Economic Forecasting: Achieved vs. Potential Growth

By Ryuhei Wakasugi

Japanese economic growth slowed down sharply in the 1970s and still more sharply in the 1980s (Table 1). As a result, some observers now contend that Japan's innate growth potential is down to 2-3%.

This "innate growth potential" is not the actual growth achieved but rather a concept used to express the potential in the economy for future growth—defined as the growth in GNP produced by capital and labor in a situation of full employment (where actual unemployment equals the natural rate of unemployment)—as a result of expansion in the factors of production and technological progress.

There are two primary methodologies in explaining economic growth. One analysis is based on the Harrod-Domar model to explain the growth rate in terms of the capital coefficient and the savings ratio. In this model, capital and labor are not seen as interchangeable and the capital coefficient is fixed. As a result, this model has fallen out of favor in explaining post oil-crisis economic growth, since there has been apparent fluctuation in the capital coefficient and labor and capital have been substituted with the growth in the tertiary industry sector.

Another explanation of economic growth, avoiding these problems, is based upon the neoclassical growth model. The 1982 White Paper on National Economy is an example of this. However, previously almost all such analyses have been made from the macroeconomic standpoint. In comparing the economy of the 1970s and beyond with that in Japan's earlier rapid growth period, it is clear that the patterns of investment and technological innovation have varied from industry to industry and that therefore there has been change in the sources of growth. As a result, many experts now feel it is important to go beyond macroeconomic analysis and analyze each industrial sector to see how much each has contributed to the economic growth.

Economic Growth by Industry

Figure 1 shows the actual growth rates for the primary, secondary, and tertiary sectors in the 1970s and their comparative contributions to the growth in GDP. Table 2 gives basically these same figures as averages over the half-decade and then decade.

The GDP which is the basis of this analysis was derived by subtracting the interim costs of primary production, manufacturing, wholesale trade, retail trade, and service sector—for all industries relevant to the nation's economy—from their total production. Because these data give a good picture of the value of production for each industrial sector, they are very convenient values in discussing the growth rate from the supply side and provide a conceptual grasp of the Japanese economy's growth potential. Although they may vary slightly from GNP figures, there is no substantative difference.

The rapid growth rate achieved by the Japanese economy in the 1960s was sustained in the first half of the 1970s but hovered around 5% in the latter half of the 1970s following the first oil crisis. By sector, the secondary sector contributed 3.2% and the tertiary sector 2.4% to the total annual economic growth rate. Not only did the tertiary sector account for approximately half of total economic growth, but its own growth rate was relatively steady at about 5%. The reason for this is that, except for the electrical power industry, the tertiary sector was not so much affected by soaring oil prices as the secondary sector was. The tertiary sector has thus evolved into a stable linchpin of economic growth since the first oil crisis.

There was major fluctuation in the secondary sector's growth rate, and it has been pointed out that this has had a major impact upon the Japanese economy's overall growth. Even within the secondary sector, there have been major growth disparities among the different industries. For example, in the first half of the 1970s, the materials industries such as paper and pulp, chemicals and metals, and the processing and assembly industries such as general, electrical and transport machinery, all contributed about 0.5% to economic growth. Yet in the latter half of the 1970s following the first oil crisis, the processing and assembly industries'

Table 1. Growth Rate of Real GNP

1965-70	12.2%
1971-75	4.7
1976-80	5.0
1981	2.9

Fig. 1. GDP by Industrial Sector
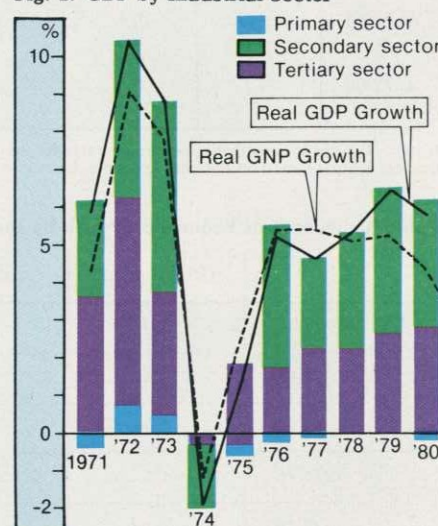
(Source) Compiled from Annual Report on National Accounts, Economic Planning Agency

growth rate jumped to 13.5%, making them a major sector supporting growth in secondary industry. The sector's contribution to total GDP growth almost quadrupled to 1.9%.

Given these dynamic changes in the growth rates achieved by different industries at different times, it is meaningful to discuss economic growth not simply in macroeconomic terms but also in terms of an industry-by-industry approach.

In order to discuss these industries' growth potential in more depth, it is useful here to attempt an analysis of the growth factors in the secondary and tertiary sectors based upon the neoclassical approach.

Given that each industry's production function is:

$$Q = F(K, L, t)$$
$$\text{where} \quad K = \text{capital}$$
$$L = \text{labor}$$
$$t = \text{time}$$

Table 2. Contributions to Economic Growth by Industry

(%)

Average per annum	All industries	Primary sector	Secondary sector	Materials industries	Processing & assembly	Tertiary sector
1971-75	4.9	0.1	1.9	0.5 (3.7)	0.6 (5.3)	2.8
1976-80	5.5	-0.1	3.2	0.7 (6.2)	1.9 (13.5)	2.4
1971-80	5.2	0.0	2.6	0.6 (5.1)	1.3 (9.4)	2.6

(Note) Figures in parentheses are growth rates for the particular industries.
(Source) Annual Report on National Accounts, Economic Planning Agency

Table 3. Sources of Economic Growth by Industry

(%)

		Growth rate	Capital stock	Labor	Residual
All industries	1971-75	4.9	4.0	0.3	0.6
	1976-80	5.5	2.2	0.8	2.5
	1971-80	5.2	3.0	0.6	1.6
Secondary sector	1971-75	4.4	3.9	0.4	0.1
	1976-78	7.1	1.7	0.3	5.1
	1971-80	5.8	2.9	0.4	2.5
Tertiary sector	1971-75	5.5	4.0	1.4	0.1
	1976-78	4.8	2.5	1.5	0.8
	1971-80	5.2	3.2	1.5	0.5

(Notes) 1.Contribution by capital stock is defined as the rate of increase in the capital stock multiplied by the share of capital stock.
2.Contribution by labor is defined as the rate of increase in the labor force multiplied by the share of labor.
(Sources) Annual Report on National Accounts and Private Corporation Capital Stock Statistics, Economic Planning Agency.

the factors of growth from the supply side can be analyzed with

$$\frac{\dot{Q}}{Q} = S_K\frac{\dot{K}}{K} + S_L\frac{\dot{L}}{L} + \frac{\dot{F}}{F}$$

for capital stock's contribution, labor's contribution, and residual factors.

Table 3 gives the results of this breakdown in each production factor's contribution to economic growth in the 1970s. The residual factors indicate the contribution to growth of technical innovation, qualitative improvements in capital and labor, changes in the industrial structure, and other factors not explained by the increase of capital or labor. Although the statistical results obtained with this approach are rather rough, it is thought to be an appropriate method of getting a general grasp on the sources of growth potential from the supply side.

First, capital stock's contribution in the second half of the 1970s was approximately half of what it was in the first half of the decade for all sectors. This relatively slower increase in the capital stock is because, compared to the period before the oil crisis, the ratio of capital investment to GNP has declined and there has been a large proportion of renewal investment to replace obsolete plant and equipment. The decline in capital stock growth has been particularly conspicuous in the secondary sector, where growth has plummeted from an annual average of about 15% in the latter half of the 1960s to about 5% per annum since the mid-1970s. As a result, capital stock growth's contribution in the secondary sector has slipped to under 30% and the importance of residual factors such as technological progress has risen to 70%. In the 1960s, the fruits of technological progress were incorporated in the capital stock through capital investment to increase production capacity. As a result, there was a very high correlation between the contributions of capital stock and technical progress as factors explaining economic growth. In the latter half of the 1970s, however, technological progress has been incorporated into the capital stock as replacement investment, and the correlation between the two as factors explaining economic growth has been weakened.

The second point of note from these results is that over 80% of the growth in the tertiary sector is explained by increase in capital stock and labor, and residual factors such as technical progress have played a relatively minor part. This is because there has been active capital investment in the tertiary sector to expand supply capacity, rationalize, and effect labor-saving, and because there has been a shift in the labor force to the tertiary sector in search of employment opportunities. As Table 4 shows, in the second half of the 1970s, the tertiary sector's capital stock growth rate was 7.5%, which is higher than the 5.3% for the secondary sector. At the same time, the contribution of residual factors such as technical progress was slight, although it should be noted that this had grown to 20% by the latter half of the 1970s. This would seem to indicate that investment in the tertiary sector has been designed to incorporate new technologies for making supply systems more rational

and labor-saving.

Although there are those who claim that Japan's ability to achieve economic growth is on the wane, in view of the decline in capital productivity through the increase in both the marginal and average capital coefficients, a review of the capital coefficient by industrial sector shows that its rise is not a general phenomenon. Rather, the capital coefficient is rising in the tertiary sector but tending downward in the secondary sector. Under the circumstances, it is questionable, as noted at the outset, whether the Harrod model which had been used to explain Japan's rapid economic growth can usefully be employed to explain recent growth rates. This was why I have attempted the above neoclassical analysis.

Potential Economic Growth

Yet there have also been people who have suggested that, along with her actual economic growth achievements, Japan's innate growth potential is also on the wane. To be sure, the real growth rate is down from 4.2% in 1980 to 2.9% in 1981. However, based upon the above discussion of the sources of Japanese economic growth since the mid-1970s with attention to economic activity in the various industrial sectors, I find it difficult to believe that the Japanese economy has suddenly suffered a decline in its innate growth potential. Allow me to discuss this further from the supply side. The major sources of economic growth as seen from the supply side are capital accumulation and technological progress. Accordingly, it is a good idea here to look at the trends in technology and in capital and labor as factors of production before going further.

Looking first at capital accumulation, the availability of money for capital investment is influenced by the savings propensity. If the savings rate slips precipitously, the savings shortfall will have a deleterious effect upon capital accumulation. (It is worth nothing that the U.S. supply-siders emphasize that the low savings rate in the U.S. has had an adverse impact on capital accumulation.) Yet the

Table 4. Capital Stock Growth Rate by Industry

(%)

	All industries	Primary sector	Secondary sector	Tertiary sector
1971-75	10.6	10.0	10.7	10.7
1976-80	6.5	8.0	5.3	7.5
1971-80	8.5	9.0	8.0	9.1

(Source) Private Corporation Capital Stock Statistics, Economic Planning Agency.

"Cash card service corner," the first step in total computerization of banking business


Japanese savings rate is significantly higher than the U.S. rate. The major reason for this high Japanese savings rate is that real income has continued to grow rapidly and has exceeded anticipated income, with high composition percentages for such irregular income as bonuses. However, this high Japanese savings rate apparently peaked in 1974. Although much of the post-1974 decline has been caused by the slower growth of real income and irregular income, other important factors are the graying of the popula-

tion and the tendency for older people to save less, the adequacy of the social security systems, and the sufficiency of housing stock and other financial asset holdings. As a result, it is assumed that the savings rate will continue to decline gradually over the medium term. However, in light of the present balance between investment and savings, it is unlikely that there will be a shortfall of savings and consequent adverse impact on capital investment in the near future.

Likewise, while the labor supply in-

Fig. 2. Average Capital Coefficients
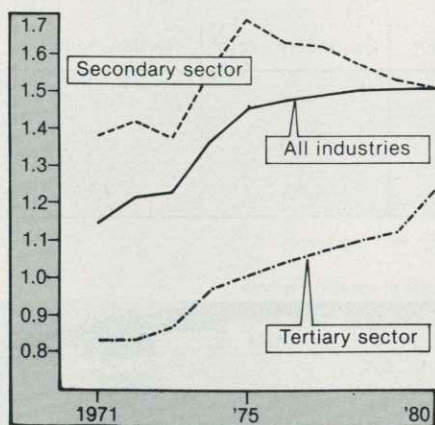
(Note) Capital coefficient is defined as capital stock for said industries (installation basis) divided by gross domestic product for said industries.

(Source) Annual Report on National Accounts and Private Corporation Capital Stock Statistics, Economic Planning Agency.

creased 0.8% per annum in the 1970s, this may be expected to grow at an average of about 1.0% per annum throughout the 1980s. However, the demographic structure is such that it is anticipated that there will be a stagnation in the supply of new labor in the 1990s.

Technological progress was also a major factor in Japan's postwar economic growth, yet its contribution to achieved growth has varied depending upon the industry—as has the timing of this contibution. The iron and steel, electrical machinery, automobile, and electronics industries, for example, have all benefited greatly from technological progress, but at different times.

Japanese technological progress has been characterized by rapid improvement in technological standards, brought about both by building upon prewar technological foundations and importing technologies developed overseas. There has been particularly striking progress made in technology for mass production, and this has been incorporated through capital investment.

Another characteristic of Japanese technological progress is that this has been a private sector-led innovation, with

approximately 70% of the costs of technology development being borne by the private sector. This allocation of capital in accordance with market mechanisms has promoted the efficient use of funds and, at the same time, led to an avoidance of high-risk and long-shot research and to a cost allocation structure which emphasizes applied and developmental research.

Looking at current research and development results in light of this pattern, technology imports have dropped from a peak of 2,450 cases in 1973 to 2,116 cases in 1979. By contrast, there has been an increase in technology exports. Japanese applications for foreign patents are also up, rising in the United States, for example, from 5% of the total in 1970 to 10% in 1978. There has also been an increase in the Japanese ratio of research and development expenditures to GNP. Research and development activity in Japan is brisk, and it can hardly be said to be on the decline or stagnating.

Implications for future economic growth

Looking first at the tertiary sector, it is expected that capital investment will be continued, to expand supply capacity, rationalize, save labor, and incorporate new technologies, and that this sector will thus maintain the 7-8% growth in capital stock which it has shown since the mid-1970s. Labor is also expected to continue to be available for the tertiary sector as before. Technological progess will maintain a strong pace, primarily for greater use of automation and electronics in the supply system. As a result, it is very possible that the tertiary sector will continue the approximately 5% growth achieved since the mid-1970s, and will continue to contribute about 2.5% to Japanese overall economic growth. Consequently, the question of whether or not the Japanese economy can maintain its innate growth potential at a high level or not hinges on the growth performance turned in by the secondary sector.

The secondary sector's contribution to growth through increased capital stock has slipped from 3.9% in the early 1970s

Table 5. Savings Rate

(%)

	Japan	U.S.	W.Germany
1971-75	20.4	8.3	15.3
1976	21.3	7.1	13.4
1977	21.2	5.8	13.4
1978	19.4	5.4	13.3
1979	18.5	5.4	13.8
1980	19.5	5.7	12.8

to 1.7% in the latter half of the decade. Because the capital stock increment is not expected to accelerate that much in coming years, it is felt that this contribution will likely be about 2.0%. However, there will continue to be a major contribution from technological progress in the form of equipment renewal investment. Technological progress starts with research and development or technology imports, and is completed when the new technology is incorporated as plant and equipment through the process of capital investment. Although imports of technology have stagnated since the oil crises, research and development activity is vigorous, as noted above. Moreover, the vigor in research and development activity spreads across a broad range of industries, including electronics, industrial robots, energy, and biotechnology. At least so far as can be seen from this research and development activity, there are little grounds for pessimism about the potential for technological innovation in the 1980s as compared to the late 1970s. Rather, it is reasonable to expect technological innovation to continue to be a strong contributor to growth in the secondary sector.

Putting secondary and tertiary sector growth together, it should not be difficult for Japan's innate growth potential to maintain a rate of approximately 5%, although this does depend upon technological innovation.

In the above discussion, I have purposely omitted petroleum and other energy from the factors of production. In the two oil crises, rising oil prices have worked through a variety of mechanisms to impede growth: one the resultant shift in
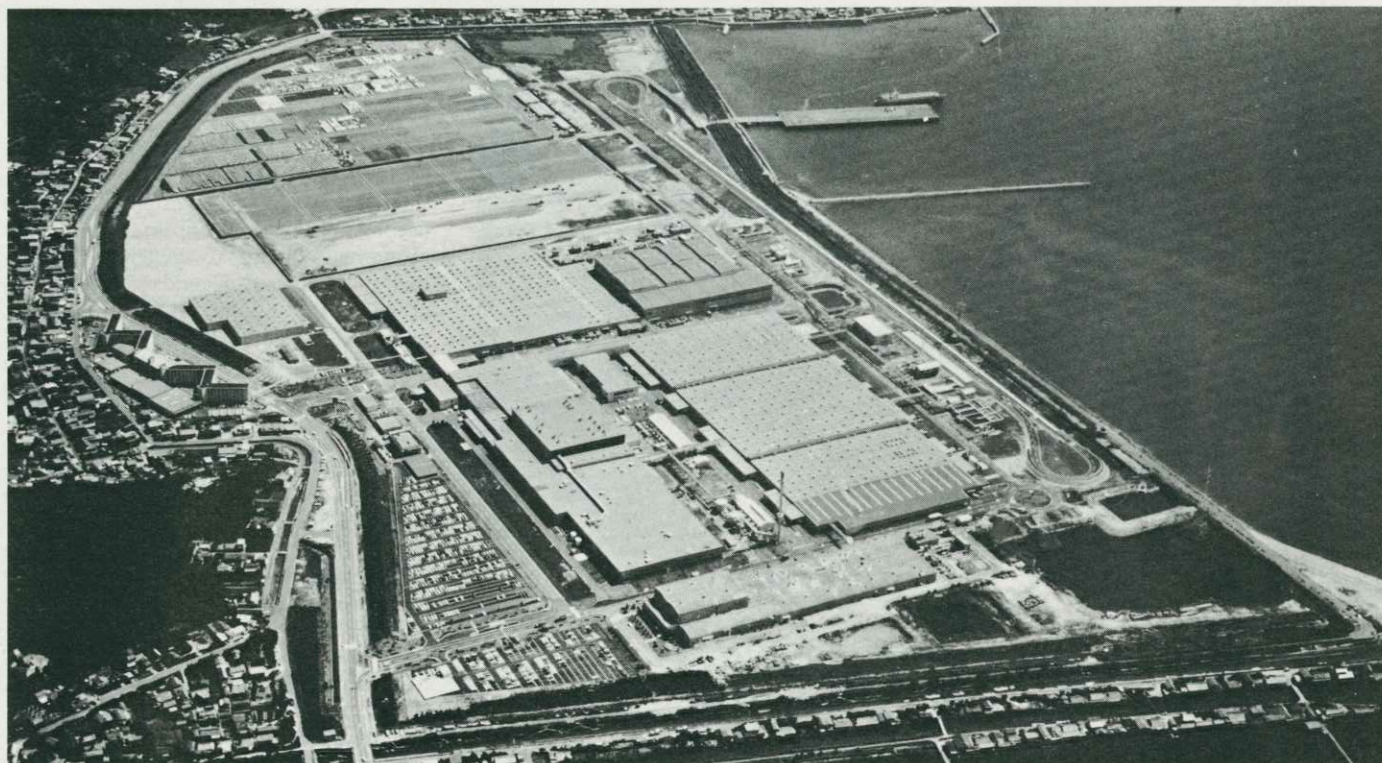
Aerial view of Toyo Kogyo's "state-of-art" passenger car plant in Hofu, west Japan, an example of technological progress leading to equipment renewal investment

aggregate supply function and another the decline in aggregate demand function as a result of the transfer of real income overseas to the oil-exporting nations. In the short term, rising oil prices have worked to reduce the growth rate sharply on both the supply and demand side.

In the medium term, higher prices have been a spur to rapid progress in energy conservation. The income elasticity of energy may be calculated by dividing the rate of growth in total energy consumed by the rate of real GNP growth. In the years from 1966 until the first oil crisis, this was 1.2 on average, but it has since fallen sharply to 0.01 since 1974.

This decline in income elasticity of energy was brought about as relative price changes stemming from the rise in energy prices forced existing production facilities to conserve on energy consumption, pushed the energy-intensive industries

Toshiba's newly-developed robot, "Self Approach System," is one example of Japan's private sector-led technological innovation.

Most of the layouts at Asahi Newspaper are done by computer.

the rate of capital stock growth has fallen to about a third of its former rate and we can no longer hope for the kind of climate which prevailed in times of rapid growth. In its place, technological innovation has become a major source for the innate growth potential. Under the circumstances, popular expectations of growth become all the more important, since the economic activity to generate technological progress depends on people's growth expectations. If, for example, people hold lowered expectations of growth as a result of a decline in the achieved GNP growth rate, research and development activity and capital investment will stagnate, especially in the secondary sector, and this may even induce a decline in the long-term innate growth potential. In this sense, the potential for future growth is largely dependent upon current demand levels. Thus the need for an appropriate aggregrate demand policy in these times of stagnation holds not only for short-term reasons of employment but, it must be stressed, for the long-term consideration of maintaining growth potential; and within this demand policy, special attention must be paid to revitalizing capital investment and research and development. ●

into decline, and effected a change in the Japanese industrial structure. In Japan, this shift to energy conservation proceeded relatively smoothly through the substitution of energy by capital. Technological progress and capital investment for energy conservation thus became new factors promoting growth. However, the elasticity of substitution between energy and capital is going down, and it is feared that another oil crisis would be even more devastating for the economic growth rate than past crises have been.

Conclusion

At least as seen from the supply side, the support from the tertiary sector and the strong efforts for technological innovation in the secondary sector make it unlikely that there will be any major or sudden decline in Japan's innate growth potential. In the latter 1970s, secondary sector growth was sustained by the processing and assembly industries. While these industries will continue to make consider-

able contributions to growth for the foreseeable future, in the long run it is technological innovation and the appearance of leading industries in the secondary sector that will determine the innate growth potential. This is commonsensical, but the main purpose of stating it is to focus attention on the importance of discussing growth potential on an industry-by-industry basis.

The current rate of growth being achieved is less than the innate growth potential, and the achieved growth rate and innate growth potential continue to show disparity.

In Japan's rapid growth period, a high rate of economic growth was achieved by a combination of an increment in capital stock, resulting from booming capital investment in the secondary sector, and technological progress, resulting from active technology imports and vigorous research and development. At the same time, a climate existed in which popular expectations of rapid growth stimulated further economic activity. In the 1980s,

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