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The Kuznets Versus the Marx Pattern in Modern Economic Growth: A Perspective from the Japanese Experience

by

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Abstract

The major question addressed in this paper is whether the pattern of economic growth consistent with Marx's theory of capitalist development preceded the pattern of "modern economic growth" as set out by Kuznets. Observations on Japan extending back to the early phase of modern economic growth, together with those on the United States by Abramovitz, support the existence of the Marx pattern. Forces underlying the shift from the Marx to the Kuznets pattern are identified as (a) a shift from artisan-based "visible technology" to science-based "invisible" technology," and (b) a shift in demand from standardized to differentiated products corresponding to increased income per capita. The implication of the Japanese experience for the sustainability of growth in newly industrializing economies in East Asia are discussed in comparison with the failure in centrally planned economies.

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The Kuznets Versus the Marx Pattern in Modern Economic Growth:

A Perspective from the Japanese Experience

Characteristics of "modern economic growth" (MEG) as set out by Simon Kuznets (1966) in terms of certain stylized facts have been widely accepted among economists. However, the historical data of advanced industrial economies, from which Kuznets' stylized facts were condensed, pertain mostly to a relatively late phase of modern economic growth. Extension of data and analysis further into the past has raised doubts about the applicability of the Kuznets pattern to the early phase of MEG during and immediately following the "industrial revolution." Most critically, Moses Abramovitz's extension of simple growth accounting analysis to the early nineteenth century United States questioned the applicability of Kuznets' basic characterization of MEG as predominantly dependent on improved efficiency (or technological progress broadly defined) rather than capital accumulation (Abramovitz, 1993). Results of the Abramovitz analysis suggested the possibility that a pattern of economic growth in the early phase is consistent with the pattern of capitalist economic development as predicted by Karl Marx (1857/58).

This paper aims to determine from Japan's modern development records whether the economic growth phase characterized by the Kuznets pattern was preceded by that of the Marx pattern. Japan has a unique advantage for a case study of this nature, because relatively reliable data became available for the early phase with the completion of Long-term Economic Statistics (LTES) by Kazushi Ohkawa, et. al. (1964-1988). We revise an early attempt of growth accounting by Ohkawa and Rosovsky (1973) for the private non-primary sector and extend to both earlier and more recent years. Results of the growth accounting analysis are compared with changes in major economic indicators such as savings rate, real wage and interest rates so that different growth patterns can be distinguished by different sets of stylized facts. Organization of this paper is as follows: Section 1 develops a working hypothesis in

terms of different sets of stylized facts that may distinguish between the Marx pattern in the late phase of MEG. Section 2 tries to test the hypothesis by the results of our growth accounting analysis for Japan, comparing with those for the United States by Abramovitz. In this comparison, not only contributions of total factor productivity to economic growth but, also, trends in capital coefficients and factor shares are examined. Changes in stylized facts with respect to the rates of savings, real wage and interest rates are observed in Japan in Section 3. Section 4 tries to identify the underlying mechanism of changing growth patterns in terms of changes in the characteristics of both production technology and product demand. Section 5 develops a perspective on the sustainability of economic growth in the newly industrializing economies in East Asia, in contrast with the failure of centrally planned economies. In the end the need for future research on the nature of an apparent new growth pattern observable for industrial economies in recent years is emphasized.

1. Characterization of Two Growth Patterns

As a working hypothesis, the Marx pattern of economic growth that might have emerged in the early phase of industrialization (Phase I) is specified in Table 1 in comparison with a set of stylized facts that have been considered to characterize MEG. The common trends in major economic indicators specified for the later phase of MEG (Phase II) were those outlined by Kuznets (1966;1971) on the basis of immense data collected and processed under his leadership. These "stylized facts" have been popularized among economists, as represented by Samuelson's textbook (Samuelson and Nordhaus, 1985, pp. 793-96). The set of stylized facts for Phase II in Table 1 may well be called "the Kuznets pattern" of economic growth.

On the other hand, presumed common trends in major economic indicators for Phase I were those implied in Marx's theory of capitalist economic development, except row (6) on the interest rate. Marx himself considered that the rate of return to capital will decline in the course of capitalist

development with the faster accumulation of "constant capital" (non-labor input) relative to "variable capital" (labor input) since profit or "surplus value" is derived only from the exploitation of labor. Yet, the decreasing returns to total capital input is not an inevitable consequence of rising "organic composition of capital" (ratio of constant capital to total capital). The profit rate can be maintained stable if the rate of surplus value can be increased due to technological progress or other reasons, so as to counteract the rising organic composition. Moreover, if the rate of return to capital were to decrease very fast, Marx's prediction of the income share of capital to increase (row 4) could be violated. Because of the theoretical implication of Marx's model as well as some empirical evidence to be advanced later, the interest rate is assumed to be constant in the Marx pattern. For this reason our Marx pattern stylized in Table 1 may well be call the "revisionist" instead of the "orthodox" pattern.

However, our revisionist Marx pattern does not rule out the possibility of a moderate decrease in the rate of return to capital. Likewise, the revisionist pattern allows the possibility of a moderate increase in the real wage rate (w), even though it is stylized as being constant in row (7) according to the original Marx model which assumes the wage-anchoring mechanism of "industrial reserve army." In our revisionist Marx pattern, however, the rate of decrease in the wage-rental ratio (w/r), if any, must be smaller than the rate of increase in capital-labor ratio (K/L) so that the income share of capital (rk/Y) increases (row 4).

As shown in rows (1) and (2), both the Marx and the Kuznets patterns are characterized by the rising trends in national income per capita (Y/N) and per worker (Y/L) as well as in capital stock per capita (K/N) and capital-labor ratio (K/L). However, the commonality ends at this point.

In the Marx pattern, (K/N) and (Y/L) increased faster than (Y/N) and (Y/L), respectively, to result in increases in capital coefficient or capital-output ratio (K/Y), whereas the reverse is the case in the Kuznets pattern as indicated in row (3). This implies that decreasing returns to capital set in

with increased applications of capital per worker for a fixed or a small shift in production function underlying the Marx pattern. In contrast, in the Kuznets pattern, the decreasing returns were overcome by a large shift in production function. Different assumptions on production function shifts are shown in row (8) in the form of small versus large contributions of total factor productivity growth to growths in per-capita and per-worker outputs between the Marx and the Kuznets patterns.

In the Marx pattern, despite increases in the K/L ratio, the income share of capital (rK/Y) increased, implying that technical progress during Phase I was biased toward the capital-using and labor-saving direction in the Hicks definition (especially if the elasticity of substitution is less than one). It is considered that because of this bias, the rate of return to capital, as reflected in the interest rate (r), was prevented from decreasing sharply relative to the wage rate (w). The capital-using bias in technical progress is consistent with the small contribution of total factor productivity to product growth in Phase I, because increases in the income share of capital tend to make capital's contribution to product growth larger with the consequence of small residual in the conventional growth accounting.

In the Kuznets pattern, the income share of capital decreased, while the wage rate increased and the interest rate remained unchanged. These trends are consistent with the hypothesis that the technical change was biased toward the labor-using and capital-saving direction, even though the less-than-unitary elasticity of substitution should have also contributed to the decreases in capital's share, corresponding to increased K/L ratio.

Marx's theory predicted an increase in the rate of saving relative to national income (S/Y) in the capitalist development process because income tends to concentrate in the hands of wealthy capitalists who have a higher propensity to save. In our interpretation, however, the high saving propensity could not have been maintained unless technology was developed toward the capital-using direction so that the rate of return to capital was maintained at a decently high level. Underlying the largely stable rate of saving in the Kuznets pattern under more equalized income distribution as reflected

in the reduced share of capital together with the increased wage rate relative to the interest rate should reflect the high propensity to save of the middle-income working class as their compensations continued to increase -- a situation totally unforseen by Marx.

While the Kuznets pattern in Table 1 was a condensation of a large body of data mainly for Phase II, the Marx pattern was a deduction from theory. In the absence of tangible evidence for the early phase of industrialization, a belief prevails amongst economists that the Kuznets pattern has been characteristic of MEG ever since the beginning of industrialization with the industrial revolution. This belief provided a basis for the criticism on Marx that his predictions did not materialize in history. While there is no question that Marx's predictions did not stand historical tests in Phase II, it is yet to be confirmed if the Marx pattern did not in fact emerge in Phase I. The purpose of this paper is to shed a light on this question in terms of growth records in modern Japan.

Demarcation between Phases I and II in an actual history is, of course, an empirical question, which varies widely among countries depending on how early or late they entered the epoch of modern economic growth and advanced to a higher stage of industrial development. Our approach is to make the inter-phase demarcation in terms of empirically observed trends in major economic indicators.

2. Growth Accounting Test

The popular presumption on the prevalence of the Kuznets pattern throughout the epoch of MEG was questioned first by Abramovitz and David (1973) and more recently by Abramovitz (1992), who extended the simple growth accounting analysis on United States economy back to the early nineteenth century.

The earlier growth accounting studies that followed the pioneering work by Abramovitz (1956) himself and Robert Solow (1957) were mostly based on data of advanced industrial economies since the fourth quarter of the 19th century. As summarized in Kuznets (1971, pp. 70-75), those studies show

that with few exceptions less than 10 percent of growth in national product per capita is accounted for by growth in labor and capital inputs. Only about 20 percent of growth in labor productivity is explained by growth in capital-labor ratio, while the rest is explained by growth in total factor productivity (abbreviated hereafter as "total productivity"). Such results underlay the basic characterization of MEG as predominantly dependent upon sustained improvements in technology rather than capital accumulation due to the "extended application of science to the problems of economic production" (Kuznets, 1966, p. 9). It is only reasonable to expect that with this rapid technical progress decreasing returns to increased application of capital have been overcome, and decreasing trends in the capital coefficients have been produced for the economies that entered the MEG epoch.

The U.S. Case

A markedly different pattern was detected for the United States in the period before the late 19th century with the extension of the growth accounting analysis by Abramovitz back to the beginning of that century. His results are summarized in a simplified form in the upper section of Table 2. For the two early periods (1800-1855 and 1855-1890) contributions of growth in total productivity to growth in labor productivity were smaller than those of growth in capital-labor ratio; this finding is coupled with the observation that the growth rates of real labor productivity were exceeded by those of capital-labor ratio to imply increases in the capital coefficient. Moreover, the income share of capital increased significantly from 0.34 in Period 1 to 0.40 in Period 2. Such a growth pattern is akin to the Marx pattern specified in Table 1.

It is difficult to identify exactly when the U.S. economy entered the MEG epoch. If we tentatively assume that the industrial revolution emerged around the 1840s and 50s, Period 1 and Period 2 in Abramovitz's time demarcations may be considered to correspond with a transition to "take-off" and a "drive to maturity" in the terminology of Rostow (1966). Period 1 might better be called "a

transition to MEG" and Period 2 "a transition to the advanced stage of industrialization." The "advanced stage" here means the stage in which industrial production became to be dependent on the invisible technology in the Rosenberg-Birdzell (1986) sense, as will be discussed later. In any case, the Abramovitz results suggest the possibility that a growth pattern analogous to the Marx pattern did emerge in the U.S. economy in the early phase of MEG before the newly-born industrial economy reached "maturity."

Further, the Abramovitz data indicate that the Marx pattern was replaced by the Kuznets pattern after the economy reached the advanced stage of industrialization. Indeed, from Period 3 (1890-1927) to Period 4 (1929-1966) both the income share of capital and the capital coefficient decreased; and the contribution of total productivity growth jumped up from 34 percent in Period 2 to 70 percent in Period 3, and further to 80 percent in Period 4 -- a typical magnitude in advanced industrial economies.

A major question is how typical this sequential change in the growth pattern in the United States could have been amongst the MEG histories of advanced economies. As for the capital coefficient, a review of empirical evidence in industrial economies supports the hypothesis that the capital-output ratio changed in an inverted-U shape, with a rising trend until a certain threshold of per-capita income and a decreasing trend thereafter (Bicanic, 1962). To our knowledge, however, little empirical evidence has yet been accumulated on the trends of factor shares and the contributions of total productivity growth to product growth.

The Case of Japan

As a step toward closing this knowledge gap, we tried to extend the simple growth accounting analysis to the beginning of MEG in Japan. Our analysis was applied to the private non-primary sector (excluding agriculture, forestry and fisheries). In examining this sector our study is similar to Solow (1957) but narrower than the analysis of total domestic private economy by Abramovitz (1993). Because

of this difference our results would not be comparable with Abramovitz's in absolute magnitudes. However, our results could be useful for the purpose of identifying changes in broad growth trends.

Our growth accounting analysis for the private non-primary sector represents a renovation of a pioneering study by Ohkawa and Rosovsky (1973) for the 1908-1964 period. While their analysis was based largely on preliminary data for LTES, we were able to use the final results of LTES published in 14 volumes, extending back to 1888 (1885-91 average). We were also able to use revised national account statistics by the Economic Planning Agency throughout the post-war period from 1958 (1955-61 average) to 1990 (1987-93 average). The reason why we chose the private non-primary sector for analysis was partly because of the advantage of data infrastructure accumulated for this sector since Ohkawa and Rosovsky. We also followed their logic in considering that the process of modern industrial development can be more clearly observable from changes in this sector. Simple growth accounting along the same approach as used by Ohkawa-Rosovsky and Abramovitz was conducted on two sets of data. Series A are in stock terms with labor measured by the number of gainful workers and capital measured by private reproducible capital stock (excluding residential construction, unadjusted for the rate of utilization). Series B are in flow terms with labor measured in the number of work hours and the capital stock adjusted for the utilization rate. For data sources and estimation procedures, see Appendix.

Results of the growth accounting analysis for Japan are summarized in the lower section of Table 2. For our purpose the results based on series A and B do not imply different conclusions. Time demarcations for our analysis were attempted so as to be comparable with Abramovitz's, albeit based on rather arbitrary judgements. It seems to be reasonable to assume that the industrial revolution or the first spurt of industrialization in Japan took place around the turn of the century from the Sino-Japanese War (1893-94) to the Russo-Japanese War (1903-04) (Nishikawa and Abe, 1990; Shimpo, 1995). If so, Period 1 (1888-1900) and Period 2 (1900-1920) may be considered to correspond with a transition

to MEG and a drive to the advanced stage of industrialization, respectively. In this early phase of MEG covering the first two periods, the rates of growth in real labor productivity were exceeded by those of capital-labor ratio to imply increases in the capital coefficient; the income share of capital increased; only about 10 to 20 percent of the labor productivity growth were explained by the total productivity growth and the rest contributed by increases in the capital-labor ratio.

As with the U.S. case the Marx pattern that had prevailed in Periods 1 and 2 began to shift to the Kuznets pattern in Period 3. Above all, the relative contribution of total productivity jumped to about 50 percent. Capital's share which reached a peak in this period, declined in the next period. Unlike the U.S. case the rate of growth in capital-labor ratio continued to exceed that of labor productivity for period 3 (1920-37) as a whole. The order was reversed, however, with implied decreases in the capital coefficient for the latter half of this period (1928-37) in which the percentage contribution of total productivity growth reached the same level as for the United States in Period 3. This similarity in the growth patterns coincided with the fact that a shift in the center of gravity in the manufacturing sector from light to heavy/chemical industries, which had progressed in the United States since the last quarter of the 19th century, began to proceed in Japan since the late 1920s.

The growth pattern in Japan for Period 4 (1958-70) is somewhat puzzling. This was the so-called "High Economic Growth" period during which Japan recorded unprecedented high rates of economic growth, closing the gap in per-capita income and labor productivity vis-a-vis advanced industrial economies in Western Europe and North America. Indeed, the average growth rate of real labor productivity was as high as seven to eight percent per year. An apparent anomaly is that this rapid growth in labor productivity was outpaced by the growth in capital-labor ratio to imply increases in the capital coefficient, though the absolute magnitude of this coefficient was smaller in Period 4 than in Period 3 (Table 3). Increases in the capital coefficient in Period 4 corresponded to relatively modest contributions of total productivity, explaining only about 50 to 60 percent of labor productivity growth,

as compared with about 80 percent in the United States for period 4. In this respect, the Japanese economy in the High Growth period did not follow a typical Kuznets pattern but followed a mongrel pattern between the Marx and the Kuznets types.

This mongrel pattern was common to both the United States and Japan for Period 5. The implication of this apparent return from the Kuznets to the Marx pattern for the most recent period shall be discussed at the end of this paper.

While some divergence from the Kuznets pattern was observed for recent years, what we have observed so far is consistent with the hypothesis that the Marx pattern did emerge in the early phase of MEG in Japan.

3. Trends in the Rates of Savings, Interest and Wage

Data presented in the previous section were consistent with the hypothesis that the Marx pattern preceded the Kuznets pattern in the course of MEG in Japan with respect to trends in major economic indicators (1), (2), (3), (4), and (8) in Table 1. Here, we will try to see if trends in (5) saving rate, (6) interest rate, and (7) wage rate were also consistent with the hypothesis.

Long-term changes in the saving rate (S/Y) in terms of both national and domestic savings relative to GNP in Japan are plotted in Figure 1; these two series do not appear to imply different conclusions for the purpose of broad trend comparisons. For the period before World War II, if we adjust for a sharp rise during the World War I boom period and a subsequent slump during the World Depression period, a basic rising trend in the saving rate from about 5 to 10 percent could be observed. This observation is somewhat consistent with the argument by Rostow (1961) that investment rises in his "take-off" period from 5 to 10 percent of national income. For the post-World War II period the saving rate remained relatively stable at a high level within the 25 to 35 percent range. Such a change

is consistent with the characteristics of the Marx and the Kuznets patterns that are supposed to emerge in the earlier and the later phases of MEG, respectively, as specified in Table 1 (column 5).

Figure 2 plots changes in both the nominal and the real rates of interest for lending by banks. Throughout the whole period the nominal rate remained relatively stable, but the real rate as calculated by subtracting from the nominal rate of change in the wholesale price index shows highly volatile fluctuations. However, neither an upward nor downward trend can be observed from the real interest series for both the earlier and the later phases of MEG in Japan. Thus, a stylized fact established for advanced industrial economies since the beginning of this century, namely that the real interest rate fluctuated violently with no systematic trend, seems also to be applicable to the early phase of MEG in Japan.

For the wage rates, a somewhat different picture emerges from the series of manufacturing and agricultural sectors as shown in Figure 3. The real wage rate in manufacturing began a rising trend with the World War I boom, whereas that of agriculture increased during the booming period but returned to the prior level with the post-war recession. Such a contrast is commonly explained in terms of emergence in the "dual" economic structure during the inter-war period. As industrialization progressed to a stage centering on heavy and chemical industries, large-scale enterprises using capital-intensive high technologies preferred to employ better educated laborers in a long-term contract with relatively favorable terms so as to internalize investments in the skill formation of their workers (Odaka, 1986; Nakamura and Odaka, 1984). On the other hand, small and medium-scale enterprises tended to specialize in labor-intensive production by employing laborers who were excluded from large enterprises. When uneducated laborers in agriculture sought for employment in nonagriculture, they had no option but to enter the lower stratum of the dual structure as unskilled workers in small and medium enterprises who were easily laid off in recession.

Thus, the wage rates in agriculture and small/medium industries moved together in a flexible manner in response to business fluctuations, whereas those of capital-intensive, large-scale industries were characterized by downward rigidity. Average wage rates in manufacturing, which did not decline in the post-war recession, are considered to include increased payments to more highly educated and skilled workers employed in the rapidly expanding capital-intensive sector. On the other hand, the agricultural wages are considered to reflect the supply price of unskilled labor to the nonagricultural sector. Thus, it seems reasonable to assume that the real wage rate for raw labor was characterized by a largely stable trend. After World War II, in contrast, both the agricultural and manufacturing wage rates showed sharply rising trends, as Japanese industries caught up with the level of advanced economies in Western Europe and North America.

Overall, changes in the trends of savings rate as well as of the real wage and interest rates in Japan are consistent with characterization of the growth patterns for the earlier and later phases of MEG as specified in Table 1 (rows 5,6, and 7).

4. Mechanism of the Changing Patterns

What mechanism would have underlain the shift from the Marx to the Kuznets pattern? Two possible explanations advanced here are: (a) a shift in the regime of industrial technology from visible to invisible technology, and (b) a shift in people's demand from standardized to differentiated products.

The Shift in the Industrial Technology Regime

Kuznets identified the systematic application of science to the problems of production as the epochal innovation that characterized the MEG epoch. However, as elucidated by Rosenberg and Birdzell (1986, Chapter 8), until about the 1870s, advances in industrial technology in Western Europe and North America had largely originated with artisans in the areas of "visible" mechanic arts such as

levers, gears, shafts, and cranks; it was the last quarter of the nineteenth century when the frontier of technology began to move to the invisible world of atoms, molecules, electron flows, and magnetism. In this new technology regime the organized research by teams of scientists who received advanced formal education and training became the major source of Western industrial technology.

For the effective operation of new invisible technologies the caliber of workers had to be changed also, from those equipped with manual dexterity through on-the-job training to those who developed the potential through formal education of decoding scientific and engineering manuals. Corresponding to this need, a wide diffusion of primary and secondary education has been paralleled with the establishment of advanced education and research institutions with practical orientation, such as land-grant colleges in the United States and Technische Hochschulen in Germany, since about the 1870s (Landes, 1965; 1969). Japan quickly followed this pattern with the establishment of an engineering college in 1886 within the newly founded Tokyo Imperial University and a network of technical high schools modelled after the German system in subsequent decades (Japan Ministry of Education, 1962).

There seems to be little doubt that sharply expanded investments in intangible capital such as education and research in the new "invisible technology" regime underlay the much larger contribution of total productivity or residual, relative to the contribution of tangible capital to product growth in the conventional growth accounting for Phase I than to Phase II.

The Shift in the Demand Structure

The shift in the technology regime may be considered a shift in the orientation of technical progress from facilitating substitution of tangible capital for labor to facilitating substitution of intangible for tangible capital. In other words, the bias in technological progress changed from the

tangible - capital using and labor saving direction to the intangible-capital using and tangible-capital saving direction.

As argued strongly by Marx, technical progress in the early phase of industrialization was oriented toward replacing labor by capital. Take an example of draining water from coal mines, which used to be a major problem at the time of industrial revolution in England. If water was lifted up by manpower using buckets, the marginal product of one additional bucket beyond the number equal to the number of water-lifting workers should have declined sharply, probably close to zero. Therefore, a profit-seeking entrepreneurs would not have invested in the purchase of more than one bucket per worker (in addition to a few spares). Suppose that a water pump run by James Watt's steam engine was invented, which could drain with only five operators the same volume of water lifted by one hundred workers with buckets. If this pump set costs equivalent to one hundred buckets, the entrepreneur should have been willing to invest up to twenty times more capital per worker with no fear of decreasing marginal productivity. Such a capital-using and labor-saving bias appears to be characteristic of mechanization in an early industrialization phase, as exemplified by Arkwright's jenny and Hargreave's spinning machine. With this bias in technical progress, any hike in the wage rate (w) was suppressed to a moderate rate; the rate of return to capital (r) was prevented from decreasing sharply despite rapid increases in the capital labor-ratio (K/L), so that the income share of capital (rK/Y) increased.

Such labor-saving mechanization should have been effective especially for the mass production of standardized commodities for which demand expanded rapidly in the early phase of MEG, when per-capita incomes were still not far from a subsistence level for the majority of people. However, as per-capita incomes rose further and people's basic needs were satisfied, demands tended to shift from standardized to differentiated products.

For example, at a low income stage the shirts of a standard make at a cheap price may be demanded in a large quantity. For the mass production of such a shirt, the use of large-scale automatic machinery can be efficient. But at a high income stage, demands would shift toward fashionable shirts differentiated by color and design. For the economic production of such differentiated commodities, large-scale mass production facilities may not be relevant. Instead, the human ability of developing attractive designs to affluent people in response to capricious changes in fashion becomes critically important.

In this new regime the marginal productivity of human ability and knowledge rose sharply relative to that of tangible capital, as typical in information industries today. Correspondingly, the measured wage rates which include returns to human capital acquired through education and training in addition to returns to raw labor, rose sharply relative to the rate of returns to tangible capital. The consequent increase in the wage-rental ratio (w/r) should have exceeded the increase in the capital-labor ratio (K/L) resulting in decreased capital's share (rK/Y).

It must be true that increases in the labor wage rates in Phase II were also accelerated by decelerations in the growth in labor supply owing to both a slow-down in population growth rates and increased preference for leisure corresponding to per-capita income rises. Yet, if the product demand structure were to have remained the same, and human capital were not to have accumulated so fast in Phase II, the traditional labor-saving and capital-using technical progress of the Phase I type could have continued to advance at a sufficiently rapid speed so that the effect of labor supply reduction could have been counteracted, resulting in no appreciable increase in the wage rate.

Thus, the shift from the Marx to the Kuznets pattern can be explained consistently in terms of both the shift from a visible technology regime to the invisible technology regime and the shift in the product demand structure from standardized to differentiated products that together increased the rate

of technical progress and, also, changed the bias in technical progress from the tangible capital-using to the intangible capital-using direction.

5. The Implications of the Japanese Experience

A major question may be raised on why the growth of the Japanese economy did not make the same shift to a typical Kuznets pattern as observed in the U.S. case in Table 2. Especially in Period 4 (1958-70) when Japan was able to catch up to the level of the advanced industrial economies in the West, a percentage contribution of total productivity to labor productivity growth was smaller than 60 percent. Moreover, the capital coefficient did increase under the extremely rapid increase in capital-labor ratio, even though the income share of capital approached a level similar to that of other industrial economies. Was this pattern unique to Japan?

The Growth Pattern Based on Technology Borrowing

In our hypothesis this Marx-Kuznets mongrel pattern tends to emerge rather universally among newly industrializing economies on the track of catching up to advanced economies based on borrowed technology. As argued by Alexander Gerschenkron (1962), late-comers to industrialization tend to borrow from their predecessors the advanced technologies of high capital intensity and labor-saving effect. This capital-using and labor-saving bias in borrowed technology for recipient economies could be strengthened by international trade and foreign direct investment.

According to the theory of product cycle by Raymond Vernon (1966), multinational corporations locate their product development base in high-income economies which are characterized by large markets for new products as well as abundant endowments of high-calibre human resources for research and development. After a product is developed in this R & D base through a series of market tests, and its production process is standardized, its mass production is typically transferred to developing

economies, such as Korea and Taiwan up to the 1980s, where cheap but relatively well educated labor is abundantly available. From this mass production base products are exported to advanced economies. Through this cycle, advanced industrial economies tend to specialize in R & D and product development activities with intensive use of high human capital, whereas newly industrializing economies (NIEs) tend to specialize in standardized mass production based on automatic machineries and cheap labor. This process could well be driven not only by multinational firms but also by domestic entrepreneurs in NIEs.

Indeed, the process of industrialization in Japan as a late comer has been similar to that described in the product cycle theory, even though the roles of domestic entrepreneurs and domestic markets played a much more important role than implied in the Vernon theory (Shinohara 1966; Yamazawa, 1986; Shimpo, 1995). The High Economic Growth period from the mid-1950s up to the early 1970s, that corresponds to Period 4 in Table 2 was essentially the process of very rapid technology borrowing based partly on a widened technology gap during the World War II vis-a-vis the United States, and partly on the prior establishment of human resources and R & D organizations that facilitated the technology borrowing. Capital-using bias inherent in borrowed technology could well explain why Japan's economic growth in period 4 diverged from a typical Kuznets pattern as observed for the United States.

The hypothesis that the Marx pattern tends to emerge more typically and persists longer in rapidly industrializing economies based on borrowed technology is consistent with the experience of Asian NIEs, including Korea, Taiwan, Hong Kong and Singapore, as analyzed by Jong-Il Kim and Lawrence Lau (1994). Kim and Lau used a translog production function with the assumption of capital-augmenting technological progress for their growth accounting analysis. However, for the sake of comparison with the U.S. and the Japanese cases in Table 2, the Kim-Lau data were transformed into a conventional growth accounting form as shown in columns (1) through (4) in Table 4, while their

original econometric estimates are shown in column (5). Results of the conventional accounting and the econometric analysis are largely the same.

The growth patterns of Asian NIEs for the past three decades shown in the upper section of Table 4 contrast sharply with those of developed economies in the lower section. While the production elasticities of capital were much higher for NIEs than developed economies, the reverse was the case in the relative contributions of total productivity growth to labor productivity growth, as shown in the parentheses in columns (4) and (5). Among the developed economies, Japan's pattern was the closest to that of NIEs. These observations are consistent with the hypothesis that the Marx pattern in the early phase of industrialization tends to emerge more typically and persist longer among "late-comers" industrialization based on borrowed technology.

If so, the Marx pattern experienced by Japan since the end of last century and by Asian NIEs for the past three decades cannot be considered a symptom of unsustainability, with economic growth primarily based on resource accumulation instead of improved efficiency, as argued by Paul Krugman (1994). In fact, the Abramovitz data show clearly that the United States also experienced this pattern in its early phase of MEG. Is there any strong reason to suspect that Asian NIEs will not be able to shift to the Kuznets pattern after their technology borrowing is completed?

The Marx Trap on Central Planned Economies

Krugman's skepticism on the sustainability of Asian NIEs' growth was based on an analogy with the collapse of centrally planned economies, such as the former Soviet Union. In retrospect, the unsustainability of the Soviet economic growth, based as it was mainly on capital accumulation, has now become clear. The rapid accumulation of capital for industrial production was planned and enforced by the central planning authority by means of short-term quantitative targeting as well as was induced by low (zero in principle) rates of interest and soft-budget constraints common to the socialist

systems. In this system, both managers and workers of state enterprises had little incentive to improve efficiency in the use of capital goods and intermediate products. Instead, their major efforts were concentrated on how to maximize quota allocation of those inputs to their shops through connections, bribery and intimidation. Under such a system it was no wonder that the Soviet economy had to face sharply decreasing returns to capital, as increasingly more capital was applied per worker with little innovation toward the capital-using and labor-saving direction, as attested by several empirical studies (Weitzman 1970; Desai, 1987; Ofer 1987; Easterly and Fisher, 1995).

It may be appropriate to call the pattern of Soviet economic growth "orthodox Marxist" in the sense that the stylized facts in the Marx pattern specified in Table 1 were valid except that the rate of return to capital (r) declined instead of our "revisionist" Marx model in which r is assumed to be constant. It is ironic that Marx himself predicted the collapse of capitalist economies on the assumption of the decreasing rate of profit corresponding to rapid capital accumulation inherent in the capitalist system. In fact, however, capitalist market economies were able to escape from this trap through innovations biased toward the capital-using direction by the profit-seeking efforts of private entrepreneurs. Instead, it was the centrally planned economies that were fatally trapped by the decreasing return to capital under largely constant technology.

This failure of central planned economies seems to imply that, if Asian NIEs and other rapidly industrializing economies would like to avoid the Marx trap and successfully transform their growth into the Kuznets pattern, they must try to facilitate innovative activities of private entrepreneurs by freeing them from undue regulations and controls on product and factor markets. Meanwhile, governments should multiply their investments for the provision of research, education, and other public infrastructure.

New Phase or New Epoch

So far we have concentrated on the succession from the Marx to the Kuznets pattern between the two phases of MEG. A disquieting observation in Table 2 is that both U.S. and Japanese economies looked as if they began to return to the Marx pattern of growth in Period 5 (1966-89 for the United States; 1970-90 for Japan). In this most recent period both economies experienced significant decreases in the relative contributions of total productivity to labor productivity growths, together with increases in the capital coefficient, as compared with the previous period.

Was this deceleration in technological progress only an interlude in the second phase of MEG due to a downswing of the Kondratieff cycle? Or, was this a symptom of the world's entry into a new phase of MEG, as the potential of invisible technologies opened up in the last quarter of the nineteenth century is exhausted? Or, might not the world be entering a new epoch after MEG, that could be based on the "epochal innovation" of new information technology? At present, our knowledge is too limited to establish even a working hypothesis.

APPENDIX

The simple growth accounting analysis is applied to the private non-primary sector of Japanese economy along the lines of a pioneering study by Ohkawa and Rosovsky (1973) for 1908-1964 (in 7-year moving averages). "Non-primary" here means the exclusion of agriculture, forestry and fishing. The Ohkawa-Rosovsky analysis was based largely on preliminary data for the preparation of Ohkawa, et al., Long-Term Economic Statistics of Japan in 1868 (LTES). We were able to use the final results of LTES published in 14 volumes, extending as far back as 1888 (1885-1891 average) for the period before World War II. For the postwar period we were able to use the data of national accounts extended forward to 1990 (1987-93 average) by the Japan Economic Planning Agency (EPA).

Y: Real Private Non-Primary Product (RPNPP)

RPNPP was calculated by subtracting from gross domestic product (GDP) value added in agriculture, forestry, and fishing as well as in the government sector. The growth rates for prewar years were computed from the 1934-36 constant price series in LTES vol. 1, National Income, (1974), pp. 227 and 231. The post-war growth rates were computed from the 1985 price series based on EPA (1995).

K: Real Private Reproducible Non-Residential Capital Stock

The 1985 constant price series of private reproducible non-residential capital stock were calculated by subtracting gross reproducible capital stock in agriculture, forestry, fishing from gross private reproducible non-residential capital stock in EPA Economic Research Institute (1968, 1992, 1995). The series for 1885-1904 were estimated from the series of gross capital stock in the non-primary sector in LTES, vol. 3 Capital Stock, 1966, to which the ratios of private non-primary capital stock to non-primary capital stock (q) were extrapolated by the following regression equation:

$$q = 13.09 + 0.0072t, \quad r = 0.95$$

which was estimated by the ordinary least squares from the EPA data for 1905-1940.

The unadjusted capital stock series were multiplied by the rates of capital utilization to produce the adjusted capital series (series B). The capital utilization rates of the private non-primary sector were approximated by those of the manufacturing sector. The capital utilization rates of the manufacturing sector (u) for 1905-39 were estimated in Odaka (1972), from which the 1885-1904 rates were extrapolated using the following regression estimated by the ordinary least squares:

$$u_t = 0.9279 + 0.0017x_t, \quad r = 0.603$$

where x_t represents the rate of deviation of manufacturing output in year t from the nine year moving average. For this calculation the index of manufacturing output in LTES vol. 10, Mining and Manufacturing (1972), pp. 140-143, was used. For 1955-1993 the index of capital utilization in the manufacturing sector was taken from Yearbook of Indices of Industrial Production by the Japan Ministry of International Trade and Industry.

L: Gainful Workers and Work Hours in the Private Non-Primary Sector

Labor data in terms of the number of gainful workers in the private non-primary sector (series A) were obtained for 1885-1905 by subtracting from the numbers of gainful workers in Japan Proper (LTES, vol. 2, Manpower, 1988, pp. 198-99) those engaged in agriculture, forestry and fishing (LTES, vol 2, pp. 216-217 and 226-227) and those in the government services (LTES, vol 7, Government Expenditure, 1966, pp. 214-215). The same procedures were applied for 1906-1919 and 1920-1940 based on data in LTES vol. 2, pp. 204-206 and 208-215, respectively. Data for the post-war period were taken from EPA (1968; 1995).

The total number of work hours (series B) was calculated by multiplying the number of work hours per year to the number of gainful workers (series A). Data on both the average number of work days per worker per year and the average number of working hours per work day were available for 1923-40 from the Japan Statistical Research Institute (1958). The 1893-1922 data of work hours per worker per year (h) were estimated by the following regression estimated from 1923-40 data by the ordinary least squares.

$$h_t = 273.80 + 0.3009\, x_t, \quad r = 0.260$$

where x_t represents the deviation of manufacturing output from the seven-year moving average. Data for the postwar period (1955-1993) were taken from Annual Report on the Labor Force Survey by Japan Management and Coordination Agency's Statistics Bureau.

β :Income Share of Capital

The income share of capital was obtained as one minus the income share of labor (α). Estimates of labor's share in Minami and Ono (1977) was extrapolated by means of the ratio of the average per-worker wage earning index in the manufacturing sector, I(w), from LTES, vol. 1, p. 140, to the index of the average product per worker in the private non-primary sector estimated in this study according to the following formula:

$$\alpha_t = \alpha_{1896}[I(w)_t / I(Y/L)_t]$$

where α_t is labor's share in year t and both $I(w)_t$ and $I(Y/L)_t$ are indices for year t with 1896=100. The same formula was applied for extrapolating the Minami-Ono estimate for 1970 to the 1971-93 period, for which average wage earnings and average incomes per worker were calculated by dividing compensations to employees and domestic factor incomes in national accounts by the number of employees in EPA (1995).

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Table 1. Stylized Facts in the Two Phases of Modern Economic Growth.

		Phase I (Marx Pattern)	Phase II (Kuznets Pattern)
(1)Income per capita	Y/N	Increase	Increase
& Labor productivity	Y/L	Increase	Increase
(2) Capital per capita	K/N	Increase	Increase
& Capital-labor ratio	K/L	Increase	Increase
(3) Capital-output ratio	K/Y	Increase	Decrease
(4) Capital's share in income	rK/Y	Increase	Decrease
(5) Saving rate	S/Y	Increase	Constant
(6) Interest rate	r	Constant	Constant
(7) Wage rate	w	Constant	Increase
(8) Relative contribution	G(A)/G(Y/N)	Small	Large
of total productivity	G(A)/G(Y/L)	Small	Large

Note: (1), (2), (3), (6), (7), (8) are defined in real terms.

Table 2. Accounting for Long-Term Growth in Labor Productivity in the United States and Japan.

	Income Share of Capital (1)	Average Growth Rate Per Year (%) Real Labor Productivity β G(Y/L) (2)	Capital-Labor Ratio G(K/L) (3)	Capital's Contribution G(K/L) (4)=(1) x (3)	Total Productivity (G/A) (5) =(2)-(4)	Percentage Contribution of Total Productivity G(A)/G (Y/L) (6)=(5)/(2) x 100
United States (Private Gross Domestic Product)						
1. 1800-1855	0.34	0.42	0.63	0.22	0.20	48
2. 1855-1890	0.45	1.06	1.54	0.70	0.36	34
3. 1890-1927	0.46	2.01	1.34	0.62	1.40	70
4. 1929-1966	0.35	2.67	1.66	0.56	2.14	80
5. 1966-1989	0.35	1.40	1.75	0.62	0.78	56
Japan (Private Gross Non-Primary Product)						
1. 1888-1900 A	0.33	2.07	5.21	1.72	0.35	17
B	0.33	2.08	5.74	1.89	0.19	9
2. 1900-1920 A	0.39	2.71	6.09	2.38	0.33	12
B	0.39	2.68	6.07	2.37	0.31	12
3. 1920-1937 A	0.43	2.27	2.62	1.13	1.14	50
B	0.43	2.29	2.75	1.18	1.11	48
1928-1937 A	0.47	3.13	2.01	0.94	2.19	70
B	0.47	3.04	2.23	1.05	1.99	65
4. 1958-1970 A	0.33	7.05	8.73	2.88	4.17	59
B	0.33	8.19	11.60	3.83	4.36	53
5. 1970-1990 A	0.28	3.32	6.48	1.81	1.51	45
B	0.28	3.78	7.44	2.08	1.70	45

United States: Abramovitz (1993, p 223); Figures of Frame 1 (Abramovitz-David series); labor in full-time equivalent work hours and capital in total fixed capital stock.

Japan: Growth rates calculated between 7-year averages centering the years shown.
A. Labor in gainful workers and capital in reproducible fixed capital stock unadjusted for utilization rate.

B. Labor in work hours and capital in reproducible fixed capital stock adjusted for utilization rate.

See Appendix for sources and procedures.

Table 3. Changes in Capital Coefficient in the Private Non-Primary Sector of Japan, 1888-1990.

	Capital Coefficient Index (1888=100)	
	(A) Unadjusted for Utilization	(B) Adjusted for Utilization
1888	100	100
1890	105	104
1900	143	143
1910	208	210
1920	271	272
1930	315	307
1937	287	294
1958	208	153
1960	210	185
1970	249	265
1980	338	315
1990	452	513

Note: Seven year averages centering the years shown. See Appendix for sources and procedures.

Table 4. Comparisons in the growth rates of labor productivity and total productivity between newly industrializing economies (NIES) and developed industrial economies

		Production elasticity of capital	Average growth rate per year (%)			
			Labor productivity	Capital-labor ratio	Total productivity	
		β (1)	G(Y/L) (2)	βG(K/L) (3)	G(A) (4)=(2)-(1)×(3)	Kim/Lau estimates (5)
NIES						
Korea	1960-90	0.45	5.1	8.9	1.1 (21)	1.2 (24)
Taiwan	1953-90	0.49	6.2	9.6	1.5 (24)	1.2 (19)
Hong Kong	1966-90	0.40	5.2	6.1	2.8 (54)	2.4 (46)
Singapore	1964-90	0.44	4.5	6.6	1.6 (36)	1.9 (42)
Average		**0.45**	**5.3**	**7.8**	**1.8 (34)**	**1.7 (33)**
Developed Economies						
France	1957-90	0.28	3.8	4.7	2.5 (66)	2.6 (68)
Germany (FR)	1960-90	0.25	3.6	4.9	2.4 (67)	2.2 (61)
U.K.	1957-90	0.27	2.3	3.0	1.5 (65)	1.5 (65)
U.S.A.	1948-90	0.23	1.5	1.6	1.2 (80)	1.5(100)
Japan	1957-90	0.30	6.0	9.7	3.1 (52)	2.9 (48)
Average		**0.27**	**3.4**	**4.8**	**2.1 (66)**	**2.1 (68)**

Note : (1) Average of estimates using the translog production function
(2) Real GDP per work hour
(3) Reproducible capital (excluding residential buildings) per work hour, adjusted for utilization rates.
(4)-(5) Relative contributions to the growth rate of labor productivity in percentages are shown in parentheses.
(5) Estimates using the translog production function with the assumption of capital-augmenting technological progress

Source : Kim and Lau (1994, Tables 3-1 and 7-1).

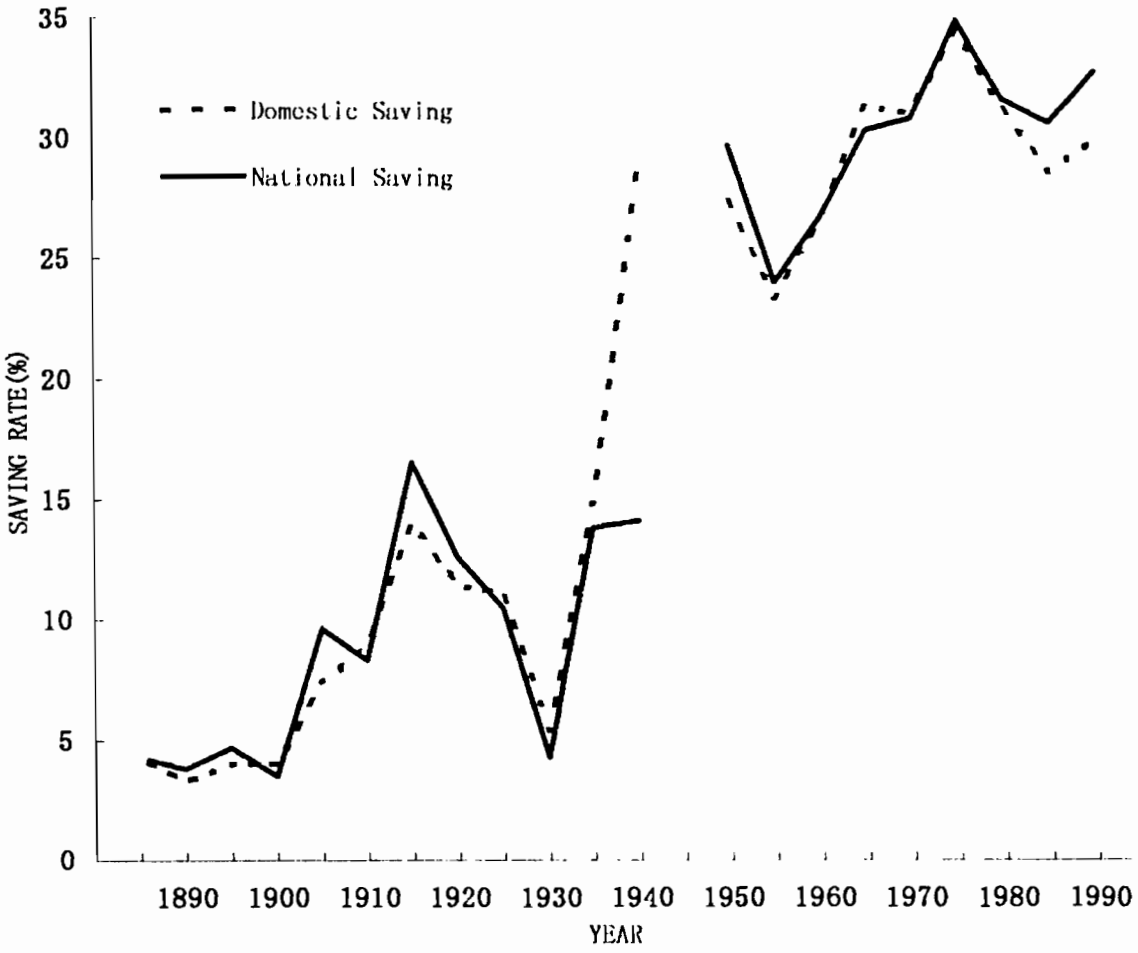

Figure 1. Movements in the ratios of national saving to GDP and domestic saving to GNP in Japan. Five-year averages centering on the shown for 1890 -1940 and ending with the years shown for 1950-90.

Source: Ohkawa et al. *LTES*, Vol. 5, ***Savings and Currency*** (1988, p. 44), supplemented for 1970 90 by Japan Economic Agency, ***National Accounts*** (annual issues).

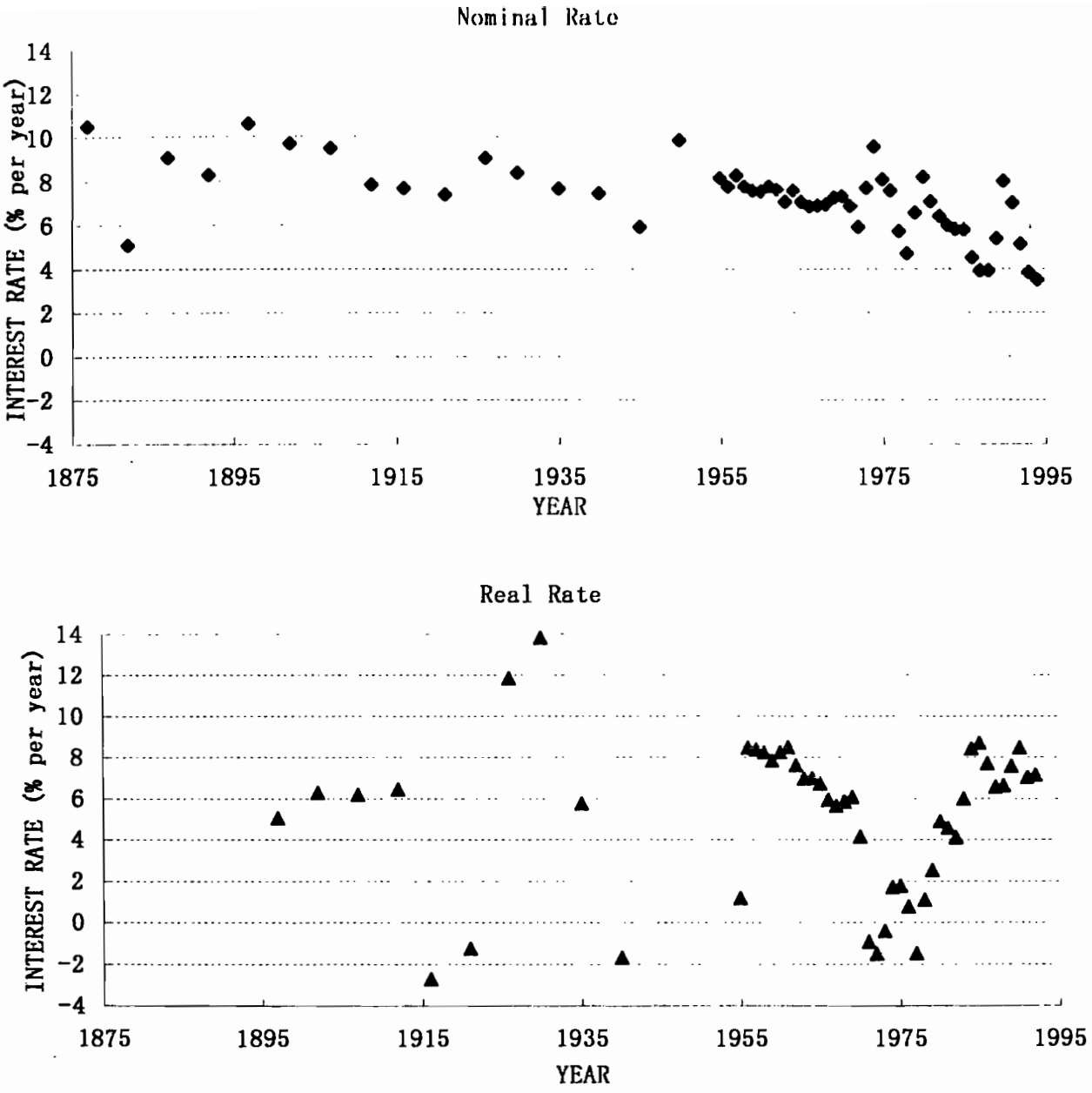

Figure 2. Movements in nominal and real rates of interest in Japan, 1877-1990

Source: Nominal rates are averages of the highest and the lowest bank lending rates from Bank of Japan (1966, pp. 260 64) for 1877-1940; all banks' average lending rate from Bank of Japan, ***Keizai Tokei Geppo*** (Economic Statistics Monthly). Real rates are nominal rates minus the rates of change in the wholesales price index in seven-year moving averages from Bank of Japan (1966, pp. 76 77) and ***Bukka Shisu Geppo*** (Price Indexes Monthly).

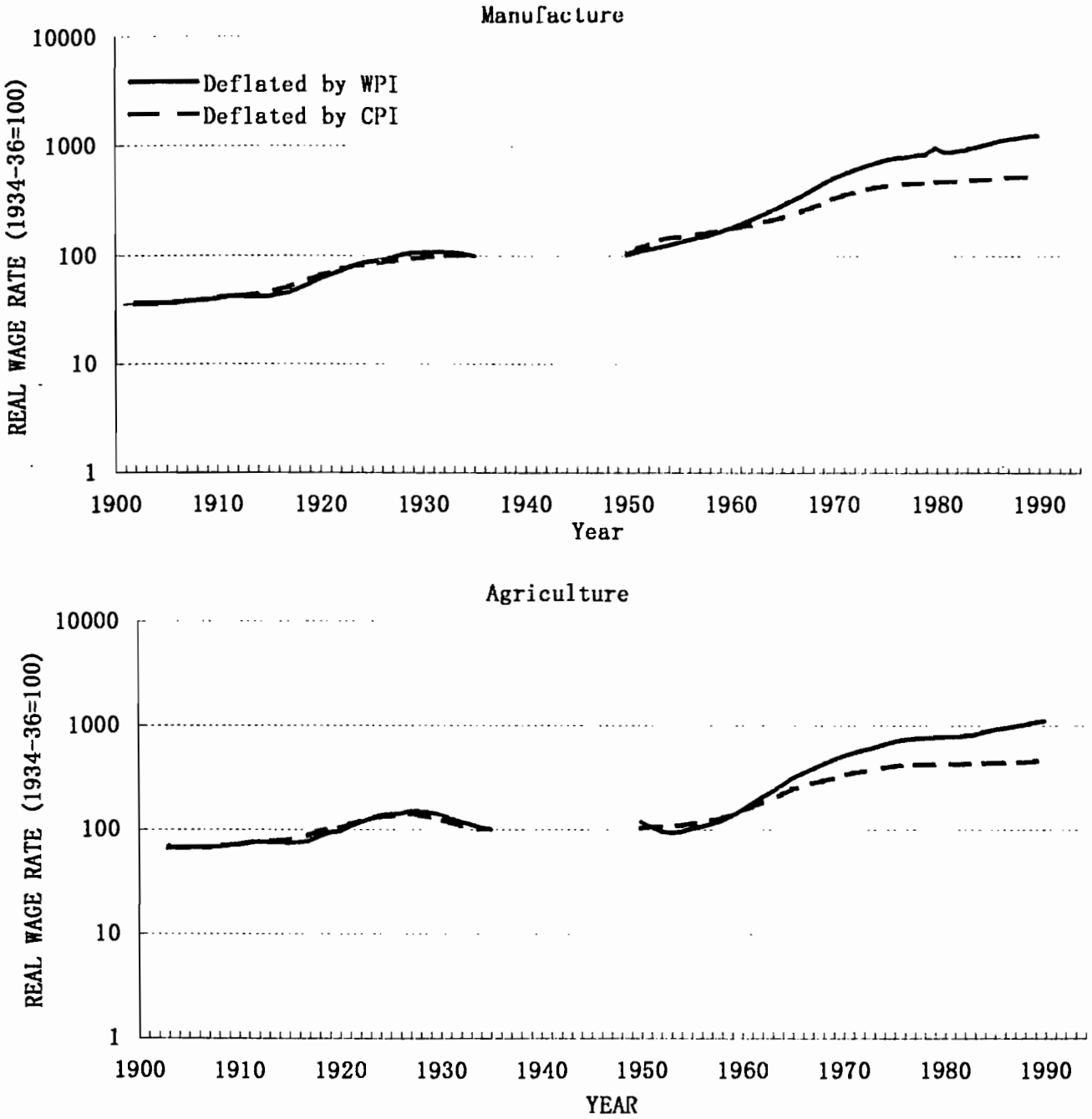

Figure 3. Movements in the real wage rate in Japan (1934-36=100), 1896-1994, seven-year averages, semi-log scale.

Source: Nominal wage rates for manufacturing from Ohkawa, et al., ***LTES***, Vol. 8, ***Prices*** (1967, p. 246) and Japan Ministry of Labor, ***Maigetu Kinro Tokei Chosa*** (Monthly Labor Survey); for agriculture from ***LTES***, Vol. 9, ***Agriculture and Forestry*** (1966, p. 107) and Japan Ministry of Agriculture, ***Noson Bukka Chingin Chosa*** (Survey on Rural Prices and Wages). WPI from Bank of Japan (1967, p. 76 77) and ***Bukka Shisu Geppo*** (Price Indexes Monthly). CPI from Ohkawa, etal., ***LTES***, Vol. 8, ***Prices*** (1967, p. 135-137) and Japan Management and Coordination Agency, ***Shohisha Bukka Shisu Geppo*** (Monthly Report on the Consumer Price Index).