

Japan's Economy in the Twentieth Century

Overview

By almost any definition, Japan's economy turned in a remarkable performance starting in the last quarter of the nineteenth century and continuing through most of the twentieth. To cite just one statistic, annual output grew a massive 70-fold between 1885 and the end of 1999. The American economy, in comparison, expanded at less than half that rate.

This absolute increase in the sheer size of economic production in Japan brought with it an immense multiplication of the standard measures for gauging economic welfare. For example, the average value of national income per person expanded by a factor of almost 21.

With its stellar performance by this and other yardsticks, Japan demonstrated to the world that it was not necessary to be European or North American to get rich. The more recent takeoff of economies in Asia and elsewhere in the developing world owes much to this example and to the lessons, learned and mislearned, from the Japanese experience.

This chapter outlines the main trends of Japan's economy over the twentieth century. Before proceeding, though, a word needs to be said about the data that were used to calculate the long-term trends discussed here. To construct more or less consistent information spanning a century-plus, several shorter time series that had been compiled on different

occasions had to be strung together. The need to convert monetary values into quantities that reflect general price changes introduced additional complications. Therefore, the analysis should carry a large, bold-faced warning: Read with caution. To say, for instance, that real gross national product per capita in 1885 was ¥188,000 in 1990 prices compared with a 1999 figure of ¥3,866,000 is, at best, a gross characterization—although not necessarily a mischaracterization. Fine distinctions are not warranted by the quality of the data.

Pre-Meiji Foundations of the Modern Japanese Economy

The rapid industrialization of Japan following the Meiji restoration in 1868 surprised most contemporary observers. Japan's military defeat of China in 1895 and Russia 10 years later demonstrated a mastery of modern technology and industrial practice that could be brought to bear in a compelling fashion. According to figures compiled by growth economist Angus Maddison, Japan's economic performance over the years 1870 to 1913 was exceeded by only seven countries out of the 29 examined.¹ From 1950 to 1973, no other country did as well as Japan. Such an amazing track record raises the question of its foundations. What was happening inside Japan before its economic prowess startled the world?

For the 250 years that ran from the beginning of the 1600s to the middle of the nineteenth century, Japan's leaders cut the nation off from contact with other countries. The Tokugawa shoguns who ruled during this period from their capital in Edo—now Tokyo—prohibited the construction of oceangoing ships and severely punished unauthorized contact with foreigners. In 1600, the largely peasant Japanese economy was not that different from most of the rest of the world in terms of technology and living standards. In the intervening years, however, the industrial revolution in Great Britain and then in North America created technology, growth, wealth, and capabilities that far surpassed what was happening in the isolated islands of Japan.

Despite the absence of the fruits of the industrial revolution that were transforming the West, Japan was not undeveloped. It boasted three of the largest cities in the world; Edo alone had more than 1,000,000 inhabitants. With this urbanization came the creation of craft industries and merchant classes that processed the food and other materials of the countryside and catered to society's elites as well as to the tastes and the incomes of the masses. Sophisticated as well as popular arts flourished.

When Japan began to open in the 1850s, the West was astounded by the creativity that had thrived there out of sight. Western artists and manufacturers quickly incorporated Japanese ideas into their own products.

Although most Japanese production was in small craft shops that used little capital, several mining establishments employed more than 1,000 full-time laborers apiece. Spread around the country were 80 to 90 iron mines, each of which had around 300 workers. The growth of an iron industry promoted the beginnings of a factory system, with the attendant accumulation of capital and the organization of paid work.²

The production and marketing of products for urban centers and the taxes-in-kind imposed on feudal lords based on rice output led to the growth of sophisticated financial practices and markets. Osaka was the main financial center. A small group of bankers performed many of the functions of a central bank, acting as lenders of last resort, making loans to local governments, controlling the level of bank credits, and establishing a market between gold and bank money. A rice market in Osaka featured such modern activities as futures trading.³

The population was relatively well fed, housed, clothed and educated. About 40 percent to 50 percent of all males and about half as many females benefited from some formal schooling. Temple schools in rural areas spread literacy, with 30 percent to 40 percent of males able to read and write.⁴ According to World Bank estimates, that level of literacy in Japan in the middle of the nineteenth century was greater than what is found today in some 40 countries.⁵

One peculiar feature of the Tokugawa shogunate was the practice known as alternate attendance. Feudal lords were required to spend every other year in Edo. When they returned to their lands, their families remained in the capital—essentially as hostages of the shogun. This policy was meant to restrict the ability of the lords to plan uprisings against the central authorities by keeping them under the direct gaze of the shogun when they were in Edo and by breaking up their periods away from the capital when they could engage in plotting. But it had unintended consequences that were important for long-term economic growth; the movement every year of several hundred feudal masters with up to several thousand retainers required roads, means of transportation, post houses, feeding and supplying people and animals, and considerable planning.⁶

When, in 1861, the emperor's younger sister traveled from Kyoto to Edo to marry the shogun, some 25,000 court retainers accompanied the royal party. Planning for this movement took several months and involved thousands of porters, animal tenders, and other staff at each of the

69 posts along the Kiso road. It required administrative competence in the capital, but local initiative and energy made the whole thing work.

Smaller versions of this once-in-a-millennium event took place almost on a daily basis. The movement of people from their native villages to metropolitan areas across the breadth of Japan educated generations of minor officials and peasants who otherwise would have known little more than the fields around their villages. At the same time that peasants were learning the ways of the big city, local methods, ideas, and arts were being introduced to Edo. This two-way flow nurtured the notion of a greater Japan.⁷

Economic growth was slow but positive in the eighteenth century and the first half of the nineteenth. Living standards even in a poor district like the Morioka region examined by University of Washington professor Kozo Yamamura rose by roughly 0.5 percent a year from the early 1700s to the end of Tokugawa rule. Nutrition, clothing and housing improved steadily throughout the period.⁸

Thus, when the leaders of the Meiji restoration decided to seek Western technology and institutions and to adapt them to national purposes, Japan already had a society that worked—and worked well. Mr. Maddison has estimated that Japan's 1820 per capita output was about \$609 in 1985 purchasing power dollars, or roughly \$750 at 1995 purchasing power parity prices. According to World Bank estimates, that level of economic output would have placed Japan ahead of about 15 countries in 1995, making it underdeveloped but not at the bottom of the economic league tables.

In the words of Kazushi Ohkawa of Hitotsubashi University and Henry Rosovsky of Harvard University, Japan “was a vigorous, advanced, and effective traditional society. In many ways it was more advanced than many countries in Africa or Latin America today. ... We tend to inevitably associate low income per capita with poor organization, corruption, lethargy, and undernourishment. And, this gives a false picture of Japan before the Restoration.”⁹ In short, Japan, on the eve of its coming out, was in a good position to absorb the lessons that the West had for it.

The Growth of National Economic Output

Phases of Development

Although Japan began to move toward economic modernity in the last decades of the Tokugawa shogunate, this transition became a burning national priority only after the installation of the new regime in 1868. The years until 1885 or so were ones of change as such traditional institutions as clans, feudal domains, and state support for samurai were disestablished and new institutions were created.

By 1885, the contours of the modern Japanese state and economy were evident. From that year through 1930, the growth of the economy was fairly steady, averaging 2.8 percent annually. However, since the population was increasing at a pace of slightly more than 1 percent a year, average individual welfare improved more slowly than the expansion of the overall economy. Real GNP per capita doubled over this period, rising by roughly 1.6 percent a year.

The ups and downs in the pre-1940 economy were, to a degree, stimulated by events in the global economy. For instance, a doubling of growth from 2 percent to 4 percent between 1915 and the 1920s was fueled at least in part by a surge in European orders due to World War I and by the economic boom that followed. A decline from the 1920s to the early 1930s reflected the effects of the Great Depression on Japan. A subsequent spurt in the late 1930s was caused largely by stepped-up production in preparation for World War II.

Despite the fluctuations in growth in the half century or so preceding World War II, the Japanese economy demonstrated considerable momentum after the Meiji restoration. Wartime destruction ended that phase of industrialization and growth. Total output failed to reach 1939's level until 1955. However, after that point, Japan's economy took off in an unprecedented fashion. Indeed, to borrow from the romantic poet, Samuel Taylor Coleridge (1772-1834), it was a "miracle of rare device." It would not be an exaggeration to assert that the economy's performance between 1956 and the early 1970s continues to color our views and understanding of Japan.

The postwar period can be divided into several phases. The first one was the immediate aftermath of the surrender, when Japan struggled with shortages of virtually every kind. Not only had domestic production capacity been destroyed by the war, but Japan also lost many of its suppli-

ers because they were either former colonies whose ties had been broken or other Asian nations that had suffered similar destruction.

Inflation of more than 100 percent annually raged from 1946 through 1948. The following year, the occupation authorities implemented a stabilization program crafted by Joseph Dodge, a Detroit banker who had undertaken a similar job in war-torn Germany. The fiscal and monetary policies known as the Dodge line stabilized the economy and set the stage for a revival of investment and growth.

The onset of the Korean War in 1950 generated large-scale orders from the American military for equipment that helped to revive the Japanese industrial sector and brought the economy out of a deep, stabilization-induced recession. From that base, the economy's expansion became self-sustaining. As early as 1960, growth over the preceding 10 years was nearly 8 percent, although, admittedly, it was from a low postwar level. From the late 1950s to 1970, the rise in GDP accelerated to double-digit rates. In the Tokugawa era, output had doubled in 150 years; after the Meiji restoration, the same increase had taken 45 years. The twentieth-century doubling was accomplished between 1963 and 1970!

Deceleration then set in. The economy's expansion during the 1970s fell to 4 percent a year, where it remained until the 1990s. Since the end of its high-speed growth, Japan has marched toward a long-term growth rate of roughly 2 percent. Although there is nothing magical about that figure, it is the maximum sustained rate that rich countries have managed to attain in the past 25 years.

The methods, institutions, habits, and psychology that were instrumental in producing the so-called miracle growth of the postwar era now must be adjusted to a new reality. The necessity to revise expectations and to recast standard operating procedures and assumptions is the problem facing the world's second-biggest economy at the beginning of a new century as it attempts to deregulate and restructure business operations in response to permanently slower growth.

Chasing the United States

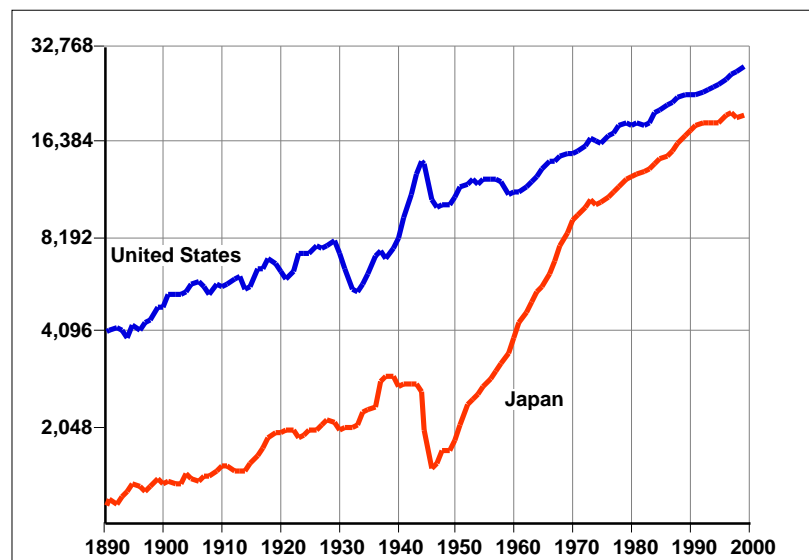
Not only did the economy's surge transform the very nature of Japan's global role, but it also produced a level of per capita income that is among the highest in the world today. One measure of the gain in personal welfare is obtained by dividing GNP by population. figure 2.1 shows real GNP per capita for Japan and the United States converted into 1990 dollars by using that year's estimated purchasing power parity of

¥196=\$1.00. Note that the vertical axis is a logarithmic scale such that each division is double the previous one and that the slopes of the curves indicate rates of growth.

In 1890, the first year of comparable data, American output per capita was 3.7 times the Japanese figure. The United States was not quite the richest country in the world at the turn of the twentieth century but, according to Mr. Maddison, then at the University of Groningen, the Netherlands, it would be in just a few years.¹⁰ Despite steady growth in Japan, the relative situations of the two countries had not changed much by 1930 because the United States also was experiencing a vigorous expansion.

Although the American economy continued to increase in size after 1945, the exceptional experience of Japan pushed its average output per capita closer to the U.S. figure. However, even in 1970, American per capita output still was 80 percent larger than Japan's. Nevertheless, Japan's faster growth gradually drew the two curves closer together, with the nearest approach reached in 1992, when the U.S. economy in per capita terms was only 24 percent bigger. The 1990s were not good to Japan, and outputs moved apart in the remaining years of the decade. The 1999 figure showed that, per person, America turned out some 40 percent more than Japan.

Figure 2.1: Real GNP per Capita, Japan, United States, 1890-1999, 1990 Dollars at Purchasing Power Parity of ¥196=\$1.00



Sources: Statistics Bureau, Management and Coordination Agency, *Historical Statistics of Japan on CD-ROM*, Japan Statistical Association, 1999, tpls. 2-01, 13-03, 13-10, Statistics Bureau, Management and Coordination Agency.; U.S. Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1970, Bicentennial Edition*, Washington, DC, 1975, Series F3, F4; *Survey of Current Business*, December 1999, 132.

It sometimes was said in the 1980s that Japan's GNP per capita would overtake that of the United States before the end of the century. Rasher voices extended the prediction to GNP itself. A little arithmetic would have shown that neither possibility was likely over the forecast span of years. If, starting in 1992, Japan had maintained its 2 percent growth differential, it would have taken 11 more years for that country's GNP per capita (measured by 1990 purchasing power parity) to catch up with the United States. In terms of the absolute size of the two economies, Japan's 1992 GNP was only 40 percent as large as America's. Again, with a 2-point expansion differential, convergence would have required another 46 years.¹¹ In fact, the gap has swung in the other direction. By 1999, America's economy was three times larger than Japan's.

Investment in Physical Capital

It is a commonplace of development economics to note that nations grow through investment in physical and human capital, through increased efficiency, and through the absorption of more productive technologies, which generally occurs in conjunction with investment. In the latter part of the 1800s, a good deal of Japan's productivity advances came from the internal diffusion of best practice, mainly in agriculture.

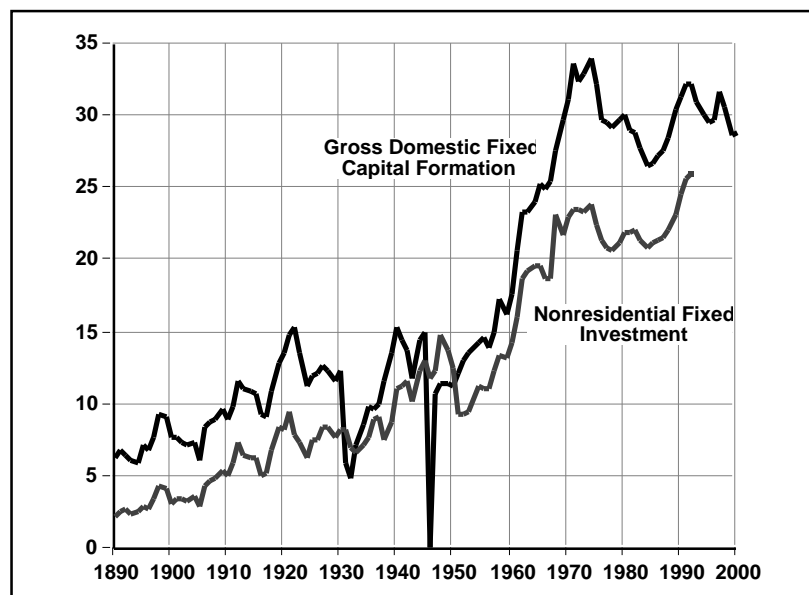
As industry and finance developed and as personal incomes rose, retained earnings and individual savings became available to fund an increasing share of investment out of total output. The long-term trend of investment is captured in a data series on gross domestic fixed capital formation, which covers the entire century. This information includes government infrastructure investment, business investment, and residential housing investment. For purposes of describing the capital accumulation that made Japanese industry more productive, however, it is too inclusive. It is better to exclude residential investment.

Mr. Maddison has produced standardized estimates of nonresidential investment and accumulated capital for the world's major economies.¹² However, his data do not include the government's contribution to infra-

structure, which represented the largest and most productive share of investment in Japan in the late 1800s.

Both investment measures are plotted in figure 2.2 as ratios of GNP, all in 1990 prices. The pattern is similar in both curves. Investment started at low levels in the nineteenth century, rose gradually as a share of total output, and reached high points in 1920 and then again in the wartime buildup of the late 1930s. Mr. Maddison estimated that one-quarter of the capital stock subsequently was destroyed in the war.

Figure 2.2. Ratio of Investment to GNP, 1990 Prices, 1890-1999, Percent



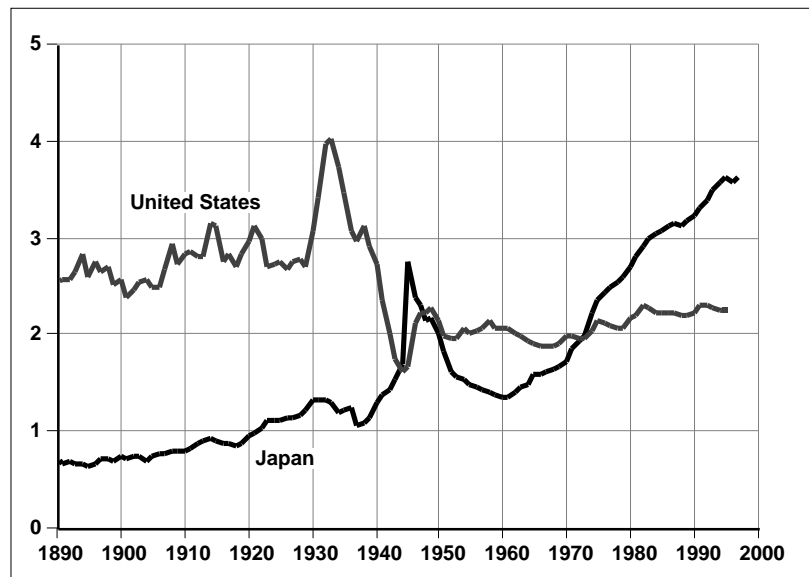
Sources: Nonresidential fixed investment: Angus Maddison, "Standardised Estimates of Fixed Capital Stock: A Six Country Comparison," in *Explaining the Economic Performance of Nations* (Brookfield, Vermont: Edward Elgar Publishing Co., 1995); gross domestic fixed capital investment: Statistics Bureau, Management and Coordination Agency, *Historical Statistics of Japan on CD-ROM*, Japan Statistical Association, 1999, tpls. 13-03, 13-08, 13-11A

It was in the postwar period that investment took off in Japan. Gross fixed capital formation soared to more than one-third of GNP in 1970.

Even the narrower measure shows that more than 20 percent of the nation's product was plowed back into plant and equipment. With the slowdown in growth in the 1970s, the pace of capital accumulation slowed—but not by as much as might have been expected by the falling rate of GNP increase. The “bubble economy” of the late 1980s stimulated a resumption of high investment reminiscent of Japan's economic glory days.

Investment has several important effects. Since new technology typically is incorporated in new equipment, not only does investment expand productive capacity, but it also increases the productivity of capital itself as well as that of other inputs. Moreover, labor productivity rises as the capital stock increases relative to the number of employees—even without new technology. Investment, therefore, is the key ingredient for growth.

Figure 2.3: Ratio of Capital Stock to GNP in 1990 Prices, Japan and United States, 1890-1999



Sources: Angus Maddison, “Standardised Estimates of Fixed Capital Stock: A Six Country Comparison,” in *Explaining the Economic Performance of Nations* (Brookfield, Vt: Edward Elgar Publishing Co., 1995).

The capital intensity of the Japanese and the American economies is shown in figure 2.3. As one of the fastest-growing and richest economies of the late nineteenth and early twentieth centuries, the United States already had a large capital base relative to output in the 1890s. The Great Depression of the 1930s caused investment to collapse as depreciation eroded the value of the capital stock faster than the dwindling additions could increase it. During World War II, little nonmilitary investment was undertaken, and the capital stock continued to deteriorate. However, sharp increases in productivity in the postwar period allowed the U.S. economy to prosper with a lower capital intensity of production than in the prewar period.

Japan's capital stock increased gradually relative to output from 1890 to 1930, with only a shallow dip during the Great Depression, followed by a wartime surge. By 1960, the very high rate of investment caused the capital-to-output ratio to resume its prewar trend, but at an accelerated pace. In the 1970s, the capital intensity of production in Japan exceeded that in the United States. Moreover, the capital stock continued to expand faster than output itself. By 1995, the capital intensity of production in Japan was 60 percent higher than in the United States. By then, the apparent excess of capital was an increasing problem for Japan. It was indicative of the economy's low productivity and inadequate rates of return on investment.

Investment in Human Capital

Primary and Secondary Education

A high priority of the government after the Meiji restoration was to promote universal education. The education law of 1872 established a three-tiered structure of primary schools, middle schools, and universities. Enrollment rates for 6 to 12 year olds increased gradually from the 1875 level of 50 percent for boys and less than 20 percent for girls to near universality by 1905 (see table 2.1)

In 1947, the educational system was changed to six years of elementary school, three years of lower secondary school, and three years of upper secondary school. Although the population was almost 100 percent literate and had basic mathematical abilities, advancement to upper secondary school was not automatic. In 1950, less than half the graduates of lower secondary schools continued their education. It was not until 1975

that more than 90 percent of those completing their ninth year of schooling moved on to the next stage of education (see. 2.2).

The relatively rapid spread of literacy and basic educational skills admirably suited the needs of an industrializing economy. Since most technology came from abroad, either embodied in investment goods or licensed directly from foreign firms, there was little need for an extensive university system to train engineers and scientists. Recent research on the impact of education on development emphasizes the importance of basic schooling, especially for women, rather than university training for an elite class.

**Table 2.1. Elementary School Enrollment,
Percent of 6 to 12 Year Olds, 1875-1920**

Year	Male	Female
1875	50.8	18.7
1880	58.7	21.9
1885	65.8	32.1
1890	65.1	31.1
1895	76.7	43.9
1900	90.4	71.7
1905	97.7	93.3
1910	98.8	97.4
1915	98.9	98.0
1920	99.2	98.8

Source: Management and Coordination Agency, Statistics Bureau, *Historical Statistics of Japan on CD-ROM* (Tokyo: Japan Statistical Association, 1999), tbl. 22-01.

**Table 2.2. Advancement Rates From Lower and Upper Secondary
Schools to Higher Grade, 1950-97, percent**

Year	Lower Secondary		Upper Secondary	
	Male	Female	Male	Female
1950	48.0	36.7	n.a.	n.a.
1955	55.5	47.4	20.9	14.9
1960	59.6	55.9	19.7	14.2
1965	71.7	69.6	30.1	20.4
1970	81.6	82.7	25.0	23.5

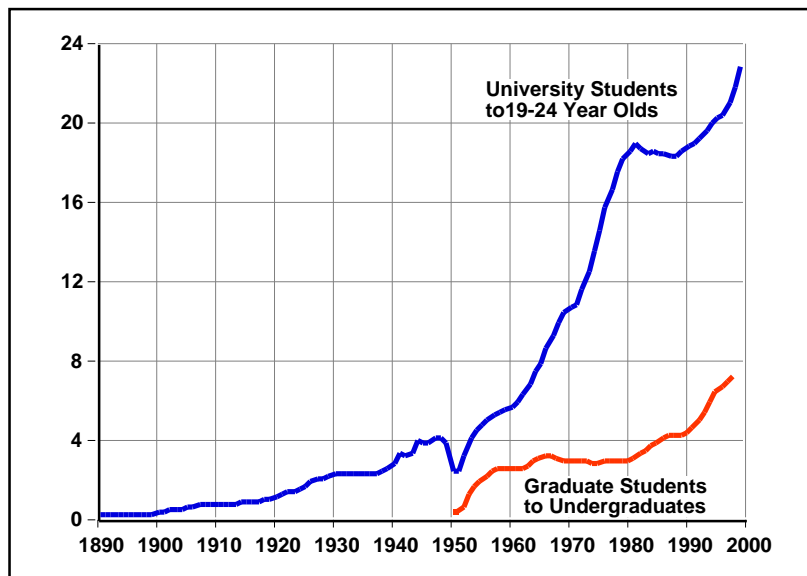
1975	91.0	93.0	33.8	34.6
1980	93.1	95.4	30.3	33.5
1985	92.8	94.9	27.0	33.9
1990		95.1	23.8	37.3
1995		96.7	29.7	45.4
1997		96.8	34.5	46.8

Source: Management and Coordination Agency, Statistics Bureau, *Japan Statistical Yearbook*, various years.

University Education

As an economy matures, a greater share of the increase in productivity flows from technology that is not incorporated in machines but rather produced by targeted research and productivity-enhancing efforts. To make the transition to a phase that is more oriented to research and development, university and graduate education becomes more important. As shown in table 2-2, the advancement rate for males from upper secondary schools plateaued in the 1970s. Female advancement, however, continued to increase, partly because of the popularity of women's junior colleges.

Figure 2.4: Ratios of Four-Year University Students to 19-24 Year Olds (1890-1998) and Graduate Students to Undergraduates (1951-98); percent



Source: Statistics Bureau, Management and Coordination Agency, Historical Statistics of Japan on CD-ROM, Japan Statistical Association, 1999, tbls. 22-04A, 22-04B; Statistics Bureau, Management and Coordination Agency, Japan Statistical Yearbook, various years

The proportion of 19 to 24 year olds enrolled in four-year colleges and universities accelerated from 1890 to 1980 and then leveled off for 10 years, only to rise again in the 1990s (see figure 2.4). Increases in college and graduate school enrollments have been typical reactions to difficult employment markets in the United States. Perhaps the sharp fall in the availability of jobs for high school graduates in Japan had the same effect there.

Enrollment in Japanese graduate schools was very low until the late 1950s. Even between 1965 and 1980, only about 3 percent of the people who graduated from four-year colleges and universities continued with graduate education. In the 1990s, the rate almost doubled at the same time that the share of 19 to 24 year olds going to college also rose. By 1998, the number of graduate students was twice as high as in 1990 and triple the 1980 level.

The growth of undergraduate and graduate education in Japan over the past 20 years has helped to equip the country with a more flexible work force that has the capability to learn new skills on a continuing basis. Compared with the United States, however, Japan still has room for improvement. Approximately 50 percent more of the U.S. college-age cohort is enrolled in four-year educational institutions, and 23 percent of the undergraduate student body goes on to graduate studies—roughly four times the Japanese ratio. Enhancing the role of higher education remains on Japan's agenda for the future.

Trade and Exchange Rates

Exports and Imports

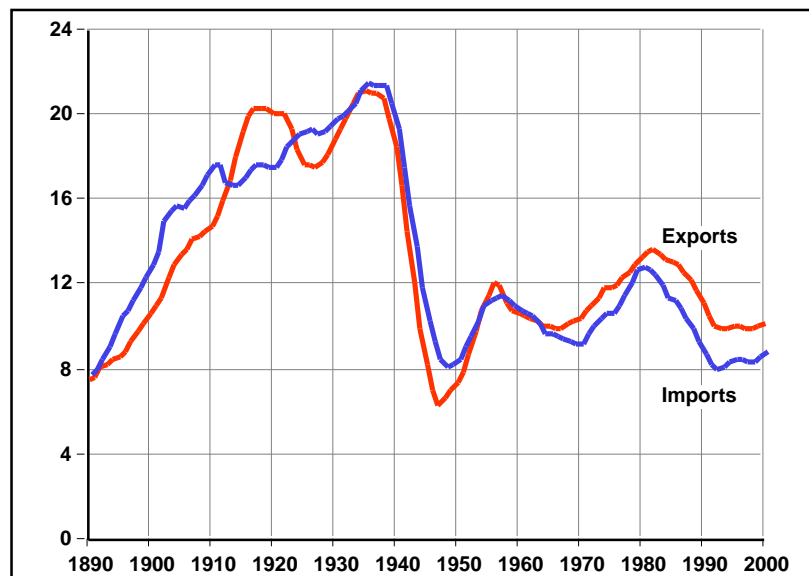
Japan depended on imports of raw materials and machinery for its development. Imports from the West allowed the nation's new businesses to access advanced technologies and products that were unavailable at home. At first, Japan paid for its purchases from abroad by exporting such traditional goods as silk and silk products. However, as industrialization occurred, it was able to sell overseas the output of its

new mills and factories, particularly nonsilk textiles. In a very real sense, exports played a critical role in Japan's development since they earned the foreign exchange to pay for essential imports. Throughout the period before World War II, imports and exports alike were a large fraction of total economic production, much more than they would be in the postwar period.

On a 10-year moving average basis, exports and imports as shares of GNP rose steadily from the end of the nineteenth century, peaking at 20 percent of national output in the 1920s and 1930s (see figure 2.5). The effects of the Great Depression, the widespread imposition of tariffs, and the onset of war combined to drive down trade in Japan, as they did in other countries as well.

In 1945, Japanese industry was destitute and unable to produce for export. The American occupation authorities managed trade on an item-by-item basis, making up differences in export earnings and import bills through subsidies provided by the U.S. government. Since many import items were deliberately subsidized to keep prices low, Japan's trade deficit turned into a burden for American taxpayers.

Figure 2.5: Ratio of Exports and Imports to GNP, 1890-1999, percent



Source: 1890-1954: Statistics Bureau, Management and Coordination Agency, *Historical Statistics of Japan on CD-ROM*, Japan Statistical Association, 1999, tbls. 13-03, 13-04; 955-99; Statistics Bureau, online at <http://www.stat.go.jp/1.htm>.

Occupation economists saw a clear need to resume trade based on market principles, but rampant inflation complicated the calculation of an exchange rate. An exchange rate of ¥360=\$1.00 was introduced in April 1949, and inflation was tamed through the implementation of the Dodge line. Those developments positioned the Japanese economy to resume unsubsidized trade. However, trade never returned to its prewar levels. During the 15 years of maximum growth from 1955 to 1970, exports averaged less than 10.5 percent of GNP. The peak export year was 1981 when sales abroad represented 13.6 percent of total output. In the 1990s, exports and imports both were equivalent to less than 10 percent of the economy.

The notion that Japan's economy is export-driven even today is hard to shake because of the visibility of Japanese products in the minds of consumers and the international fame of key exporters. The real importance of exports, as economists have noted ever since 1776 when Adam Smith developed the logic in *The Wealth of Nations*, is that they provide payment for imported goods and services. From the numbers, it is hard to understand why the idea of export-driven growth has received such prominent attention in economic histories of Japan. If anything, the discussion should be about import-driven growth, since the essential ingredients of life, economic development, and economic welfare were all supported by foreign goods and services.

A simple measure of the direct contribution of a GDP component to the growth of GDP is the ratio of the change in that component to the change in GDP. This is done in table 2-3 for 10-year movements of consumption, investment, and exports. Japan clearly was consumption-driven throughout the postwar period, with consumer spending accounting for one-half to two-thirds of the increase in output. Investment was the second-largest driver. Exports came in third, except for a few years when investment collapsed. The same exercise for the prewar period would demonstrate that consumption was even more important and exports less so than in recent decades.

Table 2-3 Percentage Contributions of Consumption, Investment, and Exports to 10-Year Growth of Gross Domestic Product, 1950-99

Years	Consumption	Investment	Exports
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1950-59	66.8	26.6	4.3
1960-69	56.3	39.1	6.8
1970-79	61.6	28.2	12.4
1980-89	52.3	34.4	15.1
1990-99	61.5	14.6	29.5

Source: Statistics Bureau, Management and Coordination Agency

Exchange Rates

The yen-dollar exchange rate has varied from parity in 1875 to ¥360=\$1.00 in 1949 to ¥80 briefly in the spring of 1995. What accounts for these fluctuations? As a good first approximation, variations in the relative prices of so-called tradable goods explain most of the changes in the exchange rate. Such other influences as interest rates and capital flows account for the remaining movement. However, the difference between inflation rates in Japan and the United States is a good place to begin.

The theory that relative prices drive exchange rates follows from the notion of the "law of one price." That is, if a product is sold at different prices, it pays arbitrageurs to buy it at the lower price and resell it at the higher one, thereby driving the gap to zero.

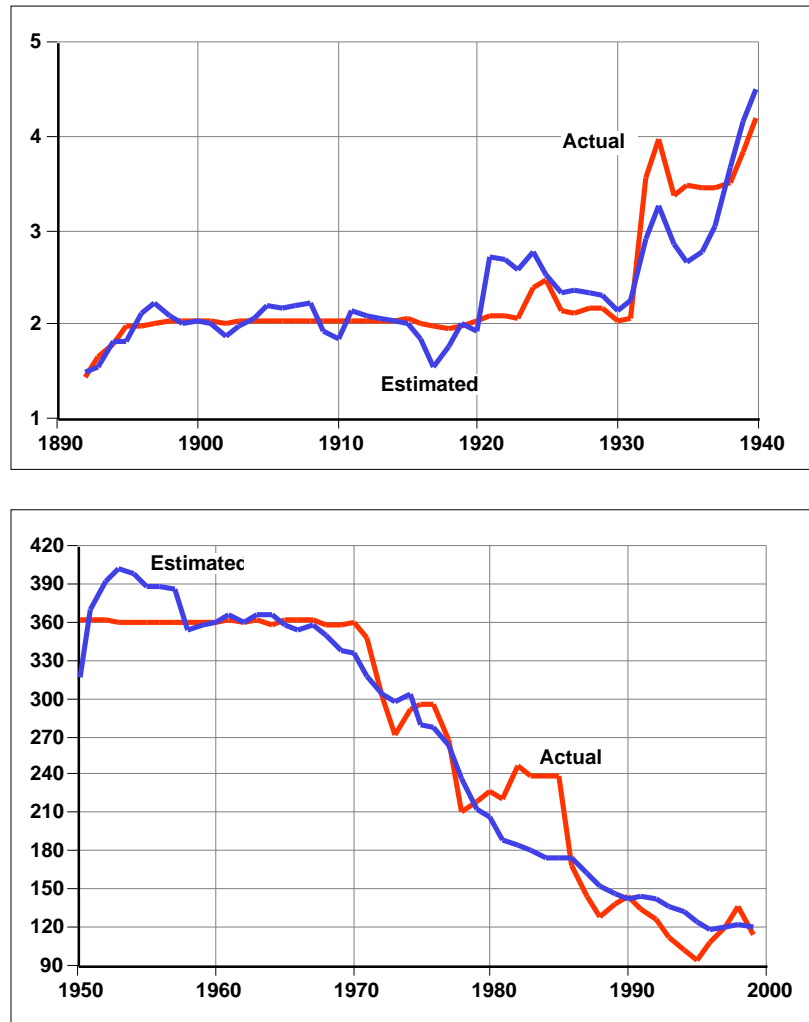
A technical issue in estimating the effects of relative inflation rates is the choice of a price index for tradable goods. Not all goods are traded, as demonstrated by the fact that only 10 percent of Japan's output enters into export channels. Thus, a broad measure like the GNP price deflator would include too many items that are unaffected by the international law of one price. Surprisingly perhaps, export and import price indexes also are inappropriate. They respond to the exchange rate at the same time that they influence it. If they did not adjust to exchange rate changes, either it would be impossible to sell a product because its international price was too high, or the product would be so cheap that the seller would face excess demand and probably would have an inadequate profit margin.

The price index chosen was the wholesale price index for Japan and the comparable producer price index for the United States. These indexes mainly reflect the prices of manufactured products and bulk commodities that potentially could enter into international trade.

To estimate the effect of these price series on the exchange rate, a simple equation was constructed with the yen-dollar exchange rate as the dependent variable and the two price indexes as independent variables,

all in natural logarithms. If the strict version of the law of one price holds such that purchasing power parity determines exchange rates, the Japanese price variable would have a coefficient of 1.0 and the U.S. price variable a coefficient of minus 1.0. In fact, the coefficients are 1.02 and minus 1.30, respectively. Actual and predicted yen-dollar values are shown in two panels in figure 2.6 to separate the very different values of the prewar and postwar eras.

Figure 2.6: Actual and Estimated Values of the Yen-Dollar Exchange Rate, 1892-2000



Sources: Japan: Statistics Bureau, Management and Coordination Agency, *Historical Statistics of Japan on CD-ROM*, Japan Statistical Association, 1999, tpls. 10-11A, 10-11B, 17-01; Bank of Japan.; United States: U.S. Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1970, Bicentennial Edition*, Washington, DC, 1975, Series E24; Bureau of Labor Statistics, Producer prices

The simple, relative-price explanation of the exchange rate does remarkably well over the entire 1892-1999 period. The bottom panel of figure 2.6 indicates that analysts did a pretty good job in 1948 in estimating an equilibrium exchange rate, given the inflation raging at the time and the absence of reliable trade data. The occupation economists working for Gen. Douglas MacArthur kept track of the individual exchange rates implicit in the negotiated prices of each trade deal. They also measured the rate of inflation to determine how fast relative prices were moving. Exchange rates for specific products varied from ¥100=\$1.00 for agar to ¥600=\$1.00 for flat glass.

In May 1948, Ralph Young, a Federal Reserve Board economist, suggested an exchange rate of ¥300=\$1.00, which he thought would undervalue the yen to encourage exports. An October 1948 Ministry of Finance report recommended that exports be priced at ¥350=\$1.00. Analysts running a price computing system proposed a rate of ¥450=\$1.00 in February 1949. The final decision, announced in April 1949, was ¥360=¥1.00. This rate was intended to be sufficiently undervalued to encourage exports, although importers found their bills rising by an average of 100 percent. The devaluation of Great Britain's pound sterling in September 1949, which countries in the sterling area followed, erased the planned advantages of a cheaper yen.¹³

According to the estimate shown in figure 2.6, the yen seemed to be overvalued for several years in the 1950s, but it then became undervalued as U.S. inflation rose faster than the increase in prices in Japan. The generally excessive strength of the dollar in the late 1960s and early 1970s led to the replacement of the fixed exchange rate regime by a system of floating rates. The other period of an overly strong dollar in the first half of the 1980s also is obvious.

On the same basis, it is possible to argue that the yen was overvalued in the 1990s. However, as noted, enough other forces act on exchange rates that conclusions based simply on relative prices are not fully warranted, although a currency's broad movement certainly responds to the price differentials of tradable goods.

Conclusion

Japan faced enormous challenges in developing the modern, affluent, and technologically advanced economy that it is today. It was the first nation to deliberately set out to change itself in fundamental ways for the

express purpose of modernizing the economy and society along Western lines. The risk-taking creativity of that endeavor left little untouched. Growth itself wrought continuing mutations and permutations in techniques, technologies, and relationships. In fact, breathtaking change has been an integral part of Japanese economic history.

Ironically, the lingering effects of one particular phase of this history—the so-called miracle years—now bind Japanese psychology and policy to inappropriate routines that once had economic logic behind them but that now are unproductive. As Japan makes the transition to a permanently slower growth trajectory, a move that requires greater attention to the mundane objectives of rates of return and profitability, the nation once again is being forced to change. History leaves little doubt about Japan's capacity to adapt to a new environment. Nevertheless, the legacy of the past can handicap the race to the future, however sure the eventual results may be.

Notes

1. Angus Maddison, "Ultimate and Proximate Growth Causality," in *Explaining the Economic Performance of Nations* (Brookfield, Vt.: Edward Elgar Publishing Co., 1995), 97.

2. Kozo Yamamura, "Toward a Reexamination of the Economic History of Tokugawa Japan, 1600-1867," *The Journal of Economic History*, September 1973, 533.

3. Sydney Crawcour, "Economic Change in the Nineteenth Century," in Marius Jansen (ed.), *The Cambridge History of Japan, Vol. 5, The Nineteenth Century* (Cambridge, England and New York: Cambridge University Press, 1989), 585.

4. Kazushi Ohkawa and Henry Rosovsky, *Japanese Economic Growth* (Stanford, California: Stanford University Press, 1973), 8.

5. World Bank, *World Development Report, 1999* (Washington, D.C.: 1999).

6. For a good description of the transportation and post-house system and for a flavor of the changes occurring during the second half of the nineteenth century, see the novel by Toson Shimazaki, *Before the Dawn (Yo-ake Mae)*, trans. William Naff (Honolulu, Hawaii: University of Hawaii Press, 1987).

7. Constantine Vaporis, "To Edo and Back: Alternate Attendance and Japanese Culture in the Early Modern Period," *Journal of Japanese Studies*, XXIII, No. 1, 1997.

8. Yamamura.

9. Ohkawa and Rosovsky, 7.

10. Maddison, 93.

11. The period of convergence depends on the current ratio of the two countries' GNPs and the difference in the rate of growth. The convergence period n is: $n = (\ln$

$U/J/(j-u)$, where U is American GNP in the base year, J is Japanese GNP, j and u are the Japanese and American growth rates (a 1.5 percent growth rate is stated as 0.015), and \ln is the natural logarithm.

12. Angus Maddison, "Standardized Estimates of Fixed Capital Stock: A Six-Country Comparison," in *Explaining the Economic Performance of Nations* (Brookfield, Vt.: Edward Elgar Publishing Co., 1995).

13. Mitsuhiro Fukao, Masao Oumi and Kimihiro Etoh, "Japan's Experience in the Immediate Postwar Period: Moving Toward a Single Exchange Rate and Denationalization of Trade," in Juro Teranishi and Yutaka Kosai (eds.), *The Japanese Experience of Economic Reforms* (New York: St. Martin's Press, 1993), 115-16.