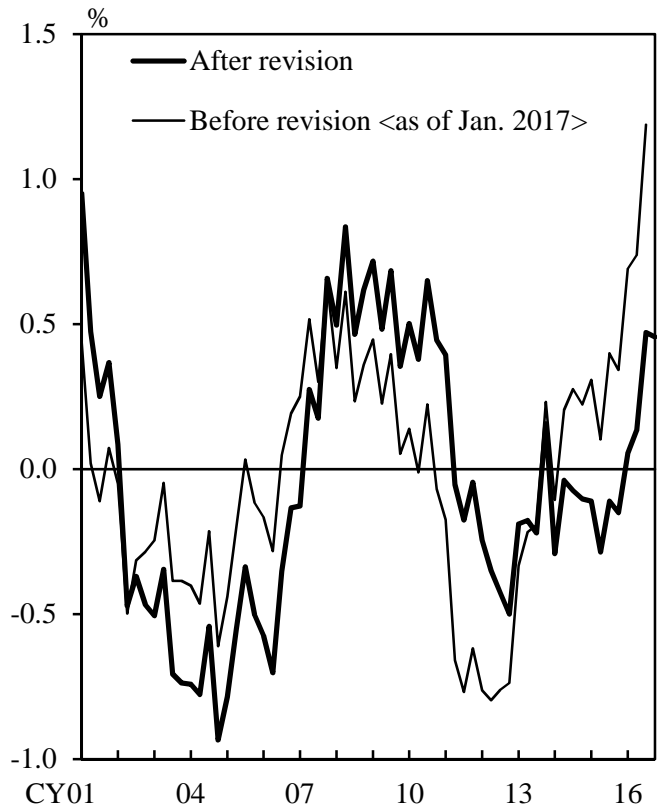
Labor and Capital Input Gap (2)

(1) Revision of Labor Force Participation Rate Gap

(a) Actual Labor Force Participation Rate and Its Trend

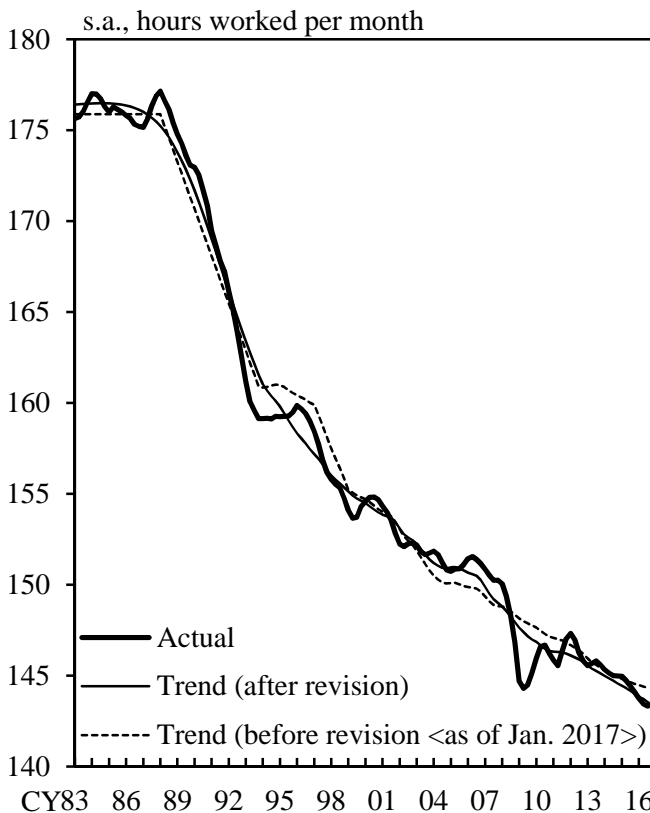


(b) Labor Force Participation Rate Gap

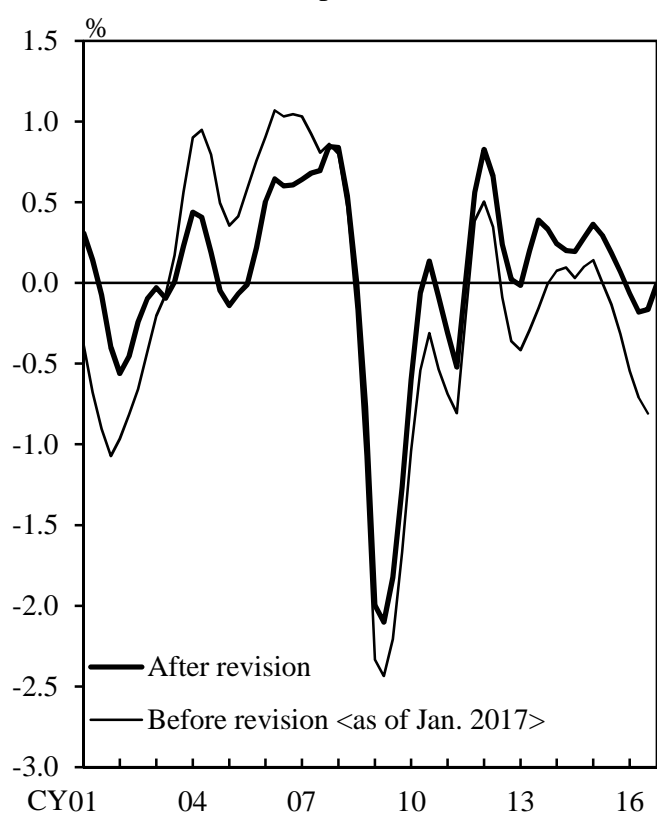


(2) Revision of Hours Worked Gap

(a) Actual Hours Worked and Their Trend



(b) Hours Worked Gap



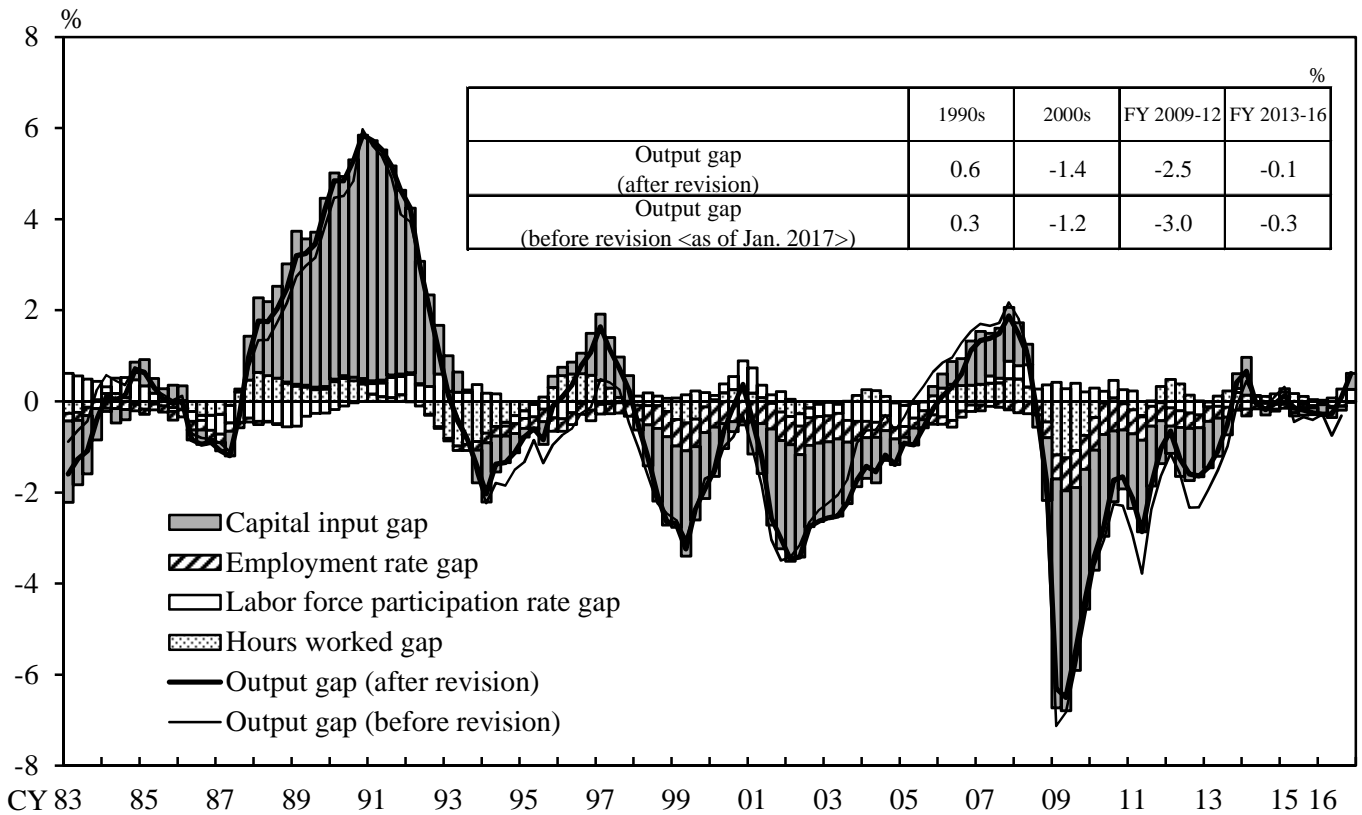
Notes: 1. The vertical lines in (1) indicate business-cycle peaks.

2. Actual hours worked in (2) are seasonally adjusted, and irregular spikes were eliminated from the original series.

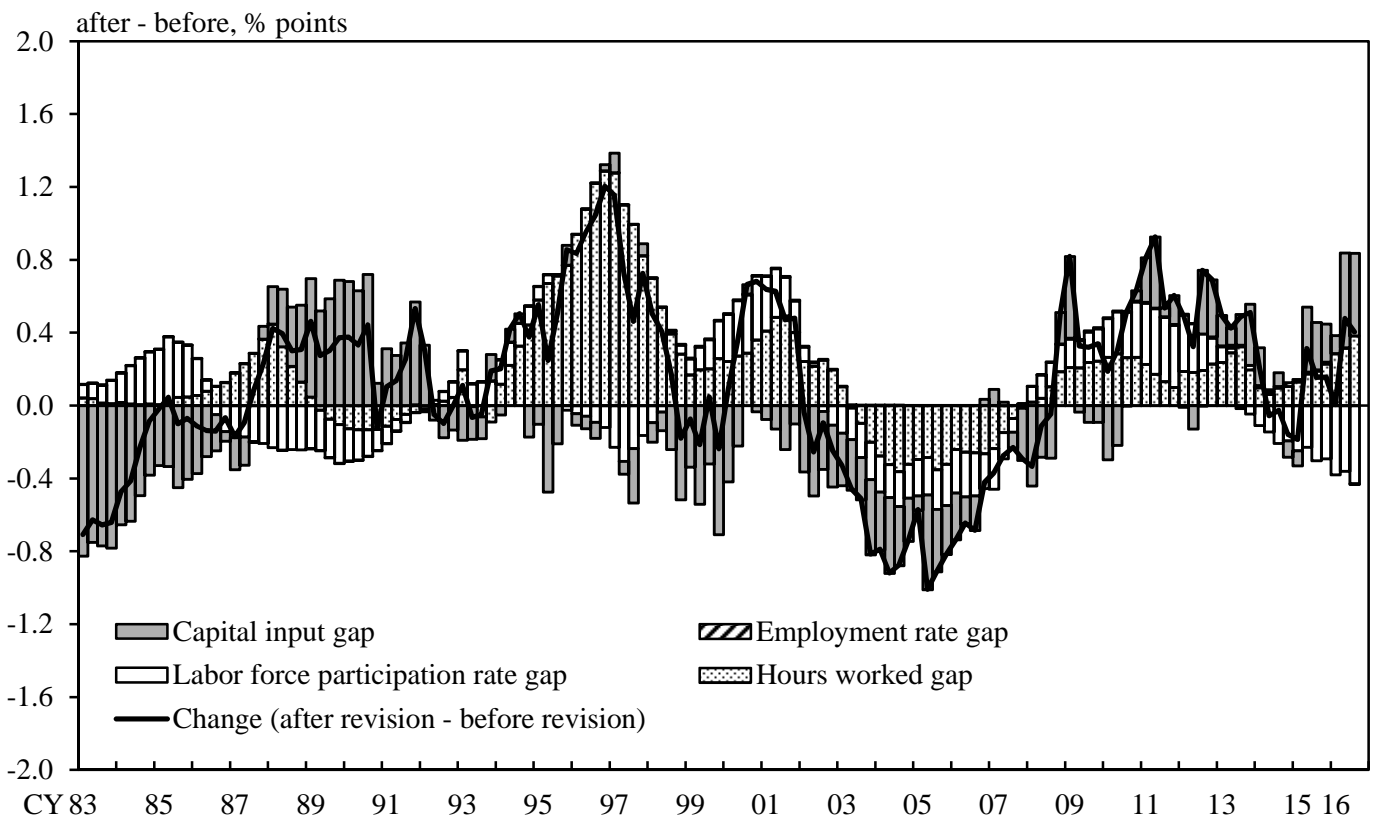
Sources: Ministry of Internal Affairs and Communications; Ministry of Health, Labour and Welfare.

Revision of the Output Gap

(1) Output Gap



(2) Difference between the Output Gap Before and After the Revision

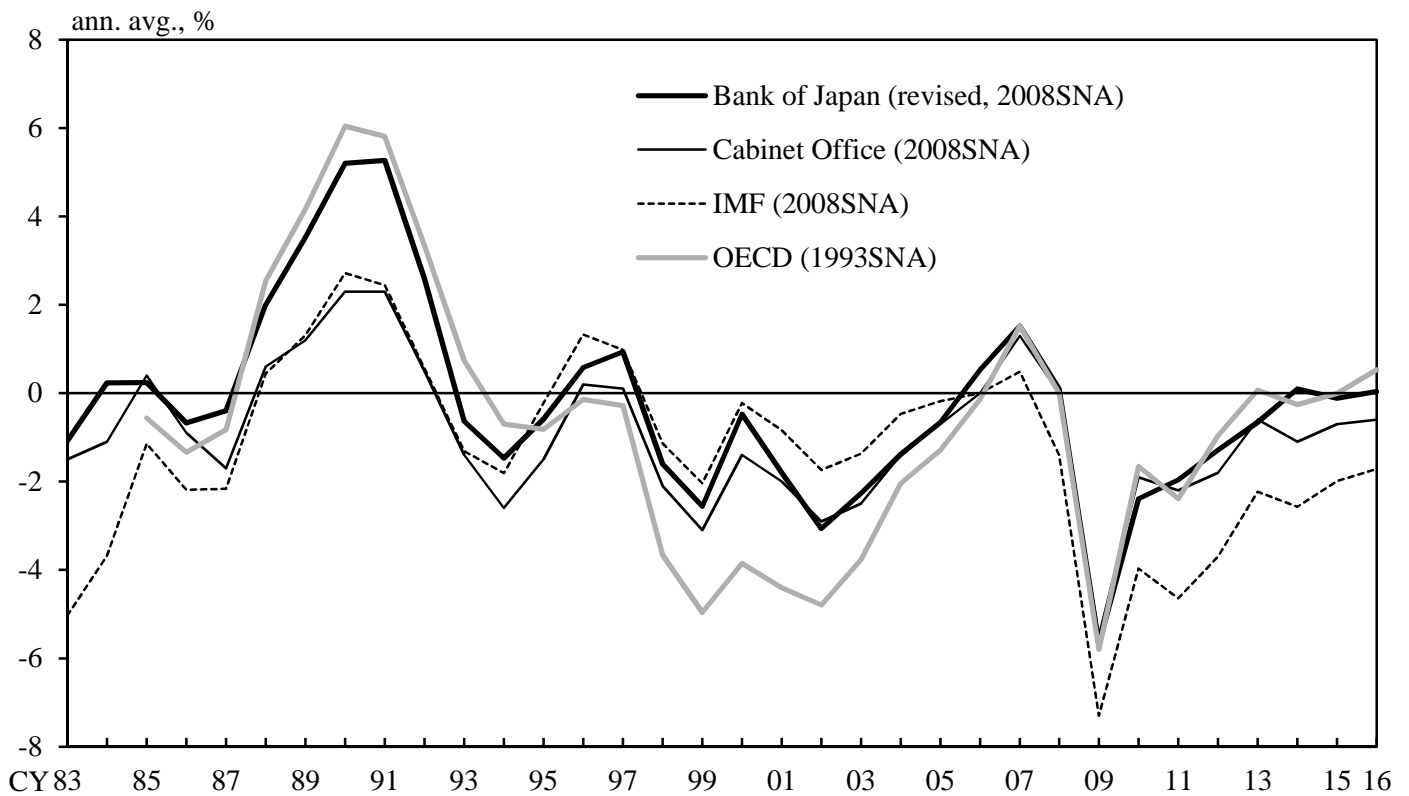


Note: Figures for before revision <as of Jan. 2017> are up to 2016/Q3.

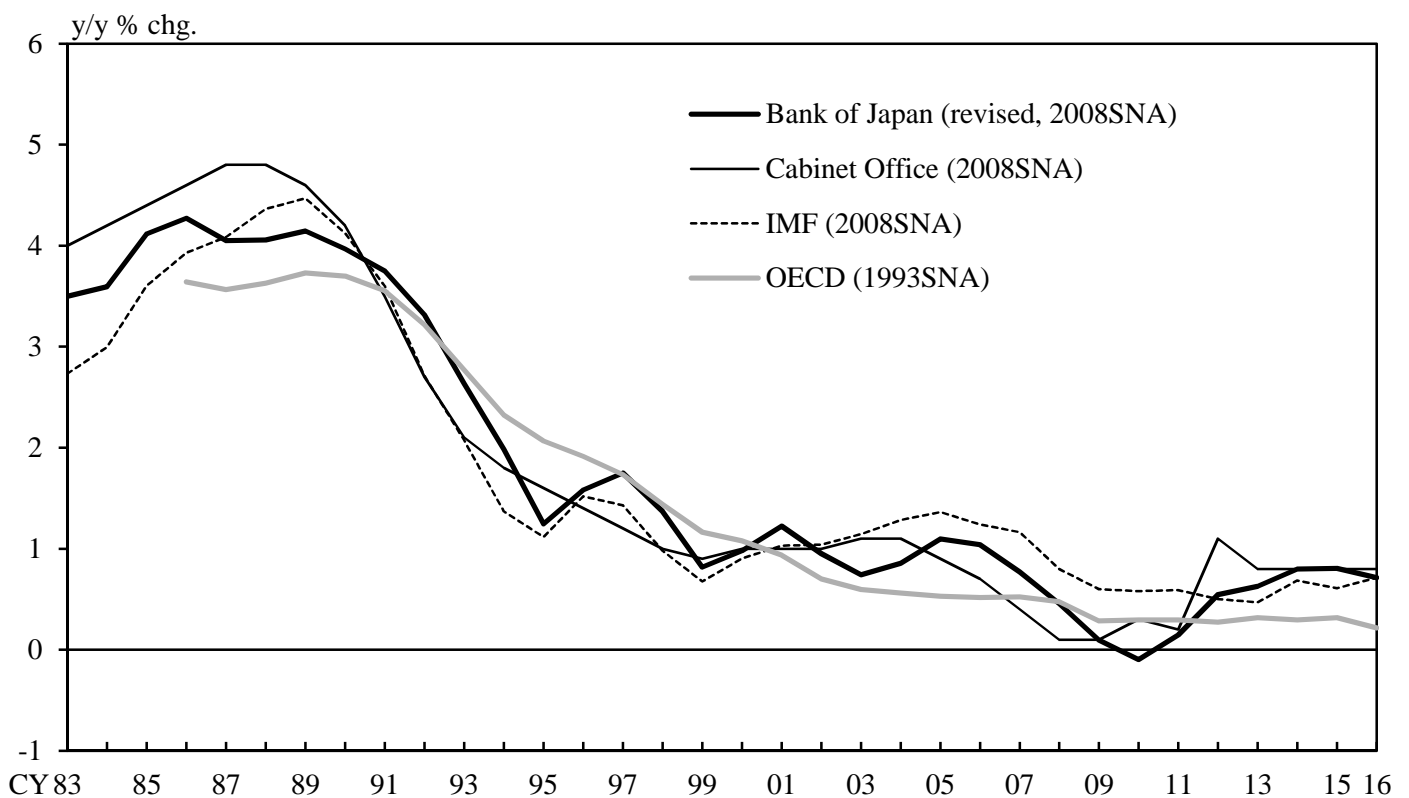
Sources: Cabinet Office; Bank of Japan; Ministry of Internal Affairs and Communications; Ministry of Health, Labour and Welfare; Ministry of Economy, Trade and Industry; Research Institute of Economy, Trade and Industry.

Various Estimates of the Output Gap and Potential Growth Rate

(1) Output Gap



(2) Potential Growth Rate

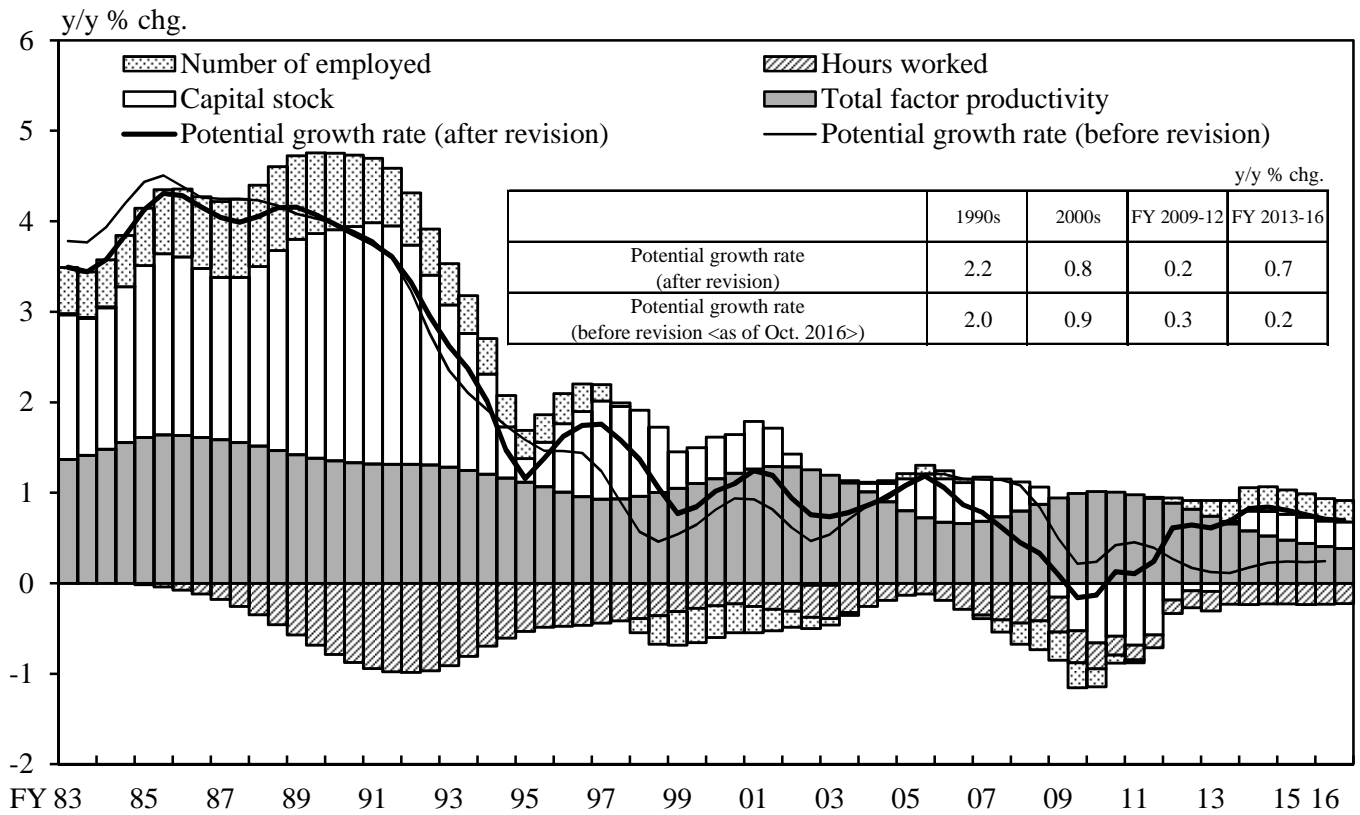


Note: Figures for the IMF are based on the April 2017 "World Economic Outlook." Figures for the OECD are based on the November 2016 "Economic Outlook." Figures for the OECD do not reflect the comprehensive revision of the SNA statistics, and those for 2016 are projections.

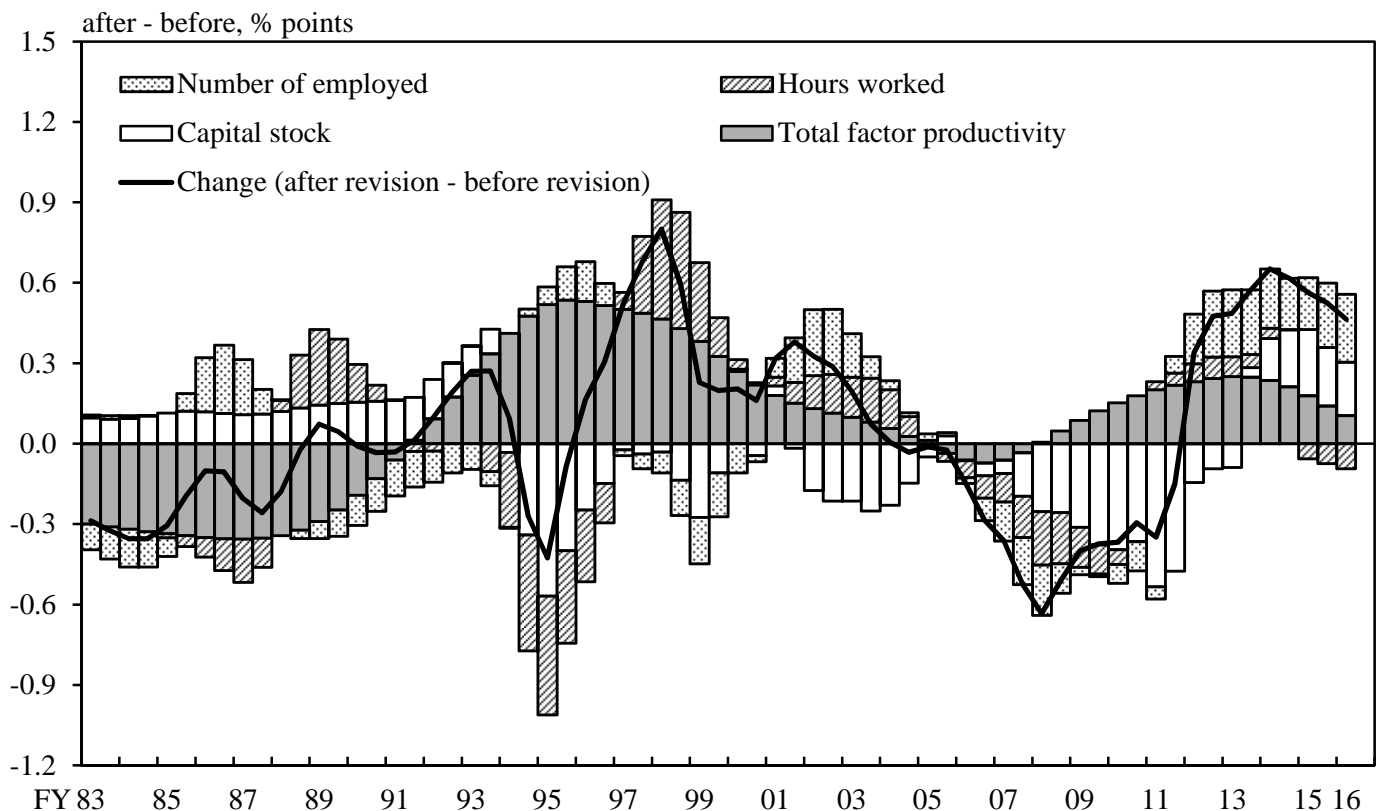
Sources: Cabinet Office; IMF; OECD, etc.

Revision of the Potential Growth Rate

(1) Potential Growth Rate



(2) Difference between the Potential Growth Rate Before and After the Revision



Note: Figures for the second half of fiscal 2016 are those of 2016/Q4. Figures for before revision <as of Oct. 2016> are up to 2016/Q2.
 Sources: Cabinet Office; Bank of Japan; Ministry of Internal Affairs and Communications; Ministry of Health, Labour and Welfare; Ministry of Economy, Trade and Industry; Research Institute of Economy, Trade and Industry.