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The New Estimates of Output Gap and Potential Growth Rate

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The Bank of Japan (BOJ) estimates the output gap and the potential growth rate, and uses these in judging economic and price conditions. The output gap and potential growth rate have been recently re-estimated in light of the benchmark revision of the GDP statistics at the end of 2005. At the same time, the estimation methods have also been thoroughly re-examined and changed. The changes include incorporating the structural changes in the labor market that have become clear over the past few years, as well as improving the data used for capital stock. We have also redefined the meaning of potential GDP.
The new output gap takes positive or negative values in comparison with the average past levels of the capital and labor utilization ratios. As for recent developments, the output gap had a large negative value when the present economic recovery began, has been steadily improving ever since, and is presently in the vicinity of zero. This level surpasses the recent peak recorded in 2000 and is more or less equal to the peak in 1997. The new potential growth rate had been hovering around 1% or slightly less since the end of the 1990s, and has recently been recovering to between 1.5% and 2.0%.
These figures, however, need to be viewed with some latitude, as the output gap and potential growth rate estimates may be revised in retrospect as new data become available.

1. Introduction

Potential GDP shows the sustainable economic growth path over the medium term, and over the long term it indicates the state of the economy which is consistent with price stability. The output gap expresses the differential between actual GDP and potential GDP. The output gap serves as an indicator for the level of economic activity, and, consequently, for pressure for price change. There is an important relation between the output gap and the potential growth rate (the rate of change in potential GDP) whereby the output gap is maintained at a constant level when the economy actually grows at the potential growth rate. In this way, the output gap and the potential growth rate are useful concepts for judging economic and price conditions and for evaluating risk, but because these cannot be observed as objective data, they have to be estimated one way or the other.

Information about the output gap and potential growth rate used by the BOJ to date, including the estimation methods, was introduced in English in the *Bank of Japan Quarterly Bulletin* in May 2003.[1] The retroactive revision of GDP statistics with the change in the base year at the end of 2005 required us to re-estimate the output gap and potential growth rate, which gave us a good opportunity to apply the new method. Specifically, the estimation now incorporates the structural changes in the labor market that have become clear over the past few years, such as the declining trend in the labor participation rate and the increased ratio of part-time workers. Efforts were also made to partially revise the data used to estimate capital stock. Moreover, the measurement scale used for the output gap, which was previously only expressed as a negative number, was changed to an expression that may take either a positive or a negative value.

In the following sections, this paper outlines the basic concept and the overall methodology, explains the actual estimation method used for the new output gap, and then presents the output gap and potential growth rate estimation results.

2. Basic Concept and Overall Methodology

As noted above, potential GDP indicates the sustainable economic growth path over the medium term. This may be considered as the supply capacity of a nation's economy premised upon the existing economic structure. The output gap shows how far actual GDP deviates from potential GDP.

Output gap = actual GDP – potential GDP --- (1)
(Strictly speaking, the right-hand term is then expressed as a percentage of potential GDP.)

Since the actual GDP is known from the data, estimating the output gap is none other than estimating the potential GDP. The BOJ estimates potential GDP using the method known as the "production function approach". In this approach, GDP is determined by the production factor inputs (capital and labor) and by the total factor productivity (TFP), or the efficiency with which these factors are used to generate output. Specifically, we assume the following Cobb-Douglas production function.

$$Y=(1-\alpha)K+\alpha L+TFP \text{ --- (2)}$$

where Y represents GDP, K the capital input, L the labor input and TFP is the total factor productivity (all expressed in logarithms). The constant α expresses labor's share, and $1-\alpha$ is capital's share.

In Equation (2), because Y, K and L are all observable, if the constant α is set, for example, as the past average of labor's share, then TFP can be derived as residual.[2] Here potential GDP is the GDP level when the capital and labor inputs in Equation (2) equal their potential levels.

$$Y^*=(1-\alpha)K^*+\alpha L^*+TFP \quad \text{--- (3)}$$

In Equation (3) Y^* represents potential GDP, K^* the potential capital input and L^* the potential labor input.

The output gap is calculated by subtracting Equation (3) from Equation (2).

$$Y - Y^* = (1-\alpha)(K - K^*)+\alpha (L - L^*) \text{ --- (4)}$$

In other words, the output gap ($Y - Y^*$) is the average of the capital input gap ($K - K^*$) and the labor input gap ($L - L^*$) weighted by labor's share α.

Because the potential growth rate is the growth rate of potential GDP, as indicated by Equation (3), it becomes the weighted sum of the growth rates of potential capital input and potential labor input combined with the TFP growth rate. However, because the TFP derived as residual in Equation (2) includes the fluctuations in GDP each period, the potential growth rate is actually calculated so as to reflect the TFP trend growth rate, which is derived by applying HP filter to TFP from Equation (2) .

$$Y^*=(1-\alpha)\Delta K^*+\alpha \Delta L^*+\Delta TFP \text{ (trend growth) ---(5)}$$

3. Defining the Concept of "Potential"

Before proceeding with our concrete explanation of the new methodology, let us confirm that estimating the output gap is ultimately a matter of estimating the capital input gap and the labor input gap, as can be understood from Equation (4). This in turn primarily involves estimating the potential input of these two factors of production, that is to say, the potential capital input and the potential labor input.

Our explanations thus far have left the meaning of "potential" somewhat vague, but this concept now needs to be specified a little more to proceed with the actual estimations. Broadly speaking, there are two ways to define the meaning of "potential".

The first views "potential" as a situation where factors of production are used to their fullest potential.

"Maximum concept" potential input
= Fullest potential

The second views "potential" as a situation in which usage of production factors is at some sort of "average" levels, such as when the utilization ratio is equal to the past average.

"Average concept" potential input
= Fullest potential × Average utilization ratio

When the "maximum concept" is adopted, the capital input gap and the labor input gap in Equation (4), and consequently the output gap itself (which is their weighted average), cannot have values greater than zero. In contrast, under the "average concept" the output gap becomes zero when the usages of the factors of production are at their averages, turns positive (indicating an excess demand) when they are above those levels, and negative (indicating an excess surplus) when they are below them.

These two types of output gap are fundamentally the same, but adopt different measurement scales. The BOJ previously calculated the output gap using the maximum concept because the criteria for determining what is "average" were not necessarily clear. The new output gap estimation adopts the average concept because (1) this average approach is frequently used by international organizations and other central banks for calculating the output gap (and is also used within Japan, for example, by the Cabinet Office), and (2) the use of the average concept facilitates comparisons with the *Tankan* DI figures for production capacity and employment situation.

Because average utilization ratios are the averages taken from multiple past business cycles, they may be considered as a rough indication of supply-demand condition of the factors of production markets being more or less in balance, or a situation with stable inflation. Nevertheless, it is important to note that by nature the "past average" changes with the passage of time, and that theoretically no special meaning can be attached to having an output gap of zero.

4. Estimation of the Capital Input Gap

First, regarding the potential capital input, we view the existing capital stock as the fullest potential and multiply that by the average utilization ratio.

Potential capital input
= Capital stock × Average utilization ratio

The actual capital input is then determined by the utilization ratio at each point in time.

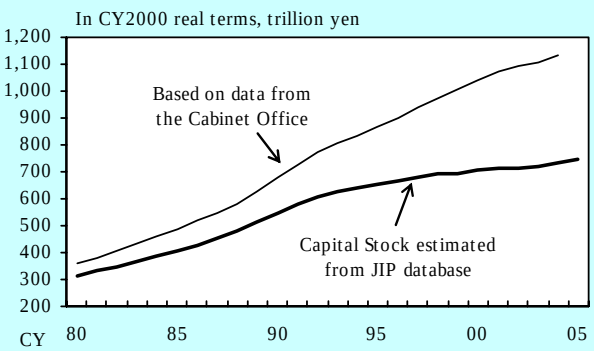
Actual capital input
= Capital stock × Utilization ratio

Because the capital input gap is calculated as the difference between the potential capital input and the actual capital input, the key point for the estimation is to assess the capital stock and utilization ratio as accurately as possible.[3]

From this perspective, we first changed the data used for capital stock. It has been often noted that the "Gross Capital Stock of Private Enterprises" statistics that had been used to date overestimate the economic value of capital stock. This is because these statistics do not accurately reflect the actual erosion in the value of equipment and facilities as they wear down and technologies become obsolete. This problem is believed to have a particularly large influence in cases where existing equipment rapidly becomes outdated due to the greater proliferation of IT and other developments. To address this, we adopted the JIP database for our capital stock data.[4] The JIP estimates depreciation using the market prices for used equipment, and deducts this from the capital stock. This approach is believed to result in figures that more closely approximate the correct economic value.

Comparing the Gross Capital Stock of Private Enterprises statistics with the JIP, the latter increases more gradually (Chart 1) because it deducts not only for physical disposal but also for the reductions in the economic value of equipment each period. The change to using the JIP database greatly reduces the assessed value of capital stock, especially since the 1990s as existing equipment has become obsolescent at a faster pace along with the wider adoption of IT and the advance of globalization.

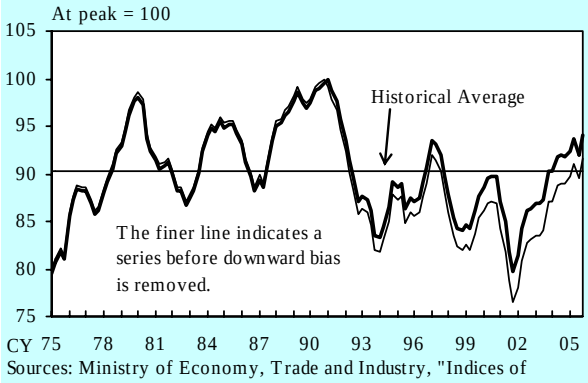
Chart 1 Capital Stock



Sources: Cabinet Office ,"Annual Report on Gross Capital Stock of Private Enterprises"; JIP database etc.

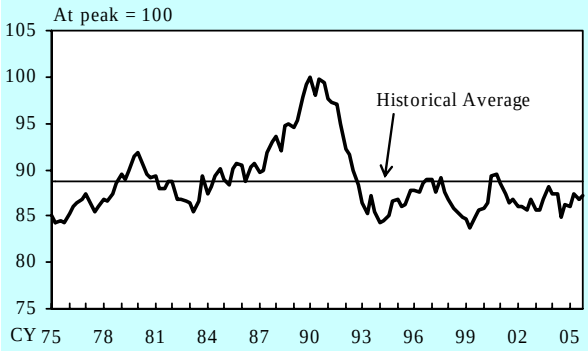
The next issue is the capital utilization ratio. For the manufacturing industry, we adopt the utilization ratio under the Indices of Industrial Production (IIP) statistics. While these IIP statistics were also used in the past, our new estimation adjusts for the downward bias seen in the utilization ratio in recent years using the production capacity DI from the *Tankan* survey (Chart 2).[5] On the other hand, for the non-manufacturing industry, no utilization ratio data exist. Thus, for this sector, we estimate using firms' perceptions on the utilization of equipment and facilities under the Business Outlook Survey (Cabinet Office and Ministry of Finance) (Chart 3).

Chart 2 Capacity Utilization (Manufacturing)



Sources: Ministry of Economy, Trade and Industry, "Indices of Industrial Production" etc.

Chart 3 Capacity Utilization (Nonmanufacturing)

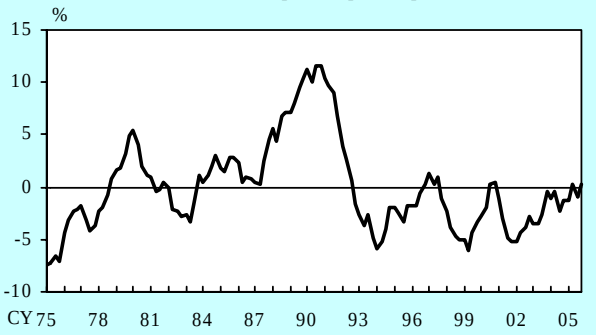


Sources: Cabinet Office and Ministry of Finance, "Business Outlook Survey" etc.

For the average utilization ratio, which is required to estimate the potential capital input, we adopted the average values from 1975 through 2005 respectively for the manufacturing and non-manufacturing industries.

For the capital input gap, we calculated the differential between the actual utilization ratio and the average utilization ratio separately for the manufacturing and non-manufacturing industries, and then computed the weighted average using the weights of the manufacturing and non-manufacturing industries in capital stock (Chart 4). The capital input gap is presently in the vicinity of zero (that is, the present utilization ratio is near the past average) and approximately equal to the peak levels posted during the past two economic recoveries.

Chart 4 Capital Input Gap



Sources: Ministry of Economy, Trade and Industry, "Indices of Industrial Production"; Cabinet Office and Ministry of Finance, "Business Outlook Survey"

5. Estimation of the Labor Input Gap

As in the above estimation of the capital input gap, we begin by determining our approach to measuring potential labor input. Assuming that the maximum potential labor input is determined by the population aged 15 or older at any particular time:

Potential labor input = Population aged 15 or over
× Average utilization ratio

Similarly, the actual labor input is calculated as follows.

Actual labor input = Population aged 15 or over
× Utilization ratio

The labor input gap is calculated as the difference between the two, which means the differential between the present utilization ratio and the average utilization ratio. Here we define the utilization ratio as expressing the percentage of the population aged 15 or over who have jobs as well as the number of hours that they work.

Utilization ratio = Labor force participation rate
× Employment rate
× Total working hours per worker[6]

So the labor input gap is calculated by measuring the differentials between the present labor force participation rate, employment rate, and total working hours per worker (hereafter "working hours") and what are viewed in some sense as their "average" levels, and then combining these three differentials.

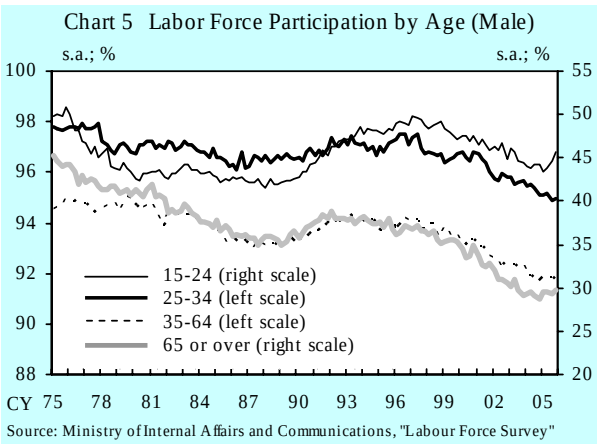
Because data exist for all three items on the right-hand side of the above utilization ratio equation, these items can easily be determined. The problem lies in the "average utilization ratio" figures that are required for stipulating the potential labor input. Because the labor force participation rate, employment rate and working hours all reflect various structural changes of the labor market and are all subject to intermittent level shifts, we cannot simply adopt the past average values as we did for the average capital utilization ratios. Rather, we need to fit curving line trends or devise various other means to estimate what may be viewed as the "average" utilization levels under the labor market structure at each point in time.

To estimate the average utilization ratios for the labor force participation and employment rates, we started from gender and age segment and aggregate them to find the potential rates. We performed these rather detailed calculations considering that structural changes manifest themselves differently by gender and age segment, and that the changes in the age structure itself influence the macro labor force participation and employment rates.[7] Also, in estimating the potential working hours, we gave consideration to the developments in the ratio of part-time workers, which has risen substantially in recent years. We now proceed to explain specifically how we estimated the gaps for the labor force participation rate, employment rate, and working hours.

(1) The Labor Force Participation Rate Gap

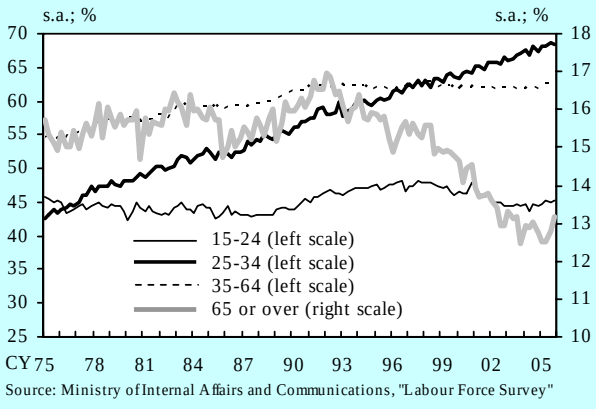
As for the labor force participation rate, the actual movements by gender and age segment (Charts 5 and 6) show substantial differences in the levels and trends. The labor force participation rate of individuals aged 65 or over has not only been on clear declining trend for both men and women in recent years, but it has been ever at a very low level in absolute terms. For that reason, the aging of society itself is functioning as a factor causing a structural decline in the overall labor force participation rate. Looking at the developments by gender, the labor force participation rate of men aged 25-34 is on a gradual declining trend, while the labor force participation rate of women of the same age group has been consistently rising to date. This is believed to reflect a structural expansion in female employment, including the spread of more flexible forms of employment such as part-time and temporary staff.

Chart 5 Labor Force Participation by Age (Male)



Source: Ministry of Internal Affairs and Communications, "Labour Force Survey"

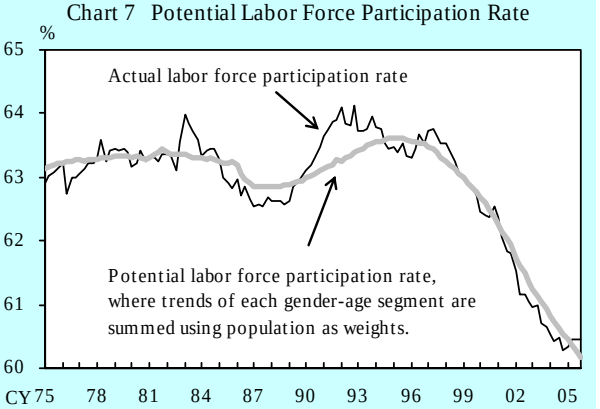
Chart 6 Labor Force Participation by Age (Female)



Source: Ministry of Internal Affairs and Communications, "Labour Force Survey"

To accurately reflect this influence from demographic changes and the overall developments by gender and age segment, we extracted the variable trends in the labor force participation rate by gender and age segment (5-year intervals) using an HP filter, and then computed the potential labor force participation rate (Chart 7) as the average weighted by the population of each group.

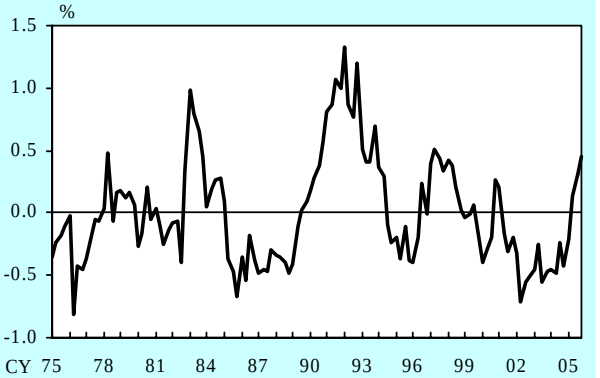
Chart 7 Potential Labor Force Participation Rate



Source: Ministry of Internal Affairs and Communications, "Labour Force Survey"

The results show that the potential labor force participation rate did not change very much until the mid-1990s, but has switched to a distinct decline from the mid-1990s, primarily because of the influence of demography.

Chart 8 Labor Force Participation Rate Gap



Source: Ministry of Internal Affairs and Communications, "Labour Force Survey"

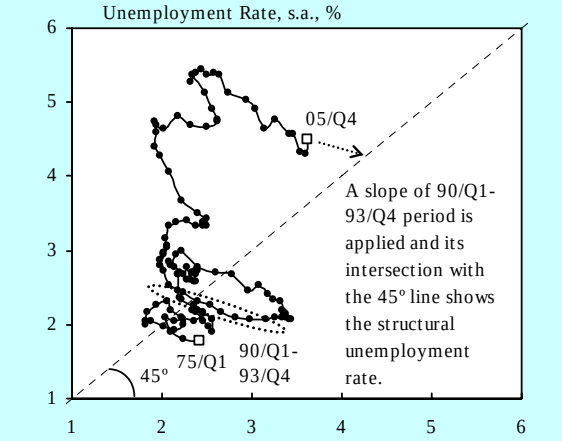
The labor force participation rate gap (Chart 8), which is the differential between the actual labor force participation rate and the potential labor force participation rate, remained at a low level for some time following the beginning of the present economic recovery phase, but then showed a clear improvement and turned positive from 2005.

(2) The Employment Rate Gap

Because the employment rate is defined as [employment rate = 1 – unemployment rate], we estimated the structural unemployment rate and then adopted [1 – the structural unemployment rate] as the potential employment rate.[8]

We estimated the structural unemployment rate using UV analysis to differentiate structural unemployment from cyclical unemployment based on the relationship between unemployment and vacancies (Chart 9).

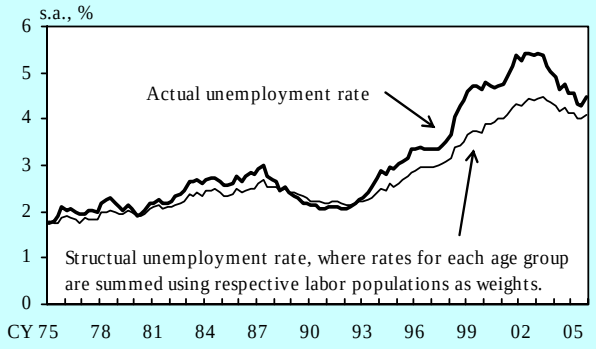
Chart 9 Basic Concept of UV analysis



Sources: Ministry of Internal Affairs and Communications, "Labour Force Survey"; Ministry of Health, Labour and Welfare, "Report on Employment Service"

UV analysis holds that overall labor supply and demand is in equilibrium when the unemployment rate (the percentage of workers who cannot find jobs) equals the vacancy rate (the percentage of jobs for which workers cannot be found), and views the unemployment rate under that condition as the structural unemployment rate.[9] First, for each age segment, we conducted UV analysis, estimated the structural unemployment rate, and then combined these using the respective labor force as weights to compute the overall structural unemployment rate (Chart 10). Because the structural unemployment rates vary in levels considerably by age segment, just as the potential labor force participation rate described above, we thought it was necessary to have the structural unemployment rate reflect influences from the aging of society and other demographic factors.[10]

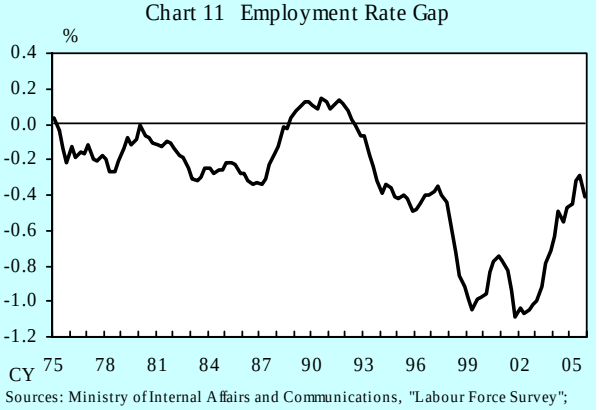
Chart 10 Structural Unemployment Rate



Sources: Ministry of Internal Affairs and Communications, "Labour Force Survey"; Ministry of Health, Labour and Welfare, "Report on Employment Service"

The employment rate gap (Chart 11), which is the differential between the actual employment rate and the potential employment rate (1 – the structural unemployment rate), continued to worsen sharply from the mid-1990s through around 2002 under the protracted economic slump, but has clearly been shrinking since around 2003.

Chart 11 Employment Rate Gap



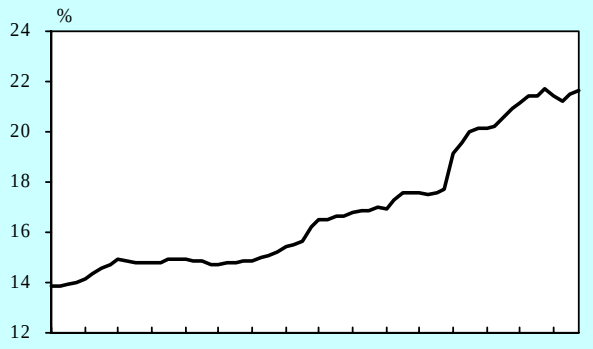
Sources: Ministry of Internal Affairs and Communications, "Labour Force Survey"; Ministry of Health, Labour and Welfare, "Report on Employment Service"

(3) The Working Hour Gap

One major characteristic of the Japanese labor market in recent years is the diversification of employment forms, with the increase in the ratio of part-time workers as one example (Chart 12). Part-time workers are defined as workers "who work fewer hours per day than regular employees" or "who work the same regular working hours per day but work fewer days per week." Thus, at the macro level, an increase in the ratio of part-time workers results in a decline in the number of working hours per worker.

The rise in the ratio of part-time workers in recent years may in principle be viewed as a structural change influenced by changes in corporate behavior under globalization, the diversification of workers' lifestyles, deregulation and other developments. Then the decline in the number of working hours per worker accompanying the rise in the ratio of part-time workers should be viewed as a structural change, that is, as a decline in the potential working hours.[11]

Chart 12 Ratio of Part-time Workers

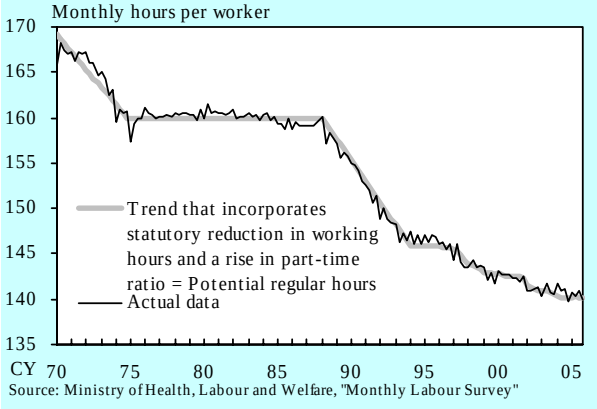


Source: Ministry of Health, Labour and Welfare, "Monthly Labour Survey"

Reflecting this line of thought, we estimated the potential working hours, both regular working hours and overtime hours, separately for full-time workers and part-time workers, and then computed the combined averages weighted by the ratio of part-time workers at each particular point in time.[12]

Specifically, first for the regular working hours of full-time workers, we took, as the potential values, the average during relatively stable periods when working hours remained essentially level. During transitional periods with level shifts, for example, from statutory reductions in working hours, we took the trend during that period as the potential values.[13] On the other hand, for part-time workers, the average values during the estimation period are adopted as the potential, since secular reductions of their regular working hours cannot be observed. The regular working hours (for all workers) are then computed as the combined average weighted by the ratio of part-time workers (Chart 13).

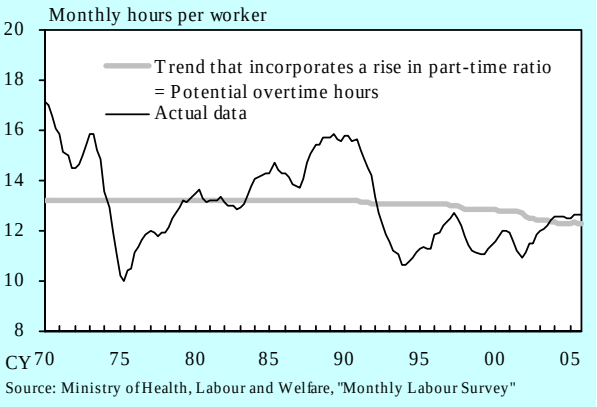
Chart 13 Regular Working Hours



Source: Ministry of Health, Labour and Welfare, "Monthly Labour Survey"

Next, turning to overtime working hours, we calculated the potential overtime working hours of both full-time and part-time workers as the average values throughout the estimation period (Chart 14).

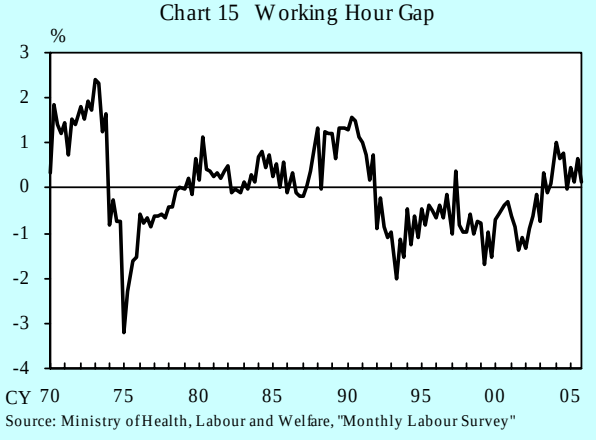
Chart 14 Overtime Working Hours



Source: Ministry of Health, Labour and Welfare, "Monthly Labour Survey"

As a result, we find that the working hours gap bottomed out in 2002 at the start of the present recovery phase, has been improving ever since, and has recently entered into positive territory (Chart 15).

Chart 15 Working Hour Gap

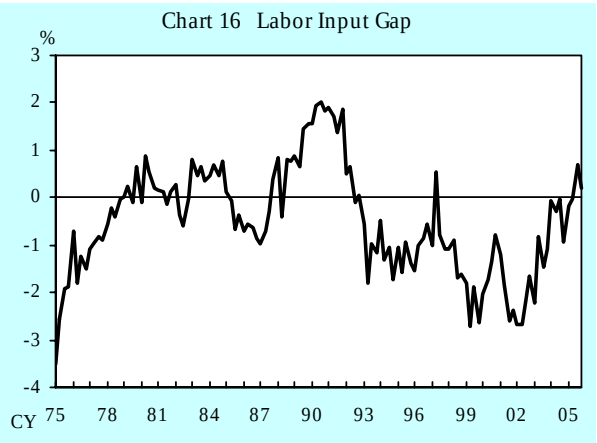


Source: Ministry of Health, Labour and Welfare, "Monthly Labour Survey"

(4) Labor Input Gap

The labor input gap is calculated as the sum of the labor force participation rate gap, the employment rate gap, and the working hour gap (Chart 16). The labor input gap was greatly negative at the start of the present recovery phase, steadily recovered thereafter, and is presently slightly above zero.

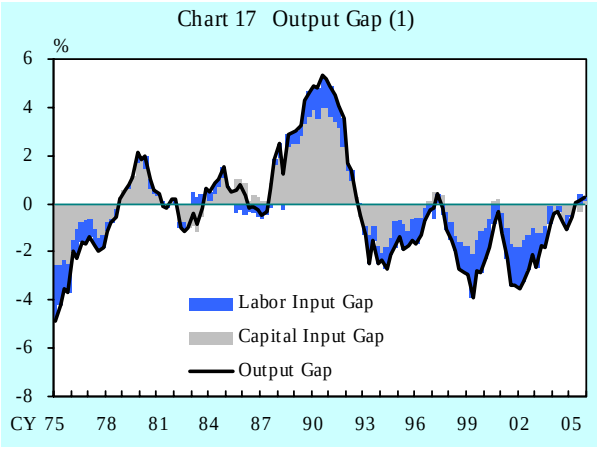
Chart 16 Labor Input Gap



6. Output Gap Estimation Results

The output gap is the average of the capital input and labor input gaps calculated above, weighted by their relative shares (Chart 17).[14]

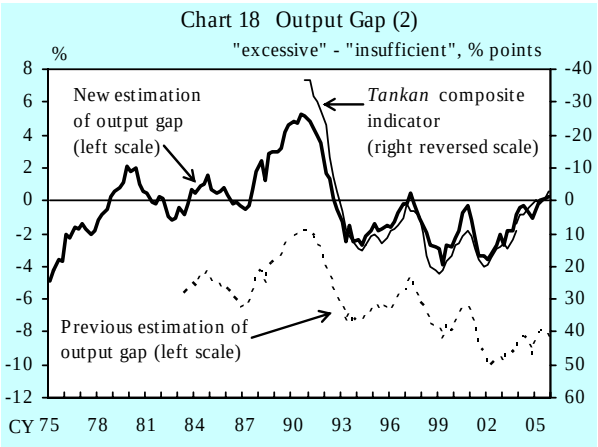
Chart 17 Output Gap (1)



The output gap calculated under this approach has been steadily contracting its negative values reflecting economic recovery, and is presently moving around zero. These estimation results need to be viewed with some latitude, and as noted above no precise meaning can be ascribed to the zero level. Nevertheless, it is appropriate to view the present supply and demand conditions in the factors of production markets as overall in balance with no significant surplus or shortage because, for example, (1) the production capacity and employment situation DI figures in the March 2006 BOJ *Tankan* survey indicate that respondents perceive almost no excess in their production capacity and, for employment, even some shortage, and (2) under the Cabinet Office estimates the output gap presently shows an excess demand but only marginally.

These new output gap figures have two distinctive characteristics compared with our former estimation (Chart 18).

Chart 18 Output Gap (2)



(1) The new output gap takes both positive and negative values due to the change from the "maximum concept" to the "average concept".

(2) The movement of the gap itself since the end of the 1990s has been revised substantially upwards. Under the former estimation the present level is still below the 2000 peak, but under the new figures the present level has surpassed the 2000

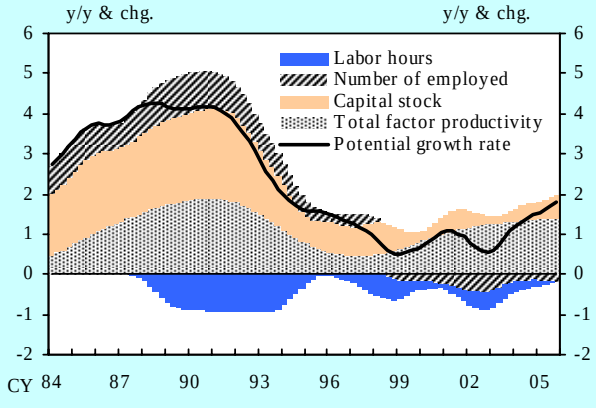
peak and is now roughly equal to the peak recorded in 1997. The movements of the new gap very closely approximate those of the weighted average of the BOJ *Tankan* production capacity and employment situation DIs not only at present, but also for more than a decade.

While characteristic (1) may be viewed as nothing more than a change in the measurement scale, characteristic (2) constitutes a substantive upward revision since the end of the 1990s. This upward revision was influenced in our estimation by such factors as (1) correction of the downward bias in the utilization ratio under the IIP statistics, (2) recognition of the downward trend in the labor force participation rate since the end of the 1990s as a structural change, and (3) recognition of the large increase in the ratio of part-time workers since 2000 as also constituting a structural change.[15]

7. Potential Growth Rate Estimation Results

The potential growth rate (Chart 19) estimated based on Equation (5) declined considerably in the mid-1990s after having reached about 4% during the bubble era. The rate then hovered around 1% or slightly below from the late 1990s, and has recently recovered to between 1.5% and 2.0%.

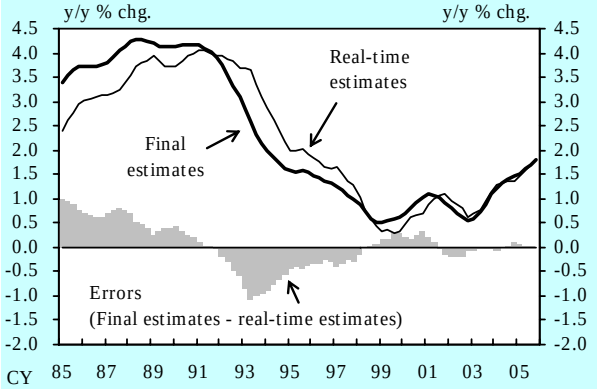
Chart 19 Potential Growth Rate



It is, however, important to note that the most recent potential growth rate estimates are subject to a high level of uncertainty and may be changed in retrospect, depending on the actual economic growth rate over the next few years. This is always true for any potential growth rate estimation.

This high level of unreliability of the most recent estimates derives from the use of diverse trends in the estimation process, such as the extraction of TFP variable trends in Equation (5) using an HP filter. For instance, a comparison between the "real-time" estimates of the potential growth rate, which are based on the data then available, and "final" estimates, which are based on the data through to 2005, shows difference that are simply too great to ignore (Chart 20). It is important to note that initial "real time" estimates, especially for periods characterized by great economic change such as the late 1980s through the mid-1990s, have subsequently been revised by as much as about 1%.

Chart 20 Errors in Potential Growth Estimation



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[1] See "The Output Gap and the Potential Growth Rate: Issues and Applications as an Indicator for the Pressure on Price Change" (*Bank of Japan Quarterly Bulletin*, May 2003) (available in English).

[2] The TFP derived in this way is often referred to as the "Solow residual".

[3] As is clear from comparing the potential capital input and actual capital input equations, ultimately the capital input gap is none other than the differential between the present utilization ratio and the average utilization ratio. Consequently, it is the utilization ratio that is critical for the estimation of the capital input gap and the output gap, while the level of capital stock is actually of secondary importance. Capital stock is just used for the weighting in computing the weighted average utilization ratios of the manufacturing and non-manufacturing industries. Nevertheless, the accuracy of the capital stock data is important in the estimation of the potential growth rate described below, especially in analyzing the capital's contribution to the potential growth rate.

[4] The JIP (Japan Industry Productivity) database was originally compiled as part of the "Japan's Potential Growth" research project conducted by the Economic and Social Research Institute of the Cabinet Office to measure the productivity growth by industry. Since the JIP database was only released for dates up until 1998, we prepared extended estimates for the subsequent years. We also adjusted the database for the switch of the GDP statistics to the 2000 base year.

[5] Production capacity, which serves as the denominator in calculating the utilization ratio, tends to be overestimated for the same reasons as the above-mentioned Gross Capital Stock of Private Enterprises statistics, and consequently the utilization ratio may tend to be underestimated.

[6] Labor force participation rate = Labor force / Population aged 15 or over; Employment rate = Number of workers / Labor force.

[7] Earlier estimates simply focused on the ratio of workers to the population aged 15 or over (the labor force participation rate × the employment rate) without separating out the labor force participation rate and the employment rate, and divided workers into just two age segments of under 65 years of age and over 65. This rough

division had seemed to have been sufficient to identify simple linear trends in each group, but a more detailed estimation is now required given the subsequent structural changes.

[8] Labor demand declines and unemployment emerges during economic downturns, but this is not the only cause of unemployment. For example, unemployment emerges from a mismatch when there is a noticeable difference between the conditions offered by employers and those desired by job seekers. Moreover, because actual hiring and job-seeking activities take some time, there are always some individuals who remain unemployed while they are in transition from one job to another (frictional unemployment). Such mismatch and frictional unemployment may be considered as structural unemployment in the sense that it remains even when economic conditions improve.

[9] Specifically, we first sought the slope expressing the tradeoff between the two from data during periods when the unemployment rate and the vacancy rate show a relatively clear negative correlation (1990 Q1 - 1993 Q4). We then drew a straight line with that same slope from each plot point on the scatter diagram, and adopted the unemployment rate where that intersects with a 45 degree line as the structural unemployment rate at each point in time.

[10] While the potential labor force participation rate was estimated separately for men and women, we estimated a single structural unemployment rate for both genders due to the limitations of the vacancy rate data.

[11] In our previous estimation, we did not take this into consideration. Admittedly, the changes in the ratio of part-time workers are also influenced by business cycle factors. For example, the great increase in the ratio of part-time workers at the beginning of the present recovery phase was caused in part by enterprise efforts to reduce personnel costs amid the after-effects of the recession. So this leaves some possibility that our estimate may overstress structural factors in the ratio of part-time workers.

[12] Due to data limitations, however, our estimates for the years prior to 1994 do not separate full-time workers and part-time workers.

[13] Because the maximum regular working hours per week have been reduced in stages as a result of revisions to the Labor Standards Law from 48 to 46 hours (April 1988), 46 to 44 hours (April 1991), and 44 to 40 hours (April 1994), regular working hours were on a declining trend from 1988 through 1994. However, grace periods were provided, mostly for smaller workplaces, for implementing these revisions. Because those grace periods expired at the end of March 1997, a second small declining trend can be seen from 1997 to 1999.

[14] See Equation (4) above. Specifically, we adopted 65% , which is the average value from 1975 through 2005, as the value of labor's share α. The definition of labor's share is as follows: Compensation of employees / (Compensation of employees + Operating surplus + Consumption of fixed capital – Household sector operating surplus).

[15] As noted above, however, this rise in the ratio of part-time workers cannot be attributed to structural factors alone. For example in 2002-2003, when cyclical factors are also believed to have had their own influence, our results may have overestimated the output gap and underestimated the potential growth rate presented below.

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