Japan's Potential Growth: An HP Filter Approach

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Potential Growth in Japan: An HP Filter Approach

I. Introduction

Once called the leader of the high-performing Asian economies (HPAEs), Japan has now experienced a decade long of economic stagnation. The current string of recessions started at the beginning of the 1990's. As recently reported by the Cabinet Office of Japan, the annual growth rate of Japan is 1.50% in 2002Q3. Is this a high rate or a low rate? One may say that this growth is trivial in comparison to the average of 5% during the 1980's. Another may suggest that this rate is already high compared to its performance in the 1990's. Further, some may even suggest that any positive growth is good as Japan had previously had negative growth rates for 4 consecutive quarters. It is obvious that these answers are based on past achievement, recent performance, or an *ad hoc* zero-percentage threshold. So, what should be an appropriate benchmark in judging the Japan's performance? This paper introduces *potential growth* as such a benchmark for the "appropriate" growth rate. Knowing the potential growth in Japan, the policy-makers will understand how far Japan's performance stands from its suitable level.

This paper is divided into 6 sections. This introduction is the first. Section II briefly describes the history of the Japanese economy. The following 2 sections explain the concept of potential growth and the methodology used in this paper, respectively. Results of estimation are shown and discussed in section V. Conclusions and suggestions in the last section then complete this paper.

II. A Brief History of Japan's Post-War Economic Performance

Economic development of Japan after the World War II is normally separated into 3 periods—the rapid growth period (1950's-1973), the slow growth period (1973-1990), and the ultra-slow growth period (1990-present). This section tries to give the overview of the development of Japan's economy.

After the defeat in WWII, Japan was left with debris. A quarter of national wealth was depleted during the War (Okuno-Fujiwara, 1992). The country seemed not to be in a position where it could grow rapidly later. However, according to Rodrik (1994), Japan already possessed crucial initial conditions—mainly high education attainment and low degree of economic inequality—for the high growth later. The burst of the Korean War ignited domestic demand in Japan as the U.S. and the United Nations used it as the supply base. The period of rapid growth started from this point and lasted for 23 years. The average growth rate of Japan was 8.45% a year during the 1950's and 10.74% a year during the 1960's.[1]

The period of rapid growth ended in 1973 when the member countries of the Organization of the Petroleum Export Countries (OPEC) decided to lower their oil production. This action, in turn, rapidly doubled the oil prices and finally led to worldwide recession, known as the "first oil shock". Also, social security benefits in Japan were drastically increased in 1973. Political reluctance to increase tax to proportionate the escalating expenditure definitely resulted in a large debt in fiscal balance. As a stabilizing tool was sterile, the oil shock had its full effect on the Japanese growth. The real GNP fell down by 1.4% in 1973. Not long after the first one, the

[1] The author calculated the average growth rate over the decade from annual GNP figures in Ito (1992), which were collected from Economic Statistics Annual (1979).

"second oil shock" took place, but Japan was thought to be affected less than other countries at this time. The main reason is that it pursued a more stable monetary policy than did the USA or other countries (Flath, 2000). During the 1970's, the average annual growth was only 5.1%, half of the average in the previous decade. As the effects from oil shocks subsided, Japan's growth in years after was not very impressive. It varied from 1.6% in 1982Q2 to 7.2% in 1988Q3, and the average was at 4.32% a year during the 1980's. Even though Japan went through the slow period, its expansion was frequently envied by other Western countries, especially the U.S.A., whose growth rate averaged only 3.3% and 3.0% during the 1970's and 1980's, respectively.

At the end of the 1980's, Japan fully stepped into a "bubble" economy. Even though the real growth had not increased very much, the land price and stock market flourish at a very rapid rate. Speculation on bubbling land prices pushed the prices up greatly. The Nikkei Stock Index increased from 6,768 in January 1980 to its peak at 38,915 in December 1989.

Japan entered the ultra-slow period at the beginning of the 1990's. Some people even called the 1990's as the "lost decade". The Bank of Japan (BOJ) and, in particular, its concomitant governor Mieno Yasushi saw the evilness of the bubble and decided to make a U-turn on the monetary policy. Monetary contraction adopted by the BOJ, however, came too strong and too quick. When "the inflated balloon suddenly withered, an asset deflation occurred" (Hideaki, 1996). Banks holding land as collateral were restricted the amount of new loans because of plunging land prices. The Nikkei Stock Index fell halfway from its peak to 16,767 in 1992. The GDP growth reached its minimum at -0.1% in the last quarter of 1992. This bubble burst is called "Heisei

recession" in Japan. Although the recession officially reached the trough in 1993 along with Mieno's term at the BOJ in a year later, the Japanese economy has not really recovered since then. Its growth rate was only at 1% in 1994 and 1.5% in 1995. Although the growth hardly climbed up to 3% in 1997, Japan stumbled again in a year later. It is believed that the bad-timing value added tax (VAT) increase in 1998 stimulated the demand in a prior year. Many people still believe that the recession in 1997 is a continuation of the previous one(s).

Tottering above the zero percent for a while, Japan finally crossed the threshold in 1998. Though faced with many recessions, Japan had never really experienced a contraction prior to 1998. All of its slumps were positive recession (a slowdown in growth but still positive). From 1998Q3 to 1999Q1, the growth rates in Japan were negative for all 3 successive quarters. This second Heisei recession was then followed by a minimal positive growth in 2000. In 2001 and 2002, Japan faced with yet another lengthy period of negative growth, known as the third Heisei recession. At this time, the negative growth rate occurred for 4 consecutive quarters or from 2001Q3 to 2002Q2. The Nikkei Stock Index dropped to 8,640 in October 2002, less than a quarter of it peak in 1989. The growth rate of Japanese economy is only at 1.50% a year in 2002Q3, and it is still a preliminary result.

The next section introduces the basic concept about potential growth, a benchmark to judge whether 1.5% is too high or too low.

III. Potential Growth and Output Gap

Even though the word of "*potential output*" has been widely used among economists, there still exists some confusion over its meaning. It is frequently mixed up

with the production possibility frontier (PPF) mainly used by international trade economists. The PPF refers to a level at which an economy can produce using all available inputs. The actual level of output can never reach the PPF due to many reasons such as imperfect information, institutions, regulations, etc.

Our potential output is quite similar but not the same as the PPF. Rather than a purely maximum level, the potential output refers to the level of maximum *sustainable* output or the level of output that is consistent with stable inflation. Whenever the actual output exceeds its potential level, it means that the currently available inputs are being over-utilized and inflation pressure begins to build up. In contrast, if the actual output is below the potential level, some inputs are being idle and there is a chance that inflation rate will decline.

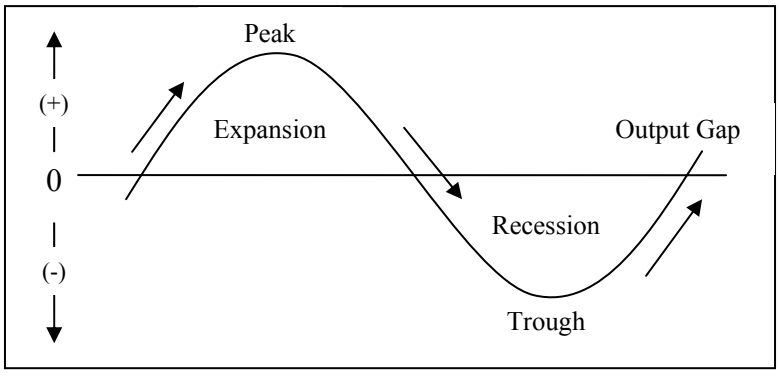
The potential level of output is not a static concept but rather a dynamic one. Changes in labor force, capital or technology will eventually lead to a change in potential output. If an economy expands at a slow rate for a period of time, lowering investment will slow down the growth of capital stock. As human capital economists state that human skills can be faded and re-training is necessary, it can also be interpreted that a long period of unemployment tends to reduce their productivity, which inevitably hurts the potential growth of a country. Further, unfavorable business environment also reduces the probability of increasing the country's total factor productivity (TFP) as enterprises emphasizes on their existence more than their R&D. The expansion of potential output in each year is called the *potential growth*.

The other important concept related to the potential output is the *output gap*. Output gap measures the difference between actual and potential output. It is calculated as the following equation.[2]

$$Output\ \ Gap = \frac{Actual\ \ Output - Potential\ \ Output}{Potential\ \ Output} \times 100 \qquad (eq.\ 1)$$

The output gap can indicate the current state of an economy. If the gap is positive, the economy is producing more than its potential, or in other words the economy is expanding (*Figure 1*). Though the expansion seems to be good, the economy cannot sustain a large gap for a long time. The large output gap will be associated with the accelerating inflation. If the gap gets too large, the accelerating inflation will reverse the course of expansion into a slowdown or a recession. When the economy is facing a recession, the output gap then turns to be negative. In this way, the output gap is occasionally used as another indicator for business cycle.

Figure 1 Output Gap and Business Cycle



[2] See Japan Center for Economic Research (2001).

The major problem with the potential output is that it can never be observed directly. The method of estimation, therefore, becomes extremely difficult but particularly important. Techniques to estimate the potential output can be broadly classified into two groups—a statistic approach and an economic approach. The statistic approach, on one hand, uses a procedure of extracting trend and cyclical component of output, and the pure trend pattern is believed to be the potential output. Although there are many instruments to decompose the trend and cyclical component, there is one outstanding method usually involved with the estimation of potential output, which is the Hodrick-Prescott (HP) filter. This paper will employ the HP filter as well, and its estimation procedure is reserved for discussion in section IV. It is called the statistical approach because the HP filter (or other methods of this type) is based mainly on statistical techniques and relates only remotely to economic theories.

The economic approach, on the other hand, utilizes economic theories more explicitly than the statistical approach. The most common method is the production function approach, which includes 3 steps of estimation. First, one needs to construct a production function and estimate coefficients in the production function using the actual level of utilized inputs. Inputs typically include capital, labor and technology. Then, in the second step, one has to find an optimum usage level of each input. This step considerably increases the difficulty of the economic approach. For labor input, the natural rate of unemployment or the Non-Accelerating Inflation Rate of Unemployment (NAIRU) is commonly accepted for the optimum level of labor idleness. However, the task becomes onerous when one needs to estimate the optimum usage of capital or technology. There is not yet a common measure of any indicator for such optima.

Different authors use different approaches to find optimum levels of these two inputs. If one could survive the second step, the last step is rather simple. The optimum levels of input are substituted into the production function, and the estimated coefficients are used to estimate the optimum output level or the potential output.

Okun (1962) was one of the first to estimate the potential GNP. He raised the question about "how much output the economy (can) produce under conditions of full employment" (p.145). The full employment goal, however, had to be achieved without causing inflation pressure. His methodology is similar to the production function approach described above, though not exactly the same. Potential output, according to Okun, can be reached only when the unemployment is 4%. As a result of this paper, the Okun's Law became generally recognized. The Law states that a shortfall in GDP of 3% relative to normal growth produces a 1-percentage point rise in the unemployment rate (Romer, 2001).

Potential growth and output gap have become increasingly important in policymaking throughout the world. The Congressional Budget Office (CBO) of the United States is required to produce budget projection in the next 10 year, and it certainly needs a reliable forecast of GDP for such projection. Instead of depending purely on the forecasted GDP, the CBO (2001) predicted the actual GDP only 2 years ahead and assumed that actual output would be consistent with the estimated level of potential output thereafter. The methodology adopted by the CBO is, however, based on the production function approach, which is different from the method used in this paper. Further, the Economic Policy Committee (EPC, 2001) of the European Commission scrutinized methods of potential output estimation used by the European Union (EU)

members and other institutes in order to suggest proper approach to be used together by the EU members. Its suggestion was that a simple production function approach should provide a better framework for the economic outlook of the EU member, even though the HP filter approach had served reasonably well in the past. The Bank of Thailand (2001), which has adopted inflation-targeting monetary policy since the economic crisis, also estimated the potential output in Thailand using the production function approach with the structural vector-autoregressive (SVAR) technique. It is now used as one of the information in making policies. The Bank of Japan (BOJ) also published 2 research papers related to the potential growth in 2000 and 2001— Kamada and Masuda (2000) and Hirose and Yamada (2001). However, the actual usage of potential growth in BOJ's decision making is unclear to the public.

IV. Methodology

As previously mentioned, there are usually 2 major methods of estimation. One is the production function approach, and the other is the statistical approach using the HP filter. This paper—due to the time, budget and length constraints—utilizes the HP filter as the method of estimation. The filter was first introduced by Hodrick-Prescott (1981, 1997) to analyze the postwar U.S. business cycle. They assumed that a series, the GNP of the U.S. in their study, consisted of a trend and a cyclical pattern as the following equation.

$$y_t = \mu_t + c_t \qquad (eq.2)$$

where y_t is a seasonally adjusted series of the interested variable (GDP in this case), and μ_t and c_t are its trend and cyclical pattern, respectively. Their objective function is

$$\min_{\mu} \{\sum_{t=1}^{T} c_t^2 + \lambda \sum_{t=2}^{T-1} [\Delta^2 \mu_{t+1}]^2\} \qquad (eq.3)$$

In words, the technique is used to estimate a smoothed series, μ_t, of y_t by minimizing the sum square of cyclical pattern ($\sum c^2$), subject to a penalty that constrains the sum square of the second-order difference of μ ($\sum[\Delta^2\mu]^2$). The parameter λ is a positive number used to penalize variability of the trend component. The larger the value of λ, the smoother is the series. The indefinitely large number of λ results in a simple linear regression line with respect to time, while the filtered series with zero value of λ replicates y_t exactly. As suggested by Hodrick and Prescott, the value of λ should be 1,600 for a quarterly series.[3] This figure was derived from their assumption that the true variance of the cyclical pattern equals to 5 and the true variance of the second-order difference of growth is 0.125. Of course, nobody knows the true variances, and this assumption is frequently criticized.

Then, substituting c_t from eq.2 and expanding the second difference term, one would get a familiar form of the HP filter as

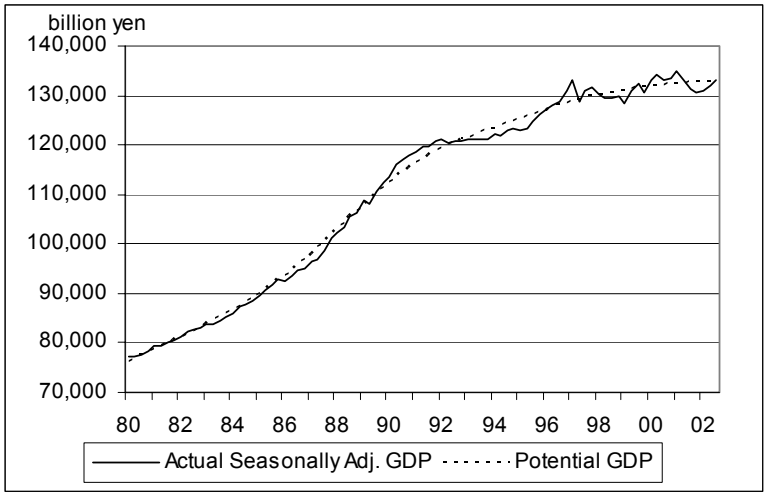
$$\min_{\mu} \{\sum_{t=1}^{T} (y_t - \mu_t)^2 + \lambda \sum_{t=2}^{T-1} [(\mu_{t+1} - \mu_t) - (\mu_t - \mu_{t-1})]^2\} \qquad (eq.\ 4)$$

This study employs the quarterly Gross Domestic Expenditures (GDP)[4] at 1995 prices with seasonal adjustment. The data are obtained from the Economic and Social Research Institute, the Cabinet Office, Government of Japan. It is important to mention here that the seasonally adjusted GDP is officially reported as annualized data. The actual reported figures are approximately 4 times larger than the unadjusted series. So, this paper adopts a simple modification by dividing each figure by 4 to get an

[3] They also suggested to set λ equal to 100 for a yearly series and 14,400 for a monthly series.
[4] Although the proper abbreviation would be "GDE", the "GDP" is still used because of its familiarity.

approximation for quarterly data. Our study period covers from 1980Q1 to 2002Q3. The trend of GDP received by running the series through the HP filter is called the potential GDP. The actual and potential GDP are shown in figure 2. Potential growth on the annual basis is calculated from the potential GDP using a discrete growth formula, and the output gap is computed as shown in equation 1. Results of estimation are shown in Appendix A.

Figure 2 Actual and Potential GDP in Japan from 1980Q1 to 2002Q3



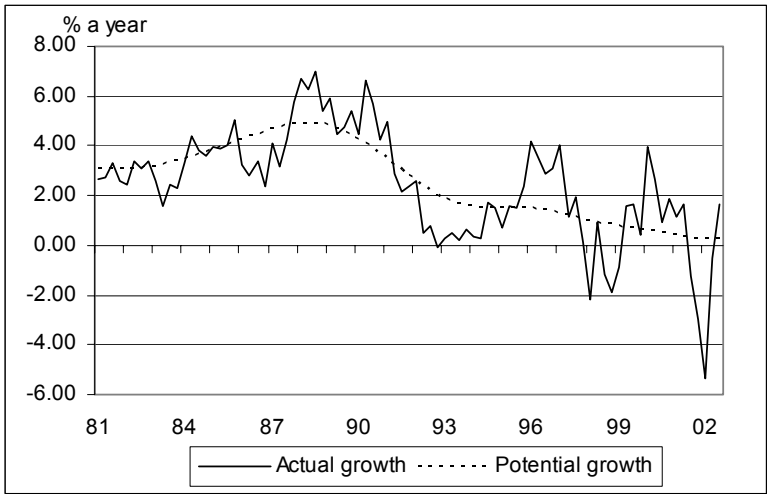
Source: Economic and Social Research Institute, Cabinet Office

V. Estimates of Potential Growth and Output Gap

During the 1980's, the potential growth of Japan varies between 3% and 5%. It started at 3.11% in 1981Q1 and slowly increased to its peak at 4.92% in 1988Q2. The actual growth during this period shows a larger fluctuation than its potential, ranging from 2% to 7% (*Figure 3*). One may wonder why Japan did not start with a high potential growth. As described in section II, Japan and the rest of the world encountered

the worldwide recession caused by the two oil shocks. As a result, the Japan's potential declined substantially. Using different method, Torres and Martin (1989) from the Organization for Economic Co-operation and Development (OECD) showed a potential growth in Japan at 8.3% in the 1966-1673 period and 4.3% in the 1974-1979 period. The oil shocks not only affected the actual growth as described in section II but lessened the potential growth as well. The beginning of the 1980's is then the time to recover from the oil shock. As the recovery continued, less proportion of resources especially labor force was left unoccupied. The rise in the potential growth may be a result of declining unemployment, increasing size of labor force from new entrants and re-entrants, increasing capital asset, and rising capacity utilization rate during this period.

Figure 3 Actual and Potential Growth in Japan from 1981Q1 to 2002Q3

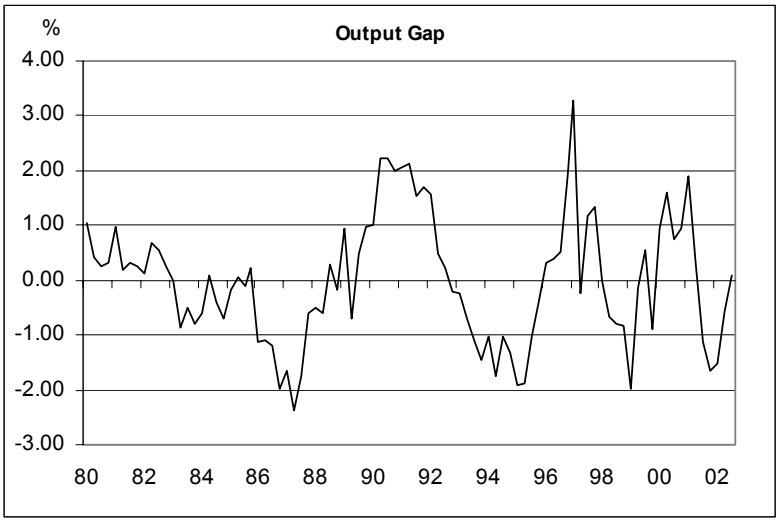


After its peak in 1988Q2, the potential growth in Japan has continuously declined. By the end of 1992, the potential growth reduces to only 2%, less than a half of its peak in 5 years earlier. As Japan entered the ultra-slow growth period, there was an increasing

amount of idle resources. Unemployment increased, and non-performing loans rose as a result of deflated assets during the Heisei recession. Although the first Heisei recession ended in 1993 and the actual growth increased to 4% in a few years later, the potential growth absolutely shows no sign of increase. It remained fairly stable at 1.5% from 1993 to 1996.

In 1997, the potential growth continues to decline again. The increase in actual growth in 1999 and 2000 did not help in increasing its potential growth or stopping it from falling at all. The problem of non-performing loans (NPLs) continually dragged on the Japanese economy. Also, the problem of idle resources is reflected in the lowering potential growth. The current annual potential growth is as trivial as 0.25% in 2002Q3, the lowest level during the study period or possible of the post-war Japanese economic history.

Figure 4 Output Gap in Japan from 1980Q1 to 2002Q3



Optimistically, the current output gap in Japan already passed its trough in 2001Q3 (*Figure 4*). As discussed earlier, the output gap is sometimes used as an indicator for business cycle. The current gap is 0.1%, the first positive gap within the past year. It may be one thing that the Japanese can be happy about at this time.

To check whether the estimated output gap is consistent with true business cycle, one needs to compare it with other 2 business cycle indicators—the coincident indicator and Tankan[5]. The coincident index includes components that tend to represent current economic activity. It is constructed by aggregating the percentage changes of the selected series, which are industrial production, capacity utilization, sales at department store, worked hours, effective job offer rate, and 6 other series. The Tankan, on the other hand, is a quarterly nationwide survey, which aimed to grasp the actual condition of the domestic economy. Respondents are asked to use their judgment on the "overall business conditions mainly in light of profits" at the time of survey. The answer could be (1) favorable, (2) not so favorable, or (3) unfavorable, and the diffusion index is calculated from the difference between the percentage share of enterprises that answer (1) and (3).

What is important in deciding the business cycle is not the value of the gap but the points of peaks and bottoms. A local maximum gap should be consistent with the business peak, and a local minimum gap should be seen at the trough. It is noted that those 2 indicators are publicly reported on the monthly basis but only the end-of-quarter data are used here. It is, therefore, possible that one-quarter difference between each output gap's spikes and others may exist due to different time specification and should not taken into account seriously. The result turns out that peaks and troughs estimated by

[5] "Tankan" is an abbreviation for "Tanki Keizai Kansoku Chousa", which means the "short-term economic survey of enterprises".

the output gap do not differ very much from those estimated by the other 2 indicators, especially after 1997 (*Table 1*). The only major inconsistency seems to be at the trough in 1993. The output gap shows that a trough exists in 1995Q1, while officially the trough was at the end of 1993. However, if one takes a close look at the output gap information, the gap is as low as -1.76% in 1994Q2, which is in harmony with the official trough. But, the lingering effect from the 1993 recession, namely the reduction of the potential growth after the trough, seems to be strong and outweighs the effect of business cycle recovery on GDP. So, the gap declines again and reaches the locally lowest value at -1.91% in 1995Q1, which needs to be interpreted as the bottom of this cycle.

Table 1 Comparison of Business Cycle Turning Points Obtained from Output Gap, Coincident Indicator, and Tankan

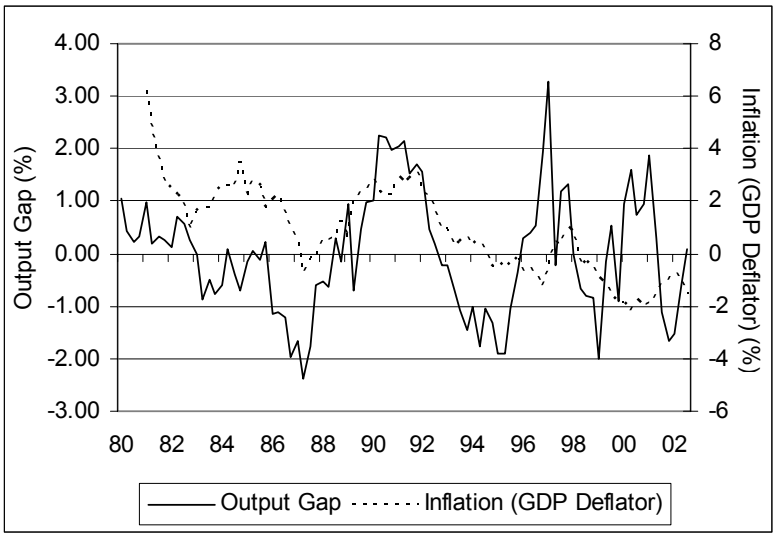
	Output gap (1)		**Coincident Index* (2)**		**Tankan (3)**		**Quarter Difference bet.**	
	Year	*Quarter*	*Year*	*Quarter*	*Year*	*Quarter*	*(1)-(2)*	*(1)-(3)*
Trough	1983	2	1982	4	1983	1	2	1
Peak	1985	4	1985	2	1984	4	2	4
Trough	1987	2	1986	2	1987	1	4	1
Peak	1990	2	1990	4	1989	2	-2	4
Trough	1995	1	1993	4	1994	1	5	4
Peak	1997	1	1997	1	1997	1	0	0
Trough	1999	1	1998	4	1998	4	1	1
Peak	2001	1	2000	4	2000	4	1	1
Trough	2001	4	2002	1	2001	4	1	0

Source: (*) Cabinet Office
(**) Bank of Japan

Since the output gap involves not only the business cycle but inflation as well, it is necessary to compare the estimate of output gap with the existing inflation rate. The

GDP deflator is used to calculate the inflation rate in Japan (*Figure 5*). By definition, a large output gap should be associated with an accelerating inflation. Unfortunately, the output gap seems to correlate with inflation only during a certain period of time or from 1985 to 1995. The correlation between those two are as high as 0.75 during this period. However, since the trough of the first Heisei recession, the movement between output gap and inflation is nowhere near what would expect in the theory. For instance, the increase of output gap between 1999 and 2001 appears together with a deflation in Japan, which is opposite to the theoretical expectation.

Figure 5 Output Gap and Inflation in Japan from 1980Q1 to 2002Q3



Source: Economic and Social Research Institute, Cabinet Office

One possible explanation for improper response of inflation to output gap is because Japan has had deflation since the mid 1990's. Deflation, by nature, is different and more harmful than inflation. Once a country gets into a deflation stage, it is really difficult to get out from it. In the expectation of falling prices in the future, consumers

have incentive to delay their consumption, which is needed today to drag the economy out of recession. The more troublesome than the deflation alone is the "cocktail of deflation and debt" (The Economist, 2002), in which is happening in Japan. Deflation pushes up the real burden of debt, while asset prices have to fall sharply in nominal term to catch up with a reduction in real term. It is possible that deflation may distort the relationship between inflation and output gap in Japan.

In contradict to its strength on simplicity, the HP filter has been widely criticized in many aspects. The author believes that it is important to point out a few weaknesses of the HP filter here. First, as discussed earlier, the HP filter depends mainly on the statistical approach and slightly on economic theories. Second, as pointed out by Ahumada and Garegnani (1999), the value of λ is rather subjective to the assumption made by Hodrick and Prescott. A change in the value of λ will certainly yield a different result. Although the figure of 1,600 has been utilized with a quarterly series as suggested by them, it does not necessary mean that it is the appropriate number.

Third, since the HP filter needs the actual value of the series to (y_t) to predict the trend pattern (μ_t), this method is therefore impossible to forecast the future trend pattern. Any forecasted value of y_t usually does not incorporate the cyclical pattern, and the filter cannot function properly. Also, if we can get the forecast of y_t (e.g. GDP) with the cyclical pattern, why should we need the whole course of economic forecasting at all? Lastly, the HP filter assumes that the actual series cannot persistently deviate from its trend. However, Posen (2001) argued that Japan's potential growth did not actually decline during the late 1990's, but it was because of this weakness of the HP filter that caused the reduction in the estimated potential growth. He pointed out many structural

changes taking place in Japan that should, by and large, lead to a rise in the potential growth. A few examples mentioned by Posen were the financial sector reforms, the improved supervision from the Financial Supervision Agency, the reform on the Large-Scale Retail Store Law, and the deregulated gasoline prices. With all these weaknesses, it seems that the economic approach is superior to the HP filter approach. However, taking the difficulty in the procedure of the economy approach, in particular the finding of the optimum usage level of inputs, the HP filter may be more suitable than the economic approach in certain circumstances.

VI. Conclusions and Suggestions

Although the methodology is rather simple, the HP filter has been widely used among economists who try to estimate the potential growth in a country. However, the HP filter approach has repeatedly been criticized for lacking economic foundations. The EPC suggested that the production function approach might be more suitable than the HP filter approach. On the extreme, McCallun (2001) strongly recommended that monetary policy should not respond to a trend-type measure of output gap; otherwise, highly undesirable consequences were likely to ensue. Another weakness of the HP filter approach is that it cannot forecast the future potential output, which is much needed in policymaking. Yet, the production function approach is known for beings complicated and time-consuming in estimation. The HP filter, therefore, may serve well as a benchmark for the current situation among time and budget constraint analyses.

In conclusion, this paper is not aimed to describe what kinds of medicines the patient, named Japan, needs. The objective is to explore what condition is considered appropriate for the patient. The study shows that the potential growth is currently at

0.25% for Japan, a low level by any standard. If there is something to be happy about, it is the currently positive output gap. Probably, Japan has already surpassed its worst time, and now it should look ahead in the future. If the Japanese government can maintain a positive gap for a long period of time, its potential growth may be lifted and inflation, instead of deflation, may return. Would it be considered as killing 2 birds with one stone?

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Appendix A

Actual GDP, Potential GDP, Potential Growth and Output Gap

Year/Quarter		Real GDP**	Real GDP Growth*	Seasonally Adj. GDP**	Potential GDP**	Pot. GDP Growth*	Output Gap (%)
1980	1	74,909		77,084	76,279		1.05
	2	74,071		77,198	76,872		0.42
	3	76,726		77,649	77,465		0.24
	4	85,013		78,312	78,059		0.32
1981	1	76,902	2.63	79,416	78,655	3.11	0.97
	2	76,126	2.74	79,415	79,255	3.10	0.20
	3	79,288	3.28	80,116	79,858	3.09	0.32
	4	87,257	2.61	80,681	80,468	3.09	0.26
1982	1	78,819	2.46	81,189	81,085	3.09	0.13
	2	78,756	3.40	82,280	81,713	3.10	0.69
	3	81,772	3.08	82,815	82,351	3.12	0.56
	4	90,274	3.40	83,216	83,003	3.15	0.26
1983	1	80,909	2.62	83,660	83,672	3.19	-0.01
	2	80,025	1.60	83,635	84,360	3.24	-0.86
	3	83,793	2.44	84,636	85,069	3.30	-0.51
	4	92,370	2.30	85,129	85,803	3.37	-0.78
1984	1	83,636	3.32	86,035	86,562	3.45	-0.61
	2	83,592	4.36	87,440	87,348	3.54	0.10
	3	87,049	3.81	87,821	88,164	3.64	-0.39
	4	95,751	3.60	88,385	89,009	3.74	-0.70
1985	1	87,045	3.99	89,736	89,885	3.84	-0.17
	2	86,902	3.88	90,848	90,793	3.94	0.06
	3	90,652	4.06	91,636	91,733	4.05	-0.11
	4	100,705	5.04	92,912	92,706	4.15	0.22
1986	1	89,925	3.26	92,644	93,712	4.26	-1.14
	2	89,347	2.77	93,713	94,753	4.36	-1.10
	3	93,797	3.41	94,671	95,827	4.46	-1.21
	4	103,087	2.34	95,018	96,935	4.56	-1.98
1987	1	93,665	4.08	96,455	98,074	4.65	-1.65
	2	92,198	3.14	96,884	99,243	4.74	-2.38
	3	97,878	4.26	98,668	100,438	4.81	-1.76
	4	109,209	5.77	101,040	101,654	4.87	-0.60
1988	1	100,158	6.70	102,353	102,885	4.90	-0.52
	2	98,189	6.30	103,481	104,123	4.92	-0.62
	3	104,942	6.97	105,681	105,363	4.90	0.30
	4	115,242	5.38	106,417	106,597	4.86	-0.17
1989	1	106,284	5.94	108,842	107,818	4.79	0.95
	2	102,654	4.45	108,239	109,018	4.70	-0.71
	3	110,036	4.74	110,718	110,192	4.58	0.48
	4	121,664	5.42	112,423	111,331	4.44	0.98
1990	1	111,115	4.44	113,578	112,430	4.28	1.02
	2	109,666	6.61	116,017	113,483	4.10	2.23
	3	116,441	5.66	117,026	114,483	3.89	2.22
	4	126,912	4.22	117,726	115,428	3.68	1.99
1991	1	116,762	4.96	118,711	116,315	3.45	2.06
	2	112,901	2.91	119,646	117,143	3.23	2.14
	3	118,955	2.14	119,730	117,914	3.00	1.54
	4	129,988	2.39	120,640	118,629	2.77	1.70

Year/Quarter		Real GDP**	Real GDP Growth*	Seasonally Adj. GDP**	Potential GDP**	Pot. GDP Growth*	Output Gap (%)
1992	1	119,816	2.58	121,171	119,293	2.56	1.57
	2	113,469	0.50	120,475	119,909	2.36	0.47
	3	119,896	0.79	120,735	120,484	2.18	0.21
	4	129,860	-0.10	120,776	121,024	2.02	-0.20
1993	1	120,152	0.28	121,255	121,536	1.88	-0.23
	2	114,049	0.51	121,184	122,026	1.77	-0.69
	3	120,164	0.22	121,177	122,500	1.67	-1.08
	4	130,698	0.64	121,172	122,963	1.60	-1.46
1994	1	120,587	0.36	122,171	123,420	1.55	-1.01
	2	114,407	0.31	121,692	123,875	1.52	-1.76
	3	122,253	1.72	123,051	124,331	1.50	-1.03
	4	132,650	1.48	123,155	124,790	1.49	-1.31
1995	1	121,421	0.69	122,863	125,251	1.48	-1.91
	2	116,263	1.61	123,335	125,715	1.48	-1.89
	3	124,065	1.47	124,883	126,179	1.49	-1.03
	4	135,838	2.37	126,181	126,641	1.48	-0.36
1996	1	126,628	4.20	127,486	127,097	1.47	0.31
	2	120,452	3.54	128,029	127,541	1.45	0.38
	3	127,649	2.85	128,642	127,970	1.42	0.52
	4	140,123	3.11	130,852	128,380	1.37	1.92
1997	1	131,830	4.03	133,002	128,768	1.31	3.29
	2	121,824	1.13	128,827	129,131	1.25	-0.24
	3	130,111	1.91	130,996	129,470	1.17	1.18
	4	140,358	0.17	131,520	129,786	1.10	1.34
1998	1	129,023	-2.15	130,068	130,081	1.02	-0.01
	2	122,981	0.95	129,469	130,357	0.95	-0.68
	3	128,646	-1.13	129,560	130,616	0.88	-0.81
	4	137,708	-1.91	129,772	130,860	0.83	-0.83
1999	1	127,869	-0.90	128,474	131,092	0.78	-2.00
	2	124,920	1.56	131,114	131,312	0.73	-0.15
	3	130,767	1.64	132,236	131,518	0.69	0.55
	4	138,271	0.41	130,529	131,709	0.65	-0.90
2000	1	132,993	3.93	133,133	131,886	0.61	0.95
	2	128,284	2.66	134,156	132,047	0.56	1.60
	3	132,032	0.96	133,188	132,190	0.51	0.76
	4	140,839	1.84	133,569	132,318	0.46	0.95
2001	1	134,535	1.15	134,931	132,430	0.41	1.89
	2	130,410	1.64	132,932	132,530	0.37	0.30
	3	130,423	-1.23	131,126	132,621	0.33	-1.13
	4	136,689	-2.99	130,495	132,707	0.29	-1.67
2002	1	127,566	-5.32	130,770	132,791	0.27	-1.52
	2p2	129,730	-0.52	132,125	132,875	0.26	-0.56
	3p1	132,596	1.65	133,098	132,959	0.25	0.10

Source: Economic and Social Research Institute, Cabinet Office, Government of Japan

Note: (*) Percent per year

(**) Billion Yen at 1995 prices

Note: Officially, the "quarterly" seasonally adjusted series is annualized, but it is divided by 4 to get an approximation for quarterly data in this study.