The Deflationary Gap in Japan, 1970–2000: A Quantitative Measurement

1. Orthodox Concept versus "False" Concept of Deflationary Gap

In Japan, from 1970 to 2000, the fixed capital stock of private enterprises (EPAJ's data, all sectors) expanded by 8.1 times in real terms and the number of unemployed persons increased by 5.4 times, while the real GDP increased by merely 2.6 times, industrial production came to a halt as indicated by the mere 2.2 times' increase, during the same period. [1] Seeing these simple statistics, the recent deflationary gap (or GDP gap) in the economy of Japan is undoubtedly very large. However, if we inappropriately give a definition to the concept of 'deflationary gap' as the temporal downward deviation of real GDP from its average trend line, the size of such a 'deflationary gap' would appear to be rather small. Unfortunately, the *White Paper* series of EPAJ (Economic Planning Agency of Japanese Government) in the 1990s depends on the questionable concept of 'deflationary gap' (or GDP gap), so that its estimated values of the gap were very small, only a few % for every year, during the later half of 1990s, and then its analyses have been very misleading.[2] For the estimation of the average trend line, EPAJ uses the production function. It seems, it would be too pedantic. A mere free-hand drawing would be enough and it could yield similar estimated results. Any way, properly saying from the standpoint of common sense of economics, such a very small-size deflationary-gap would mean extremely heated situations of boom, while the actual state of things of Japan in 1990s was a worst slump. From the beginning of 2001, EPAJ has been incorporated to Cabinet Office of Government. Though the estimating method of 'deflationary gap' (or 'GDP gap') has been changed a little, however, in so far as the first new *White Paper* edited by the Cabinet Office (published in Dec. 2001) is concerned, the computed results and its shortcomings are almost same to the former calculations by EPAJ (see Supplement below).

As shown in Graphs 1, 2, 3 and 4 below, the computed results of statistical-quantitative measurement by the our study clearly indicate that, since the 1st half of the 1970s to the present time, in the Japanese economy, such an average trend line of actual real GDP as cited above itself has been deviating below from the potential 'full-employment and full-utilization ceiling' of productive capacity by a large margin. There has been a long-lasting tendency of ever-diverging difference between both real-term trends of actual GDP and potential full-capacity GDP. It should be regarded that the divergence is the deflationary gap in a widely accepted orthodox sense. [3]

2. Unreliable Data Compilation in EPAJ's *White Paper*

For the EPAJ's estimate of production function cited above, the data for capital inputs rely upon the index of capacity utilization of fixed capital stock in the manufacturing industry calculated by MITI (Ministry of International Trade and Industry). Namely, the index of enterprises' real fixed capital stock estimated by EPAJ has been multiplied by the MITI's index of capacity utilization.

. However, it should be noted that the reliability of the MITI's index is very questionable.[4] The index has been computed from only 150 sample items of rather old-type traditional commodities of mostly mature and stagnant industries (in case of '1985 base' index), so that it is not sensitive to trade cycle and economic changes. It appears that the MITI's index always tends to underestimate the magnitude of not only fluctuations but also long-term changes on capacity utilization as a whole.[5]

Worse still, the EPAJ's estimation studies of production functions made no allowance for any changes in the capacity-utilization-ratios of capital inputs in any sectors other than the manufacturing industry.[6] In other words, EPAJ had always assumed the full-utilization of fixed capital stocks in all sectors other than manufacturing. It would be very unrealistic assumption. Consequently, the EPAJ's estimation procedure entails a strong upward bias in the trend of capital input data. If we base our estimates on the EPAJ's procedure of data compilation, we would get the computed results shown in Table 1.

As is well known, the Japanese performance in building up high-technology sectors of industry was quite remarkable during the 1970s and 80s and the consequent rate of technological progress was actually splendid. Nevertheless, the computed rates of productivity increase of aggregate inputs (i.e., the Solow's residual) shown in Table 1 are very low, i.e., 0.15 – 0.17% per annum, or virtually nil, during 1970–93. (The year,1993, was the final year for many important series of official real term indexes at 1985 prices; so that we must rely on some linked indexes, mostly linked with indexes at 1990 prices, for the period from 1993 to the present.)

As discussed in Section 6, when we tried to adjust the imputation of the incomes of the not-incorporated small private enterprises, the aggregation weights were altered to 0.42 for capital and 0.58 for labor, while the original weights derived from the official national income accounts (GDP accounts) for 1985 were 0.456 and 0.544. However, the consequent changes in the obtained results by the use of 'adjusted weights' are trivial as cited in the note to Table 1. In this case, the computed average rate of technological progress is 0.38% per annum during the period of 1970-93. Though the adjusted value of technological progress is slightly higher than original computation, it is still too small, i.e., only 1/10 of the actual growth rate of real GDP. The very small value would also be far from the reality.

In Japan, these two decades (1970s and 80s) were also an era of remarkable structural change in the manufacturing sector from capital intensive 'big plant industry' to knowledge intensive 'light-thin-short-small goods' industry. There were no necessary conditions for large increases in the 'required capital /output ratio'. Contrary to this, Table 1 shows a very large increase in 'required capital /output ratio'. Needless to say, the calculations cited in Table 1 are extremely unrealistic. These computed results surely have come from the above-stated upwardly biased data for capital inputs. Therefore, the estimation research by the author himself has had to work out in the present study without using the official 'index of capacity utilization'.

3. Conventional Estimating Methods for Production Functions and its Shortcomings

Probably the most common procedure for estimating the parameters of a production function, especially in the case of widely used Cobb-Douglas type function, would be come from multiple regression measurements by the method of least squares. However, it seems, the conventional method is subject to serious shortcomings due to some effects of multicollinearity.[7]

Fundamentally speaking, as widely shown in many text books for econometrics, a basic prerequisite for stochastic function estimated by conventional multiple regression method is that there must be no inter-correlations among regressors. In the estimating works for production functions by multiple regression procedures, in so far as we use time-series data, we should expect a very high multiple inter-correlations among three regressors, i.e., capital, labor and time-trend. In such cases, even in the case of a seemingly good fit in which the calculated value of R^2-coefficient is high and t-values for the estimated parameters are also acceptable, we cannot easily escape the consequences of multicollinearity, i.e., the estimated regression coefficients must be largely distorted and unreliable.

Basically speaking, the regression coefficients for labor and capital in a estimated Cobb-Douglas type production function, would be merely an indirect approximation to the relative proportions of earnings of both production factors. However, in case especially we use the data of time-series samples, the values of these coefficients are uncertain, and consistency of the regression coefficients with the relative proportions of each factor's earnings in national income accounts may be lost, because of the effects of multicollinearity. On several occasions, it would be responsible for intolerable distortions in the computed results of some important policy-simulation analyses. Therefore, when we can find out more reliable actual value of the relative proportions of factors' earnings from official national income accounts, this value should have priority of usage. The series of EPAJ's *White Pape*r in 1990s mostly ignores this principle of priority in its estimates of production functions.[8]

In this regards, it should be called to mind that the well-known studies by Edward Denison(1974), Abram Bergson(1963), Richard Moorsteen and Raymond Powell(1966) and others to measure increases in productivity of aggregated inputs without use of the methods of multiple regression estimates of production functions provide a means to avoid the shortcomings of stochastic production function approach.[9] After due consideration of the above-stated shortcomings, the author chooses to give up the idea of using the method of multiple regression estimates of a production function. Then, in the present study, the author has tried to contrive an alternative way for measurement of deflationary gap.

4. "Natural Rate of Unemployment" versus "Full Employment"

In this study, a way of doing of substitution with the some employment level corresponded to the 'natural rate of unemployment' in stead of 'full employment' is not adopted.

One reason for it is that, considering by the neo-classical way of thinking, any 'natural rate of unemployment' is always bound to be very closely resemble to actual rate of unemployment, as a basic theorem. Therefore, substituting with the employment level under the conditions of 'natural rate of unemployment' to the 'full employment' level means any deflationary gap would be negligible at all times. Or, if we assume some definite 'natural rate of unemployment' continuously has considerable differences from actual unemployment rates, in the middle or long run, as not shorter than several years, it is conceptually inconsistent with the basic theorem cited above.

Another reason is that, as minutely analyzed in a previous paper written by the author, the Lucasian 'aggregate supply function' (i.e., ASL/LAS) and related derivation of 'natural rate of unemployment' is based on a rigorous presumption of no–change in the rate of operation of enterprises' fixed capital stock and related no–shift (in real terms) of short term production function.[10] Of cause, such an assumption is extremely unrealistic and implausible for any actual policy making economics. Needless to say, the upward changes in the rate of operation of fixed capital stock would be took place due to some augmented demands, and it might induce some shifts of production function in real terms, bringing about increases in productivity and profits. As shown by the author in the previous paper, under the generalized conditions reckoned with the effects through such shifts of production function, Lucasian LAS is not vertical but rather flat and the value of 'natural rate of unemployment' turns into be flexibly changeable, corresponding to changes in total demand. In sum, in the actual world under the generalized conditions, Lucasian ASL/LAS and 'natural rate of unemployment' are become to be consistent with the most Keynesian policies.[11]

5. Estimating Procedure in the Present Study

The estimating procedure in this study is composed of five steps as follows:

〔Step 1〕<u>Computation of the aggregate 'full capacity inputs index', i.e., 'full employment & full utilization index' of labor force and enterprises' real fixed capital stock</u>**:**

Here, it is operationally assumed that the rate of employed labor force and average weekly hours worked per head of employed persons in 1970 are practically equivalent to the conceptual conditions of 'full employment'. Hence, it can be assumed that the rate of change in the full-employment level could be regarded as identical with the rate of change in the actual level of total labor force.

Of cause, we can alternatively use, for example, the rate of employed labor force and average weekly hours worked in 1990 as the conceptual conditions of full employment. To tell the truth, the author himself actually tried to work out such an alternative computation based on the '1990 standard'. However, the computed results are rather disappointing, because, for the every year up to 1990, the 'full employment labor force' by this alternative concept has been computed as lower than actual employment level. Needless to say, the concept of 'full employment' means the potential maximum of mobilize-able labor force. Therefore, the author had to consider that such an alternatively computed result with '1990 standard' might be quite implausible.

For capital inputs, it has been made use of the EPAJ index of enterprises' fixed capital stock in all sectors (in real terms at 1985 prices) as the indicator. The Economic Research Institute of EPAJ urged that the index of enterprises' real fixed capital stock (in terms of 'gross' concept subtracted with the acquisition cost of worn out and abandoned assets) should be regarded as a good indicator for the productive capability of capital plant.[12]

The aggregate 'full capacity inputs index' in real terms at 1985 prices (as particularly shown in Appendix Table 1 below) has been consistently computed by a weighted geometric mean formula with '1985 weights' as the relative proportions of earnings of both production factors (i.e., labor and capital) which have been derived from the official GDP accounts. The relative shares of factors' earnings were very stable during the period of 1975-95.[13] In Sections 6 and 7, the probable adjustments of the weights and its consequent results are discussed.

Any way in this our study, the computation procedure stated here does not rely to multiple regression method for estimation of production function, and so, it does not need to use MITI's operating ratio index.

〔Step 2〕<u>Experimental-exogenous setting of the δ ratio</u>:

The definition of δ, which is the ratio of the rate of technological progress to the rate of economic growth, is as follows:

$$\delta = \text{yearly rate of technological progress(\%)} \;/\; \text{yearly growth rate of real GDP (\%)} \quad .$$

Here, the meaning of 'technological progress' is not the ex-post value of 'Solow's residual' (inclusive of some effect from idle capacities) but the ex-ante pure concept (excluding the idle-capacity effect).[14] During the 'high-speed growth era' of the 1950s and 60s, the δ ratio in the Japanese economy was approximately 1/2.[15] However, it seems, the δ ratio was a somewhat smaller value in the 1970-2000 period.[16] For the simulation work in this study, four cases of the value for δ ratio have been experimentally assumed as 1/3, 1/3.5, 1/4 and 1/5.

〔Step 3〕Computation of the indexes of 'full capacity GDP' and 'required capital/output ratio':

According to the procedures Step1 and Step2, we can work out some series of yearly growth rates of 'full capacity GDP' (in real terms at 1985 prices) which could be produced by 'full employment and full utilization' of labor force and fixed capital stock, corresponding to each given δ ratio respectively, as

growth rate (%) of real 'full capacity GDP'
＝ growth rate (%) of aggregate 'full capacity input' / (1 - δ) .

Of course, the indexes of the level of 'full capacity GDP' can also be computed with ease as the link series of these growth rates (see Table 2 and Appendix Table 2). In the initial value adjustment for the indexes, it is operationally considered that a deflationary gap as low as 3% is practically equivalent to the economic situation of 'full employment and full utilization' of labor force and fixed capital stock.[17] At the same time, the indexes of 'required capital / output ratio' corresponding to each δ can be also computed.

〔Step 4〕Measurement of deflationary gap:

From comparisons of the calculated indexes of 'full capacity real GDP' with the index of 'actual level of real GDP' (at 1985 prices), we can easily identify the sizes of the annual deflationary gap in the Japanese economy (see Tables 2(A), 2(B), Appendix Table 2 and Graphs 1, 2, 3 and 4).

6. Computation by Adjusted Weights

In the official national income accounts, the income of private not-incorporated small businesses are counted as one portion of the 'enterprises income', that is mostly classified as the 'operating surplus' of businesses. In other words, it has been officially treated just as that the employees' compensations are not included in it. However, there may be some possibilities that it is better to impute a part of such income of not-incorporated private small businesses to the 'compensations of employees'.

Based on such thinking, in this study, I have tried to adjust the weights for aggregation of factors' inputs and to do computations by it. . The derived 'adjusted weights' are 0.58 for labor and 0.42 for capital (the detailed procedure of derivation and sources for it is shown in Footnote 18).[18]

The results of computation by the use of the 'adjusted weights' are summarized for 1995 and 200 in Table 2(A) (line (b)). As cited in the table, though the values of deflationary gap computed by 'adjusted weights' are slightly smaller than the results of the original computation (as shown on line (b) of Table 2(A), we must consider that the deflationary gap in recent Japan would be around 30-45% of the potential full-capacity GDP, in case we stand on the ground of the adjusted computation. Of course, it is also big. The long term trend of the deflationary gap, 1970–2000, computed by the use of the 'adjusted weights' is shown in Appendix Table 2 and Graph 2.

7. Computations based on GDP at Factor Cost

All the aforementioned measurements of deflationary-gap have been based on real GDP account at market prices (i.e., at '1985 constant market prices'). An important alternative would be another set of similar computations for real GDP at factor cost. In the present study, the alternative computations also have been worked out

In the first instance for it, a series of real GDP at factor cost was derived through subtractions of indirect tax net of subsidies in real terms from the series of real GDP at market prices.[19] Then, aggregation weights for inputs of factors of production, labor and capital, have been calculated from the GDP account at factor cost for 1985: i.e., 0.58 for labor and 0.42 for capital.[20]

In case the adjustments for imputation of the incomes of small not-incorporated private enterprises applied to the factor cost GDP, the derived adjusted weights are 0.62 for labor and 0.38 for capital.[21]

The calculated results of deflationary–gap and increases in required capital／output ratio based on the factor cost GDP for 1995 and 2000 are shown in the Table 2(B). The computed values of deflationary gap are 26.1－41.1% for 1995 and 31.3-46.5% when the original weights were used, and 19.8－35.2% for 1995 and 24.8- 40.5% for 2000 in case the adjusted weights are applied. However, if we assume the probable limitation to changes in required capital／output ratio might be around 1.7–1.8 times increase from 1970 to1995 as discussed below, the realistically meaningful values of deflationary–gap would be 31.5-41.1% for 1995 and 36.8-46.5% for 2000 in the case with 'original weights' and about 35 % for 1995 and 40% for 2000 in the case with 'adjusted weights'. Of cause, these computed values of deflationary-gap based on factor cost GDP are also not so small.

8. Computed Results

The computed results of deflationary gap in Japan for 1995 and 2000 by the above-stated estimating procedure are summarized in Table 2(A) and Table 2(B). And its long term trends from 1970 to 2000 are shown in Appendix Table 2 〔1〕～〔4〕and Graphs 1～4 cited below.

Here, it should be noted that, in the cases where the value of δ is rather high (e.g. 1/3 or 1/3.5), the increases in the 'required capital／output ratio' are relatively small. However, in cases where the value of δ is rather low (e.g. 1/4 or 1/5), the 'required capital ／output ratio' shows relatively large increases. In sum, larger increase in 'required capital／output ratio' entails smaller rate of technological progress.

As cited above, during the two decades of the 1970s and 80s, technological progress in high-tech sectors of Japanese industry was obviously excellent as a historical fact. At the same time, in Japan, these decades (i.e., 1970s and 1980s) were also an era of remarkable structural changes in the manufacturing branch for shifting from capital intensive 'big plant industry' to knowledge intensive 'light-thin-short--small-goods' industry. In so far as any effects of idle capacity arising from insufficient total demand were conceptually excluded, there were no definite reasons for large increases in 'required capital / output ratio' for the manufacturing industry of Japan in those days. As calculated in Table 1, in case we strictly follow to the

EPAJ's data compiling, a very large increase in the 'required capital ⁄output ratio' as 2.3 times during 1970–93 entails extremely small rate of technological progress as 0.15 % per annum, that is virtually nil. Seeing carefully the computed results in Table 1, we must recognize that the calculated rate of increases in 'required capital⁄output ratio' larger than 2 times during the period from 1970 to the first half of 1990s would be too unrealistic and implausible. It seems, the plausible limit to the increases in 'required capital⁄output ratio' would be around 1.7–1.8 times for the same period. Therefore, a value such as $\delta = 1/5$ would be an underestimate of the economic efficiency of Japan. Even a value of $\delta = 1/4$ would still tend to underestimate Japan's economic performance. In the light of the computed results, cited in Table 2 (A) and Table 2(B), we must conclude that the deflationary gap in Japanese economy in the middle of 1990s would amount to around 30–45% of the potential full–capacity GDP. The gap values for 2000 would be 40–50% as cited in Tables 2 (A) and 2(B). It is quite large.

9. A Replying Comment to the Criticism by Professor Sato

However, Kazuo Sato criticized the calculations of this study presented in the author's previous paper as the experimental-exogenous setting of the values of δ ratio for simulation work entails some arbitrariness.[22] Here, in this regards, as a replying comment to Sato, the author has to stress that, we must carefully watch two check points for any estimating study of deflationary-gap. The one is the computed rate of increase in required capital⁄output ratio which is exclusive of idle-capacity effect. The other check point is the value of the implied rate of technological progress, namely the 'Solow's residual' as an ex-ante pure concept excluding ex-post idle-capacity effect. Needless to say, values of δ ratio are nothing but the good synthetic indicator for the rate of technological progress. As described fully in this paper above and in previous paper written by the author too, in every case we get the computed results of rather smaller sized deflationary-gap as below than around 25% as for recent Japanese economy, the rate of technological progress and the rate of increases in required capital/output ratio could not be plausible values. In this study, the author has very carefully watched the two check points and has been obliged to consider that, for the period from 1970 to 1995 in Japan, the permissible limit of the calculated rates of increases in required capital/output ratio would be about 1.7–1.8 times as cited above. It means that the value of δ ratio as 1/5 would be inappropriate due to some underestimations of technological progress, in case the calculations by 'original weights' for real GDP at market prices . In the same meaning, as shown in Table 2 (A), the values of δ ratio as 1/5 and 1/4 would be implausible for the computations by 'adjusted weights' for real GDP at market prices. As for the computations based on factor cost GDP, with similar considerations, the values of δ as 1/5 and 1/4 should be treated as inappropriate, in case of using 'original weights'. Similarly, values of δ ratio as 1/5, 1/4 and 1/3.5 could not be permissible for calculations based on factor cost GDP by 'adjusted weights' (see Table 2(B)). It must be afraid that the estimated results of deflationary gap for recent Japan computed by many economists other than the author himself could not clear to do pass the very important two check-points cited here.

10. On the Okun's Law

As widely known, the empirical finding by Arthur Okun about US economy was that e.g.1% decrease in the rate of unemployment (i.e., 1% increase in the rate of employment), bringing on some increases in participation ratio and average hours per head of employed persons, would result in around 2% growth of total labor inputs in terms of total annual worked hours. Then, such 2% increase in total labor inputs would bear 1% rise of labor productivity. So, ultimately, it would bring forth 3% growth in GDP.[23]

That is to say, when we denote the ratio of 'rate of increase in labor productivity (%)/ growth rate of real GDP (%)' as symbol θ , Okun's finding can be summarized as

$$\text{rate of real GDP growth (\%)} = \text{rate of increase of total labor inputs (\%)} / (1-\theta) \ .$$

As cited above, according Okun's study, the value of θ in US economy in 1960s was around 1/3. However, in the economy of Japan during 1980s and 1990s, the θ ratio has had rather higher values as 0.75 for 1980 $\rightarrow$ 1990 and 0.83 for 1980 $\rightarrow$ 1995.[24]

The ratios of 'full-employment total labor inputs/actual total labor inputs' (in terms of total worked hours) in Japan are 1.0653 for 1990 and 1.1331 for 1995.[25] Hence, the probable increases (%) of real GDP, when full employment has been achieved, could be calculated as 26.1% (= 6.53 $\div$ (1 – 0.75)) for 1990 and 78.3% (=13.31 $\div$ (1 – 0.83)) for 1995.

This calculation, too, is an approach to the estimation of deflationary gap through another way by the use of 'Okun's law': namely the calculated deflationary gap is 20.7% (= 1－(1÷1.261)〕×100) for 1990 and 43.9% (=〔1－(1÷1.783)〕×100) for 1995. It seems, the computed values of 'deflationary gap' are also rather big, despite the calculation dose not include the effects of induced increases of 'participation ratio'.

Though Okun's such method is mere empirical rough approach, the calculation shown above suggests that the sizes of recent deflationary gap in Japan cited in Tables 2(A) and 2(B) computed by the author in this study would be not overestimate but rather plausible.

If we substitute some employment level corresponding to any 'natural rate of unemployment' instead of the full employment, the calculation by the Okun's method would result in somewhat smaller size value of deflationary gap than above.[26] However, as particularly argued in Section 4 above, the author cannot approve to do such procedure.

11. Conclusion

The theoretical framework in the study is quite clear and widely acceptable. All the computations in the study relied upon the standard database of the official statistics of Japan. Any artificial alteration or modification to the official statistical data was avoided except for the derivations of the 'adjusted weights' in Section 6 and of the GDP account at factor cost in Section 7. Of course, some kind of upward or downward biases may be more or less involved in these official statistical data. However, the wide range of the exogenously assumed values of δ for simulation may be able to make up for the large portion of the distorted effects of such biases.

In either of the computations by the use of 'original weights' or 'adjusted weights', as shown in Tables 2(A), 2(B), Graphs 1～4, and Appendix Tables 2〔1〕～〔4〕we see that the deflationary gap in the recent Japan is very large. In view of the aforementioned considerations, it seems, there would be little doubt about it.

Finally, as have been aforementioned in the author's previous paper, the very important two findings in this study should be noted here again.[27]

1. As indicated in Graphs 1～4, even in 1990, the peak year of the 'bubble' period, the deflationary gap in Japanese economy did not diminish out. Its reason would be rather easily

conceivable because the average yearly growth rate of real GDP during the 'bubble' period (three years from 1988 to 1990) was 5.2 %, while the average rate of real GDP growth in the period of 1973-87(fourteen years from 1974-87) was 3.6% per annum.[28] As is widely known, 1973 was the final year of the high-speed growth era in Japan. The growth rate of 3.6% per annum during 1973–87 was about 1/3 of the average yearly growth rate in the 1950s or 1960s. Owing to the drastic decline in the growth rate, we have to be obliged to consider, a large deflationary gap was appeared during the 1970s and 80s. In the 'bubble' period, the expansion in total effective demand for currently produced goods and services was not so large despite various speculative activities, so that the increase in the growth rate of real GDP was mere 1.6 % per annum (5.2–3.6 =1.6). And that it continued for only three years. Therefore, the deflationary gap did not diminish even in the 'bubble' period.

2. As shown in Graphs 1～4, the successive breeding of deflationary gap in the Japanese economy was not a cyclical phenomenon but a long-term cumulative trend. On the 'supply side' of the recent Japanese economy, there are seemingly no serious barriers to the economic growth, because the potential GDP in real terms is much larger than the actual real GDP. Therefore, the cumulative tendency of deflationary gap has come from the 'demand side', i.e., from the long continuing stagnant trend of total demand. On the basis of the computed results of this study, it should be estimated that, since the first half of 1970s to 2000, the loss of lost potential real GDP in Japan resulting from the cumulated deflationary gap would approximately be 4000 trillion yen (at 1990 constant prices; in the case of calculation with 'original weights' and simulation by $\delta = 3.5$). It is quite huge value. In current day Japan, some policy to sharply bend up the long lasting trend of stagnant total demand is urgently needed.

Supplement:

A Critical Comment on the Computations by Cabinet Office of Government

As mentioned above in Section 1 of the text, EPAJ has been incorporated to the Cabinet Office of Government since 2001. Then, some alterations were made to the method for estimation of 'deflationary gap' (or 'GDP gap').[29]

In the new method, the Cabinet Office has tried to compile and apply some capacity utilization index for other sectors than manufacturing industry. For the estimation of production function, the calculating procedure of multiple regression measurements was left off. Through the new system, the ‘deflationary gap’ has been calculated as the downward deviation of GDP from not the simple ‘average trend line’ but the ‘potential GDP level’. These changes might be some methodological improvements.

Unfortunately, however, the Cabinet Office has calculated the ‘potential GDP’ as extremely low level which is practically same to the simple average trend line. It seems, the implausible result would be attributable to four reasons as follows:

Ⅰ. The Cabinet Office’s calculation depends upon extensive use of capacity utilization index for fixed capital stocks. As cited above, Cabinet Office tried to compile new index of capacity utilization for non-manufacturing sectors. It would be understandable as an improvement. Even so, however, official MITI’s (or METI’s) index of capacity utilization for manufacturing industry, any way, has serious shortcomings as discussed in Section 2 of the text. Because of insufficient sensibility of the MITI’s (or METI’s) index of capacity utilization to recession or slump, any extensive use of it by Cabinet Office would inevitably breeds some underestimates of idle-potential capacities in depression days.

Ⅱ. In the Cabinet Office’s calculation, the potential level of capacity-utilization for fixed capital stock has been decided through some empirically estimated function for the capacity utilization index with definite value of ‘DI index’ (which is compiled by Bank of Japan) as the regressor.[30] However, during the past decade, all values of the ‘DI index’, even its peak values, were always corresponded to very low growth rate of GDP. This fact might also surely be very important cause for underestimation of the size of idle-potential capacities.

Ⅲ. For the calculation of aggregate inputs, the Cabinet Office has applied the value, 0.33, as the weight for capital input. The weight value is extremely small and inconsistent with the GDP account’s data at market prices.[31] As stated above in the Section 4 and footnote to Table 1 in this paper, the ‘1985 weight’ for capital input derived from the official GDP account at market prices as 0.456 (original weight) or 0.42 (adjust weight). The relative share of capital’s earnings occupied in GDP at market prices has been very stable during past three decades since 1970s (see Footnote 13). It seems, the weight, 0.33, which is used by Cabinet Office is derived from some transformed GDP account at factor cost. However, Cabinet Office applied this weight to the production function for real GDP not at factor cost but at market prices. It would be a gravely inconsistent procedure.

Ⅳ. The Cabinet Office estimated the unemployed ratio (excluding frictional unemployment) in recent Japan as 0 % or as only a little less than 1%.[32] In other words, research staffs of the Cabinet Office have analyzed the economic conditions of Japan during 1990s and 2000-2001 as full employment situation. Of course, it would be extremely unrealistic thinking. Undoubtedly, such a mistake is due to some incorrect calculating formula. Cabinet Office uses a stochastic function estimated by multiple regression method, in order to calculate the sizes of total and frictional unemployment. For the function, 'vacancy rate' of jobs in labor market is treated as main regressor and the estimated size of unemployment attributed to the regressor is regarded as 'frictional unemployment'. By the subtraction of it from the estimated total unemployment, as the residual, the size of deflationary unemployment is computed. However, needless to say, such 'vacancy rate' is an indicator not only for frictional miss much in labor market but also very important indicator for macro deflationary–inflationary situations. Therefore, by the use of such a calculating method, the computed volumes of 'frictional unemployment' would be largely exaggerated and 'non–frictional–deflationary unemployment' inevitably underestimated extremely.

Footnote:

1) For the official governmental statistics of enterprises' fixed capital stock and real GDP index, see Appendix Table 1 and footnote to Table 2(A) and Table 2(B) below. For the unemployment data and index of industrial production, see Cabinet Office (2001, p. 267 and p. 264).

2) See, for instance, EPAJ(1994, pp. 145-147), EPAJ (1998, pp. 146-147 and pp.429-430) and also see EPAJ(2000, pp.250–252 and pp.380–381). In the case of recent US economic performance, it is also possible that the policy makers tend to underestimate the potential GDP of US, as analyzed in the paper by Klein and Kumasaka (1995, pp.3-19). However, even in the comparison with it, it seems that the baneful influence of faulty methodology by EPAJ is extremely serious in its official estimates of Japanese potential GDP. See a comment by Noguchi in Harada & Iwata (ed.) (2002, pp.

21-25).In this regard, a critical comment by Yoshikawa on the Lucas's work (1987) is very suggestive. See Yoshikawa (1998, pp.7-9). See also Fair (1989, pp.104-105).

3) As for the widely accepted truthful concept of 'deflationary gap' ('GDP gap' or 'GNP gap'), for example, see the famous textbook of macroeconomics by R. Dornbusch and S. Fischer (1978), Chapter 1. And see also the author's previous works, Niwa (1995, pp.65-102) and Niwa & Special Committee of SCJ (1996, pp.37-58). See especially Niwa (2000, pp.245–258) and Niwa (1999, pp. 313-344).

4) See Niwa (1995, op. cit., footnote 1, p. 68).

5) The value of the MITI's capacity utilization index for 1993, compared with the level in 1970, was 0.82 (1970=1.0). See EPAJ(1993), Handbook of Economic Statistics, 1993, p. 17, and EPAJ(1993FY), Japanese Economic Indicators Quarterly, No.4, April 1994, p.52. During the same period of 1970–93, the actual increase in manufacturing production in Japan was twofold. Therefore, it seems we ought to consider that the level of productive capacity in Japanese manufacturing industry should be increased by about 2.4 times (= 2 times÷0.82) from 1970 to 1993. (The year, 1993, was the final year for many important series of official real term indexes at '1985 prices'.) However, according to the estimate by the EPAJ, the increase in real fixed capital stock in manufacturing enterprises was fivefold during the same period (see back number series of EPAJ, National Economic Accounts Quarterly, and see also Niwa (1995, p.89)). The discrepancy between the two values (2.4 times vs. 5 times) is quite large, though we must consider the possibility of increases in the required capital/output ratio. The EPAJ has ignored this inconsistency.

6) See EPAJ (1994, op. cit., pp. 145-146 and annotation 1-16, pp. 451-452).

7) Cf. L. R. Klein (1968, p. 101).

8) See also EPAJ (1994, op. cit., annotation 1-16, pp. 451-452).

9) See Denison (1974), Bergson (1963, pp. 1-37), and Moorsteen & and Powell (1966, pp. 245-273).

10) Niwa (2001, pp. 42-50).

11) See Niwa (2001, op. cit., pp. 47-50).

12) The Economic Research Institute of EPAJ emphasized that the series of statistics of the enterprises' fixed capital stock compiled by EPAJ would be a very good reliable indicator for the productive capability of capital plant. See Economic research Institute of EPAJ (1993), *National Economic Accounts Quarterly*, No. 96, March, pp. 170-172.

13) The relative shares of earnings of both production factors can be derived from the official GDP accounts as follows (at current prices).

Year	Labor	Capital
1975	0.550	0.450
1980	0.542	0.458
1985	0.544	0.456
1990	0.548	0.452
1995	0.569	0.431

See EPAJ (1989, p. 80 and p.139), EPAJ (1995, PP.80-81 and 138-141). See also EPAJ (1997, pp. 67 and 112-113).

14) Cf. Solow (1957, pp. 312-320).

15) See EPAJ (1967, pp.68-69). See also Kashiwagi and Sekiguchi (1999, pp. 62-75).

16) See Kashiwagi and Sekiguchi (1999, pp. 62-75). However, it should be noted that in this work by Kashiwagi and Sekiguchi did not calculate the rate of technological progress as a pure ex-ante concept (excluding the idle-capacity effect) .

17) In the computing procedure for the ‘full capacity GDP (or GNP) index’, we must check whether the initial value (i.e., value for 1970) of the index is appropriate for the assumed economic situation of ‘full employment & full utilization’. Of course, in 1970 Japan surely enjoyed high-speed economic growth. Even so, in 1970, according to the *White Paper, 1972*, (Japanese edition), EPAJ(1972), p. 282, the deflationary gap for the manufacturing industry of Japan (not using the inappropriate concept) was cited as 9.47%. In other words, the operating-ratio of manufacturing industry in 1970 was 0.9053.

The *White Paper, 1972* did not show any yearly value of the deflationary gap or operating ratio in 1970 for all sectors of the national economy, as a whole. However, the EPAJ(1973), *White Paper, 1973*, p. 301 provided a set of quarterly data series of the deflationary gap (the orthodox concept) for both the manufacturing industry and all economic sectors as a whole in the period, 1962–72. Using the data series, we can estimate a regression equation as cited below:

$$Y = 0.5001 + 0.49165 \cdot X$$

$$(14.851) \quad (13.443) \qquad R = 0.8983, \quad DW = 1.2943 ,$$

where Y is the operating ratio in all economic sectors as a whole, while X is the operating ratio in manufacturing industry. Substituting 0.9053, the yearly value for 1970, for X in this equation, we can compute the yearly value of Y for 1970 as 0.9452. In other words, the yearly value of the deflationary gap for all economic sectors as a whole in 1970 is estimated as 5.48% . It would be not quite up to the situation of ‘full employment & full utilization’.

In this study, as stated in the text, I assumed that a deflationary gap as low as 3%, i.e., 0.97 as the operating ratio, would be virtually equivalent to the situation of ‘full employment & full utilization’. Therefore, the author has fixed 102.62 (= 100×1.0262) as the initial value (for 1970) of the index number (actual value in 1970 = 100) of ‘full capacity GDP (or GNP)’, because 0.97 ÷ 0.9452 = 1.0262 .

18) In the official national income accounts for 1985, the income (other than imputed rent) of not-incorporated private enterprises is 22.73 trillion yen. The ratio of employees' compensations excluding public sectors to GNP (exclusive of public sectors and private not-incorporated enterprises) is 0.549. Therefore, it is plausible to impute 12.48 (=22.73×0.549) trillion yen to the earnings of labor. Adding the 12.48 to 173.89, which is the original official value of the employees' compensations in the national income accounts for 1985, we get 186.38 trillion yen. Hence, the official value of GNP for 1985 is 321.56 (while GDP is 320.42) trillion yen, the adjusted weight for labor is 0.58 (=186.38÷321.56) and for capital is 0.42. As for the source for the derivation of 'adjusted weights' stated here, see EPAJ (1991, pp. 81, 141, 180-181).

19) The series of real GDP at factor cost is derived from the official '68 SNA' GDP account as follows.

(Calendar year; trillion yen)

	1970	1985	1990	1993	1995	2000
① GDP at 1985 market prices	171.7	320.4	399.0	419.8		
② Indirect taxes at 1985 market prices*	10.3	21.3	28.7	30.4		
③ GDP at 1985 factor cost (①-②)	161.4	299.1	370.3	389.4		
④ GDP at 1990 market prices				452.3	461.9	487.0
⑤ Indirect taxes at 1990 market prices*				32.1	34.1	39.6
⑥ GDP at 1990 factor cost (④-⑤)				420.2	427.8	446.4
⑦ Linked index (1970 = 100)**	100.0	185.3	229.4	241.3	245.7	256.3

* ····· Net of subsidies. Values at current prices have been deflated by 'GDP deflator'.

** ····· The series of ③ has been liked with the series of ⑥ at 1993.

Sources: EPAJ and Cabinet Office of Government, *Annual Report on National Accounts, 1995, 2000 and 2002,* and the official announcement of '68 SNA' estimate for 2000 on the internet home page of Cabinet Office, posted on June 21, 2001.

20) Needless to say, for imputation reckoning to estimate the factor cost account of

GDP by end use, as a matter of fact, almost all the values of indirect taxes net of subsidies must be subtracted from ‘private final consumption expenditures’ at market prices. It means, in the total values of government expenditures there would be little changes through such imputation reckoning. Its implied corollary is that the subtracted values of indirect taxes net of subsidies should be treated as an imputed fictitious addition to direct taxes, e.g. income tax. After due consideration about it, the author has tried to derive the aggregation weight for labor inputs as the ratio of ‘actual value of the compensations for employee／value of GDP at factor cost’ in 1985. The value of employees’ compensation in i985 is 173.1 trillion yen (see EPAJ, *Annual Report on National Accounts, 1995*, p.140), and the 1985 value of GDP at factor cost is 299.1 trillion yen (as cited in Footnote 19 above).Therefore, the weight for labor inputs is 0.58 (= 173.8÷299.1).Then, the weight for capital inputs is 0.42.

21) The adjusted value of employees’ compensations inclusive of a part of the income of not-incorporated private enterprises in 1985 is estimated as 186.3 trillion yen as cited in Footnote 18 above. So, for the factor cost account, the adjusted weight for labor inputs is calculated as 0.62 (= 186.3 ÷ 299.1). The weight for capital is 0.38.

22) Sato (2001, pp. 24–25).

23) Okun (1973, pp. 211–213).

24) The trend of labor productivity can be derived as follows.

	1990	1995
①The number of employed persons (1980=100)	112.90	116.64
②Average weekly hours worked (1980=1.0)*	0.9807	0.9313
③Total hours worked (①×②) (1980=100)	110.72	108.63
④ Real GDP (1980=100)	149.61	160.73
⑤ Labor productivity (④÷③) (1980=1.0)	1.3512	1.4796
⑥Annual growth rate of labor productivity (%)	3.06	2.65

*…… per head of employed persons

Sources: For ① and ②, see Bureau of Statistics, *Monthly Statistics of Japan*, back number series. For ④ see footnote to Table 2.

25) Derivation of the ratios is as follows.

	1990	1995
①The actual number of employed persons (1970=100)	122.7	126.8
②Average weekly hours worked (1970=1.0)*	0.9481	0.9004
③Total actual hours worked (①×②) (1970=100)	116.3	114.2
④Total full employment worked hours (1970=100)	123.9	129.4
⑤Full employment/actual employment (④÷③)	1.0653	1.1331

*…… per head of employed persons

Sources: For ① and ②, see Bureau of Statistics, *Monthly Statistics of Japan*, back number series. For ④, see Appendix Table 1.

26) See Harada and Iwata (2002, pp.23-25), chapter 2, written by Noguchi. However, the usage of the word 'natural rate of unemployment' by Noguchi has somewhat definite meaning different from neo-classical Lucasian concept.

27) Niwa (2000, p.255).

28) See EPAJ (1995, pp. 118–121).

29) See Cabinet Office (2001, pp. 119–120 and 226–228).

30) See Cabinet Office (2001, op. cit., p. 227).

31) See Cabinet Office (2001, op. cit., pp.226–227).

32) See Cabinet Office (2001, op. cit., pp. 33–34).

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Table 1 Implausible Rate of Technological Progress Derived from EPAJ's White Paper Data

	1970 → 93	1980 → 93
(1) Aggregate Input (fixed capital stock & labor)	2.363 times (3.81% per annum)	1.541 times (3.38% per annum)
(2) Real GDP (at 1985 prices)	2.445 times (3.96% per annum)	1.574 times (3.55% per annum)
(3) Technological Progress (2) – (1) (Solow's residual)	(0.15% per annum)	(0.17% per annum)
(4) Capital / Output Ratio	2.310 times (3.71% per annum)	1.491 times (3.12% per annum)

Note: For the computation of aggregate inputs index (Line 1), the aggregation weight is 0.456 for real input index of enterprises' fixed capital stock (at 1985 prices) and 0.544 for labor input index (in terms of total hours worked). The weights are derived from the official national income (GDP) account for 1985 as the relative proportions of earnings for capital and labor. See EPAJ(1991, pp.80-81). The aggregate computation has been worked out by the use of a weighted geometric mean formula. For the detailed procedures of calculation and data sources for the table, see Haruki Niwa (1995, p.74). For official GDP index, see footnote to Appendix Table 2 〔1〕below.

In case we tried to adjust the imputation of the incomes of small not-incorporated private enterprises, the computed weight is 0.42 for capital and 0.58 for labor, as discussed in Section 6 in the text. When we use the adjusted weights, the computed increase in aggregate input is 2.245 times during the 1970-93 period or 3.579% growth per annum. The rate of technological progress (the Sollow's residual) is 0.38% per annum. The increase in capital/output ratio is 2.31 times during the same period.

Table 2 (A) Computation of Deflationary Gap in Japan, 1995 and 2000

(Based on real GDP accounts at 1985 market prices)

δ ↓	full capacity real GDP+	required capital/output ratio	(actual real GDP) ÷(full capacity real GDP)++	Deflationary-Gap (%)
	---(actual 1970 = 100)---			
	Computed 1995 level of			
1/3	(a) 455.1	146.1	(a) 0.549	(a) 45.1
	(b) 417.4	159.2	(b) 0.598	(b) 40.2
1/3.5	(a) 413.3	160.8	(a) 0.604	(a) 39.6
	(b) 381.1	174.4	(b) 0.655	(b) 34.5
1/4	(a) 387.5	171.5	(a) 0.644	(a) 35.6
	(b) 358.6	185.4	(b) 0.696	(b) 30.4
1/5	(a) 357.4	186.0	(a) 0.699	(a) 30.1
	(b) 332.3	200.0	(b) 0.751	(b) 24.9
	Computed 2000 level of			
1/3	(a) 528.0	153.8	(a) 0.498	(a) 50.2
	(b) 479.5	169.4	(b) 0.548	(b) 45.2
1/3.5	(a) 474.9	171.0	(a) 0.553	(a) 44.7
	(b) 433.8	187.3	(b) 0.606	(b) 39.4
1/4	(a) 442.3	183.7	(a) 0.594	(a) 40.6
	(b) 405.7	200.2	(b) 0.648	(b) 35.2
1/5	(a) 404.7	200.7	(a) 0.649	(a) 35.1
	(b) 373.1	217.7	(b) 0.704	(b) 29.6

(a) By the use of 'original weights'. (b) By the use of 'adjusted weights'.

\+ With allowance for the minimum deflationary-gap (i.e., 3%). See footnote 17 in the text.

++ The value of index number for actual 1995 GDP is 249.7 and for actual 2000 GDP is 262.8 (1970 = 100). See note to Appendix Table 2〔1〕.

Table 2 (B) Computation of Deflationary Gap in Japan, 1995 and 2000

(Based on real GDP accounts at 1985 factor cost)

δ ↓	full capacity real GDP[+]	required capital/output ratio	(actual real GDP) ÷(full capacity real GDP)[++]	Deflationary-Gap (%)
	---(actual 1970 = 100)---			
	Computed 1995 level of			
1/3	(a) 417.4 (b) 379.1	159.2 175.3	(a) 0.589 (b) 0.648	(a) 41.1 (b) 35.2
1/3.5	(a) 381.1 (b) 348.2	174.4 190.9	(a) 0.645 (b) 0.706	(a) 35.5 (b) 29.4
1/4	(a) 358.6 (b) 329.0	185.3 202.0	(a) 0.685 (b) 0.747	(a) 31.5 (b) 25.3
1/5	(a) 332.3 (b) 306.4	200.0 216.9	(a) 0.739 (b) 0.802	(a) 26.1 (b) 19.8
	Computed 2000 level of			
1/3	(a) 479.5 (b) 430.7	169.5 188.7	(a) 0.535 (b) 0.595	(a) 46.5 (b) 40.5
1/3.5	(a) 433.8 (b) 392.3	187.3 207.1	(a) 0.591 (b) 0.653	(a) 40.9 (b) 34.7
1/4	(a) 405.7 (b) 368.6	200.2 220.4	(a) 0.632 (b) 0.695	(a) 36.8 (b) 30.5
1/5	(a) 373.1 (b) 340.9	217.8 238.3	(a) 0.687 (b) 0.752	(a) 31.3 (b) 24.8

(b) By the use of 'original weights'. (b) By the use of 'adjusted weights'.

\+ With allowance for the minimum deflationary-gap (i.e., 3%). See footnote 17 in the text.

++ The value of index number for actual factor cost GDP in 1995 is 245.7 and for actual factor cost GDP in 2000 is 256.3 (1970 = 100). See footnote 19 in the text.

Appendix Table 1 Aggregate 'Full-Employment & Full-Utilization Index' of Labor Force and Enterprises' Fixed Capital Stock, 1970-2000

Year	(1) Full-employment level of labor force# (Actual employment level in 1985 = 100)	(2) Real fixed capital stock of enterprises in all sectors## (at the beginning of each year) (1985 = 100)	Aggregate 'full-employment & full-utilization index' (3) Weighted geometric mean of (1) and (2) (based on market prices account)###		(4) The same series as (3) (based on factor cost account)####	
			(a) Original	(b) Adjusted	(c) Original	(d) Adjusted
1970	90.49	29.71	54.45	56.68	56.68	59.26
1971	91.06	34.56	58.54	60.62	60.62	63.01
1972	91.29	39.17	62.07	63.99	63.99	66.19
1973	93.50	43.96	66.28	68.10	68.10	70.19
1974	93.23	48.86	69.44	71.07	71.07	72.93
1975	93.46	53.47	72.45	73.92	73.92	75.59
1976	94.44	57.86	75.53	76.87	76.87	78.40
1977	95.73	61.78	78.40	79.65	79.65	81.05
1978	97.13	65.71	81.28	82.43	82.43	83.73
1979	98.26	69.50	83.90	84.96	84.96	86.14
1980	99.20	74.17	86.89	87.80	87.80	88.83
1981	100.21	79.21	90.02	90.78	90.78	91.64
1982	101.38	84.42	93.26	93.87	93.87	94.56
1983	103.39	89.43	96.77	97.28	97.28	97.84
1984	104.07	94.37	99.53	99.88	99.88	100.27
1985	104.70	100.00	102.53	102.70	102.70	102.89
1986	105.69	111.57	108.33	108.12	108.12	107.89
1987	106.82	118.78	112.11	111.69	111.69	111.21
1988	108.27	127.71	116.74	116.05	116.05	115.28
1989	110.09	135.34	120.96	120.06	120.06	119.08
1990	112.10	145.29	126.17	125.00	125.00	123.71
1991	114.22	156.88	132.00	130.50	130.50	128.86
1992	115.50	171.40	138.27	136.32	136.32	134.19
1993	116.14	182.16	142.60	140.31	140.31	137.80
1994	116.68	190.18	145.79	143.25	143.25	140.48
1995	117.05	197.44	148.56	145.79	145.79	142.78
1996	117.83	205.06	151.70	148.70	148.70	145.44
1997	119.18	214.43	155.78	152.52	152.52	148.98
1998	119.28	225.05	159.33	155.73	155.73	151.82
1999	119.04	233.95	161.99	158.10	158.10	153.88
2000	118.79	241.34	164.12	159.98	159.98	155.51

As cited in the text, in the present study, it is operationally assumed that the rate of employed labor force and average hours worked per head of employed persons in 1970 are virtually equivalent to the conceptual conditions of 'full employment'. Therefore, it can be assumed that the index number of full-employment level could be regarded as identical with the index number of actual total labor force (1985 = 100) multiplied by 1.047 (in consequence, the value of the index number for

1985 is 104.7 as cited in the table). Of course, the index of total labor force can be easily derived from the official statistics published by the Statistics Bureau of the Government of Japan. Here, the coefficient, 1.047, shows the difference of 'rate of employed' (adjusted for changes in hours worked) in 1970 compared with the corresponding rate in 1985. The derivation of the coefficient is as follows. That is, the comparative 'rates of employed' in 1970 and 1985 unadjusted for hours worked are shown below.

	Total labor force	Employed	Rate of employed
	— (Millions of persons) —		
1970	51.536	50.939	0.9884
1985	59.634	58.070	0.9738

The average weekly worked hours per head of employed persons were 48.2 in 1970 and 46.7 in 1985. Consequently, the coefficient should be computed as

$$(0.9884 \div 0.9738) \times (48.2 \div 46.7) = 1.047 .$$

The computations relied on the database, NEEDS, provided by Nihon Keizai Shinbun Sha. See also Bureau of Statistics, Office of the Prime Minister (1974, Oct. pp. 7–10, & 1989, Jan.pp.15 –19).

This is a linked index. The series of enterprises' fixed capital stock in real terms at 1985 prices (inclusive of construction work in progress) compiled by the Economic Research Institute of EPAJ for 1970–93 has been linked with the similar series for 1993–2000 in real terns at 1990 prices. See the back number series of EPAJ, *Japanese Economic Indicators Quarterly* and Economic Research Institute, EPAJ, *National Economic Accounts Quarterly*.

(a) 'Original weight' for labor (column (1)) is 0.544 and weight for capital (column (2)) is 0.456. The weights are derived from the official GDP account for 1985(68 SNA) as the relative proportions of earnings for labor and capital. See EPAJ(1991, pp. 80 – 81).

(b) 'Adjusted weight' for labor is 0.58 and for capital is 0.42. See Section 6 in the text.

(c) 'Original weight' for labor (column (1)) is o.58 and weight for capital (column (2)) is 0.42. See footnote 20 in the text. The computed results of (c) is same to (b) due to same weights.

(d) 'Adjusted weight' for labor is 0.62 and for capital is 0.38. See footnote 21 in the text.

Appendix Table 2 〔1〕 Results of Simulation

(Actual 1970 = 100)

δ = 1 / 3		1970	1980	1985	1990	1993	1995	1997	2000
(1) Actual real GDP	mp	100	155.4	186.7	232.5	244.5	249.7*	266.5*	262.8*
	fc	100	155.6	185.4	229.5	241.3	245.7#	262.2#	256.3#
(2) Full capacity real GDP	(a)mp	102.6	205.1	262.4	357.0	428.1	455.1	488.5	528.0
	(b)mp	102.6	196.4	248.0	332.0	394.2	417.4	446.4	479.5
	(a)fc	102.6	196.4	248.0	332.0	394.2	417.4	446.4	479.5
	(b)fc	102.6	187.1	232.9	306.2	359.5	379.1	403.9	430.7
(3) (1) ÷ (2)	(a)mp	0.974§	0.758	0.712	0.651	0.571	0.549	0.546	0.498
	(b)mp	0.974§	0.791	0.753	0.700	0.620	0.598	0.597	0.548
	(a)fc	0.974§	0.792	0.748	0.691	0.612	0.589	0.587	0.535
	(b)fc	0.974§	0.832	0.796	0.749	0.671	0.648	0.649	0.595
(4) Required capital/output ratio for (2)									
	(a)mp	97.4	121.7	128.3	137.0	143.2	146.1	147.7	153.8
	(b)mp	97.4	127.2	135.8	147.3	155.6	159.2	161.7	169.4
	(a)fc	97.4	127.2	135.8	147.3	155.6	159.2	161.7	169.5
	(b)fc	97.4	133.5	144.6	159.7	170.6	175.3	178.7	188.7

mp ··· Real GDP at market prices. fc ··· Real GDP at factor cost.

* ··· This is a linked index. The official real GDP (68 SNA) index at 1985 prices for 1970–93 has been linked with the similar official index for 1993–2000 at 1990 prices. See EPAJ, *Annual Report on National Accounts*, (1995, pp.118-121 and 2000, p. 101). The value for 2000 (68 SNA) has been posted (June 21, 2001) on the internet home page of Cabinet Office.

··· This is also a similar linked index of real GDP at factor cost. See footnote 19 in the text.

(a) ··· By the use of ‘original weights’. See footnotes to Table 1 and Appendix Table 1.

(b) ··· By the use of ‘adjusted weights’. See Section 6 in the text and also see footnotes to Table 1 and Appendix Table 1.

§ ··· Exclusive of the minimum deflationary gap (i.e., 3%). As cited in footnote 17 in the text, 0.97 ÷ 0.9452 = 1.0262 . 100 ÷ 102.62 = 0.97447 0.974 .

Lines (b)mp and (a)fc of (2) have a series of same values. Similarly, Lines (b)mp and (a)fc of (4) also have a series of same values. Reason for it is that the aggregation weights are happened to be same to both.

Appendix Table 2 〔2〕 Results of Simulation (Continued) (Actual 1970 = 100)

δ =1/3.5		1970	1980	1985	1990	1993	1995	1997	2000
(1) Actual real GDP	mp	100	155.4	186.7	232.5	244.5	249.7*	266.5*	262.8*
	fc	100	155.6	185.4	229.5	241.3	245.7#	262.2#	256.3#
(2) Full capacity real GDP	(a)mp	102.6	196.1	246.9	329.4	390.4	413.3	444.6	474.9
	(b)mp	102.6	188.3	234.2	307.7	361.3	381.1	405.9	433.8
	(a)fc	102.6	188.3	234.2	307.7	361.3	381.1	405.9	433.8
	(d)fc	102.6	180.0	220.8	285.3	331.4	348.2	369.5	392.3
(3) (1) ÷ (2)	(a)mp	0.974§	0.792	0.756	0.706	0.626	0.604	0.599	0.553
	(b)mp	0.974§	0.825	0.797	0.756	0.677	0.655	0.657	0.606
	(a)fc	0.974§	0.826	0.792	0.746	0.668	0.645	0.646	0.591
	(b)fc	0.974§	0.865	0.840	0.805	0.728	0.706	0.710	0.653
(4) Required capital/output ratio for (2)									
	(a)mp	97.4	127.3	136.3	148.5	157.1	160.8	162.3	171.0
	(b)mp	97.4	132.6	143.7	159.0	169.7	174.4	177.9	187.3
	(a)fc	97.4	132.6	143.7	159.0	169.7	174.4	177.9	187.3
	(b)fc	97.4	138.7	152.4	171.5	185.0	190.9	195.4	207.1

(a), (b), mp, fc, *, #, and §····· See footnote to Appendix Table 2 [1] above.

Appendix Table 2 〔3〕 Results of Simulation (C0ntinued) (Actual 1970 = 100)

δ = 1 / 4		1970	1980	1985	1990	1993	1995	1997	2000
(1) Actual real GDP	mp	100	155.4	186.7	232.5	244.5	249.7*	266.5*	262.8*
	fc	100	155.6	185.4	229.5	241.3	245.7#	262.2#	256.3#
(2) Full capacity real GDP	(a)mp	102.6	190.4	237.1	312.1	367.0	387.5	412.7	442.3
	(b)mp	102.6	183.1	225.4	292.4	340.8	358.6	380.8	405.7
	(a)fc	102.6	183.1	225.4	292.4	340.8	358.6	380.8	405.7
	(d)fc	102.6	175.4	213.1	272.0	313.9	329.0	348.1	368.6
(3) (1) ÷ (2)	(a)mp	0.974§	0.816	0.787	0.745	0.666	0644	0.646	0.594
	(b)mp	0.974§	0.849	0.828	0.795	0.717	0.696	0.700	0.648
	(a)fc	0.974§	0.850	0.822	0.785	0.708	0.685	0.689	0.632
	(b)fc	0.974§	0.887	0.870	0.844	0.769	0.747	0.753	0.695
(4) Required capital/output ratio for (2)									
	(a)mp	97.4	131.1	142.0	156.7	167.1	171.5	174.9	183.7
	(b)mp	97.4	136.4	149.3	167.3	179.9	185.3	189.6	200.2
	(a)fc	97.4	136.4	149.3	167.3	179.9	185.3	189.6	200.2
	(b)fc	97.4	142.4	158.0	179.8	195.4	202.0	207.3	220.4

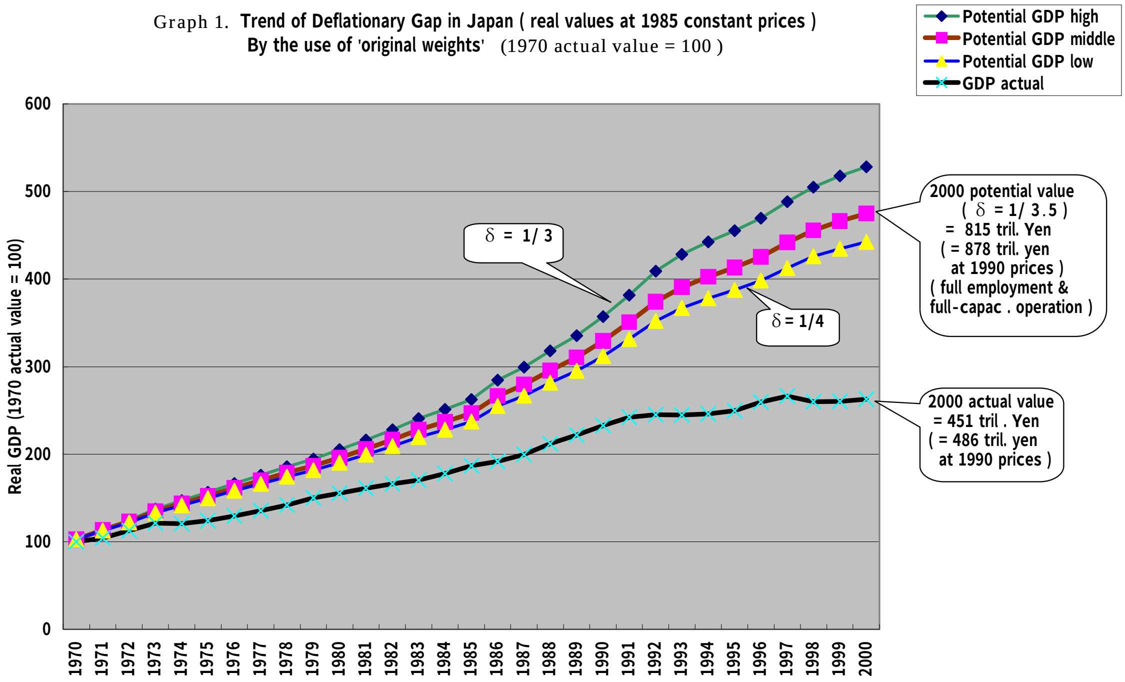
(a), (b), mp, fc, *, #, and §····· See footnote to Appendix Table 2 [1] above.

<u>Appendix Table 2</u> 〔4〕 Results of Simulation (Continued) (Actual 1970 = 100)

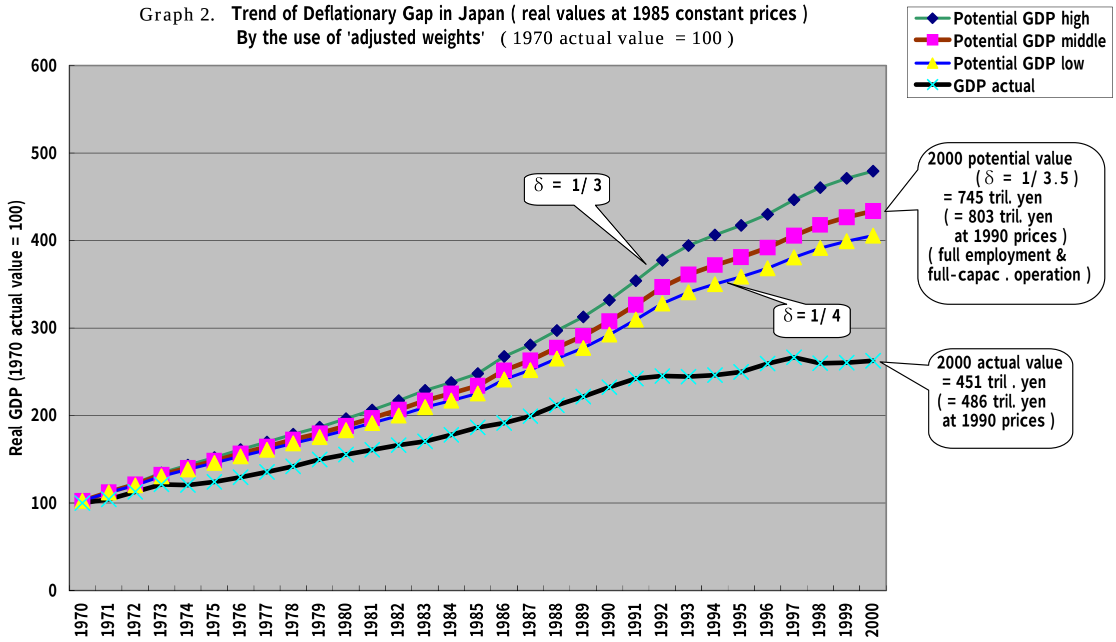
δ = 1 / 5		1970	1980	1985	1990	1993	1995	1997	2000
(1) Actual real GDP	mp	100	155.4	186.7	232.5	244.5	249.7*	266.5*	262.8*
	fc	100	155.6	185.4	229.5	241.3	245.7#	262.2#	256.3#
(2) Full capacity real GDP	(a)mp	102.6	183.4	225.4	291.7	339.6	357.4	379.2	404.7
	(b)mp	102.6	176.8	214.9	274.4	316.8	332.3	351.5	373.1
	(a)fc	102.6	176.8	214.9	274.4	316.8	332.3	351.5	373.1
	(d)fc	102.6	169.7	203.8	256.3	293.2	306.4	323.1	340.9
(3) (1) ÷ (2)	(a)mp	0.974§	0.849	0.828	0.804	0.720	0.699	0703	0.647
	(b)mp	0.974§	0.881	0.869	0.855	0.772	0.751	0.758	0.704
	(a)fc	0.974§	0.880	0.863	0.836	0.762	0.739	0.746	0.687
	(b)fc	0.974§	0.917	0.910	0.895	0.823	0.802	0.811	0.752
(4) Required capital/output ratio for (2)									
	(a)mp	97.4	136.2	149.3	167.7	180.6	186.0	190.3	200.7
	(b)mp	97.4	141.2	156.7	1783	193.6	200.0	205.3	217.8
	(a)fc	97.4	141.2	156.7	178.3	193.6	200.0	205.3	217.8
	(b)fc	97.4	147.1	165.2	190.8	209.2	216.9	223.4	238.3

(a), (b), mp, fc, *, #, and § ····· See footnote to <u>Appendix Table 2 [1]</u> above.

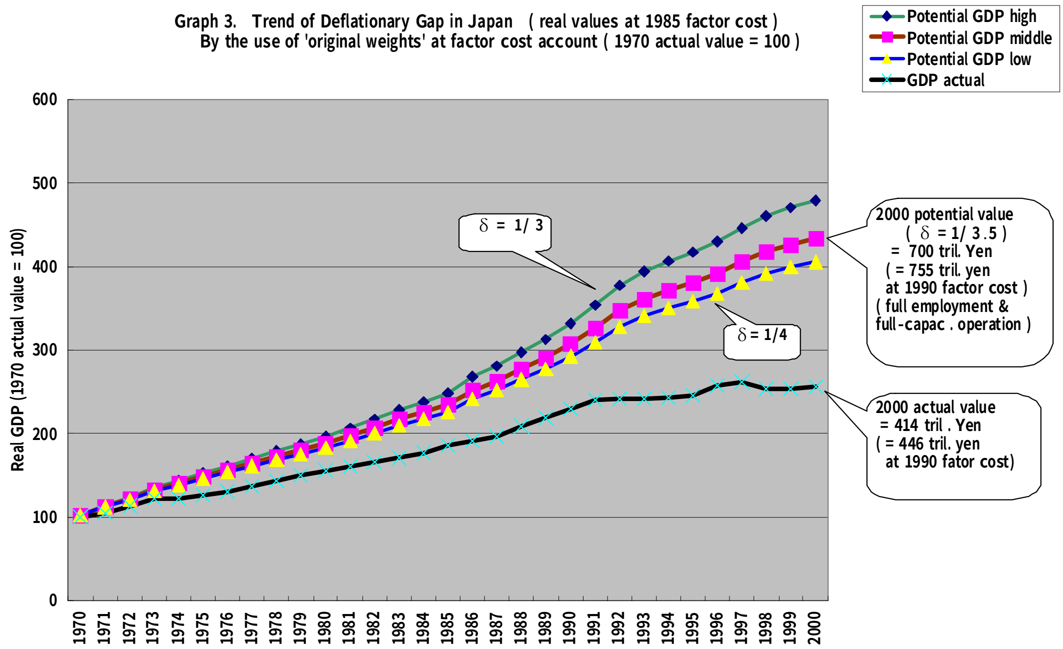
Graph 1. Trend of Deflationary Gap in Japan (real values at 1985 constant prices)
By the use of 'original weights' (1970 actual value = 100)



Graph 2. Trend of Deflationary Gap in Japan (real values at 1985 constant prices)
By the use of 'adjusted weights' (1970 actual value = 100)



Graph 3. Trend of Deflationary Gap in Japan (real values at 1985 factor cost)
By the use of 'original weights' at factor cost account (1970 actual value = 100)



Graph 4. Trend of Deflationary Gap in Japan (real values at 1985 factor cost)
By the use of 'adjusted weights' at factor cost account (1970 actual value = 100)