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An export strategy and technology networks in the Republic of Korea

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Abstract

In Korea, trade with Japan has had a deficit since the normalization of Japan-Korea diplomatic relations in 1965. Korea's trade balance with Japan has remained in deficit since then, although Korean companies have become bigger compared to Japanese companies. My hypothesis is that the problem has been caused because Korea introduced technologies from Japan. However, in recent years Korean companies could not introduce technologies through technical cooperation with Japan like in the 1990s. In addition, the Korean government seemed to encourage domestic production for import substitution. Nevertheless, the deficit has continued. I thought it necessary to check my hypothesis in order to discover whether or not it was persuasive.

Keywords: Korea's trade balance with Japan, Technology networks

JEL classification: F1, O1, O5

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Preface

In Korea, trade with Japan has had a deficit since the normalization of Japan-Korea diplomatic relations in 1965 (see figure 1).

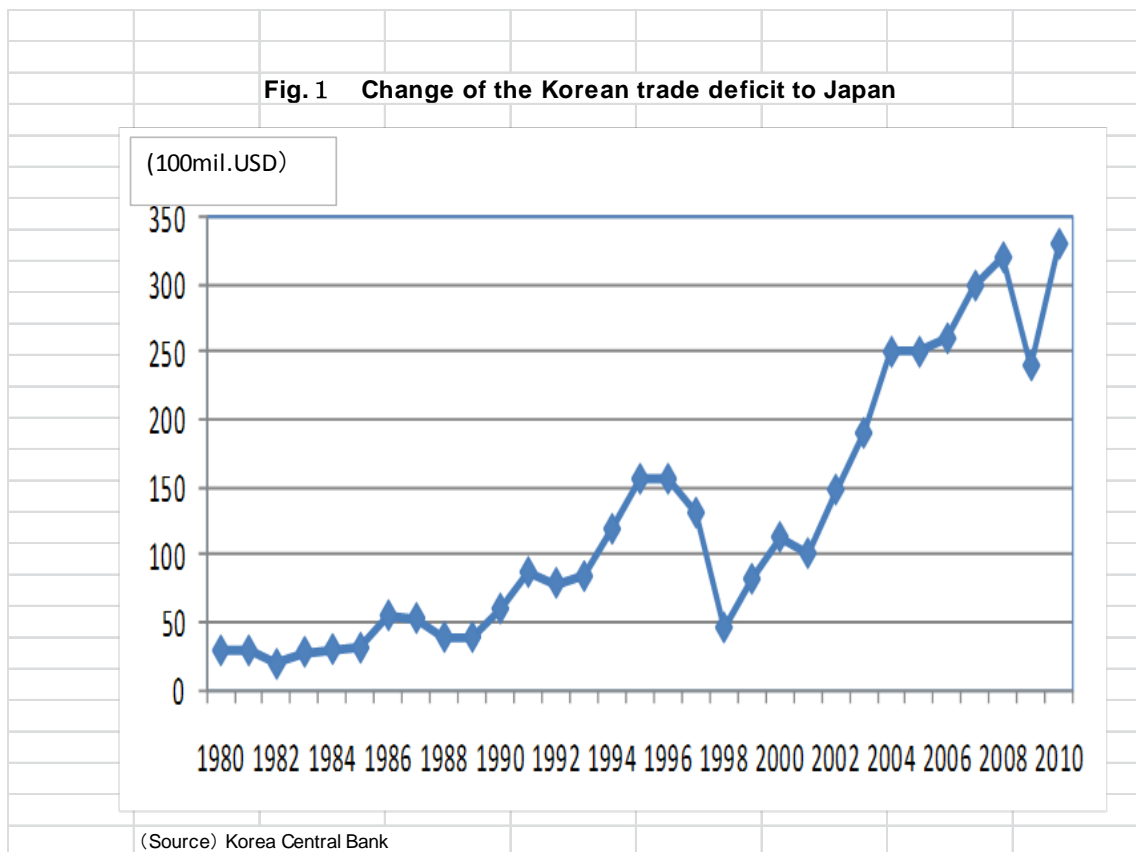
"Since the medium- and small-sized enterprises in Korea were weak, Korea should have imported parts and material from Japanese medium- and small-sized enterprises. Because Japan did not give technologies to Korea, Korea has had a trade deficit". For many years, the Korean government has strongly insisted during Japanese-Korean diplomatic negotiations that this is so and it has complained about the lack of technology transfers.

In view of such a history and to solve Korea's trade deficit with Japan, both the Japanese and the Korean governments established the Japan-Korea Industrial Technology Co-Operation Foundation for the purpose of transferring technologies to Korea from Japan's medium- and small-sized enterprises with investments from both governments in 1992.

Korea's trade balance with Japan has remained in deficit since then, although Korean companies have become bigger compared to Japanese companies.

Since the normalization of Japan-Korea relations, during diplomatic negotiations the government of Korea has insisted that Japan should bear the responsibility for Korea's trade deficit, and the Korean government has invited Japanese medium- and small-sized enterprises to give technologies to Korea.

In the Japan-Korea FTA negotiations and the negotiations over the Japan, China and Korea FTA, the government of Korea has strongly insisted that "the solution to Korea's trade deficit with Japan was a premise for the conclusion of an FTA with Japan".



Because this issue has not been solved for 40 years, we must consider other possible reasons for the problem. In the present situation, where Korea's conglomerates are looking down on the deficits of Japanese companies as the former increase their sales, it is common to think that this analysis of the cause for the deficit which has lasted more than 40 years may have been mistaken and that it might not be the case that "because Japan does not transfer technologies to Korea, Korean medium- and small-sized businesses are weak and must import parts and material from Japanese medium- and small-sized producers."

My hypothesis is that the problem has been caused because Korea introduced technologies from Japan. However, in recent years Korean companies could not introduce technologies through technical cooperation with Japan like in the 1990s. In addition, the Korean government seemed to encourage domestic production for import substitution. Nevertheless, the deficit has continued. I thought it necessary to check my hypothesis in order to discover whether or not it was persuasive.

1. The procedure and results of the verification

I therefore decided to examine the hypothesis afresh and see whether the Korean government's claim was rational.

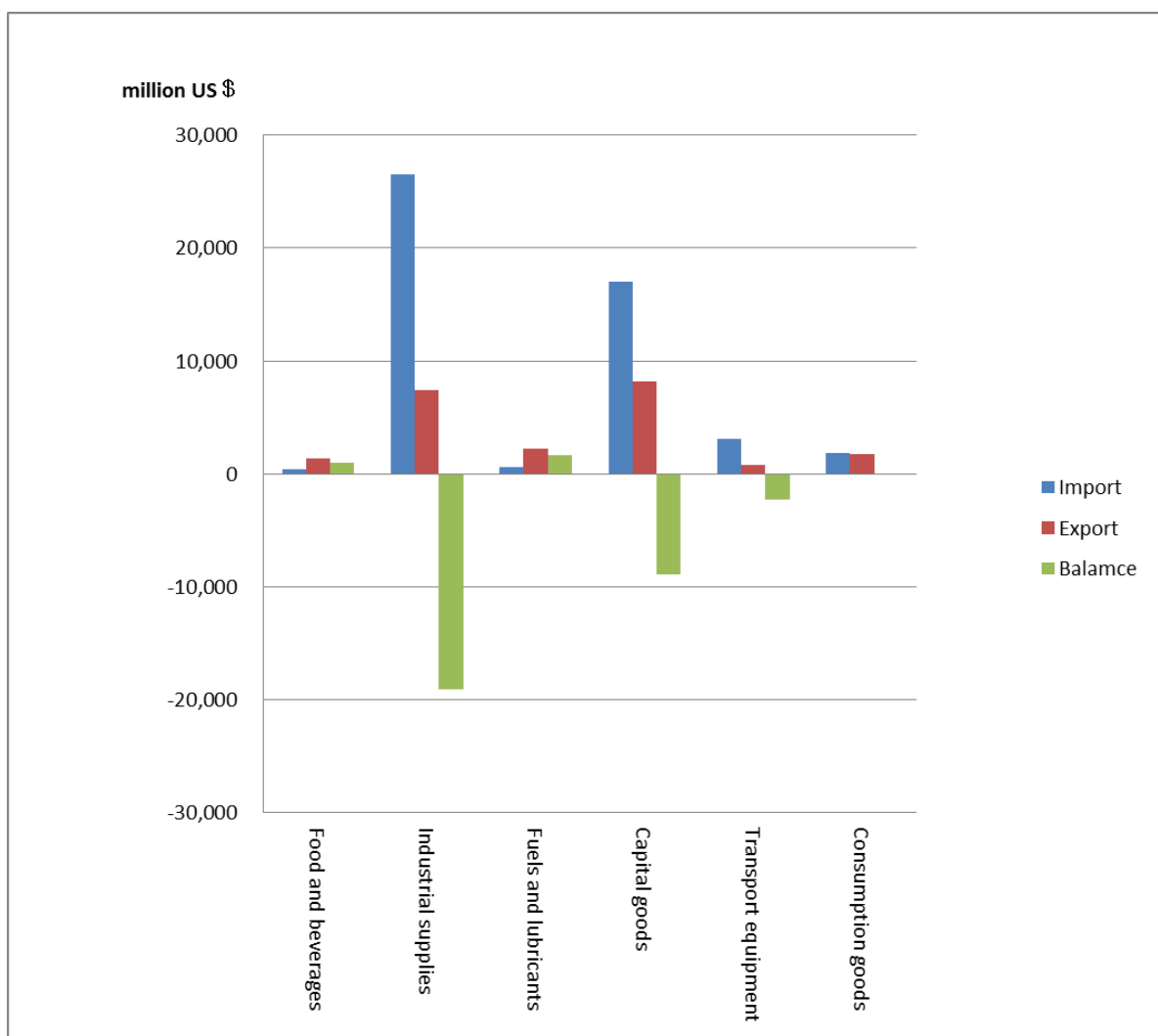
The procedures of the verification are as follows. First, a study team tried to discover the names of the items called "parts, material" that the Korean government said were the cause of the deficit. On investigation, the "parts, material" that the Korean government was talking about were like the black box of a flight recorder in that we could not find precise details about the contents. The system behind the trade balance

was such that an outsider could not obtain the information we needed. Therefore, we used the UN Com Trade's statistics, where the government of every country, including Korea, provides its trade statistics to the United Nations. These statistics are then shown on the homepage of the United Nations. The study team decided to use them to check the names of the commodities imported from Japan. On investigation, 100 high-ranking items (for the classification standard of two digit classifications) that Korea imported from Japan accounted for approximately 60% of imports from Japan. I inspected these to see whether they were products produced by Japanese medium- and small-sized businesses. I then excluded items like steel sheets or semiconductors, because these were obviously the products of big companies and not produced by the medium- and small-sized businesses that the Korean government was complaining about. Third, for the other imported items, which were not definitely the products of big companies, I checked to see if the products were produced by medium- and small-sized businesses. Fourth, I considered why the items had been imported from Japan. As a result, the following things became clear.

Firstly, according to the United Nations Com Trade, it became clear that Korea imports capital goods and industrial supplies from Japan, and the ratio was one-third of the deficit for capital goods imports and two-thirds for industrial supplies. Even up to this year, this pattern has roughly stayed the same. Figure 2 shows Korean imports from Japan and the trade balance with Japan in 2009. When the Korean government says "parts, material", in Korean they actually mean industrial supplies and capital goods. However, in Japanese, the words "parts, material" do not include capital goods. However, the person in charge of the Korean government calls both machine tools, which are representative of factory machinery, and semiconductor production equipment "parts" and feels no sense of incongruity when doing this. In Japan and

Korea, it became clear that the content of what was being talked about for each party was very different when the two countries were discussing the term "parts, material". Japan and Korea negotiated an "understanding" without recognizing that there was such a difference between the governments in their use of the term "parts, material", and without realizing that there was such a misunderstanding.

Figure 2 : Korean trade and the balance with Japan by goods (2009)



(Source) UN Com Trade

Secondly, checking the Japanese companies that produced the 100 high-ranking

imports from Japan, surprisingly, they are all from big companies, not the medium- and small-sized businesses which the Korean government insisted were the problem. There is a law which defines medium- and small-sized businesses in Korea as in Japan. The name of the law is called the "Fundamental Law of Small and Medium-sized Enterprises' Enforcement Order". By law, as for the manufacturing industry, a medium- or small-sized business is defined as one that has "less than 300 employees as a general rule or capital of 8 billion won (approximately 1 billion yen or less)." However, the image of the general medium- and small-sized business in Korea really has nothing to do with the legal definition. Generally, a Korean often calls most companies, except some famous huge companies, medium- or small-sized businesses. Similarly, because Koreans generally only know the famous, big Japanese companies like Toyota or Panasonic, they call almost all Japanese companies "a medium and small-sized business". For example, when the Korean government wants to invite a Japanese "medium and small-sized business" to Korea, the company which the Korean government wants to invite is often actually a large company. There is a difference in Japanese-Korean understanding here.

| Table 1: Korean import commodities and amounts from Japan | | | | | | | |
|---|--|--------------------------------|--------|--------|--|------|------|
| HS code | name of commodities | Amount of import (million USD) | | | Ratio to the import total sum from Japan (%) | | |
| | | 2007 | 2008 | 2009 | 2007 | 2008 | 2009 |
| 7208 | Flat-rolled products of iron or non-alloy steel, | 3,121 | 4,528 | 3,741 | 5.55 | 7.43 | 7.57 |
| 3920 | Other plates, sheets, film, foil and strip, of plastics, | 1,536 | 1,817 | 2,260 | 2.73 | 2.98 | 4.57 |
| 8542 | Electronic integrated circuits and microassemblies | 3,853 | 3,139 | 2,210 | 6.85 | 5.15 | 4.47 |
| 8486 | Machines and apparatus of a kind used solely or principally for the manufacture of semiconductor boules or wafers, semiconductor devices, electronic integrated circuits or flat panel displays; | 2,882 | 3,472 | 1,664 | 5.12 | 5.7 | 3.37 |
| 2902 | Cyclic hydrocarbons | 1,308 | 1,409 | 1,262 | 2.33 | 2.31 | 2.55 |
| 7204 | Ferrous waste or scrap, ingots or iron or steel | 1,384 | 1,504 | 1,208 | 2.46 | 2.47 | 2.44 |
| 7207 | Semi-finished products of iron or non-alloy steel | 1,095 | 1,495 | 1,204 | 1.95 | 2.45 | 2.44 |
| 9001 | Optical fibres, lenses, mirrors, prisms, etc | 998 | 1,063 | 1,136 | 1.77 | 1.74 | 2.3 |
| 3824 | Prepr binder for foundry | 863 | 918 | 1,062 | 1.53 | 1.51 | 2.15 |
| 7004 | Drawn or blown glass, in sheets | 721 | 948 | 1,008 | 1.28 | 1.56 | 2.04 |
| 8541 | Diodes, transistors, semi-conductors, etc | 1,014 | 1,196 | 1,008 | 1.8 | 1.96 | 2.04 |
| 8708 | Parts and accessories for motor vehicles | 1,021 | 1,107 | 893 | 1.82 | 1.82 | 1.81 |
| 8479 | Machines nes having individual functions | 887 | 985 | 748 | 1.58 | 1.62 | 1.51 |
| 3818 | Chemical element/compound wafers doped for electronics | 1,487 | 1,292 | 600 | 2.64 | 2.12 | 1.21 |
| 8901 | Passenger and goods transport ships, boats | 993 | 1,150 | 580 | 1.77 | 1.89 | 1.17 |
| 8517 | Electric apparatus for line telephony, telegraphy | 416 | 545 | 524 | 0.74 | 0.9 | 1.06 |
| 8536 | Electrical switches, connectors, | 548 | 576 | 503 | 0.97 | 0.94 | 1.02 |
| 2707 | Coal-tar distillation products including oils | 594 | 746 | 422 | 1.06 | 1.22 | 0.85 |
| 2901 | Acyclic hydrocarbons | 400 | 437 | 402 | 0.71 | 0.72 | 0.81 |
| 8703 | Motor vehicles for transport of persons (except buses) | 583 | 650 | 395 | 1.04 | 1.07 | 0.8 |
| 8538 | Parts for electrical switches, protectors, connectors | 246 | 400 | 391 | 0.44 | 0.66 | 0.79 |
| 8443 | Printing and ancillary machinery | 545 | 548 | 388 | 0.97 | 0.9 | 0.79 |
| 7219 | Rolled stainless steel sheet, width > 600mm | 463 | 537 | 382 | 0.82 | 0.88 | 0.77 |
| 7304 | | 408 | 461 | 361 | 0.73 | 0.76 | 0.73 |
| 7216 | Angles, shapes and sections of iron or non-alloy steel | 401 | 782 | 359 | 0.71 | 1.28 | 0.73 |
| 2710 | Oils petroleum, bituminous, distillates, except crude | 315 | 521 | 347 | 0.56 | 0.85 | 0.7 |
| | Total of 26 commodities | 28,082 | 32,227 | 25,058 | — | — | — |
| | Ratio of 26 commodities to the import total sum from Japan | 56,250 | 60,956 | 49,428 | 49.9 | 52.9 | 50.7 |
| 参考 | The export total sum to Japan | 26,370 | 28,252 | 21,771 | — | — | — |
| | The ratio of 26 commodities to trade deficit with Japan | 29,880 | 32,704 | 27,657 | 94 | 98.5 | 90.6 |

(Source) The World Trade Atlas original data are Korean entry statistics

Thirdly, which commodities did Korea import from Japan? We also decided to check the reason why Korea imported these goods. Therefore, we decided to get the names of the commodities imported by Korea from Japan using the UN Com Trade statistics. We picked trade items by sub-classification from 1990. The classification used is the HS (Harmonized Commodity Description and Coding System) code, which is the classification for all the entries in the statistics. There is a classification (four digits), a sub-classification (six digits) within a macro-taxonomy (two digits). In the case of Korea, there is a detailed classification of ten digits. Looking at the two-digit classification of HS, there are many HS72 "steel product", HS84 "instrumentation and parts", HS85 "electric apparatus and parts" among the 26 highest ranking imports from Japan. Of these, HS72 "steel product" is a product from big companies such as Nippon Steel as described above and is not the product of a medium- or small-sized business, so the study team excluded it from their objects for detailed analysis. When we look at the imported commodities from Japan in detail, using the ten-digit classification, we found commodities, such as semiconductor devices, LCD (Liquid Crystal Display) panels and products to produce mobile phones. In other words, regarding the products that Korea imported from Japan, it was clear that there were many things which large, Korean enterprises imported to produce the main exports of Korea.

Therefore the study team decided to check whether the commodities that Korea imported from Japan in order to produce semiconductors, LCD panels and mobile phones were really the products of Japanese medium- and small-sized businesses. In addition, the study team also inspected the introduction of new technologies, the relations between the procurement of industrial supplies and capital goods, and the situation with regards to localization in these three Korean industries. I decided to

inspect a hypothesis that suggests the trade deficit is the result of the introduction of imports of new technologies from Japan.

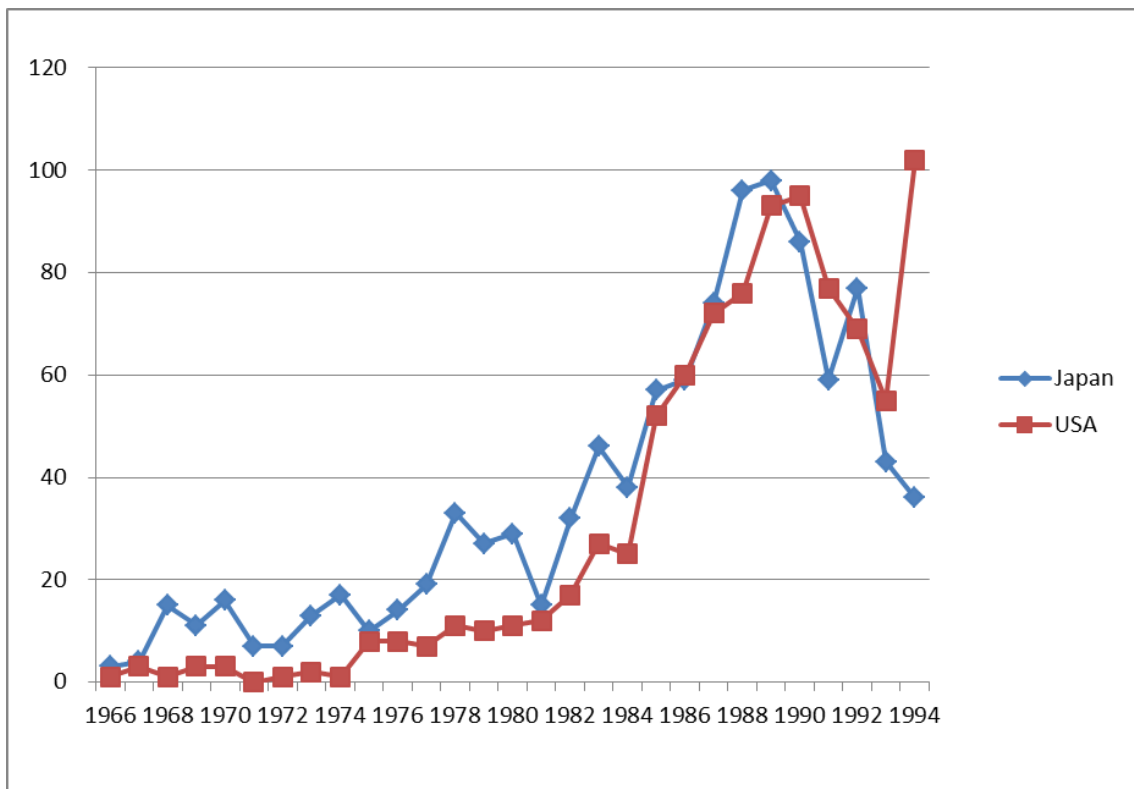
2. The introduction of new technology-producing imports

Korea has introduced technologies from Japan, and it is indisputable that Korea has produced products using these technologies and has exported these products, which has made Korea grow. Information about the introduction of these technologies from Japan can be understood from "The technologies introduction contract, present situation in '62 - '95", which was published by the Korea Industrial Technology Association until 1995. The situation is not clear after 1995 because we could get no information for after that year. According to Figure 3, in the electronics and electrical equipment industry, the top country of origin for the introduction of new technologies to Korea was Japan before 1990. However, the United States rose to the top position with respect to new technologies exports after that. Because the Japanese-Korean technological gap was reduced around the 1990s, Japanese companies began to refuse to transfer technology to Korea. This is the reason why these numbers for the electronics and electrical equipment industry fell.

When competition began in the Japanese-Korean electronics and electrical equipment industry, the import of technologies from Japan became difficult. In those days, the number of Japanese engineers being headhunted away from Japanese electronics and electrical equipment companies by Korean companies began to increase. The number of Japanese engineers in Korean companies reached a peak in 1997 when an economic crisis occurred and the number suddenly declined, but it increased again afterwards.

Technological diffusion from Japan to Korea varies from a form of direct investment and technical cooperation to the headhunting of Japanese engineers. If either form introduces a technology, Korea must supply capital goods and industrial supplies to produce products using these technologies and enter the technology network of the technology exporting company. When developing countries introduce a technology from a developed country and produce a product, they must import capital goods and

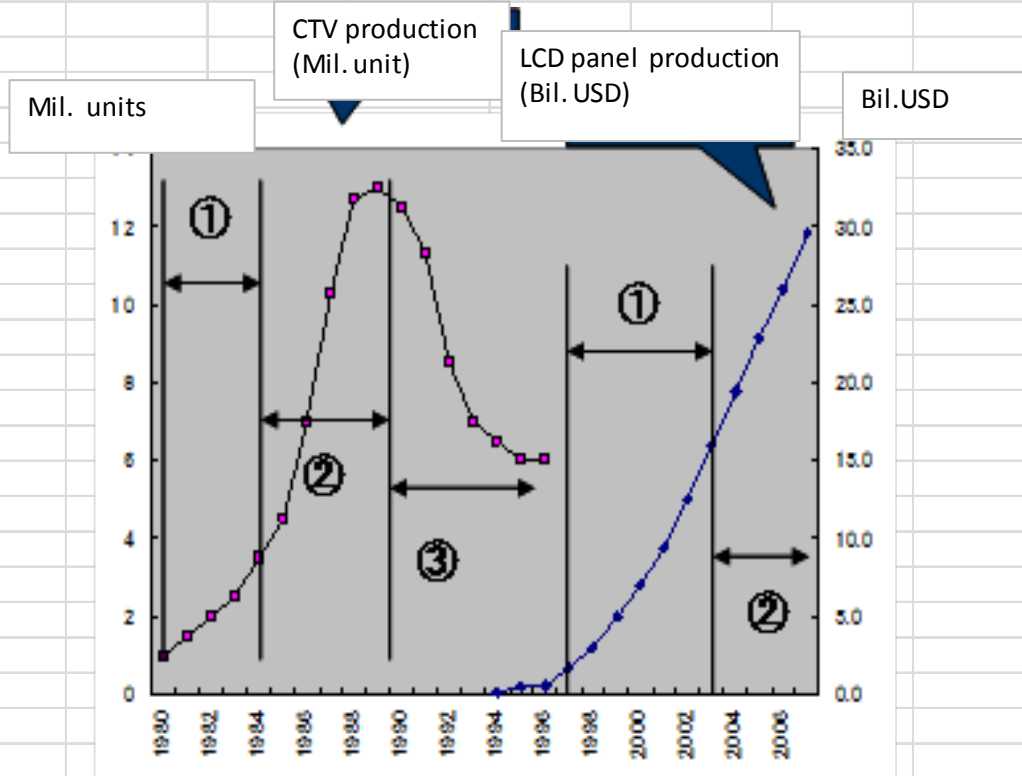
Fig. 3 Number of technologies introduced from Japan and the USA in the electronics and electrical equipment industry in Korea



(Source) Korea Industrial Technology Association [1995] "The technologies introduction contract, present situation in '62 - '95", pp.509-725.

industrial supplies to fill any technology gaps. Figure 4 shows that Korea produces product using technologies introduced from Japan, and it imports capital goods and

Fig.4 Relations of the production change of the Korean color television and LCD panel and the procurement of industrial supplies and capital goods



(Source) Junko Mizuno [2010] p.22.

①In the set-up period, many industrial supplies and capital goods are imported from Japan.

②Import substitution begins. The industrial supplies and capital goods imported from Japan begin to decrease.

③When offshore production begins, imports of industrial supplies and capital goods from Japan decreases .

In order to inspect the above hypothesis, I will look below at procurement and technology transfers

regarding semiconductors, LCD panels, and mobile phones.

industrial supplies for the production required at the time of set-up, but the figure also shows that, at the second stage, if the Korean company can get enough profit from their production because the market is big enough to make fresh investments, import substitution begins. The production units of color televisions hit their peak in 1989, but they had imported many industrial supplies and capital goods from 1980 through 1984 from Japan during the period needed to set up production. Import substitution began afterwards because there was enough volume and profits for Korean companies to be able to invest the huge amounts of money needed to produce the goods they needed to substitute for their imports. Then the second period started. However, because Korea introduced other technologies again when the production of color televisions began to decrease, the same process was repeated, and imports from Japan increased.

3. Technologies introduction in the semiconductor industry in Korea and imports from Japan

Technologies for semiconductor production in Korea entered from the United States and Japan. Processing technologies were diffused from Japan but production technologies came from the United States. Mitarai's analysis [2011a] shows that the rate of localization for the production of the semiconductor materials is over 50%, which marks considerable progress in comparison with the figure of around 20% for the rate of localization for producing the devices in 2009. In particular, the rates of localization for advanced production, such as for photomasks, special gases, process chemicals and metals, are 70-95%, a high value. On the other hand, regarding silicon

wafers and CMP slurry, the rate of localization is around 30%, the photoresist is at a level of more than 50%. Korean companies import silicon wafers, for which there is the biggest demand, from big companies such as SUMCO CORP. (40%), Shin-Etsu Chemical Co. Ltd (25%), LG Siltron (20%), and Siltronic Samsung Wafer Pte. Ltd. (15%). These companies are, in fact, big companies; they are not medium- or small-sized businesses. The only local company is LG Siltron, the others are Japanese exporters (SUMCO CORP. and Shin-Etsu Chemical Co. Ltd), with Siltronic Samsung Wafer Pte. Ltd. operating under joint management in Singapore.

Looking at semiconductor production in Korea, together with domestic industrial supplies and imported industrial supplies, Korea increased its imports from Japan to about 200-250 billion Japanese yen in the mid-2000s from 100-150 billion Japanese yen in the early 2000s, but, affected by the fall in semiconductor production from 2009 to 2010, imports decreased to 180 -170 billion Japanese yen. The imports depended on the amount of production.

This was the same with respect to the United States with the figures there being 35% (down from 40% in 2006) and Japan 28% (down from 35% in 2006), but for Europe it was 32% (up from 24%), and Taiwan 5% (up from 2%), according to information from Korea's KSIA on the imports of semiconductor production devices in 2009. Japanese volumes fell together with the United States, and instead Europe and Taiwan took their place, because their prices were more competitive. From the data on the Japanese side regarding this situation, exports to Korea of Japanese semiconductor production devices totaled from 50 billion yen to 140 billion yen around 2000, increased to 200 billion yen in the mid-2000s and reached a peak at approximately 270 billion yen in 2007. Although the exchange rates, the classification of the statistics and the years are

slightly different, a comparison of the data between 2006 and 2009 supports the information from the KSIA.

Import substitution for the imported capital goods and industrial supplies was gradually realized, but Korea imports capital goods and industrial supplies strategically, since the manufacture of such products is not sufficiently profitable in Korea, even though Korea has the technology necessary to engage in such manufacturing if it so wished. Therefore, the expansion of the semiconductor production of Korean companies became the reason for the increase in the imports of industrial supplies and production devices, and caused the trade deficit with Japan.

4. Technology introduction in the LCD panel industry in Korea and imports from Japan

Because the technology of LCD panels was developed in Japan, the technology was diffused from Japan. Korean companies asked for technological cooperation regarding LCD panels from Japan because they predicted that the cathode-ray tube market would decline and that LCD panels and plasma display panels would replace cathode-ray tubes in the future. But the Japanese companies refused. Therefore, after the 1990s, Korean companies began to catch up by headhunting Japanese engineers and importing capital goods and production supplies. According to Mitarai [2011b], the rate of localization reached around 60% with regard to the purchase of industrial supplies, then it reached 80% at the end of 2009, if one adds the local production of Japanese companies in Korea. Although the dependence on Japan for raw materials is still sizeable, it is necessary to regard this in terms of investment costs and benefits. As for the production materials required for LCDs, national policy has judged this to be

easier than is the case for semiconductor production devices, so domestic production has progressed and dependence on Japan has decreased.

5. Technology introduction in the mobile phone industry and imports from Japan

Korea did well in technological development and technology transfers in terms of practical digital mobile phones under the national project system, according to QUALCOMM Incorporated of the USA, which was looking for a joint development partner in the early 1990s. In Japan, the NTT group pushed for practical use with an original method called the PDC (Personal Digital Cellular), but the plan to go global did not turn out well, for various reasons. Because of this, technological relations in the mobile phone sector between Japan and Korea are weak. There is not much of a relationship in basic technologies regarding Korean mobile phones. As a result, in mobile phone production, Korean companies depend more on the USA than on Japan.

According to Mitarai [2011c], 80-90 % of displays, cameras, batteries, printed circuit boards, and housing use locally made products. On the other hand, almost all of the baseband processors, which constitute the basic technology in mobile phones, come from imports from Europe and the USA. The percentage of domestic production is high for semiconductor memory. The localization of semiconductors and LSIs, which are used in the application processors that perform internet correspondence and multimedia processing, has already started with Samsung Electron on the expectation of growing demand due to the spread of smart phones in the near future. Very important elements, such as displays, cameras and batteries, which were first almost entirely imported from Japan, are going to be localized on the basis of modules. It is just with regard to matrix systems, such as the high frequency parts of the RF system, the wireless interface systems, and the sensors or tip parts that Korea still strongly depends on Japan. Of course, this dependence on Japan is strengthened with the high-tech parts connected to the new mobile phones like the smart phone to begin with, but domestic production will soon start, and dependence on Japan will be reduced. The Japanese exporters here are big companies and not medium- and small-sized businesses.

Conclusion

Korea intended to catch up with Japan and overtake it, and it selected semiconductors and LCD panels for strategic reasons and nurtured these sectors as export industries. As a result, this strategy forces Korea to participate in Japanese technology networks and depend on Japan. This is shown to be the cause of the deficit. On the other hand, in the case of the mobile phone industry, as for the issue of dependence on Japan, in comparison with semiconductors and LCD panels, Korea's dependency is relatively light, because the original technology came from the USA.

Herein above, we saw that the reason why the Korean trade deficit with Japan has been a big issue for many years is that Korean companies have chosen their technologies from among Japan's main export products strategically. This goes for products like color televisions, VCRs, semiconductors, and LCD panels, and they have imported capital goods and industrial supplies from Japan in order to invest in and produce the same products on a large scale so as to take a large share of the global market in the short term. Developing countries can have the same industries as developed countries, but they cannot avoid importing industrial supplies and capital goods to fill a technological gap which they cannot fill with goods produced domestically. In addition, if a developing country cannot secure enough demand to make it worth investing in the production of goods that would fill such a technological gap, they will import existing industrial supplies and capital goods from a developed country like Japan, because it is more profitable to do this than make the investment required to do otherwise.

Generally, it may be said that the best course to solve the deficit with Japan is to develop product in Korea, but there is no guarantee that this would be a business model that would maximize profits. Also, there has been a strong tendency in recent years in Korea to think that original development in Korea is a waste of time. In theory,

there are other ways to solve the trade deficit with Japan. For example, Korea could increase its exports to Japan, or Korean companies could enter Japan. Korea holds the key to solving their trade deficit with Japan.

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