Japan's Long-term Recession in 1990's: Fall of Industrial Competitiveness?

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Summary

This paper provides an overall picture of current stage of Japan's competitiveness in a context of innovation competition with the United States and other East Asian economies. A long term recession in the 1990's casts some doubts about Japan's international competitiveness. Careful examination of Japanese economy in 1990's, by looking at industry level value added growth, competitiveness index by trade statistics and productivity trends, does not suggests substantial falls in Japan's competitive position.

However, there is some concern about innovation activities of Japanese firms in R&D and patent statistics. More seriously, due to changing innovation environment, particularly for high-tech industries, Japanese national innovation system dominated by large companies with inward looking orientation is loosing its comparative advantage the over open and network type system, which is found in the U.S. A detail look at IMD's competitiveness survey supports this hypothesis.

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1. *Introduction*

In the postwar years, the Japanese economy caught up with the United States and Europe at an astonishing speed. Japanese automobiles and electronic products spread worldwide, and in the 1980s, even Made in America, a Massachusetts Institute of Technology (MIT) report on U.S. industrial competitiveness, rated the practices of Japan's auto and semiconductor industries the best in the world (Dertouzos, M.L. et al (1989)). In the late 1980s, the Japanese economy entered its longest postwar expansionary phase. This economic boom, later to be described as the "bubble" economy, ended abruptly in the early 1990s following the 1990 stock market crash and the subsequent tumble in land prices. In the wake of the collapse of the so-called bubble, the 1980s approbation of Japan's industrial competitiveness became the economic gloom of the 1990s. The annual economic growth rate fell from 4.1% of the 1980s to an average rate of 1.4% for the 1990s. These economic conditions led the 1990s to be dubbed "the lost decade." What would be the future of the Japanese economy? Was it all over for Japan? Yet this pessimism could also be reshaped to regard the same decade as a period of economic systemic reform in the broad sense, revisiting the main bank system, lifelong employment and other practices which had previously functioned so well. (Aoki (2002)) Given the complementary nature of systems, the transition to new systems will inevitably take time. The poor economic performance of the Japanese economy over that period may not merit the gloom it seems to have inspired.

In this paper, the structural causes affecting the long-term performance of the Japanese economy are examined, based to the greatest possible extent on objective data. The recent performance of the Japanese economy inevitably engenders pessimism over its prospects, while this loss of confidence on the part of consumers and business managers is in turn impacting negatively on short-term macroeconomic trends. However, discussion of Japan's medium to long-term competitiveness requires a level-headed analysis of the various structural factors involved, including corporate innovation activities such as new product development and the creation of new businesses, as well as problems relating to the human resources underpinning innovation, and economic systems in the midst of growing international competition.

This paper begins by comparing economic performance between Japan and the U.S. since 1980’s. A sharp contrast of economic growth rate can be found between two countries, and data analysis is provided for identifying the industries contributing to the difference. The next section highlights Japan's manufacturing industry, considering industrial competitiveness from a trade

perspective. In this section, focus is put on electronics industry, particularly loosing its competitive edge against the thrust of China and other parts of Asia. Then, recent trend of productivity is discussed in relationship with IT revolution. A section on innovation activities under the framework of National Innovation System follows. Finally, this paper concludes with discussion on overall assessment of Japan's competitiveness by using the IMD World Competitiveness Yearbook (IMD WCY), covering broad range of competitiveness indicators.

2. Slowdown of Economic Growth: A Sharp Contrast with U.S.

In this section, a slowdown of economic growth rate of Japan after the early 1990's is discussed in relationship with industry level value added data. In contrast to Japan's economy mired in a long-term recession, the US economy has its boom in 1990's. The economic growth rate jumped to over 4%, and it had achieved significant improvement of unemployment rate without incurring inflation. A comparison with the U.S. provides can throw Japanese situation into relief.

Figure 1 shows industry contributions to aggregated economic growth for the periods of 1985-90, 1990-95 and 1995-2000. A total growth rate dropped by 3.04% from the late 80's to the early 90's, and a major contribution of this fall comes from manufacturing sector (-1.49%). Private services sector also contributes to -0.96% point. However, within this sector, it is found that wholesale and retail sector drags down a whole trend. Since a slowdown of manufacturing activities has a significant impact on the demand for wholesale and retail sector, we can conclude that economic slowdown in Japan is mainly due to manufacturing sector problems.

(Figure 1)

Figure 2 compared industry value added growth between Japan and the U.S in 1990's. In the annual growth rate of the U.S. in 1990's is 3.0%, as compared to 1.4% for Japan. A major difference between two countries comes from private services. Within this sector, FIRB (finance, insurance, real estate and other business services) and wholesale and retail sector are two major ones to explain the difference. Manufacturing sector comes next. No growth can be found for Japan, while this sector contributes to US growth by 0.5% in the U.S.

(Figure 2)

It should be noted that the share of manufacturing sector in total economy in 2000 are only

20.5% and 15.3% for Japan and the U.S. respectively, while those of private sector are over 50% for both two countries. Although its share is relatively small, manufacturing activities have a significant influence on the trend of macro economy. In addition, substantial demands for private services are derived by manufacturing activities. Therefore, it is important to look into manufacturing sector in more detail.

(Figure 3)

Figure 3 shows that electrical and electronics (E&E hereafter) industry contributes 0.41% slowdown out of 1.49% for total manufacturing from the late 1980's to the early 1990's. E&E industry is still growing after 1990's but substantial slowdown of growth rate is found after its tremendous success in the late 1980's. However, when we compare this industry between two countries, the contribution to economic growth is not so different in 1990's. Cross country difference comes from other industries, such as general machinery, fabricated metals and textile industry.

(Figure 4)

Slowdown of growth contribution of E&E industry raises some concern about falls in competitiveness of this industry due to catching up of other East Asian economies. In order to understand this point further, it is necessary to decompose the growth rate into domestic and international demand. Figures 5(a), 5(b) and 5(c) show this result for E&E industry as well as general machinery and transportation machinery industry.

(Figure 5(a)-5(c))

For E&E industry, both domestic and international demands are growing in 1990's as well, but slowdown of growth rate after 1990's can be explained mainly by domestic factors. It should be also noted that rapid increase in import can be found recently. Increasing both export and import is due to expanding overseas production by Japanese E&E companies, as is discussed in more detail in the next section. A slump in domestic demand in 1990's hit also the other two machinery industries. The production of general machinery started to decrease after 1990 due to sluggish private investment in 1990's. The production of transportation machinery was also dragged by decreasing domestic demand, but it could keep its level due to a strong performance in export. Foregoing observations suggest that Japanese machinery industry has not lost its international competitiveness at this aggregated level.

3. Assessing Manufacturing Competitiveness by Trade Statistics

One useful way of understanding "competitiveness" is to consider the competitors. For example, "corporate competitiveness" focuses on the degree of competitive advantage of a company in inter-corporate market competition. This is straightforward because of the clear-cut nature of the competitors. Porter (1990) takes this framework for the analysis of corporate competitiveness a step further to analyze the competitiveness of nations. It examines the competitive advantage of nations using four factors: 1) firm strategy, 2) structure and rivalry, and 3) demand conditions - in other words, the market conditions for the particular industry - and 4) factor conditions and related and supporting industries, which pertain to the environment in which the industry is located. However, there is some critical views on competitiveness of nations. For example, Krugman (1996) rejects the image of national competitiveness as a kind of trade war, in that unlike corporate competition, which is a battle for limited markets, international trade is often a plus-sum game which offers merits for both countries.

In discussing international competitiveness at the industrial level, reference is often made to manufacturing industry performance. The logic is that industrial products which are the output of the manufacturing industry are usually exposed to competition on international markets, the results of which emerge as the trade patterns of individual industries. Trends in productivity are certainly important in considering long-term industrial competitiveness, but using trade statistics produces more timely and detailed information on competitiveness by product. For example, the electronics industry is one of Japan's leading export industries, but with the recent catch-up by South Korea, Taiwan and other Asian countries, trade statistics reveal a steady decline in the exports of some products even as imports climb. While this is not the case at the aggregated level in previous section, there may be some field for Japanese firms to loose international competitiveness against those of other East Asian countries.

In order to assess international competitiveness of Japanese manufacturing industries, trade specialization indexes (TSIs)[2] are calculated by using detail trade statistics in Japan. Figures 6 and 7 compare TSIs in 1988 and 2001 for trade with the United States and East Asia.[3] Firstly, looking at the United States, the TSI has held close to 1 for automobiles and auto parts, suggesting that Japan's auto industry has strong international competitiveness. However, the TSIs for computers and integrated circuits (ICs) have been declining over the last decade, and

[2] TSI is defined as the ratio of the value of trade surplus (export – import) to the value of total trade (export + import).
[3] "East Asia" here refers to China (including Hong Kong), Taiwan, South Korea, Singapore, Thailand, Malaysia, the Philippines and Indonesia.

ICs in particular evidence an import excess. The TSIs for organic chemical products and aircraft have remained negative, with imports in surplus, and although these figures are moving close to zero, this would seem to reflect a decline in imports following the recent economic slump in Japan.

(Figure 6) and (Figure 7)

A comparison of the TSIs with East Asia over the last decade clearly reveals those areas which have undergone major change, as well as areas where this has not been the case. For example, looking at automobiles and auto parts, the TSI for auto parts has fallen slightly, but Japan's export competitiveness seems to remain strong. There has also been little change in the export competitiveness of iron and steel or organic chemical products, while apparel has sustained an import surplus. By contrast, in the electronics sector, Japan has lost competitiveness in regard to numerous products. For final products such as computers and TV receivers, export surpluses have turned overnight into import surpluses. Similarly for electronic parts, the TSI for semiconductor ICs has plunged. Final-assembly products seem to have been affected by Japanese companies shifting their production bases to East Asia. The slump in semiconductor ICs, for example, has been heavily influenced by slipping TSIs with South Korea, Taiwan and other Newly Industrializing Economies (NIEs), indicating that technological progress in local companies in East Asia is reducing the comparative advantage of Japanese companies.

In order to look closely at electronics sector, Table 1 shows changes in TSIs in detail level of product classification. First, it is found that TSIs in most of computer and peripheral products has plunged into import surplus in these 10 years. Even for Laptop PCs and LC displays at which Japanese firms used to be strong, TSIs became negative as compared to NIES3. As for semiconductor ICs, the significant drop can be observed in MOS memories, as compared to NIES3. In 1990, Japanese electronics firms dominated world DRAM market, but they are completely replaced by Korean firms in 2000. One category where Japan still keeps its competitiveness is “other Logic”, i.e. custom made logic chips including ASIC and system LSIs.

When examining trade patterns with East Asia, it is important to include consideration of the impact of the offshore shift of production bases, mainly of electrical machinery. Production bases were transferred to East Asia in response to the yen appreciation which followed the 1985 Plaza Accord, starting with increased direct investment in Thailand, Malaysia and other Association of South-East Asian Nations (ASEAN) countries. Since the 1990s, policies introduced by the Chinese government to encourage the transition to a market economy have

seen investment in China by Japanese companies. According to the Ministry of Finance's foreign direct investment statistics, direct investment in East Asia by manufacturing industry comprised a cumulative total of around ¥6 trillion between fiscal 1990 and fiscal 2001, 27% of which was in the electrical machinery industry. In addition, chemicals, steel and nonferrous metals and transportation machinery accounted for more than 10%. This vigorous direct investment was followed by the offshore transfer of production which had been conducted in Japan, also impacting on trade patterns. For example, negative TSIs in MPUs in 2000 in Japan-ASEAN trade comes from factories of western companies such as Intel in Malaysia. In addition, some negative sign in Japan-China trade are also partly explained by overseas production activities of Japanese firms.

To quantify the impact of increasing offshore production on trade patterns, we will examine the offshore activities of Japanese companies as revealed in the Survey of Overseas Business Activities by METI. Figure 8 indicates the sales amount in fiscal 2000 according to the destination of products manufactured by Japanese overseas affiliates established locally in East Asia. It appears that 66.2% of production by these local operations is supplied to the same regional market, with 24.7% reverse-imported to Japan. The Japanese local operations in the United States and Europe sell more than 90% of their products in the domestic markets, which suggests that they were established with an eye to the local market. By contrast, many of the Japanese operations established in East Asia were looking for division of production with Japan.

(Figure 8) and (Figure 9)

Figure 9 conversely delineates the sources from which local affiliates procure their parts. The local procurement rate in East Asia is 57.7%, with 36.6% dependent on imports from Japan. The reliance of foreign production operations on imports from Japan for the bulk of parts procurement is also true for operations in the United States and Europe. Finally, when the extent of the impact on trade as a whole of the activities of these foreign-based operations was examined by comparing trade amounts with East Asia in the trade statistics for 2000, reverse-imports accounted for around ¥5 trillion of the gross import amount of around ¥17 trillion, while exports to locally-established operations accounted for around ¥5 trillion of the gross export amount of around ¥21 trillion, indicating a substantial share of trade absorbed by transactions with locally-established Japanese companies.

To assess the impact of this overseas production for trade statistics, Table 2 is provided to see the value of trade associated with oversea production by region in 2000. First, it is interesting to

see the value of overseas production is about the same size of the value of export in all regions. In addition, the significant portion of international trade can be explained by the value associated with overseas production. In case of Asia, the values of export and import associated with overseas production are almost balanced. Therefore, the impact of overseas production on trade surplus or TSIs, depends on export substitution effect, i.e. the amount of export which would be conducted, if it were no overseas production. The purpose of overseas production is not only using production cost, but also for targeting at new markets. Therefore, all of about 20 trillion yen, the value of overseas production, cannot be counted as “export substitution”, but there should be non negligible downward bias by overseas production with TSIs in trade statistics.

(Table 2)

In terms of competitiveness of Japanese manufacturing industry, the overseas production activities by Japanese firms lift another concern about hollowing out of Japanese production base. Japanese companies in the electronics industry have been transferring their production operations, particularly assembly processes, abroad to East Asia. This globalization of business activities by Japanese companies is basically in line with Heckscher-Ohlin model of international trade theory. Therefore, it should be welcomed by standard economic theory. So, how can we understand hollowing out concern from theoretical viewpoints?

Firstly, given a perfect production factor market (the labor market is particularly important here), an offshore production shift would cause domestic employment to decline, but the surplus employment would be absorbed by areas with high productivity. However, in reality, because workers find it difficult to change professions, inter-industry labor shifts do not necessarily proceed smoothly. Further, although the law of diminishing returns is an important concept forming the basis of microeconomics, increasing returns can be observed in industries such as software, where fixed costs are high and marginal costs are small, and semiconductor ICs, where "learning by doing" boosts productivity. In these industries, the shift of production operations based on temporary comparative advantage could lead to a reduction in the long-term industrial competitiveness of the industries in question.

The difficulty of shifting workers between industries is a labor market problem, and should be resolved through active labor policies such as re-employment assistance, while an unemployment insurance system and other safety nets are being set in place to deal with the unemployment arising from industrial structure transformation. Accordingly, it would be a

mistake to restrict the global movement of industries which have lost their international competitiveness in order to secure domestic employment. However, a more serious examination is necessary for the argument that manufacturing technology, which has been the wellspring of the competitiveness of the Japanese manufacturing industry, is now being eroded. The law of increasing returns suggests that if workers' skills are accumulating according to the growing production volume in a certain industry, productivity will rise. Where this law is functioning, major economic damage could be caused by the loss of the accumulated skills due to the offshore shift of production. Further, the external economic effect created by the clusters of related industries is also a factor in increasing returns, and where one industry which is part of an industrial cluster shifts overseas, the external effect produced by the cluster will be lost, impacting negatively on those industries remaining at home. In trade theory too, strategic trade theory has emerged as a new area incorporating increasing returns and imperfect competition.[4] This cutting-edge theory postulates that the merits and demerits of offshore production shifts have to be determined by the productivity characteristics of the particular industry, as well as the situation of the external economies with related industries.

Returning to the pattern of TSIs with East Asia, because the assembly processes for electric appliances and computers are labor-intensive, these are not areas in which technological progress will lead to an explosive surge in productivity. In that sense, the offshore shift of production of these products which has continued since the late 1980s represents a decision by companies to optimize their production bases from a global standpoint, and as such, should provide merit for industry as a whole. On the other hand, the declining TSIs for such products as semiconductors and computer parts require serious investigation. As these industries are capital-intensive and are open to swift technological innovation, there is great strategic significance in manufacturing such products domestically. Moreover, the falling TSIs in these areas seem to be primarily due to the emergence of South Korean and Taiwanese companies. As the international competitiveness of products with a rapid pace of technological innovation is critical in boosting the medium to long-term productivity of the nation as a whole, strategic steps will need to be taken to restore Japan's electronics industry.

4. Productivity performance in the Information Age

Trade statistics shows product level competitiveness in global market. In contrast, productivity can be used as an indicator to benchmark industry level effectiveness, i.e., to what extent each

[4] Numerous papers have been published on this subject, including Helpman, E. and P. Krugman (1985)

industry can produce internationally competitive goods and services. In addition, while competitiveness indicators based on trade statistics are limited to trade in goods, productivity can be applied to all industries, services included. Productivity is used in *Made in America*, to conducts its industrial analyses using the concept of industrial performance (productive performance in the case of products). In this study, productivity statistics are combined with qualitative information on factors which do not emerge in such statistics, such as quality, the speed of technological innovation and ability to adapt strategically to technological changes, to produce an overall evaluation for industrial competitiveness.

As a determinant of productivity, use of information technology has been extensively examined in academic literature. IT revolutions, with rapid technological progress in computers and proliferation of Internet in 1990's coincide with a kinked point of US labor productivity trend, i.e., after productivity slow-down in 1980's, US labor productivity trend has regained its speed in the late 1990's. Oliner and Sichel (2000) show that about two thirds of 1.5% productivity revival after 1995 can be attributed to the growth in IT investment. Even after so-called IT bubble burst in 2001, US labor productivity by BLS shows strong performance. It is fair to say IT investment surge can explain not all but significant portion of US productivity revival after the middle 1990's. (Bailiy (2002)) This is the case not only for the U.S. Jorgenson and Motohashi (2003) conducts growth accounting exercise to compare the role of IT in economic growth between two countries, and finds that the contribution of IT capital services to economic growth in Japan's late 90's has about the same size as that in the US. Figure 10 shows the result of this study.

(Figure 10)

The growth rate of gross domestic output can be decomposed among the contributions of IT capital services, non-IT capital services, labor services and the growth rate of total factor productivity (TFP). Our most striking finding on the sources of Japanese economic growth is the surge in the contribution of capital services from IT equipment and software during the last half of the 1990's, reflecting the sharp rise of IT investment. The contribution of IT capital services in the U.S. rose steadily throughout the period 1973-2000, but fell short of the Japanese contribution before 1990. The contribution of IT capital in Japan declined during the first half of the 1990's, but rebounded strongly after 1995. The contribution of IT capital in Japan during this period was 0.90 percent per year, while the corresponding figure for the U.S. was 0.99 percent. The increase in the contribution of IT investment in Japan during the last half of the 1990's actually outstripped the substantial rise in the U.S.

Another notable finding is that the TFP growth rate in Japan rose in the last half of the 1990's

during a period of relatively slow growth in the Japanese GDP. In addition, the growth rate of TFP in Japan is higher than that of the U.S. in general. For example, TFP growth rate of Japan in the late 1990's is 1.13% as compared to 0.68% in the U.S. Therefore, we can conclude that 'New Economy', active IT investments and productivity resurgence, can be found also in Japan.

The positive relationship between IT and productivity at firm level is confirmed by Motohashi (2003), which conducted econometric analysis of use of IT network and firm performacen, by using data from METI's Basic Survey of Business Structure and Activity. This study shows that IT stock contributes to value added growth significantly, and use of information network shows positive impacts on TFP growth, which further pushes up firm's output. In addition, IT's impacts on firm's output and productivity becomes greater in recent years.

This bright picture of productivity GROWTH of Japanese economy can be interpreted as a mirror image of low productivity LEVEL in Japan. The postwar Japanese economy staged a lightning catch-up on the United States and Europe, and in the process of which it has been ascertained that Japan maintained high productivity growth. During the catch-up period, Japan in fact undoubtedly secured higher productivity growth than in the West, but that is not to say that Japanese industry was internationally competitive, as Japan's productivity level was actually still low at that time. Figure 11 compares Japan's TFP level by industry where the United States is 100. In major Japanese export industries such as automobiles and electrical machinery, the TFP level is over 100, which suggests a higher productivity level than the United States.

（Figure 11）

In stark contrast to the continued comparatively high productivity demonstrated by Japanese manufacturing industry, and particularly the above kind of export industries, is the low productivity of the service industry. In the areas of transport and communications, Japan's productivity is approximately half that of the United States, around a third when it comes to electricity. The inefficiency of the service sector is thought to arise from the lack of exposure to the kind of harsh international competition which the manufacturing industry must deal with. Most of these service areas are also regulated, which means that the regulatory system could be preventing inter-corporate competition, as well as the stimulation to innovation and higher productivity which competition can produce. The United States, on the other hand, engaged in sweeping regulatory reform of its infrastructure sectors - electricity, transport and communications - as of the late 1970s, establishing a competitive environment. (METI (2000)) Low productivity in infrastructure sectors pushes up costs for the companies using these

services, and can even impede the competitiveness of other industries, manufacturing included. While Japan is finally advancing regulatory reform of the services sector, the issue of Japan's international competitiveness demands an accelerated program in this area.

5. *Slowdown of innovation activity and NIS performance?*

Where international competitiveness is defined as the realization of medium to long-term economic prosperity by a nation as a whole and the basic conditions for realizing that prosperity, the most critical basic condition is the capacity to realize sustained innovation. Growth accounting decomposition allows us to look at supply side of aggregated economy, i.e., factor inputs such as labor and capital services and TFP. Where capital and labor inputs are unlikely to grow substantially over the long term, TFP trends become pivotal to the future economic growth rate. TFP indicates the technological progress of the economy as a whole, and is boosted by sustained innovation - namely, the development of new products and services with higher added-value and the introduction of new production methods. A conventional measure for monitoring innovation activities is R&D investment as an input to 'knowledge production function'. In addition, patent statistics is becoming popular as an output indicator of innovation.

Figure 12(a) and 12(b) show trends of gross expenditure of R&D (GERD), which include not only private R&D, but also public spending on R&D, in Japan and the U.S., respectively. In 1980's, the size of GERD was doubled in both countries. In contrast, a diverging pattern is found in 1990's, i.e., US GERD increased steadily, while in Japan, there are ups and downs in Japanese GERD, and the growth rate was substantially decelerated from the previous decade. In Japan, government initiative for increasing public spending of R&D, based on the First Science and Technology Basic Plan for 1995-2000, pushed up the size of R&D expenditure by the government. However, business expenditure of R&D (BERD) was stagnated in this period. Because R&D is typically financed from internal cash flow (Bond et. al, 2003), negative macro economic condition may lead to financial constraints to R&D investments. In contrast, US GERD growth acceleration in the late 1990's comes from BERD increase.

(Figure 12 (a) and 12 (b)).

This diverging pattern of R&D spending of two countries casts a shadow on competitiveness of Japanese firms. There is another sign in patent statistics showing that Japan is loosing its competitive edge in high-tech industries. The number of patents can be used as an indicator for innovation outputs. OECD's works on patent family data make it possible to conduct

international comparison by using patent statistics.[5] Figure 13 shows the share of patent family counts of EU, Japan and the U.S. The share of Japanese patent families has a peak in 1990, and is declining steadily in 1990's. A simple patent count may be a biased estimator for innovation performance. There is an observation that Japanese large firms in pharmaceuticals and electronics reduced the number of patent applications, by introducing higher internal threshold point for patent application, in 1990's (Motohashi, 2004). However, a positive relationship between R&D and patent count is generally found in academic literature, and slowdown of Japanese BERD may causes decreasing share of Japanese patents.

(Figure 13)

In Figure 14, the share of patents of information and communication technology (ICT patents) and those of biotechnology (BT patents) at EPO is compared between Japan and the United States. Again, the share of Japanese ICT and BT patents were stagnated in 1990's, while steady increases can be found for US high-tech patents. Lost of Japan's competitive position by patent statistics can be found in these high-tech sectors.

(Figure 14 (a) and 14 (b))

Financial constraints during 1990's at firm may lead to shifting R&D focus for Japanese firms. Figure 15 shows the share of researchers at central laboratory to total number of researchers and the share of all researchers to total number of employees. This graph suggests that large Japanese enterprises are shifting R&D resources from independent central laboratories to R&D section attached to business development groups. This implies their focus on R&D is shifting from basic research to more application oriented research.

(Figure 15)

Instead of cutting down internal research project on basic science and technology for this type of technology, Japanese firms started to tapping on external resources, i.e. collaborative research with universities and public research institutions. In addition, growing importance of scientific

[5] EPO (European Patent Office), JPO (Japanese Patent Office) and USPTO (US Patent Office) publishes its own patent data, but these data are suffered from home country bias. For example, the share of Japanese firm's patents becomes larger for JPO data, and comparing patent counts with US firm's patent at JPO does not provide useful information. OECD's have picked up only internationally granted patents (patents granted by at least two patent offices), and harmonized the size of invention by introducing the concept of patent family (Dernis, 2003)

knowledge in industrial innovation, particularly found in pharmaceutical industry (Cockburn and Henderson, 2001), further accelerates active collaboration strategy for Japanese firms.

Electronics industry is facing another thrust for networking business model by modularization of product architecture and industrial organizations. In computer industry, it is impossible to find integrated manufacturers producing all various components and assembling them in-house into the final product. Instead, specialized manufacturers concentrate on their own strengths and work together in "unbundled" supply chains. With a product like personal computers, interfaces for CPUs, memory chips, hard disks, CD drives and other components have become standardized, giving rise to "modular architecture." (Ando and Motohashi, 2002)

All of these factors lead to a concern that Japan's national innovation system does not fit to this rapidly changing innovation environment. Japan's NIS has been focused on large companies, with few linkages between universities/public research institutes and industry. A complementary relationship has existed between the NIS and the financing system, which leans heavily toward indirect finance, as well as the labor system, which is characterized by in-house personnel training and low labor mobility. Large companies have established their own central research institutes, and in the course of post-war economic development have concentrated on the creation of products based on Western advanced technology. In the 1980s, when Japanese industrial technology caught up to Western levels, corporate central research institutes began to emphasize basic research. The central research institutes of big companies have been almost entirely isolated, with few links with universities and public research institutes. The role of venture companies has also been limited, in contrast to the key role played by these firms in the United States.

NISs have developed out of the historical and systemic circumstances of individual nations, and it is impossible to identify any one as superior. Japan's strong postwar economic performance was in fact backed by innovation in the form of vigorous new product development by domestic companies and a unique Japanese-style production system. The Japanese innovation system could therefore be said to have functioned well at least up until the collapse of the economic bubble in the early 1990s. However, with changing innovation environments and IT revolution ushering in a wave of global competition, the network-based U.S. system has begun to function more effectively.

The Japanese innovation system centering around large companies' central research institutes reached a critical point with the collapse of the bubble economy. As their business performance

declines, companies are losing their capacity to conduct basic research with the requisite large-scale research funding, and the mission of central research institutes has swung heavily away from basic research to commercialization research. Moreover, intensifying global competition among companies has accelerated the speed of new product development, and Japanese companies too are beginning to turn their backs on in-house R&D in favor of acquisition and development (A&D), procuring basic research results from outside and focusing on product development.

6. *Conclusion -overall assessment of Japan's competitiveness-*

The very nature of competitiveness is therefore subject to debate, but here we will regard it as a synthesis of the various structural factors affecting the medium to long-term economic performance of a nation. The International Institute for Management Development (IMD), gathers an enormous amount of data on national competitiveness from around the world as the basis for a quantitative analysis of overall competitiveness indexes. The IMD's analysis draws on the various economic indexes and an Executive Opinion Survey to rank national competitiveness in the form of the annual World Competitiveness Yearbook. The 2002 rankings published in April place Japan's competitiveness at 30th among 49 countries, a four-place drop from 26th position last year. Japan in fact held on to first place from 1989, the year the report was first launched, through to 1993, but that ranking has plunged since the late 1990s in particular and still remains low.

The IMD's competitiveness rankings are calculated from a synthesis of around 250 criteria based on various types of hard data (such as economic size, investment in technology development, compensation levels for workers and financial market size) and the Executive Opinion Survey, which targets the leaders of more than 3,000 businesses worldwide. (IMD(2002)) In addition to the overall ranking, the IMD also provides rankings in the four areas of economic performance, government efficiency, business efficiency and infrastructure, as well as rankings in 19 detailed sub-categories. In 2002, Japan came in 29th among 49 countries in terms of economic performance (as compared to 16th last year), 31st for government efficiency (29th last year), 35th for business efficiency (30th last year) and 16th for infrastructure (19th last year). Economic performance in particular dragged the figures down, causing Japan's slump in the overall rankings.

While the IMD announces competitiveness rankings every year, slight changes have taken place in the particular areas examined and the countries covered. Because the ranked indexes have

been heavily revamped a number of times, a perfect time series analysis is impossible, but Table 1 looks at changes in those categories with some extent of conceptual commonality between 1990 and 2002 in regard to Japan's rankings by area. Japan stood at fourth place in the overall ranking in 1995, which highlights the extent of the plunge since the late 1990s. In terms of causes, the slide in Japan's overall ranking is echoed by domestic economic performance, which is based on such factors as gross domestic product (GDP), unemployment rates and price levels. On the other hand, Japan's external economic performance, which is based on the balance of payments and trade statistics, has undergone a comparatively limited slide, still ranking 16th in 2002. Because such economic indicators are heavily influenced by cyclical factors in the macro economy, their use as indexes of competitiveness would seem slightly problematic.

(Table 3)

Other areas of the IMD report are extremely significant in analyzing the current status of Japan's competitiveness. The role of government is calculated on the basis of the Executive Opinion Survey to assess whether the transparency of government procurement, venture policy, immigration policy, regulations pertaining to financial institutions and other economic regulations and policies are contributing to national competitiveness. Japan's ranking had already dropped to 27th among 48 countries by 1995, which would seem to have been strongly influenced by concern over failures in macroeconomic policy as evidenced in the collapse of the bubble and the inappropriate handling of financial scandals. Japan was already scoring poorly in 1990 for transparency of government procurement and immigration policy.

The finance index combines economic data on bank asset holdings, stock market trends and other factors, with the results of the Executive Opinion Survey, which includes evaluations of financial services and the stock market. Japan ranked sixth in 1995, falling heavily primarily in the late 1990s. The low ranking in 2002 reflects Japan's performance in regard to "rights and responsibilities of shareholders" (49th among 49 countries), while it also scored poorly in terms of "financial institutions' transparency" and "banking regulation." These assessments will have been influenced by the financial slump sparked by the collapse of Yamaichi Securities and Hokkaido Takushoku Bank in the fall of 1997.

Japan also saw its management practices ranking plummet from fourth in 1995 to 41st in 2002 as a result of Executive Opinion Survey assessments of "adaptability to market change," the functioning of "corporate boards," "entrepreneurship," "marketing," "ethical practices" and other related areas. As these areas are unlikely to have changed so dramatically between 1995 and

2002, there would seem to be a substantial bias caused by changes in the subjective perceptions of business leaders. At the same time, with the enormous changes in market competition conditions epitomized by the intensifying competition which has accompanied globalization and the advance of the information technology (IT) revolution, old management models are undeniably losing their potency. The failure to implement a dynamic response to these environmental changes seems to be eroding the credibility of Japanese businesses. The same goes for the labor market. Japan's ranking dropped steeply between 1995 and 2002, and yet it is difficult to imagine that the level of the same human resources fell so far so fast. The tumble in rankings was primarily influenced by a poor performance in macroeconomic indicators such as worker compensation and working hours. "Employee training" and the availability of "skilled labor," both key indexes in judging competitiveness, slipped only slightly to ninth and 12th respectively.

While rankings crashed almost across the board in the 1990s, science and technology was one area where Japan is still ranked second among 49 countries even in 2002. The index for this category is based primarily on statistical data related to science and technology, such as research and development (R&D) spending levels, the number of patents acquired, and the number of scientists. However, as is analyzed in section 5, economic downturn in 1990's lead to Japanese firms' cutting down R&D investments. At the same time, there is a concern that Japanese innovation system does not fit to new environments needing open and network model.

To bring together the above argument, is the IMD's placing of Japan at a low position reasonable? In terms of competitiveness, the impact of macroeconomic indexes (such as GDP, working hours and stock market indexes) which are easily affected by short-term economic fluctuations has resulted in a slight underestimation. The vaguely pessimistic view of the Japanese economy revealed in the Executive Opinion Survey has also had an effect. Consequently, the slip from first place in 1990 to 30th in 2002 is a little exaggerated. At the same time, we cannot afford to shrug off negative perceptions of the Japanese government and financial institutions. The same problems existed latently before the collapse of the bubble, but seem to have surfaced with a vengeance in response to the deterioration of the macro economy.

In that context, it will be vital to seize the opportunity to push forward with a bold reform program which will strengthen Japan's future competitiveness. The issue of most serious concern in comparing the 1980s and 1990s rankings is management practices. With technological innovation, the advance of the IT revolution and economic globalization all contributing to increasingly intense international competition, management practices too need to

be exposed to flexible reform. Japan's management model was once studied as among the world's best practices. The rapid changes to the corporate competition environment require an urgent reanalysis of those strengths of Japanese management which should be retained, as well as those points which no longer make the grade in the new competition environment. While science and technology was the only area in which Japan scored highly, Japan has been criticized for its inefficiency in terms of the innovation linking such results to new products and businesses. All efforts on NIS reform in Japan are critical. Policies on activating linkages among innovation actors, such as promotion of university industry collaboration are particularly important. In addition, complemental economic policies for enhancing market transactions of managerial resources, such active labor market policy, capital market reform for facilitating entrepreneurship are also important for open and network type system.

As growth accounting decomposition of Japanese economy shows, slowdown of Japanese economic growth in 1990's is explained by negative labor contribution. TFP growth rate was higher for Japan as compared to the U.S., but this efficiency gain can be achieved by cutting down employment. Substantial restructuring of Japanese firms has pulled back their profitability level to that before long term recession. However, the rule of innovation competition has completely changed in these 10 years. Regaining Japan's competitiveness depends on how effectively Japan can transform its national innovation system with help of these policy initiatives.

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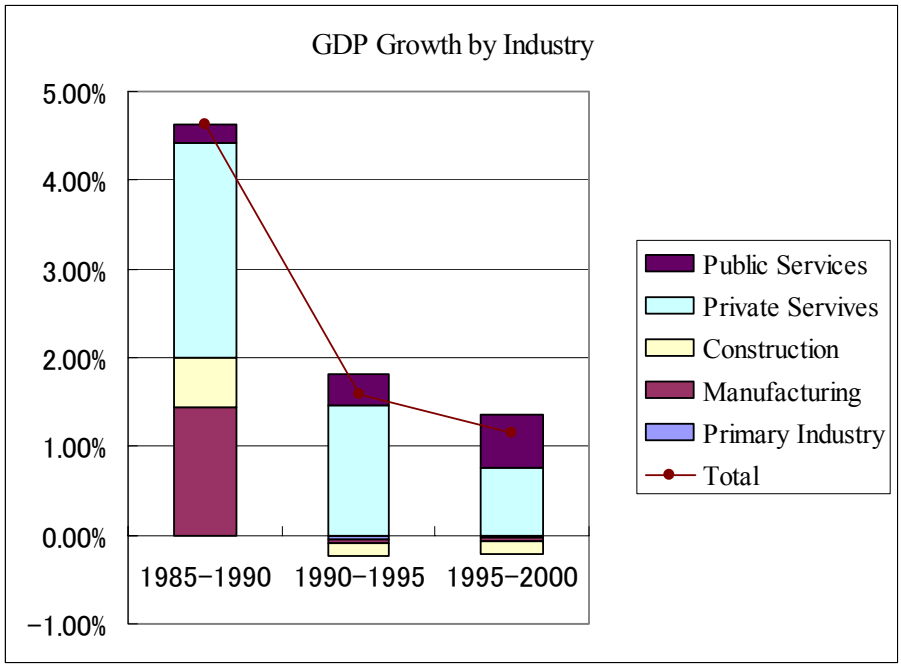
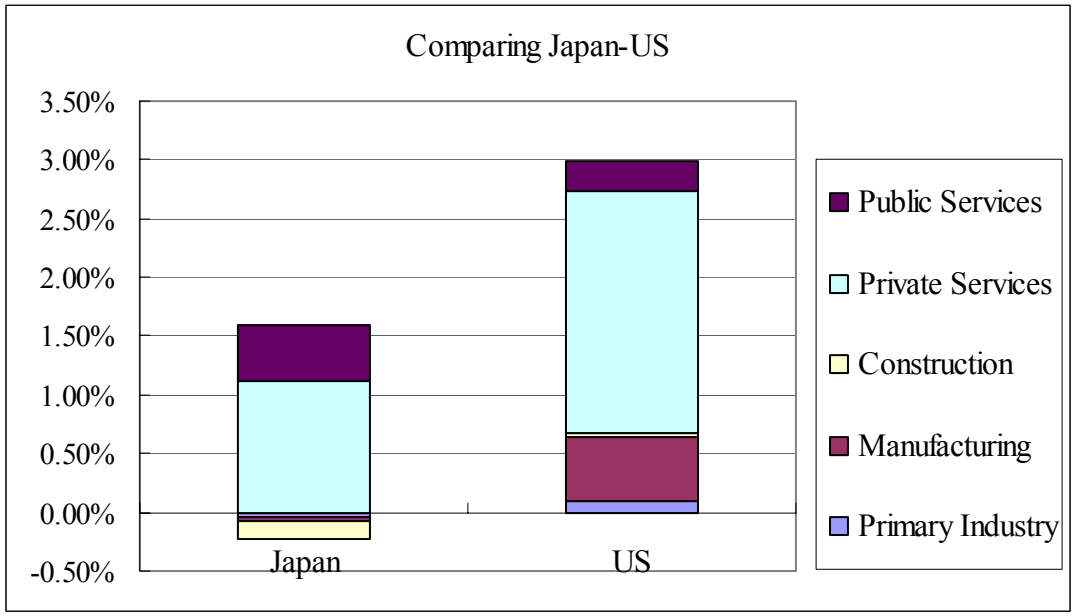
Figure 1: GDP Growth by Undustry



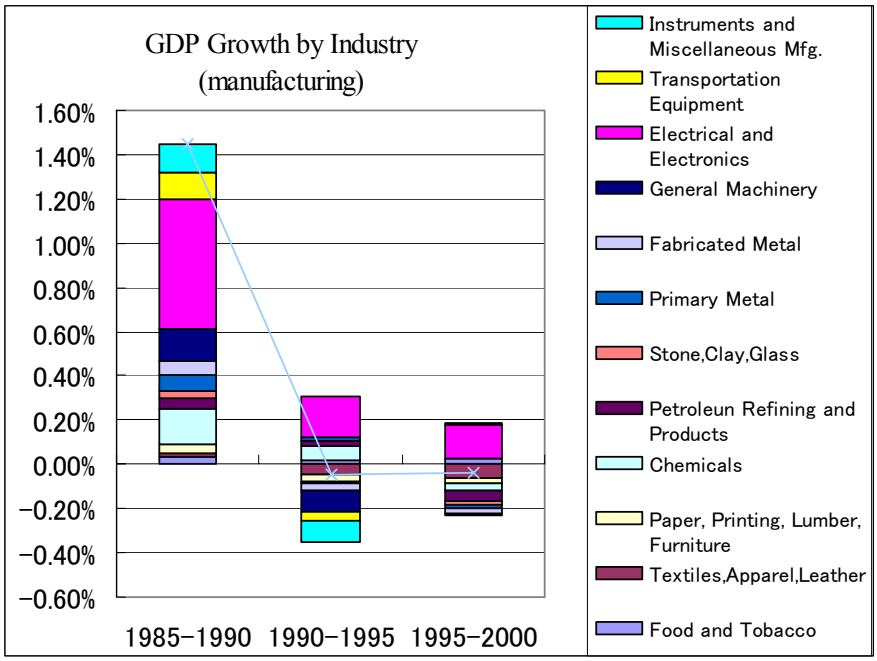
Source: Author's Calculation using Input-Output Tables

Figure 2: GDP Growth: Japan-US Comparison



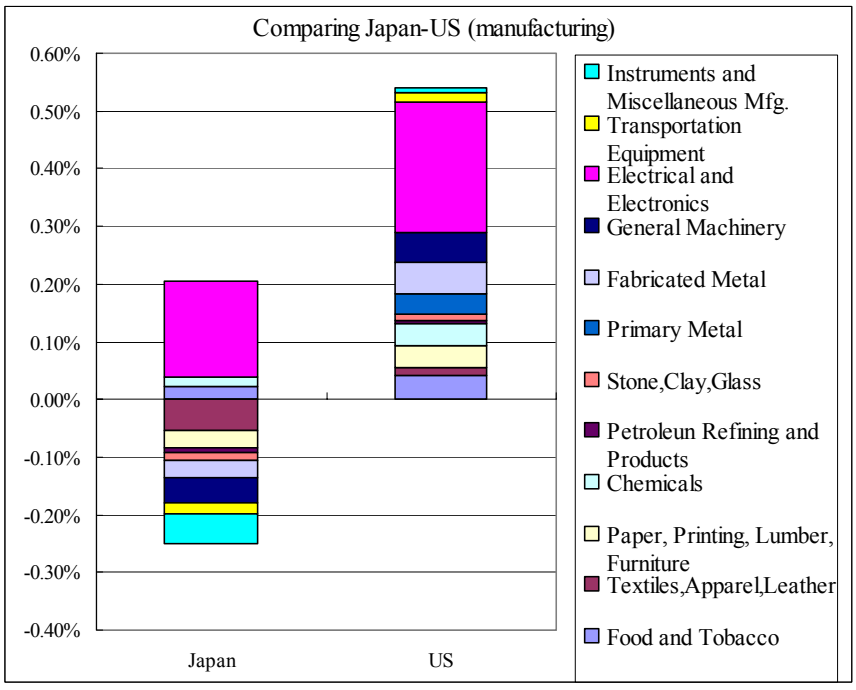
Source: Author's Calculation using Input-Output Tables

Figure 3 : GDP Growth by Industry: Manufacturing



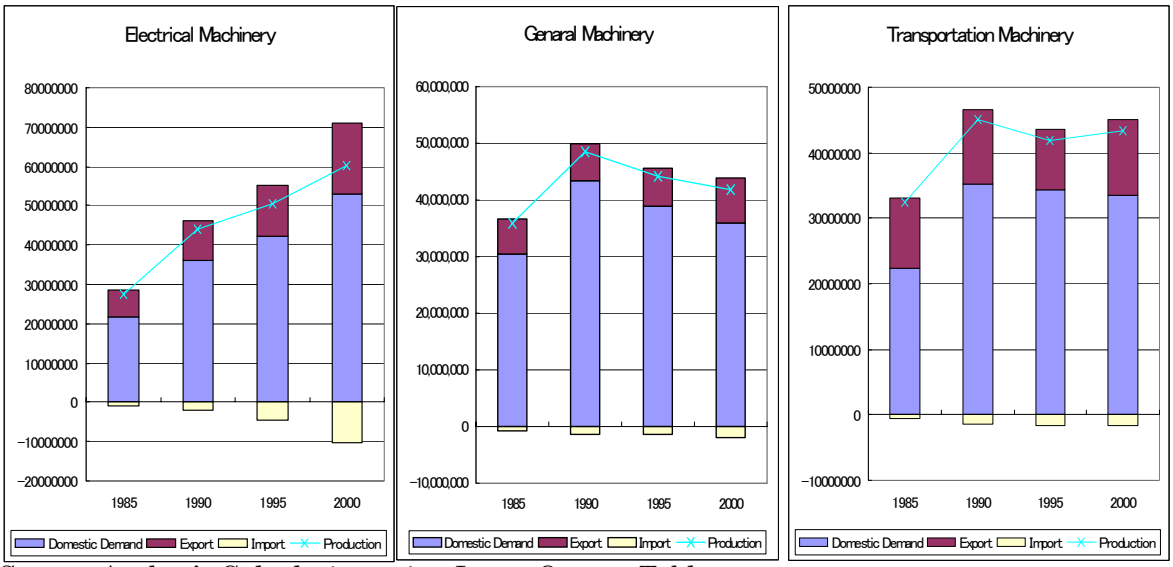
Source: Author's Calculation using Input-Output Tables

Figure 4: Japan-US Comparison: Manufacturing



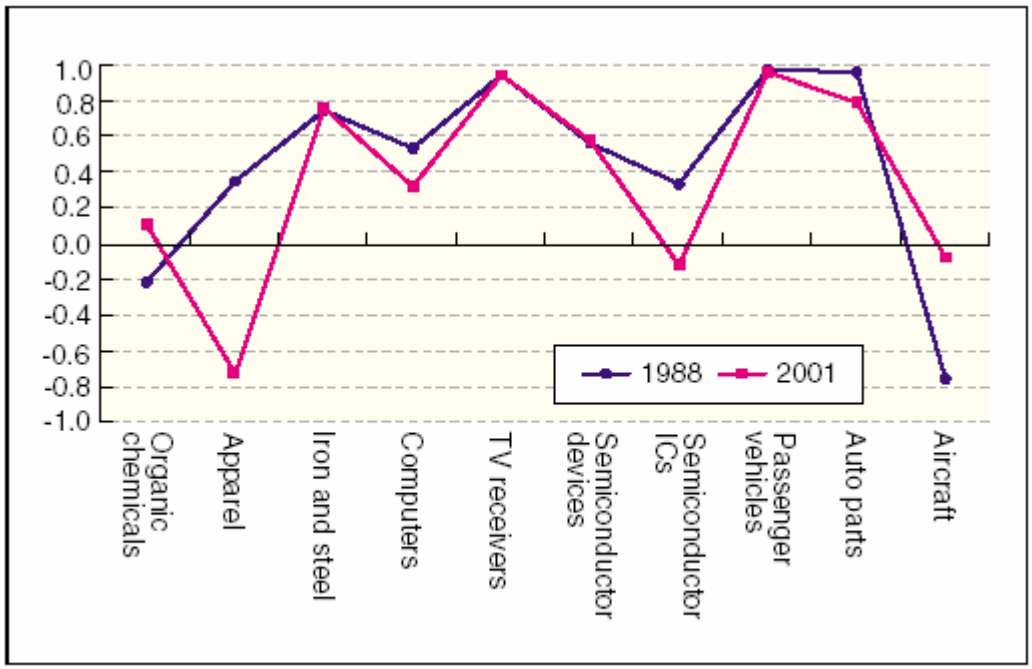
Source: Author's Calculation using Input-Output Tables

Figure 5(a)-5(c) Sources of value added growth: domestic or international demand



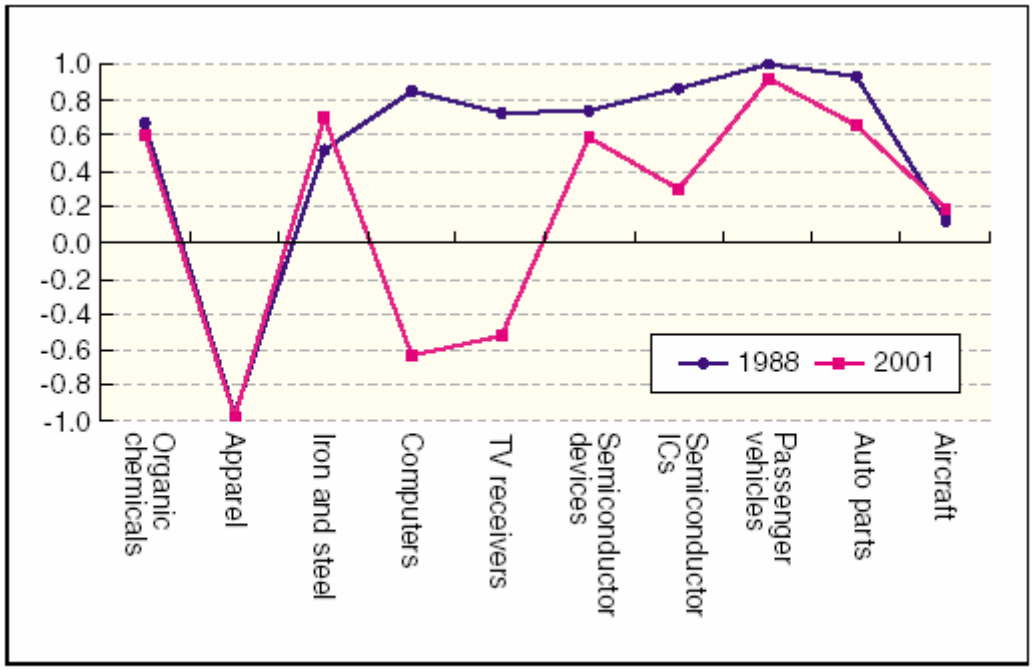
Source: Author's Calculation using Input-Output Tables

Figure 6 : Trade specialization index for Japan-US trade



Source: Author's calculation using "Trade Statistics," Ministry of Finance

Figure 7 : Trade specialization index for Japan-East Asia trade



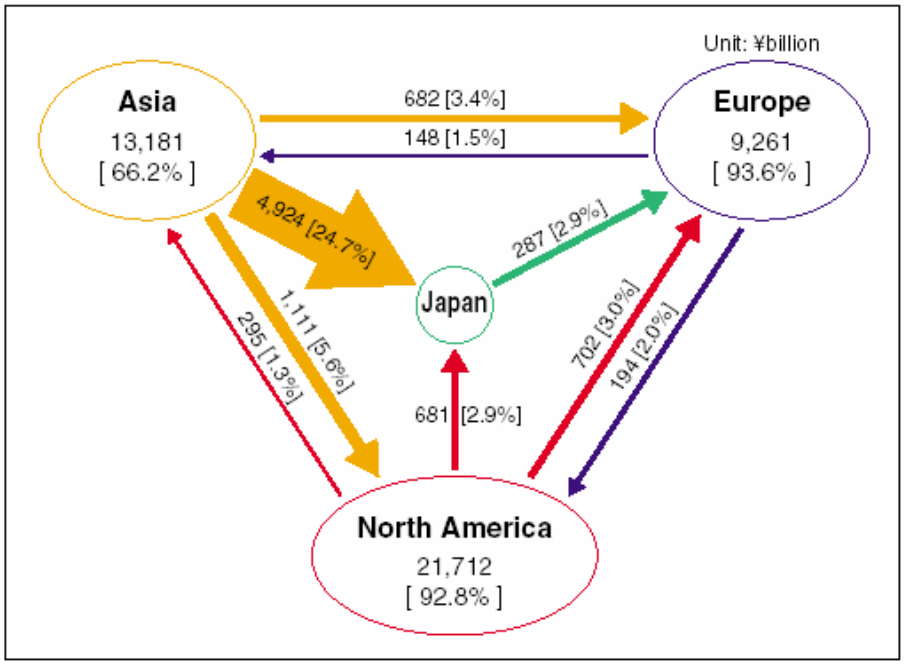
Source: Author's calculation using "Trade Statistics," Ministry of Finance

Table 1: Trade specialization index for computers and ICs

	World		NIES3		ASEAN		China(+HK)	
	1990	2000	1990	2000	1990	2000	1990	2000
Computers	0.24	−0.25	0.29	−0.86	0.99	0.03	0.92	−0.02
Laptop		0.07		−0.80		0.03		0.65
Desktop		−0.48		−0.92		0.03		−0.45
Peripherals	0.93	0.26	0.82	−0.53	0.78	0.42	0.91	−0.48
LC Display		−0.05		−0.74		−0.08		0.30
Strorage Unit	0.64	0.04	0.40	0.24	−0.53	−0.40	0.99	−0.22
MOS-Memory	0.71	−0.02	0.75	−0.37	0.60	0.14	0.99	0.65
DRAM		−0.17		−0.71		−0.37		0.40
SRAM		0.06		−0.76		0.75		0.99
ROM		0.15		−0.30		−0.87		0.74
MOC-Logic	0.29	0.31	0.93	0.50	0.90	−0.59	0.99	0.92
MPU		−0.47		−0.04		−0.97		0.99
MCU		0.83		0.76		0.58		0.97
MPR		−0.21		1.00		−0.25		1.00
Other Logic		0.48		0.45		−0.40		0.85

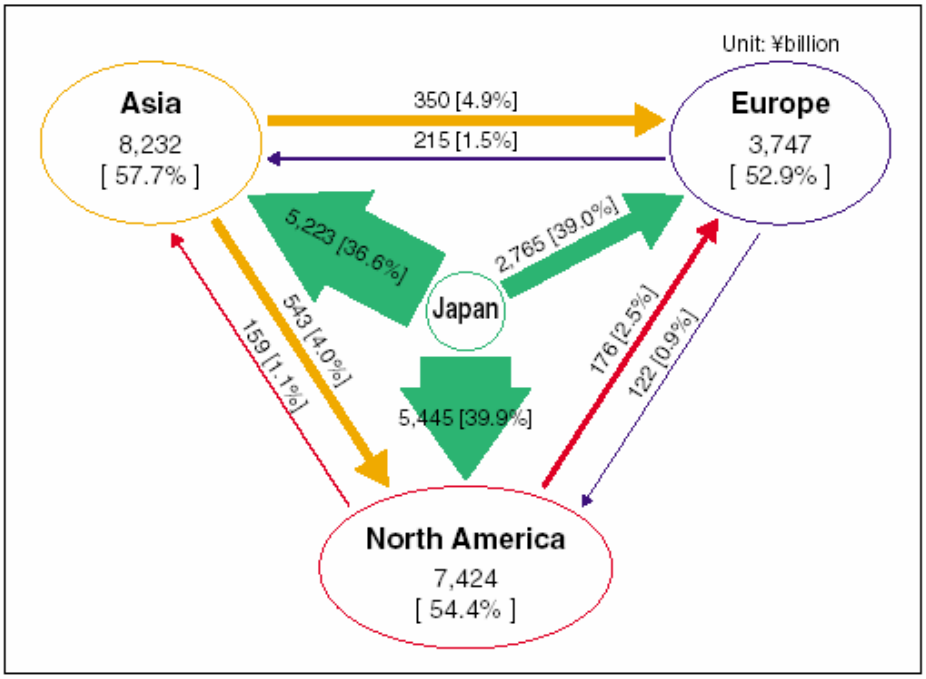
Source: Author's calculation using trade statistics, Ministry of Finance

Figure 8: Sales of Japanese overseas affiliates by destination in 2000FY



Source: Survey of Overseas Business Activities, Ministry of Economy, Trade and Industry

Figure 9: Procurement of Japanese overseas affiliates by destination in 2000FY



Source: Survey of Overseas Business Activities, Ministry of Economy, Trade and Industry

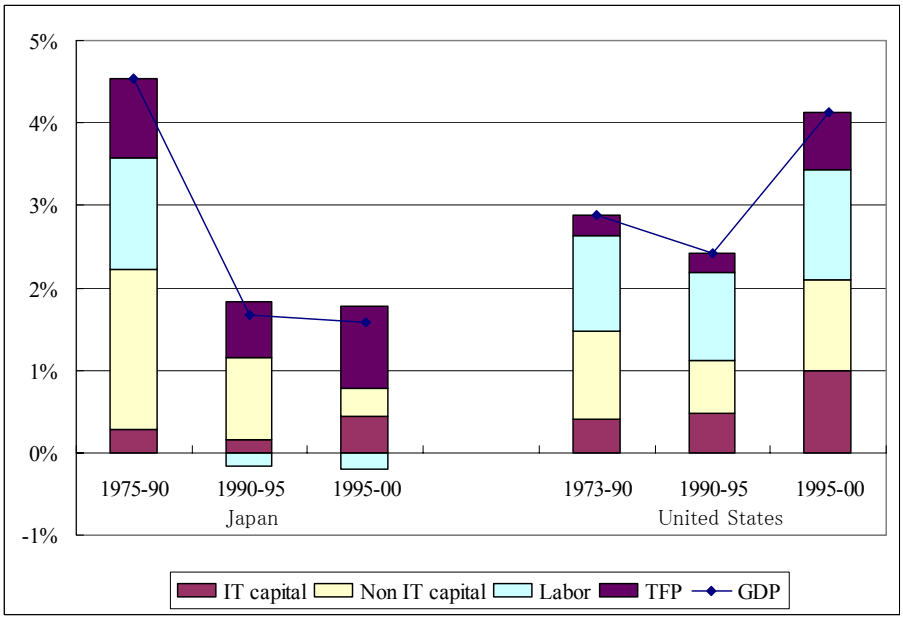
Table 2: Overseas production and trade by region in 2000

(unit: billion JP yen)

	Overseas production	Export	Export associated with overseas production	Import	Import back from overseas production
Asia	19,898	20,520	5,223 (25%)	16,197	4,924 (30%)
North America	23,390	16,162	5,445 (34%)	8,717	681 (8%)
Europe	9,890	8,432	2,765 (33%)	5,042	287 (6%)

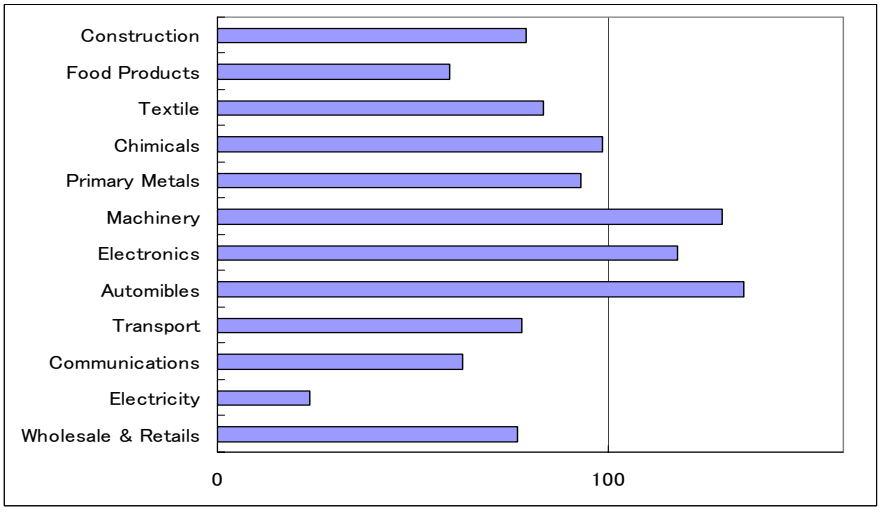
Source: Trade Statistics, Survey of Overseas Business Activities

Figure 10: Contribution of IT to macro economic growth in Japan and the United States



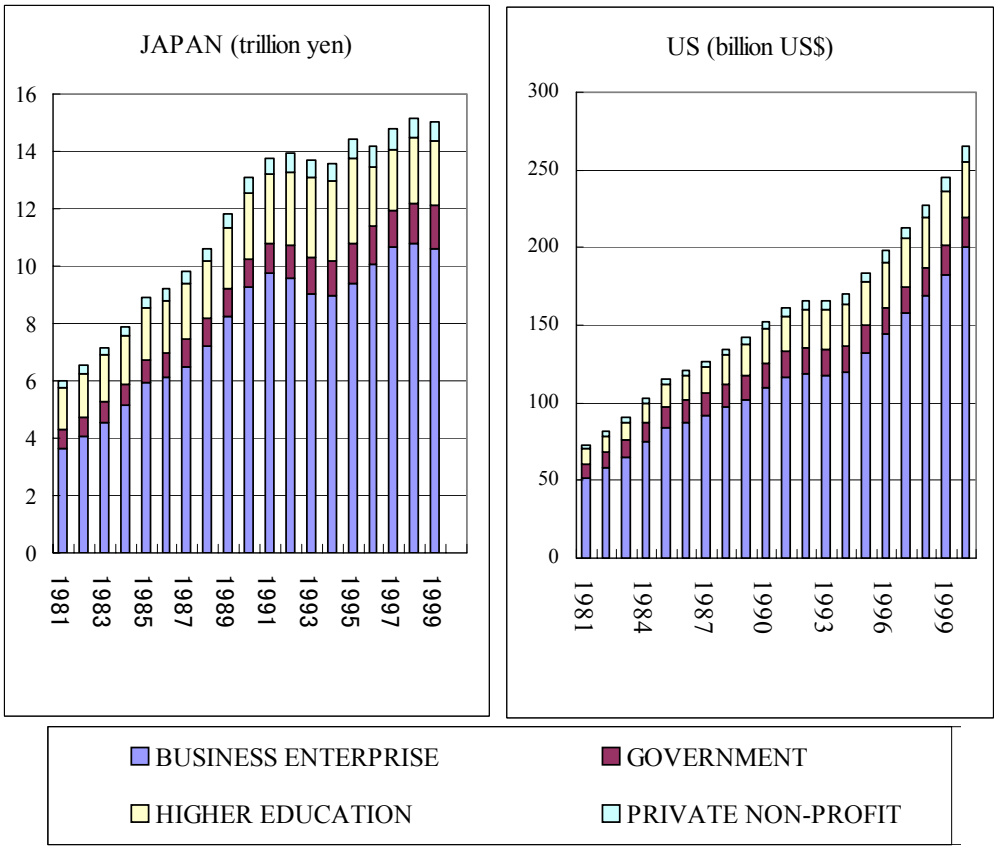
Source: Jorgenson and Motohashi (2003)

Figure 11: TFP Level of Japanese Industry in 1995 (US=100)



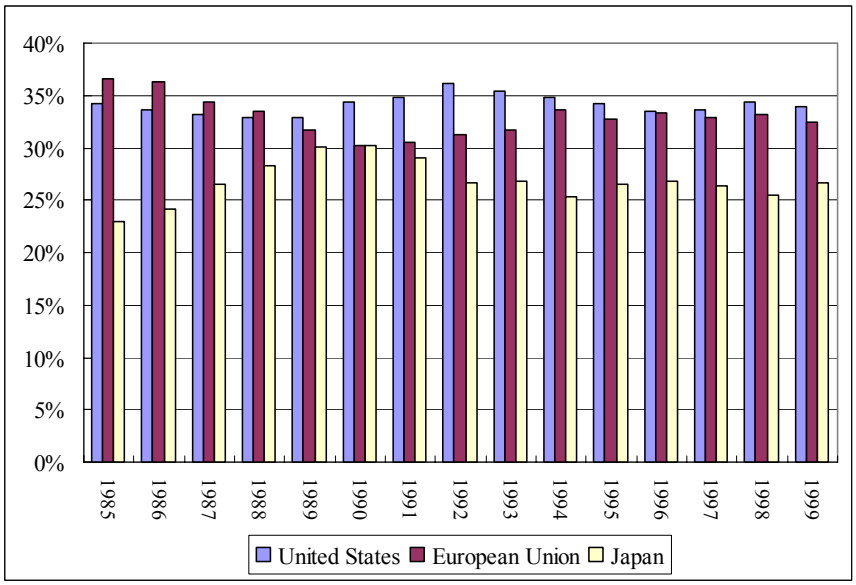
Source: White Paper on International Trade 2000, METI

Figure 12(a)-12(b): Gross Expenditure of R&D in Japan and the US



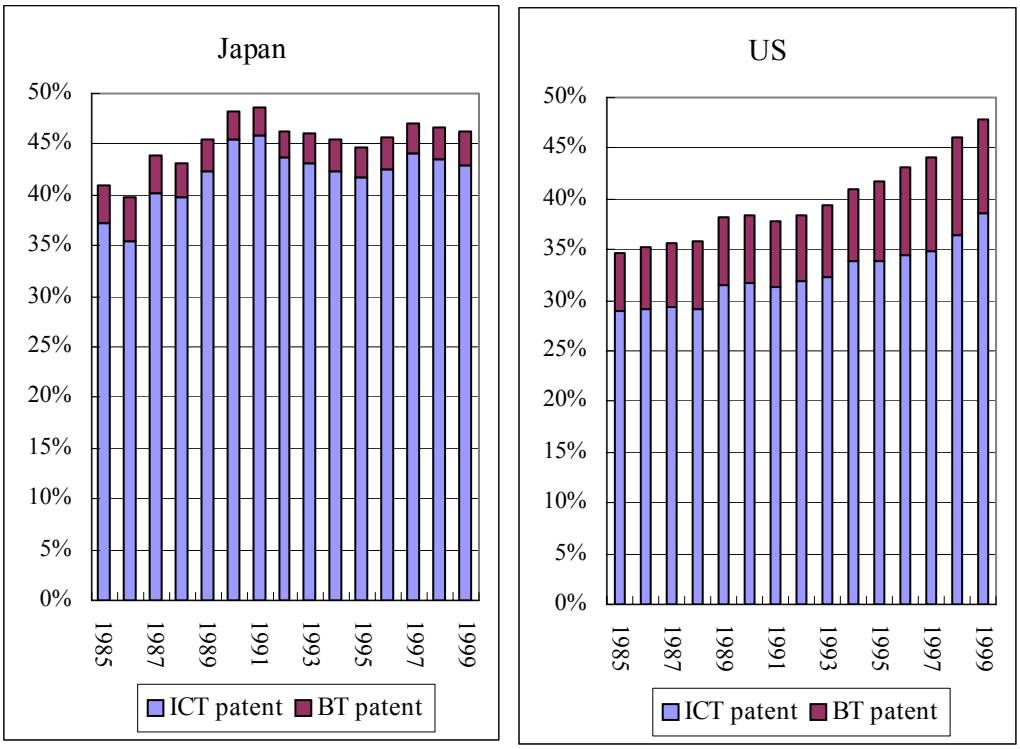
Source: Author's calculation using OECD ANBERD

Figure 13: Share of patent counts by OECD patent family data



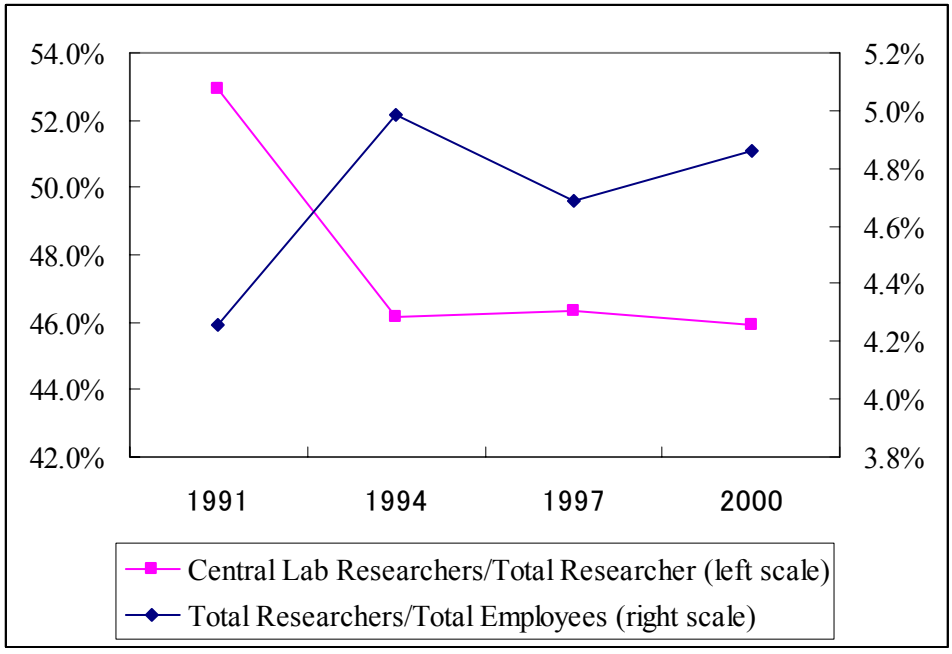
Source: OECD Patent Family Database

Figure 14: Share of ICT and BT patent at EPO



Source: OECD

Figure 15: Shift in Private R&D Focus



Source: Author's calculation using Basic Survey of Business Structure and Activity, METI

Table 3: Changes in Japan's Ranking in IMD World Competitiveness Yearbook

	1990	1995	2002
Overall ranking	1	4	30
Domestic economic performance	1	4	29
External economic performance	1	9	16
Role of government	2	27	31
Finance	3	6	33
Social infrastructure	—	28	28
Management practices	—	4	41
Science and technology	1	2	2
Labor market	2	6	41
No. of countries	33(*)	48	49

Note: (*)These rankings reflect Japan's place among 23 developed countries, but it was decided that the rankings would not change even if 10 developing countries were included. The rankings for 1995 and 2002 include developing countries.