

Irony in Steel –
Foundation Myths of Shin Nippon Steel, and POSCO

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Abstract

This study reviews the considerations of the Japanese and Koreans in negotiating the founding of the Pohang Steel Corporation (POSCO), soon after the establishment of the Shin Nippon Steel Corporation. s as an inquiry into the issues of industrial adjustment, in managing the maturation and decline of an industry. The key issue is: did the MITI help to create a future rival?

Key Words:

Comparative advantage

Product cycles

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1. Introduction

In a globalized world, strategic trade is shaped under interacting national policies. Governments pursue national interest over long periods of time, over both the rise and the decline of industries as national factor proportions shift and international comparative advantages reconfigure themselves. While day-to-day trades are conducted at arm's length in the world market, major investment decisions alter the course of events that last decades.

To understand the controlling factors at work, case studies are by far the most realistic approach. This study is focused on the development of the steel industry of both Japan and Korea at the formation of both Shin Nippon Steel of Japan and POSCO, Korea, in the late 1960s. Both firms are ranking steel-makers in the world. Why did Japan assist the rise of Korea to become a premiere steel-maker is a story about how to manage a key industry of one's own from maturity to eventual relative decline.

In any country where successful development is accompanied with secularly rising income and cost, the maturation and then phasing out of industries is an inevitable theme. Logically, the exit from a market is exactly in symmetry of the entry into one. Yet in spite of its importance, this topic is rarely, if ever, systematically discussed in the literature.

Nature of the industry

Steel industry is not only an important in its own right, but also an industry having characteristics, some shared with many other industries, but others are particular to

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that industry. The list below goes from the more general to those special for the industry.

- a. The sector has a well-defined upstream-downstream structure, from the steel-making equipment embodying expert knowledge, to the more standard stages of steel production for the final products. In this it is like many other industries, such as the chemical – textiles – apparel nexus.
- b. The industry also contains a segmented market, comprising both a mass-produced portion and the high value-added, but thin market for specialized steel, supplying such project like Trans-Alaska Pipeline. There is much inter-industry trade in the world market, similar to the semiconductor industry which produces the memory chips, the application specific integrated circuits, and the central processing unit.
- c. Steel making involves a skill level between the labor-intensive products like apparel and footwear and the high tech sectors of biotech and information technology.
- d. During the past decades, there has been a major shift in the center of production in the world, displaying the product cycle phenomenon.
- e. Steel industry requires lumpy, irreversible investments, in sunk cost, which implies both scale economy but also a low supply elasticity, and hence an intense cyclicity in the world market, carrying the risk of high excess capacity in extended slumps.
- f. There is technical complementarity among equipment of overlapping generations, similar to the persistence of QWERT design in keyboard technology. Thus the source of technology imposes strong path-dependency in industrial development.
- g. Steel is a basic commodity, at the foundation of the machinery, transportation equipment, construction industries and defense industries. For that reason, many countries protect their domestic markets, for reasons of defense, or programs of import substitution.
- h. Therefore steel industry is ideal for study since major decisions are undertaken only after well-documented deliberations.

But even with the well-documented facts and the relatively readily available production and trade statistics, it still takes some analysis to unravel the truth about

how decisions are made and whether the original decisions have been justified by history.

Organization of this study

Next in Section 2, some relevant historical highlight will be stated. Essentially, they raise the question: were the Japanese decisions wrong, in simultaneously making heavy investment that assured Japan as the world leader in steel production, and helping Korea to become the next leader? If so, what caused the erroneous decisions? Following this is Section 3, presenting a number of additional facts, to provide context to Japan's actions. It is suggested that, by and large, Japan's choices were not only mutually self-consistent, but also in the best Japanese national interest. One then comes down, in Section 4, to the conclusion that what Japan did was in fact a three-stage optimal strategy to manage a maturing industry. In fact, what Japan did toward Korea in steel then bears some resemblance to what Japan is practicing toward China now, in general trading. It is also in tune with the descriptive theory of flying geese by Akamatsu. Next in Section 5, we consider from the angle of Korea, in response to the strategic posture of Japan: to benefit from the action of Japan, as long as it is to one's own interest, and to take appropriate actions, so that it will not give undue advantage to the Japanese. Section 6 contains some remarks about the steel industry in general. Some concluding remarks are then supplied in Section 7.

2. Facts and Artifacts

History is complex. For analytical tractability, a short list of stylized facts may serve as first approximation, leaving modification later.

In the current context, two essential facts are:

- A. (*On Shin Nippon Steel*) Facing decade-long excess supply in the world steel industry and the need of liberalization as an OECD member, Japan desired to consolidate its steel industry, to face foreign competitors like the US Steel, and the West German rivals. Thus, Yawata and Fuji were merged into the Shin Nippon Steel in 1970. After making large fixed investment, Japan became a world leader in steel - making. Total Japanese output rose by half by the mid-1970s, and utilization rate reached 90% in 1973.

B. (*On POSCO*) After years of futile negotiations with international institutions (which Japan abstained from), Korea turned to Japan for assistance to build up its steel industry, using about 1/6 of the indemnity fund Japan promised in 1965 for this purpose. After much debate on the Japanese side, it was decided in 1969, to send a Japanese team to Korea to help setting up POSCO. Their enthusiastic effort made POSCO the world's most advanced plant. While Japanese steel production stagnated after the mid-1970s, eventually, Korean emerged as a major worldwide producer of steel¹, supplying large amount to the Japanese home market, and eliminating the import balance in steel trade relative to Japan.

In 2004 and 2005, Shin Nippon and POSCO are the world's 3rd and 4th largest steel companies, producing 32 and 30 million metric tons, respectively². Together, Facts A and B seem to substantiate what some Japanese have complained as the 'boomerang effect': as a supreme irony, under its supposedly redoubtable industrial policy, Japan had actually helped to create a tough competitor against its own interest.

In principle, the 'boomerang effect' may be under the result of any or the following:

- i) The decision is decided by market force.
- ii) The ignorance of future consequences is due to oversight.
- iii) The capture of the State by interest groups.

There is also the issue of Japanese motivation to assist Korea in steel production. This is presented as Stylized Fact C.

C. Arguments were made that Japan should help for non-economic reasons:

- i) National security. The steel industry is important for Korean prosperity, and a prosperous Korea is important to Japanese security.
- ii) Diplomacy. Japanese assistance would make the Korean public more friendly with Japan.

¹ By late 1980s, POSCO already ranked as the fifth largest in the world (D'Costa, 1999).

² Source: International Iron and Steel Institute

iii) Historical sentiments. Japan should compensate for past occupation.

The first two arguments were made by Koreans to argue for support³ and the last was in the statement for Chairman Nagano of Shin Nippon Steel.

Logically, even if Stylized Facts A and B indicate that Japan acted against its own economic interest, Stylized Fact C can be sufficient reason for such a choice.

3. Assessment

To begin with, regarding to Stylized Fact A, Japan's heavy investment in Shin Nippon Steel may or may not be an overkill. On the one hand, Japan had out-competed both America and Germany, and tripled its raw steel production between the mid-1960s to mid-1970s. On the other hand, the grand merger planned in 1966 only happened in 1970, and with the Oil Crisis, that output started to peak only five years afterwards.

However, regarding Stylized Fact B, there seems to be sufficient economic justification for Japanese assistance in the founding of POSCO, without any non-economic argument under Stylized Fact C.

Staged development

A sequence of facts are relevant here:

First, Japan engaged in exporting steel plants to many countries before its involvement in POSCO. Such projects satisfied the desire of countries to produce their own steel for the protected market under the import-substitution policy which was popular through out the developing world. POSCO was no exception⁴. See Table 1 of Japanese export of steel producing facility prior to the founding of POSCO.

Second, because of the QWERT effect, once after Japan had supplied the initial equipment, facilities for the subsequent expansion of POSCO were almost exclusively imported from Japan. See Figure 1 for the rise of cumulative productive capacity of POSCO. Stage 1 of POSCO, mainly financed out of Japanese indemnity

³ The security argument first came in the Nixon-Sato communique of November 21, 1969.

⁴ Another source for Japanese export of steel-making facilities is Kang (1989). His statement of Japan exported its own used equipment certainly does not apply to POSCO, where the plant represented the state of art at that time.

(in grants and loans, already agreed upon in 1965) accounts for a capacity of one million ton, the cumulative capacity of the Pohang plant was 9.6 million tons, at the Stage IV expansion in 1983. Most of the facility was made in Japan. Subsequently, by the completion of Stage IV of the Kwangyang plant in 1992, total capacity of POSCO reached 21 million tons. From available data, at the least, half of the equipment of the first two stages was imported from Japan.

Third, for a long period of time, the efficient plant of POSCO would mainly supply low value-added steel for the booming Korean domestic market, which was *complementary* to the high value-added steel, exported by Japan. Thus the Korean import of steel from Japan and the steel output of POSCO *rose together*, until after the Kwangyang plant was in operation. See Figure 2.

Fourth, the Korean export expanded tremendously only much after the peaking of the Japanese output around 1974, at more than 130 million tons (when the output capacity of POSCO was about 1 million ton). See Figure 3, with the initial output capacity of POSCO shown as a column. The stagnation of Japanese steel output was largely the result of Japanese over all growth. The rise of wage signifies the increase of Japanese value of labor product, the rise of Yen (displayed in Figure 4) although a result of *gaiyatsu* (external pressure), also reflects the relative increase of Japanese productivity against its trading partners, and finally the concern about pollution is an indication of both the level of (pollution-causing) industrial activity and the affordability for cleaner quality of life a now prosperous Japanese society. Competition from Korean industry is not a major factor at this stage.

Fifth, after the Korean export expanded tremendously, more recently its foreign market was mainly Japan, not America. See Figure 5.

Two implications need elaboration. First, for the American market, import from Japanese has always been larger than import from Korea, and far more so, in early years. Therefore, (a) by the latter fact, not only POSCO was no immediate threat, nor is it likely that the Japanese initial motivation was to use POSCO's sales to America as export by detour. (b) At the eventual phase of rapid export expansion of POSCO, it can be construed as an unintended indirect export of Japan. Given the rising Japan's export to Korea which matches Korea's export to Japan (seen in Figure 6), and the

latter dominates Korea's export to America (already seen in Figure 5), so Japan still did not lose.

Second, the rising two-way Japanese – Korean intra-industry trade in steel, seen in Figure 6, shows that there are considerable complementarities beside substitutability, between the steel outputs of Korea and Japan. Otherwise, should Korean product supplant the Japanese on a broad front, rising Korean export to Japan would be accompanied by the falling export of Japan to Korea. This is further confirmed in Figure 7, the index for Japan's overall advantage goes from near the value 1 to hovering about zero, without heading straight toward the value -1. The fact that the current output value of Shin Nippon still stays a little ahead of POSCO shows Japan still retains certain core competency in steel-making. The changing nature of intra-industry trade is elaborated in Table 2.

Finally, when the center of gravity of the Japanese industry has moved to high tech industries, the Korean sales of its upgraded steel output to Japan still works to reduce the cost of steel input for Japanese industries, given the wage differential between the two countries.

Asymmetric information and differential control

In the detailed description of Song (2000) on the deliberation and negotiation prior to the founding of POSCO, the facts are revealing about decision-making under information asymmetry and differential influence on a successful outcome:

- a. On the Japanese side, the industrialists were enthusiastic right from the beginning, in 1964-5 (Song, 21-22).
- b. Japanese industrialists' interest initially cooled in 1966 when externally, they could not be the exclusive decision maker but had to defer to others in a consortium under American leadership, and internally, Yawata was invited into the consortium causing the ire of other steel makers (Song, 24-5).
- c. Japanese industrialists' interest revived when other foreign parties withdrew, after the Korean counterproposals (formulated with Japanese consultation), and Japanese steel-makers reached consensus to formulate their team (Song, 39).
- d. Initial objections raised by Japanese government bureaucrats (Song, 42-5) concerned about

- i) whether Korea could repay the funding (which became a non-issue, when Korea asked to divert fund from the Japanese indemnity already agreed upon),
 - ii) the need for liquidity if other recipients of indemnity also request the conversion of installment payments to immediate spending, and
 - iii) to the possible ire of the Westerners (whose project failed, and the Japanese consultation played some role).
- e. Doubts about the economic viability of the Korean proposals came from the non-Japanese foreigners, whose steel industries were eventually eclipsed by their Japanese competitors. Their doubt centered on the Korean demand for steel, which depends in turn to no small extent on Korea's potential to develop manufacturing exports, in the Japanese mode, and perhaps with Japanese intermediation.
- f. Only some Korean officials speculated that the earlier hesitancy of the Japanese was due to concerns about future Korean competition.

All these facts imply that a successful POSCO was to the best economic interest of Japan. On that issue, the best information came precisely from those Japanese with both the most experience (from Song, 22, the Japanese industrialists readily noted that Japan succeeded in steel-making under quite similar conditions), and in a position to influence the outcome, namely, the steel makers as well as Mitsubishi, the general trading group whose expertise is in intermediation. The latter played an essential role for the entry of Korean manufacture into the American market.

From the decision theoretic point of view, project evaluation depends upon the conditional expectation of the present value over the net benefit stream. The major differences between the international group and the Japanese come down to two points, regarding the cost of finance and the viability of the undertaking.

Why experts disagree

With 20-20 vision in hindsight, one must wonder why the non-Japanese experts erred so much, in denying the Korea under President Park the steel project, after the Koreans had excluded Japanese competition in the formation of international

consortium (but retained the Japanese Consultant Group for a second opinion). This turns out not a mystery,

For the non-Japanese foreigners, raising funds involves new commitment of resources and forecasting Korean development prospects was based upon the assumption that there would be little future growth and a continued Korean current account deficit: a realistic prospect if one extrapolates the performance of the Korean track record under Rhee. That implies to limit the scale of the project for an increasing returns industry, to Korean domestic needs, purely in the hope of saving some import bill.

In contrast, for the Japanese officials, to allocate indemnity funds, already promised before, to a steel project rather than other uses means zero marginal cost to the public treasury. Their main concern was diplomatic fall out. Future competition from Korea was no more pressing than from USIMINAS of Brazil, Sazack Driam of Thailand, or Utter Pradish Steel of India, recent clients from developing countries for exported steel plants from Japan. After all, the current capacity and future plans of such clients were decided with the consultation of Japanese steel interests, who should see any threat first. Under the Japanese consensual decision process, the risk of oversight was not very likely.

The Japanese steelmakers only saw opportunities, in immediate revenue (when their government transfer the indemnity funds to them) and future synergy, with a Korean industry developing under plans they would help to design, provided they enjoy exclusive control without interference from Westerners' interest. Their superior efficiency, soon would be revealed in their competition against American and German steel industries, allowed them to make a more realistically optimistic feasibility forecast than the non-Japanese. This prospect would become far more promising for plants of a larger scale, if they factored in a rapid growing Korean economy. This would be an economy with export drives, powered by the low Korean wage and introduced by experienced Japanese intermediaries (like the Mitusubishi Trading Company), into their own former markets, sometimes even under their own brand, to fill the gap Japan then had to vacate in view of the rising Japanese labor cost.

4. Lessons for industrial policy: the Japanese angle

Traditionally, the study of industrial policy focuses on individual economies as latecomers, introducing new industries on their own. The founding of POSCO does not fill that mold. It concerns Japan and Korea, two war-devastated economies, planning to realize their respective potentials in the world, and cooperated for the occasion, to realize a win-win solution for themselves. For Japan, it was on the eve of challenging the incumbent industry leaders on the world market, but already envisioned the maturity (and then decline) of an industry, and plan for the best possible. For Korea, it was a matter of recognizing what were the best achievable choices for oneself, and acted accordingly.

Leaving the issues for Korea in the next section, a few words should be said about the problem of *industry adjustment* (or less euphemistically, managing the decline), for which the Japanese performance deserves careful study.

By pure logic, for an economy in the position of Japan, its self-interest rests on three principles:

First, to ‘redeploy’ upscale in the output market, and concentrate on the high value-added portion of the product line, seeking gains from the horizontal division of labor in inter-industry trade.

Second, to ‘redeploy’ upstream in the input market, and by the QWERT effect, prolong the benefit stream as long as feasible.

Third, to secure a favorable future terms of trade, even after one’s own total exit from the industry, as much as possible.

So far, Japan’s record with Korea and for the steel industry, appears evident in the pattern of the first two principles. On the other hand, Japan’s export of the steel-making technology to many partners is observationally also consistent with the third principle, and not just the second.

To be more specific, suppose one had emerged among many oligopolists to become the world’s industry leader in the past, and circumstance now forces one to leave the field once for all, transforming oneself from an exporter into a permanent importer. Then the question naturally becomes, if one can help it, is it to one’s own best interest to see the emergence of *another* paramount industry leader? Probably

not. Then, in the words of List, *kicking back the ladder* would be the natural course of action. In practical terms, this means to make the product a *commodity*, producible by many suppliers at minimum cost.

5. Lessons for industrial policy: the Korean angle

On the Korean side, several points can also be made:

- a. For national advantage, Koreans also did what they could in exploring alternative sources of technology, till the Japanese pulled out (Song, 22).
- b. Even then, the Japanese were retained for second opinion, when dealing with the international consortium (Song, 31).
- c. After being denied financing by international sources, Koreans were persistent enough to go back and get the project completed with Japanese assistance (Song, 35).
- d. Throughout the years, Korea managed to outperform all other recipients of Japanese technology⁵. This can be an effective way to dissuade Japan from playing one recipient of Japanese technology against another, if that eventuality arises.
- e. Yet, efforts were constantly made to be sure whether one has obtained the best deal with the Japanese.
- f. Eventually, with the expansion of the Kwangyang plant, domestic supply began to substitute for some import from Japan, and Korea started to diversify sources for equipment acquisition.
- g. The ultimate goal is of course to create core competence in the technology of one's own. Koreans have been out-investing both the Japanese and Americans for each ton output⁶.

6. An over all perspective

⁵ The performance of Korea as a recipient of technology set a standard among the developing economies (Enos and Park, 1988) and such capacity formed the basis to attract Japanese assistance in the first place (Cumings, 1987).

⁶ The comparative figures per ton are \$100-\$120 (Korean) to \$40-\$60 (Japanese) to \$20-\$25 (American), according to Cyert and Fruehant (1996).

A bird's eye view of the world steel industry is presented below, mainly from Cyert and Furehant, *ibid.* Until the expansion of Chinese demand in the last a few years, the world steel industry has been facing over-capacity for more than 100 million metric tons since the 1970s, and twice as much since 1980. The oil crises made automobile makers to use more aluminum and plastic than steel. World consumption fell more than 8% in 1975.

Japan made great progress in raising labor productivity (value-added per worker) ten fold between 1958 and 1993. Although Japan set the world record on labor productivity since the mid-1970s, facing reduced demand, Shin Nippon sustained huge loss several times from 1981 on, and had to closed down facilities and reassign workers to diversified activities, including mushroom growing, using the waste heat from the blast furnaces.

Starting with newer plant to begin with, POSCO bought newer equipment in its successive expansion. With workers working on average 54 hour weeks at a wage rate which was 50 to 65 percent lower than American and Japanese workers in the mid - 1990s, Korea has been very competitive. Still, by Stern et al. (1995), the rate of return of investment in the steel industry was fair, but not particularly outstanding in the rapidly growing Korean economy.

By the same token, the difficulties faced by the efficient Japanese steel mills due to high labor cost reflect how productive are Japanese workers in other sectors.

The above observations are important. Lest the difficulties faced by certain sectors in an efficient economy distracts one's attention about the efficient performance of those sectors and the over-all sagaciousness of the industrial policies in such economies.

7. Concluding remarks

This is an exploratory study, relying heavily upon the meticulous record of Song (2000) to analyze industrial policy in action. One crucial issue here is that at end of 1960s, decision-making was quite different between Seoul and Tokyo. On the one hand, words from the House of Blue Tiles represented the final position of Korea, in a mode traditional scholars of industrial policy are familiar with. But on the other hand,

questions of Japanese national interest were decided in round and round of consensus-generating public meetings, by bureaucrats with seemingly diverse objectives. To uncover what may serve as the Japanese national agenda is an exercise with both challenge and reward.

For illustration, consider the hypothesis that Japanese exported steel mills in order to show Japan is a country exporting capital, and ease the American for revaluating the Yen. What is known in the negotiations about POSCO seems to contradict this view. The export of steel plants was presumably decided by the Japanese steel interest. Yet, their leaders never mentioned any concern for exporting capital. The intervention to prevent revaluating the Yen presumably was a subject closer to the interest of the Finance Ministry than to others, yet this was a government branch objecting to fund the POSCO. Indication suggests that this argument of being a *capital-exporting country* served as an argument against American pressure. But this argument was not successful to avoid exchange rate revaluation⁷, so it was not emphasized in debates among the Japanese leaders.

Thus, the record of deliberation serves well as a key to reveal the Japanese collective preference.

What holds true in the trade for steel also suggests certain economic truths hard as iron, which is broadly applicable to all sorts of industries. Currently. The Japanese find it too expensive to produce certain consumption goods at home for their domestic market, they supply the technology to produce them in China instead. This includes for example, top scale ladies' apparels, produced under conditions of clean room for computer components. This is how in using China as an export platform to tap its low wage labor, firms from Hong Kong and Taiwan seek profits in foreign currency, usually dollars, but those from Japan focus instead on the outputs themselves, and runs an import surplus.

⁷ As a temporary concession to American pressure, Japan already had accepted the request to impose the so-called voluntary export restriction, on steel and other goods (Lim, 1998).

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Year of Decision	Projects	Destinations
1958	1	Brazil
1961	1	Hong Kong
1963	4	Nigeria, Singapore, Hong Kong, Peru
1964	5	Thailand, Venezuela, Singapore, Ethiopia, Guatemala, UK
1965	7	Canada
1966	2	India, Columbia
1969	1	Korea (POSCO)

Period	Export volume		Export content	
	Korea	Japan	Korea	Japan
Before 1973	Insignificant	Rising slowly	Very little	All types
1973-1978	Rising slowly	Rising rapidly	SITC 671,678,679	SITC 672,673,674
After 1978†	Rising rapidly	Fluctuating	SITC 672,673,674	SITC 672,673,674

† Two-way intra-industry trade goes on inside SITC Rev. 2 code 67271 and 67441.

Figure 1 Output capacity of POSCO

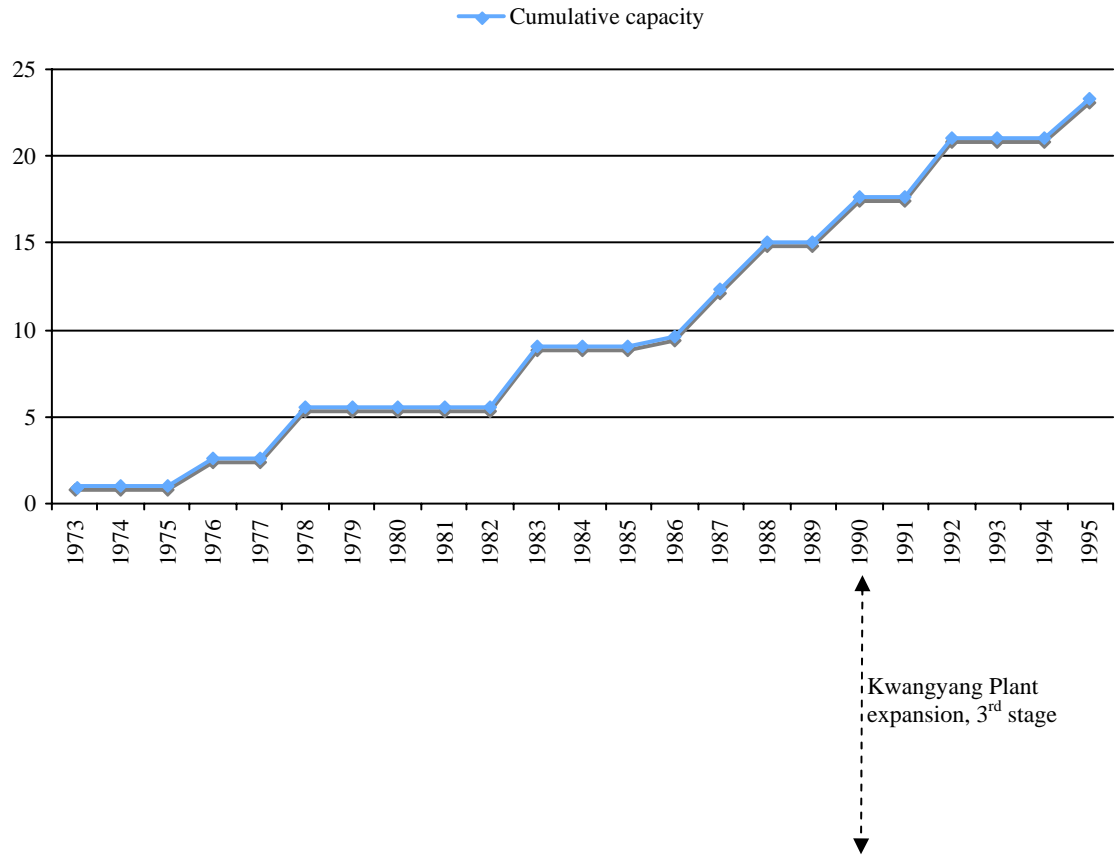


Figure 2 Korean steel import from Japan (\$)

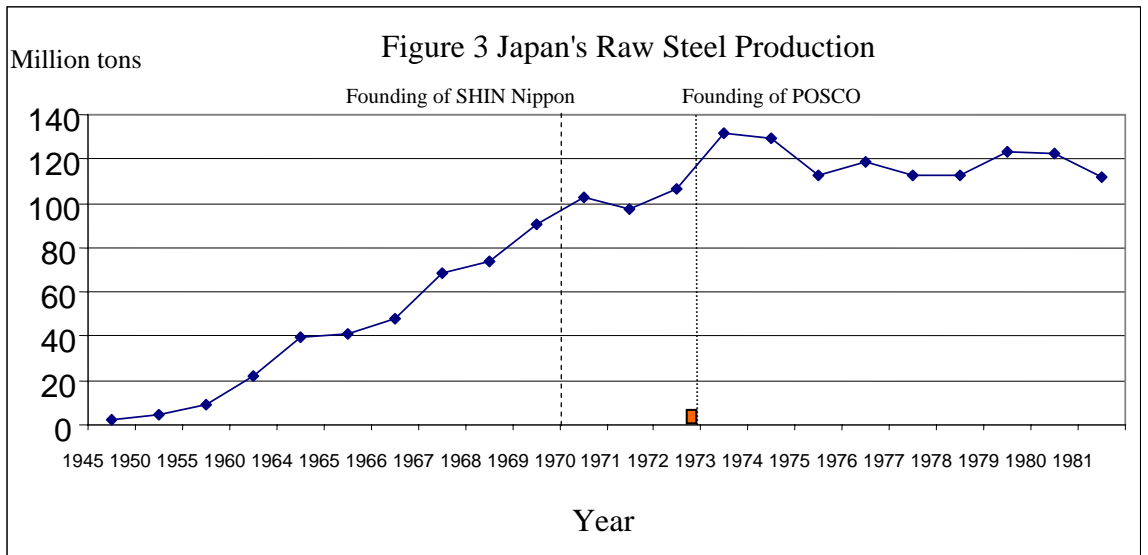
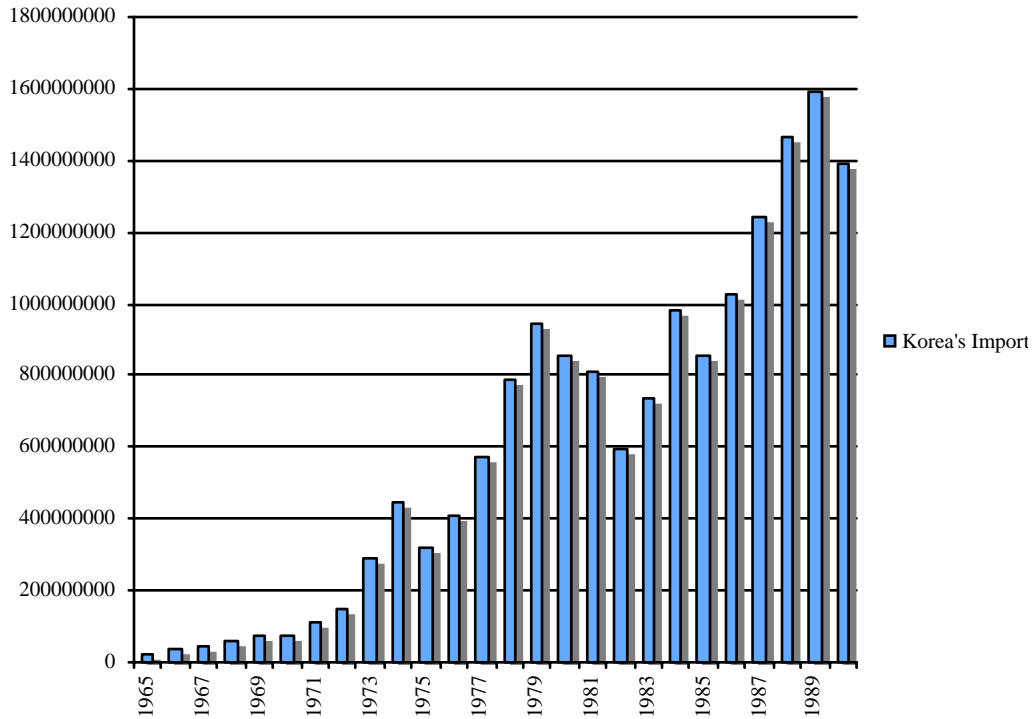


Figure 4 Yen per Dollar

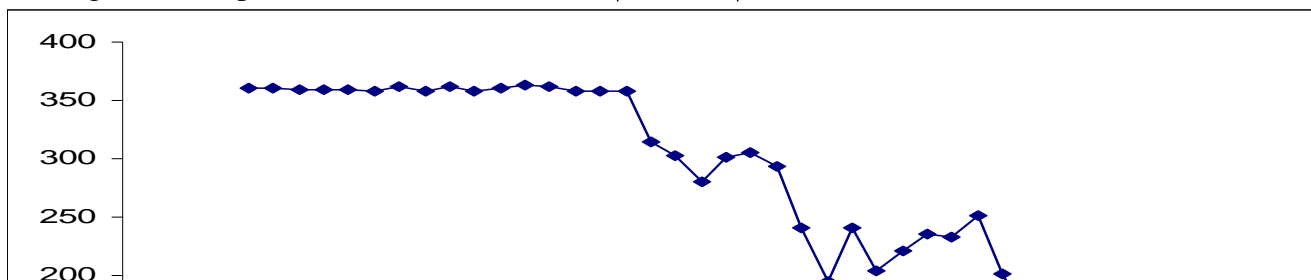


Table 5 Selected trade statistics

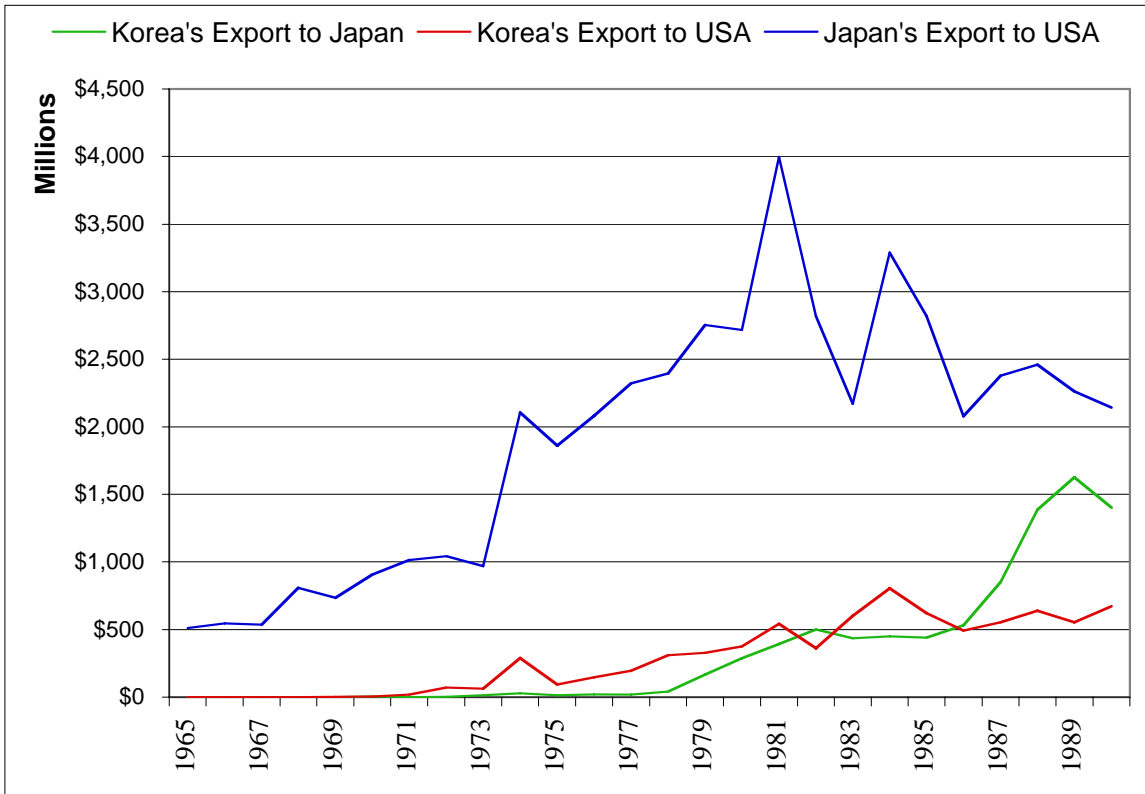


Figure 6 Steel Trade between Korea and Japan

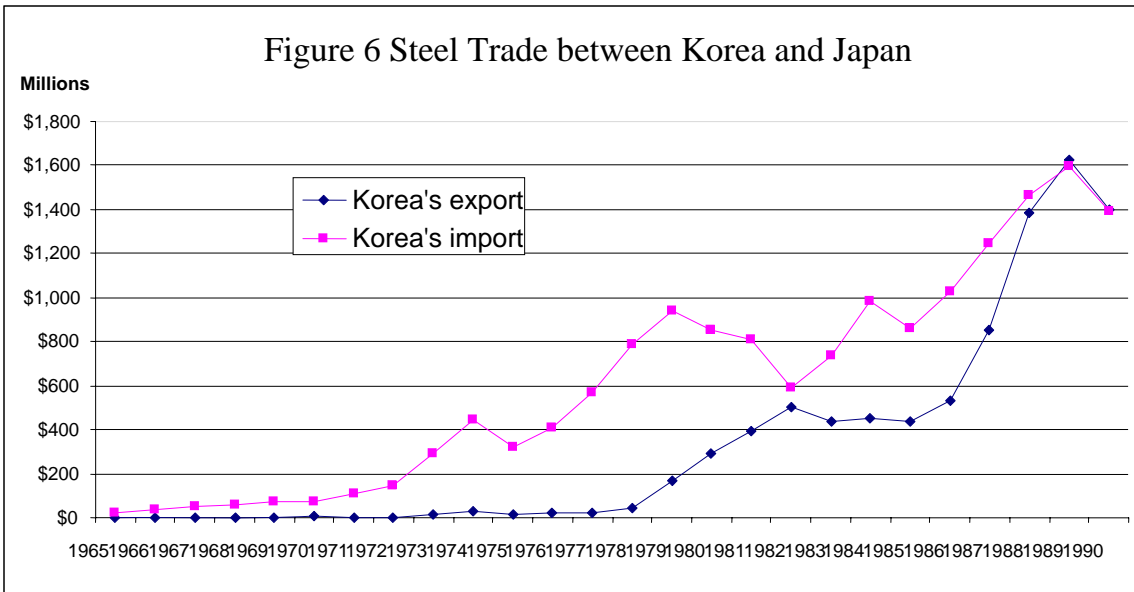


Figure 7 Japan - Korea steel trade surplus /Total steel trade

